

ルワンダ国
ルワンダ農業・動物資源開発庁

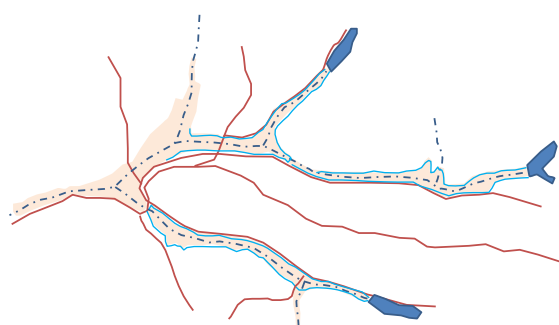
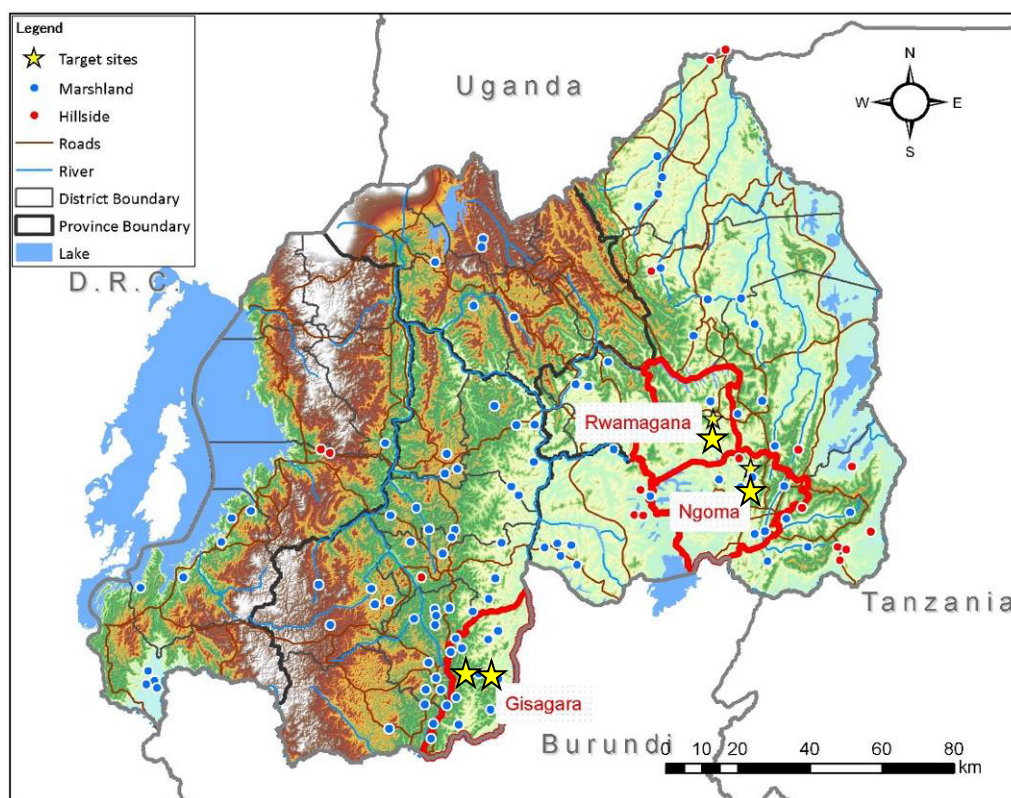
ルワンダ国
灌漑水管理能力向上プロジェクト
プロジェクト業務完了報告書

2025 年 2 月

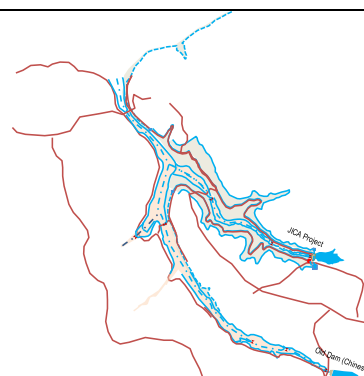
独立行政法人
国際協力機構（JICA）

NTC インターナショナル株式会社

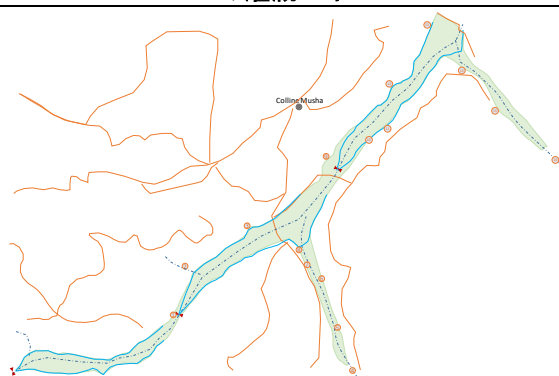
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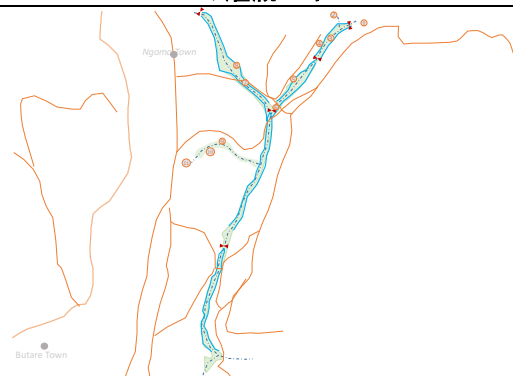
低湿地水田: 265 ha
ルワマガナ郡チャルホゴ モデル地区
4つの灌漑スキーム



低湿地水田: 170 ha、丘陵畑地: 265 ha: 計 435 ha
ンゴマ郡ンゴマ モデル地区
2つの灌漑スキーム



低湿地水田: 168 ha
ギサガラ郡ンギリ モデル地区
1つの灌漑スキーム



低湿地畑地: 109 ha
ギサガラ郡ニャボゲラ モデル地区
1つの灌漑スキーム

プロジェクト対象地域位置図（モデル地区）



プロジェクト対象地域位置図（普及対象スキーム）

写 真



写真 1
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写真 2
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（2021 年 9 月）



写真 10
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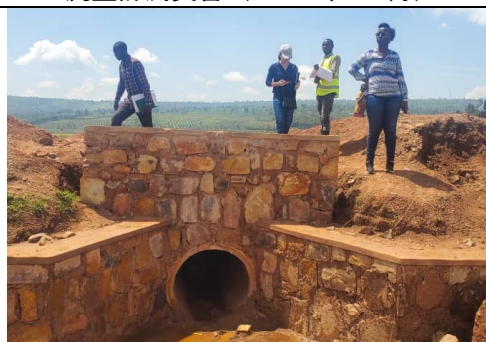


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ルワンダ国灌漑水管理能力向上プロジェクト

プロジェクト業務完了報告書

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単位と通貨

kg	kilogram
t, MT	Metric tons = 1,000 kg
h	hour
mm	millimeter
cm	centimeter
km	kilometer
ha	hectare
HP	Horsepower
km ² , sq.km	square kilometer
m ³	cubic meter
MCM	million cubic meter
MSL	Mean Sea Level
MW	mega Watt
LPS, l/s	litters per second
mm/mon	millimeter per month
mm/d	millimeter per day
m/s	meter per second
m ³ /s	cubic meter per second
°C	degrees centigrade
%	percent
RWF	Rwandan franc
US\$	United States Dollar
JPY	Japanese Yen

通貨換算率 (2025 年 2 月現在)

	RWF	US\$	JPY
RWF		0.0007252	0.11197
US\$	1378.95		154.401
JPY	8.931	0.006477	

略 語 表

略語	英語	日本語
C/P	Counterpart Personnel	カウンターパート
COVID-19	Coronavirus disease 2019	新型コロナウイルス感染症
DISC	District Irrigation Steering Committee	郡灌漑運営委員会
DP	Development Partners	開発パートナー
FC	Field Collaborator	現場協力者
HoReCo	Horticulture in Reality Cooperative	(イスラエルで研修を受けた若者たちが中心となって運営する会社であり、サービスプロバイダーの一例)
IFAD	International Fund for Agricultural Development	国際農業開発基金
IMP	Irrigation Master Plan	灌漑マスタープラン
IMT	Irrigation Management Transfer	灌漑管理移管
IMTA	Irrigation Management Transfer Agreement	灌漑管理移管合意
IP/TP	Improvement Plan and Training Plan	改善計画／研修実施計画
IWUO	Irrigation Water Users Organization	灌漑水利組合
IWUO-SU	Irrigation Water Users Organization Support Unit	灌漑水利組合支援ユニット
JCC	Joint Coordinating Committee	合同調整委員会
JICA	Japan International Cooperation Agency	国際協力機構
KCCP	Knowledge Co-Creation Program	知識共創プログラム
LII-TT	Land Husbandary Irrigation Innovation and Technology Transfer Department	土地管理灌漑革新技術移転局
MINAGRI	Ministry of Agriculture and Animal Resources	農業・動物資源省
MINALOC	Ministry of Local Government	地方政府省
MINECOFIN	Ministry of Finance and Economic Planning	財政経済計画省
MOU	Memorandum of Understanding	了解覚書
O&M	Operation and Maintenance	維持管理
PDM	Project Design Matrix	プロジェクト・デザイン・マトリックス
PO	Plan of Operation	活動計画
PPP	Public-Private Partnership	官民パートナーシップ
PSTA4	Strategic Plan for Agriculture Transformation (仏 : Plan Stratégique de Transformation Agricole)	第4次農業改革戦略計画
R/D	Record of Discussions	合意議事録
RAB	Rwanda Agriculture and Animal Resources Development Board	ルワンダ農業・動物資源開発庁
RCA	Rwanda Cooperative Agency	ルワンダ協同組合局
SAIP	Sustainable Agricultural Intensification and Food security Project	(世界銀行が実施するプロジェクト)
SHEP	Smallholder Horticulture Empowerment & Promotion	市場志向型農業振興
SMC	Scheme Management Committee	スキーム管理委員会
SP	Service Provider	サービスプロバイダー
SPIU	Single Project Implementation Unit	単一事業実施ユニット
SSIT	Small-Scale Irrigation Technology	小規模灌漑
TOT	Training of Trainers	講師育成研修

農業生産と農家所得の向上に向け、灌漑農業の推進を重要な政策課題として捉え、急速な灌漑開発を進めている。一方、地方分権・小さな政府の政策も進めており、開発された灌漑スキームの運営維持管理の責任を、政府から灌漑水利組合（Irrigation Water Users Organization : IWUO）に移管する灌漑管理移管（Irrigation Management Transfer : IMT）を進めている。これに対し、主管する農業・動物資源省（Ministry of Agriculture and Animal Resources : MINAGRI）傘下のルワンダ農業・動物資源開発庁（Rwanda Agriculture and Animal Resources Development Board : RAB）は、灌漑水利組合支援ユニット（Irrigation Water Users Organization Support Unit : IWUO-SU）を設け業務に従事している。しかし、制度整備は不十分で、政府側、IWUO 側ともに能力が追いついていないのが現状であった。このため、ルワンダ政府の要請に基づいて、国際協力機構（Japan International Cooperation Agency : JICA）は、RAB を実施機関及び JICA のカウンターパート（Counterpart Personnel : C/P）機関とした灌漑水管理能力向上プロジェクト（The Project for Water Management and Capacity Building in the Republic of Rwanda : WAMCAB）を実施することとなった。

1.2.2 上位目標及びプロジェクト目標

WAMCAB は 2018 年 9 月 27 日に調印された R/D に基づき、下表に示すとおり、期待される成果 1 から 5 を発現させ、IWUO が主体となった灌漑スキームの持続的な管理・運営に向けた好循環を創出し、プロジェクト目標を達成するとともに、プロジェクト終了後の上位目標達成にも貢献するものである。

表 1.1 プロジェクトの概要

項目	内容
上位目標	IWUO による灌漑地区管理のモデルがターゲット郡で実践される
プロジェクト目標	モデル地区において IWUO によるスキーム管理能力が向上する
期待される成果	成果 1: IMT の実施手順、IWUO の支援体制（役割分担を含む）・支援内容及びモニタリング手法を明確化する
	成果 2: モデル地区における IWUO の組織強化が図られる
	成果 3: モデル地区における維持管理が適正に行われる
	成果 4: モデル地区における水管理が適正に行われる
	成果 5: モデル地区における営農活動が促進される

1.2.3 プロジェクト実施機関

WAMCAB は、MINAGRI 傘下 RAB 内の IWUO-SU を主たる C/P とする。プロジェクトの運営を担う JCC の構成及びプロジェクトの実施体制は、2019 年 5 月 8 日開催の第 1 回 JCC における協議の結果、図 1.2 のとおり承認された。

また、プロジェクト開始に当たって、RAB 本部の C/P5 名のほか、対象郡を管轄する各 RAB ステーション（ンゴマ、ルビリジ、ルボナ）の職員計 11 名及び対象 3 郡（ンゴマ、ルワマガナ、ギサガラ）の職員計 9 名がタスクフォース（Task Force : TF）メンバーとしてプロジェクト・ダイレクターである RAB 長官から任命された。

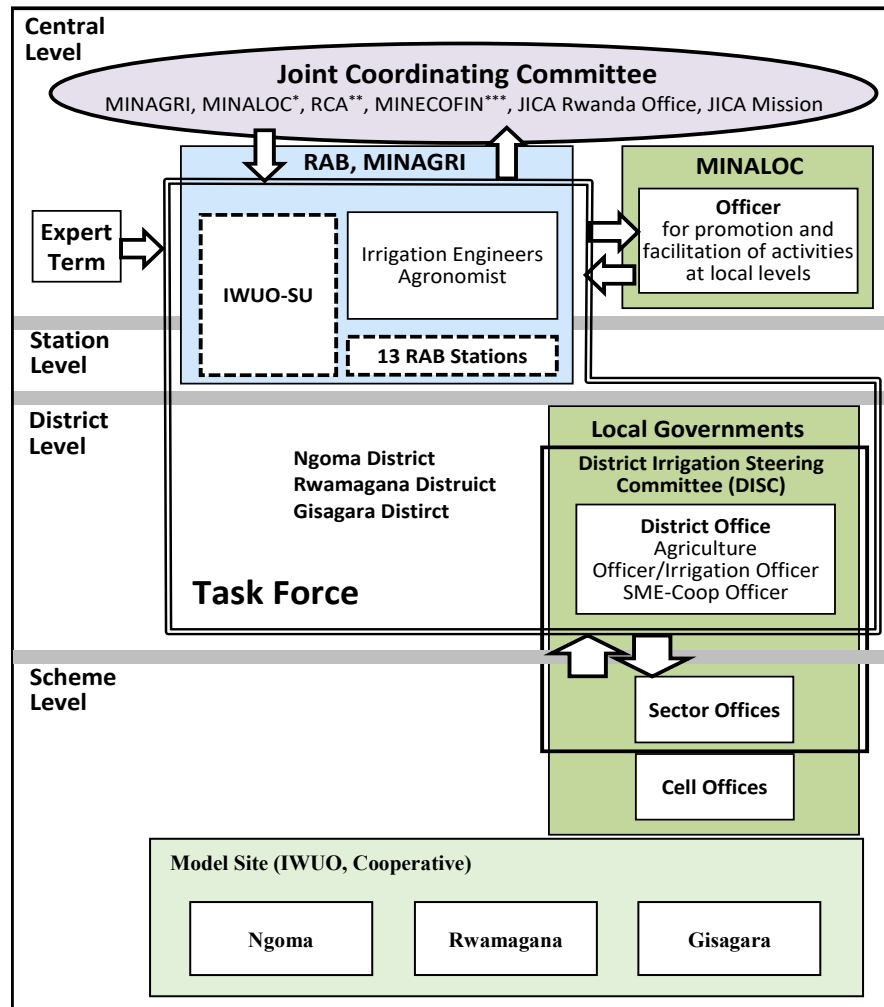
ただし、2020 年末から 2021 年にかけてチーフ・インプリメンター及び維持管理を担当する RAB 本部の C/P の計 2 名が、IFAD の支援により RAB が実施している灌漑・流域管理プロジェクト（Kayonza Irrigation and Integrated Watershed Management Project : KIIWP）のメンバーに任命され

（うち1名はプロジェクト・コーディネーター）、実質的に WAMCAB の活動に参加できていない状況となった。RAB 職員の人員不足により C/P の補充・交代は難しく、プロジェクト終了時点においてもなお上記2名は WAMCAB の C/P としての立場を継続しているが、可能な範囲で会議や研修等に参加するに留まっている。ただし、TF メンバーを率いてプロジェクト活動の実施を担うチーフ・インプリメンターについては、その役割の重要性に鑑み、2021年5月1日より、水管理を担当していた RAB 本部の C/P がその職務を担っている状況である。

TF メンバーに関しても、人事異動や非正規雇用の一時打ち切り、留学等の理由による離任や交代が相次いで発生しているが、2024年9月現在、RAB ステーション職員計10名（うち第1期当初メンバーは3名）、対象郡職員計9名（うち第1期当初メンバーは5名）が TF メンバーとして活動を行っている。最新の TF メンバーを別添1-3として整理する。

また、成果2～5に関する能力向上を図る改善計画／研修実施計画（Improvement Plan and Training Plan : IP/TP）の具体的な実施体制に関し、プロジェクト開始時点では、日本側専門家と RAB 本部の C/P が RAB ステーションや対象郡の職員に TOT を実施し、彼らから IWUO や農協のメンバーに研修を行うカスケード方式の技術移転を想定していた。しかしながら、第1期の調査・計画フェーズでの経験を通じて、コア C/P や RAB ステーション・対象郡の職員が多忙のため活動範囲が限定されることが判明し、プロジェクト開始後1年の段階で、カスケード方式の技術移転を修正し、C/P についてはモニタリング・評価を主たる役割とし、一部研修講師の役割を担わせつつも、農家向けの研修は IWUO や農協に配置する現場協力者（Field Collaborator : FC）が主体となって実施する方式に変更した。

FC についてはプロジェクト終了後を見据え、IWUO・農協の職員として定着できる現地人材であることを条件とした上で採用し、WAMCAB と IWUO・農協との間で給与負担を分担している。FC 雇用開始時には WAMCAB が全額を負担するが、その後の協議により負担率を減少させ、プロジェクト終了時点では IWUO または農協が全額負担することを目標としてきた。最新の給与分担について別添1-4として整理しているが、2023年12月以降は IWUO についてはンゴマ、チャルホゴ、ンギリの3地区において75%まで負担額を引き上げる状況であり、プロジェクト終了時点では、全額を IWUO または農協が負担することとなっている。ニャブヨゲラ地区における灌漑担当 FC については、所属するスキーム管理委員会（Scheme Management Committee : SMC）の上位組織である農協が給与負担を行っている。



*MINALOC : 地方政府省 (Ministry of Local Government)

**RCA : ルワンダ協同組合局 (Rwanda Cooperative Agency)

***MINECOFIN : 財政経済計画省 (Ministry of Finance and Economic Planning)

図 1.2 プロジェクト実施体制

第2章 プロジェクトの結果

2.1 プロジェクトの結果

2.1.1 日本側の投入

日本側の投入に係る当初計画と実績を以下に記載する（詳細は別添 1-5 を参照）。

表 2.1 日本側の投入（計画・実績）

計画
(1) 専門家派遣 i) 総括／灌漑政策 ii) 灌漑水利組織 iii) 維持管理／水管理 iv) 営農 v) 業務調整／研修 (2) カウンターパート研修（日本ならびに第3国） (3) 機材提供プロジェクト実施に必要な機材
実績
(1) 専門家派遣 i) 総括／灌漑政策 1 ii) 副総括／灌漑政策 2 iii) 灌漑水利組織 iv) 維持管理／水管理 v) 営農 vi) 営農／栄養 vii) 業務調整／研修 viii) 灌漑戦略作成支援 ix) IMT 支援促進 x) 研修運営管理 (2) カウンターパート研修（日本）：5 人 (3) 機材提供プロジェクト実施に必要な機材： 総額：1.3 百万円 i) コピー機 ii) ラップトップ PC iii) テンシオメーター iv) データ表示器 v) 流速計 vi) オートレベル（三脚付） vii) 唐箕機

2.1.2 ルワンダ側の投入

ルワンダ側の投入に係る当初計画と実績を以下に記載する。

表 2.2 ルワンダ側の投入（計画・実績）

計画
(1) C/P の配置 1) プロジェクト・ダイレクター 2) プロジェクト・マネージャー 3) チーフ・インプリメンター

計画
4) 日本人専門家と共に活動する中央、ゾーン、郡レベルの C/Ps (2) プロジェクト事務所ならびに 2 県でのゾーン事務所での会議スペース (3) C/P による現地活動のための費用
実績
(1) C/P の配置 1) プロジェクト・ダイレクター 2) 副プロジェクト・ダイレクター 3) プロジェクト・マネージャー 4) チーフ・インプリメンター 5) 日本人専門家と共に活動する中央、ステーション、郡レベルの TF メンバー (2) プロジェクト事務所及びモデル地区に関するステーション・郡庁内の作業スペース (3) C/P による現地活動のための費用 1) プロジェクト事務所の水道・電気代 2) C/P の交通費 3) 通信費

2.1.3 プロジェクトの活動

基本的なプロジェクト活動の流れについて、成果 1 から 5 を通じ、ベースライン調査等から情報収集・課題分析・目的整理を行い、IP/TP を作成し、モデル地区では IP/TP に沿った形での一連の研修を実施し、技術的な内容のマニュアル・テキスト案を作成した。研修実施と C/P 達との協議を通じ、マニュアル・テキストを段階的に議論し、第 12 回 JCC 会議において承認した。普及を視野に選定した普及対象スキームでは、モデル地区で作成した IP/TP のうち、各普及対象スキームの特色に沿って、コアとなる研修・活動を仮説に基づき特定し、普及対象スキームごとの IP/TP も作成した。普及対象スキームで得られた教訓は、マニュアル・テキスト類にも反映・最終化した。

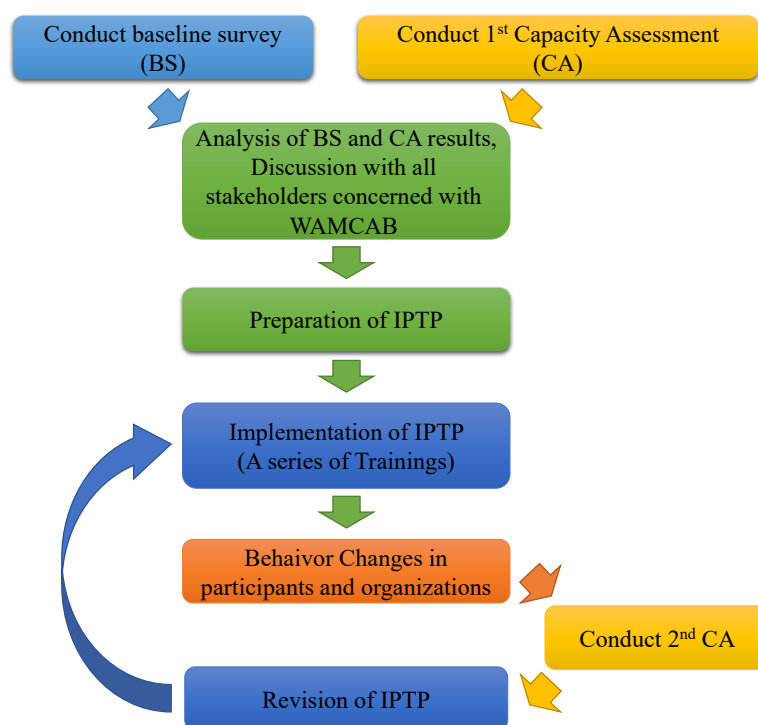


図 2.1 基本的なプロジェクト活動の流れ

下表に示すとおり、一部の活動については運用面を改善しつつ、5つの成果すべてにおいて計画どおりプロジェクト活動を実施した。

表 2.3 プロジェクト活動の計画／実績一覧

計画	実績
成果 1：IMT の実施手順、IWUO の支援体制（役割分担を含む）・支援内容及びモニタリング手法を明確化する。	
1-1：ベースライン調査を通して、現在の IMT の実施手順の課題を整理する。	（計画どおり実施済） プロジェクト開始以降の基礎情報収集及び 2019 年 6 月から 7 月にかけて実施したベースライン調査を通じ、IMT の実施手順に関する情報を収集し、課題を整理した。また、同年 8 月のワークショップ及び第 2 回 TF 会議にて、各郡の整理結果を各関係者に共有した。共有結果の再整理を踏まえ、同年 9 月に最終化した。
1-2：ベースライン調査を通して、IMT 推進及び IWUO への支援に係る役割分担の課題を整理する。	（計画どおり実施済） 1-1 同様、IMT 推進及び IWUO 支援に係る役割分担に関する情報収集・課題整理を行い、ワークショップ及び第 2 回 TF 会議にて、各郡の整理結果を各関係者に共有し、再整理・最終化した。
1-3：ベースライン調査を通して、IWUO への支援システムの課題を整理する。	（計画どおり実施済） 1-1 及び 1-2 同様、IWUO 支援システムに関する情報収集・課題整理を行い、ワークショップ及び第 2 回 TF 会議にて、各郡の整理結果を各関係者に共有し、再整理・最終化した。
1-4：JCC でモデル地区の選定が承認される。	（計画どおり実施済） 第 1 回 JCC において、当初予定されていた東部県のルワマガナ郡、ンゴマ郡に加え、事前調査で対応保留となっていた南部県のギサガラ郡がルワンダ側の強い要望を踏まえ対象郡として承認された。 また、ベースライン調査とその後の各郡でのワークショップでの議論に基づき第 2 回 JCC にて 8 つの灌漑スキームを対象とする計 4 つのモデル地区が承認された。
1-5：上記 1.1～1.3 の課題に対する改善活動を実施する。	（計画どおり実施済） 上述のワークショップ及び第 2 回 TF 会議にて、改善計画／研修実施計画（Improvement Plan and Training Plan：IP/TP）のコンセプトを紹介し、各活動に対する日本側とルワンダ側の役割分担を確認した。 IMT 及び IWUO に関係し、2019 年 11 月の第 3 回 TF 会議にて、日本の政策を紹介した。
1-6：改善状況のモニタリングを実施する。	（計画どおり実施済） 策定した IPTP に沿って、必要な活動やそれらに対するモニタリングを実施した。
1-7：IMT の実施手順、支援体制（役割分担を含む）、支援内容及びモニタリングについての IMT 実施マニュアル（案）を作成する。	（計画どおり実施済） IMT 実施マニュアル（案）を作成するため、必要な活動を実施した。また、5 回のウェビナーを 2020 年 10 月から 2021 年 11 月に実施した。マニュアル第 1 稿は第 16 回 TF 会議で議論し、2025 年 1 月の第 12 回 JCC 会議で承認された。
1-8：C/P が実施する IWUO 政策・戦略と省令の改正案の作成を支援する。	（計画どおり実施済） 1-7 同様、IWUO 政策・戦略と省令の改正案を作成するため、必要な活動を実施した。政策提言第 1 稿は 2021 年 7 月の第 5 回 JCC 会議で議論し、第 12 回 JCC 会議に提出した。
成果 2：モデル地区における IWUO の組織強化が図られる。	
2-1：ベースライン調査を通して現状の課題（IWUO の登録、規則や内規、IMTA の条件、農協との連携、水利権等）を整理する。	（計画どおり実施済） 2019 年 6 月から 7 月にかけて実施したベースライン調査を通じ、対象地区の既存の IWUO に関するデータを収集した。収集したデータは、IWUO のステータス、水利用許可、法人格、IWUO の機能、IMTA 関連の課題点、各 IWUO の能力（財政的及び人的）を確認し、上記の項目により分析し、整理した。 また、IWUO に係る農業省令などの既存の制度も分析の対象とし

計画	実績
	た。調査の分析結果は、2019 年 8 月に開催された第 2 回 TF 会議にて、関係者全員に共有され、TF メンバーや C/P から提案やコメントを収集し、IWUO の現状について最終的なベースライン情報が確定・最終化された。
2-2：上記活動 2-1 を踏まえて、IWUO 管理に係る改善計画（リーダーシップ、会計、総会・理事会及び農協との連携等）作成する。	（計画どおり実施済） ベースライン情報に基づいて実施された分析結果から、既存の灌漑計画の管理を改善するために提案された IWUO 管理モデル（WAMCAB アプローチ）に焦点を当てた IP/TP を作成した。提案された同管理モデルは、まだ具体的に確立されていない農業省令の実施手順を確立することに重点を置いている。 提案された管理モデルに基づいて、IWUO の強化、財務管理、参加型モニタリングや評価など、IWUO のリーダーシップを発揮するための様々なマニュアルを作成した。
2-3：改善計画を踏まえ、C/P に講師としての研修を実施する。	（計画に変更なく、運用面を改善して実施済） 提案された管理モデルと研修マニュアルは、C/P 及び TF メンバーへ共有された。2021 年 10 月に C/P と TF メンバーに対して様々なワークショップが実施され、C/P からのコメントや提案を収集した。一方で、COVID-19 の発生により、技術フェーズの 1 年間の延長する必要が生じ、期間の延長が承認された。
2-4：IWUO 運営強化マニュアル（案）を作成する。	（計画どおり実施済） 提案された管理モデルを使用し、既存の IWUO を末端の施設である取水口ごとに設置した灌漑ユニットを基本単位として、幹線水路、分水堰、灌漑スキーム全体に至るボトムアップのアプローチ ¹ により再編成し、IWUO の強化に下部レベルの組織を活用できるようにした。 この状況を踏まえ、IWUO の能力強化、財務管理、参加型モニタリングと評価など各種マニュアル（案）が作成された。これらに対するコメントや提案を受けて IWUO 運営能力を強化するためのマニュアルが作成され、2025 年 1 月の第 12 回 JCC 会議で承認された。
2-5：モデル地区において C/P 講師により IWUO への研修を実施する。	（計画に変更なく、運用面を改善して実施済） IP/TP に沿って、また、WAMCAB の現地スタッフの協力を得て、TF メンバーは主に 2021 年から 2023 年までの期間に実施されたモデル地区の IWUO 及び農協リーダーに対する研修を実施した。より高い成果を出すため、リーダーシップの強化、財務管理、モニタリング及び評価研修が実施された。IWUO の下位レベルのリーダーに対して、スキームの施設や配置図及び管理責任の認識を高めることに焦点を当てた研修も実施された。 普及対象スキームでは、上記と同様の実施体制で IWUO 及び農協関係者へ研修を実施した。一方で、普及対象スキームの IP/TP は、コアとなる研修に絞って作成した。将来の WAMCAB で整備された研修資料の実施主体を想定し、サービスプロバイダー（Service Provider：SP）も研修へ招待し、彼らからのフィードバックを受けた。
2-6：上記 2-5 の実践を踏まえ、マニュアルの改善を行う。	（計画どおり実施済） 2022 年 11 月に、作成した研修マニュアルの改善方法について C/P と TF メンバーで 3 日間のワークショップを実施した。関係者よりコメントや提案を収集し、最終的な研修マニュアルが作成された。
2-7：IWUO 管理に係るモニタリ	（計画どおり実施済）

¹ ルワンダにおける IWUO では、理事会等からのトップダウン式の指示により施設の維持管理、用水配分等に行われ、個々の組合員の参画や要望の反映が限定されている事例が多い、このため本プロジェクトでは、末端施設（取水口）ごとに設立した灌漑ユニットを基本単位として、幹線水路、分水堰、灌漑スキーム全体に至るボトムアップのアプローチにより組織を再編成し、個々の組合員の要望や意向が IWUO 幹部に伝わり、参加型組織としての主体性を持った運営に生かされる形態とした。

計画	実績
ング・評価システムを立ち上げる。	IWUO 財務管理のモニタリングの一環として、郡庁による歳出の承認システムが確立された。郡庁は、IWUO が年次行動計画に沿って四半期ごとに要求する予算の承認に関与する。 加えて、ルワマガナ郡では IWUO の活動をモニタリングするための技術チーム（技官、農務官、農協職員、IWUO 代表及びマネージャーで構成）が郡庁の発意により主体的に設立されている。
2-8：モニタリング及び評価を実施する。	（計画どおり実施済） 郡レベルでは、郡灌漑運営委員会（District Irrigation Steering Committee：DISC）会議が年に2回開催され、IWUO の活動をモニタリングする役割を果たしている。同会議では、IWUO は財務諸表及び行動計画に従って実施された活動を報告する必要がある、その報告が実施されるようになった。
成果3：モデル地区における維持管理が適正に行われる。	
3-1：ベースライン調査を通して、維持管理の現状及び課題を整理する。	（計画どおり実施済） プロジェクト開始以降の基礎情報収集及び2019年6月から7月にかけて実施したベースライン調査を通じ、灌漑地区における維持管理の現状に関する情報を収集し、課題を整理した。また、8月のワークショップ及び第2回TF会議にて、各郡の整理結果を各関係者に共有した。共有結果を踏まえた再整理を行い、9月に最終化した。
3-2：上記3-1を踏まえ、モデル地区の維持管理計画（案）を作成する。	（計画どおり実施済） 前掲の課題及び対応策案の検討結果に基づき、より詳細な研修活動項目の検討が行われ、対象地区ごとの研修項目案が決定された。 2019年11月の第3回、2020年2月の第4回、2020年7月の第5回TF会議においてIP/TP案の協議をC/Pと行い、2020年8月の第3回JCC会議において、IP/TPが承認された。
3-3：維持管理計画（案）を踏まえ、C/Pに講師としての研修を実施する。	（計画に変更なく、運用面を改善して実施済） 後述のとおり、C/PやTFメンバーの活動予算の制約や本来業務が多忙なことにより、想定されていたC/PやTFメンバーが十分に活動できないことが判明したため、OJTの形式でC/PやTFメンバーを研修に呼び、講師としての技術習得を促した。
3-4：維持管理マニュアル（案）を作成する。	（計画どおり実施済） 2020年から2021年のモデル地区での活動を基に維持管理マニュアル（案）を作成した。 2022年5月に維持管理マニュアル（案）策定に係るTFメンバー及びFC向けのワークショップを開催した。マニュアル（案）の内容に関するグループごとの協議を行い、追記が必要な内容や改善点を取りまとめるとともに、2022年6月から12月にかけてTFメンバーが講師となって各モデル地区でマニュアル（案）を用いた研修スケジュールを策定した。
3-5：モデル地区においてC/P講師によりIWUOへの研修を実施する。	（計画に変更なく、運用面を改善して実施済） モデル地区では、前掲の2022年5月のマニュアル（案）に関するワークショップの際に、同マニュアルを用いTFメンバーが講師となって研修を実施するスケジュールを策定した。そのスケジュールに沿って、各モデル地区において、ナショナルスタッフ（National Staff：NS）の支援を受けながらIWUOや農協関係者への研修のうち一部を講師として実施した。 普及対象スキームでは、上記と同様の実施体制でIWUO及び農協関係者へ研修を実施した。一方で、普及対象スキームのIP/TPは、コアとなる研修に絞って作成した。将来のWAMCABで整備された研修資料の実施先を想定し、SPも研修へ招待し、彼らからのフィードバックを受けた。
3-6：上記3-5の実践を踏まえ、マニュアルの改善を行う。	（計画どおり実施済） 2023年1月にマニュアル（案）最終化ワークショップをTFメンバー及びFCが参加し実施した。マニュアルの最終化のため参加

計画	実績
	者ごとにフィードバックを記入し、その内容を基にグループワークを行い、グループ内でフィードバックをまとめ、全体に発表するという内容で実施し、マニュアルの改善を行った。
3-7: モニタリング及び評価を実施する。	<p>(計画どおり実施済)</p> <p>能力強化のモニタリング・評価システムとしてプロジェクトで導入しているカークパトリック手法に基づき、各活動のモニタリング及び評価を実施した。研修への満足度（レベル1）、ミニテストを用いた理解度（レベル2）、質問票を用いた行動変化（レベル3）、組織の生産性向上（レベル4）の4段階に分けて実施した。モニタリング及び評価はTFメンバーが実施者として行い、分析結果から達成項目と未達成項目が明確となり、その後の研修内容改善に生かされるとともに、C/P及びTFメンバーにおける自己研鑽意識の向上に繋がった。</p> <p>なお、レベル4評価として実施したキャパシティアセスメントの結果（2.2.2で後述）はTF会議やJCC会議において共有された。</p>
成果4: モデル地区における水管理が適正に行われる。	
4-1: ベースライン調査を通して、灌漑地区の水管理及び圃場レベルの水管理の現状及び課題を整理する。	<p>(計画どおり実施済)</p> <p>プロジェクト開始以降の基礎情報収集及び2019年6月から7月にかけて実施したベースライン調査を通じ、水管理の現状に関する情報を収集し、課題を整理した。また、8月のワークショップ及び第2回TF会議にて、各郡の整理結果を各関係者に共有した。共有結果を踏まえた再整理を行い、9月に最終化した。</p>
4-2: 上記4-1を踏まえ、モデル地区の水管理計画(案)を作成する。	<p>(計画どおり実施済)</p> <p>前掲の課題及び対応策案の検討結果に基づき、より詳細な研修活動項目の検討が行われ、対象地区ごとの研修項目案が決定された。</p> <p>2019年11月の第3回、2020年2月の第4回、2020年7月の第5回TF会議においてIP/TP案の協議をC/Pと行い、2020年8月の第3回JCC会議において、IP/TPが承認された。</p>
4-3: 水管理計画(案)を踏まえ、C/Pに講師としての研修を実施する。	<p>(計画に変更なく、運用面を改善して実施済)</p> <p>後述のとおり、C/PやTFメンバーの活動予算の制約や本来業務が多忙なことにより、想定されていたC/PやTFメンバーが十分に活動できないことが判明したため、OJTの形式でC/PやTFメンバーを研修に呼び、講師としての技術習得を促した。</p>
4-4: 水管理改善マニュアル(案)を作成する。	<p>(計画どおり実施済)</p> <p>2020年から2021年のモデル地区での活動を基に水管理改善マニュアル(案)を作成した。</p> <p>2022年5月に、作成された水管理改善マニュアル(案)に係るTFメンバー及びFC向けのワークショップを開催した。マニュアル(案)の内容に関するグループごとの協議を行い、追記が必要な内容や改善点を取りまとめるとともに、2022年6月から12月にかけてTFメンバーが講師となって各モデル地区でマニュアル(案)を用いた研修スケジュールを策定した。</p>
4-5: モデル地区においてC/P講師によりIWUOへの研修を実施する。	<p>(計画に変更なく、運用面を改善して実施済)</p> <p>モデル地区では、前掲の2022年5月のマニュアル(案)に関するワークショップの際に、同マニュアルを用いTFメンバーが講師となって研修を実施するスケジュールを策定した。そのスケジュールに沿って、各モデル地区において、NSの支援を受けながらIWUOや農協関係者への研修のうち一部を講師として実施した。</p> <p>普及対象スキームでは、上記と同様の実施体制でIWUO及び農協関係者へ研修を実施した。一方で、普及対象スキームのIP/TPは、コアとなる研修に絞って作成した。将来のWAMCABで整備された研修資料の実施先を想定し、SPも研修へ招待し、彼らからのフィードバックを受けた。</p>
4-6: 上記4-5の実践を踏まえ、	(計画どおり実施済)

計画	実績
マニュアルの改善を行う。	2023 年 1 月にマニュアル（案）最終化ワークショップを TF メンバー及び FC が参加し実施した。マニュアルの最終化のため参加者ごとにフィードバックを記入し、その内容を基にグループワークを行い、グループ内でフィードバックをまとめ、全体に発表するという内容で実施し、マニュアルの改善をおこなった。
4-7：モニタリング及び評価を実施する。	<p>（計画どおり実施済）</p> <p>能力強化のモニタリング・評価システムとしてプロジェクトで導入しているカークパトリック手法に基づき、各活動のモニタリング及び評価を実施した。研修への満足度（レベル 1）、ミニテストを用いた理解度（レベル 2）、質問票を用いた行動変化（レベル 3）、組織の生産性向上（レベル 4）の 4 段階に分けて実施した。モニタリング及び評価は CP や TF メンバーが実施者として行い、分析結果から達成項目と未達成項目が明確となり、その後の研修内容改善に生かされるとともに、C/P 及び TF メンバーにおける自己研鑽意識の向上に繋がった。</p> <p>なお、レベル 4 評価として実施したキャパシティアセスメントの結果（2.2.2 で後述）は TF 会議や JCC 会議において共有された。</p>
成果 5：モデル地区における営農活動が促進される。	
5-1：ベースライン調査を通して、普及体制、営農に係る現状及び課題を整理する。	<p>（計画どおり実施済）</p> <p>プロジェクト開始以降の基礎情報収集及び 2019 年 6 月から 7 月にかけて実施したベースライン調査を通じ、普及体制、営農に係る情報を収集し、Problem Tree 等で課題を整理した。また、8 月のワークショップ及び第 2 回 TF 会議にて、各郡の整理結果を各関係者に共有した。共有結果を踏まえた再整理を踏まえ、9 月に最終化した。</p>
5-2：関連プロジェクトの実施を通して得られた経験や教訓をもとに、適切な営農技術を抽出する。	<p>（計画どおり実施済）</p> <p>5-1 同様、普及体制、営農に係る役割分担に関する情報収集・課題整理を行い、ワークショップ及び第 2 回 TF 会議にて、各郡の整理結果を各関係者に共有し、再整理・最終化した。なお、情報収集は C/P や民間企業、Horticulture Center of Excellence や USAID などのドナー、SMAP などの JICA プロジェクトを対象に行った。2019 年 11 月の第 3 回、2020 年 2 月の第 4 回、2020 年 7 月の第 5 回 TF 会議において IP/TP 案の協議を C/P と行い、2020 年 8 月の第 3 回 JCC 会議において、IP/TP が承認された。</p>
5-3：抽出された適正な営農技術を実践させるために、C/P に講師としての研修を実施する。	<p>（計画に変更なく、運用面を改善して実施済）</p> <p>後述のとおり、C/P や TF メンバーの活動予算の制約や本来業務が多忙なことにより、想定されていた C/P や TF メンバーが十分に活動できないことが判明したため、OJT の形式で C/P や TF メンバーを農家研修に呼び、講師としての技術習得を促した。研修は前述のとおり、IP/TP に沿って実施した。</p> <p>2023 年 5 月～6 月には、普及対象スキームで研修講師を務める SP、農協アグロノミスト、TF メンバーを対象にプレ研修を実施し、講師として技術を指導できるように育成した。</p>
5-4：営農研修テキストを作成する。	<p>（計画どおり実施済）</p> <p>5-3 の適正な営農技術を集約するとともに、対象灌漑スキームの優良事例や教訓を整理した営農研修テキストを作成した。</p> <p>営農研修テキストは、栽培技術（園芸、稲作）、市場開拓、農協管理、IWUO との連携の 4 部構成としている。先行案件 SMAP のマニュアルは小規模農家を対象にした内容であるのに対し、本テキストは灌漑スキーム下にある農協に特化した内容とし、求められる栽培技術や適切なグループ管理方法、IWUO を含む関係者との調整を中心にまとめた。</p> <p>テキスト案を作成後、2023 年 4 月に C/P 及び TF メンバー向けにワークショップを実施し、現地から寄せられたコメントや変更点の反映を対応した。</p> <p>普及対象スキームに対しては、講師となるアグロノミストや SP</p>

計画	実績
5-5：モデル地区において C/P 講師により研修を実施する。	<p>に配布し、研修教材として活用した。</p> <p>(計画に変更なく、運用面を改善して実施済)</p> <p>カスケード式の研修実施体制について見直しを行い、研修の初期段階から裨益者（IWUO や農協メンバー）を巻き込み、郡行政の関与をモニタリング・評価等に特化させる新しい実施体制を試行するため、2020 年 2 月に 3 郡モデル地区の IWUO 及び農協代表を対象に成果 5 に係るプレ研修とモニタリング・評価を実施した。</p> <p>モデル地区では、IP/TP に沿って、TF メンバーが研修講師を務め、栽培技術研修や農協管理・ジェンダー研修、マーケット研修、スタディツアー等を実施した。なお、栽培技術研修は地区内にてデモ圃場を設置し、圃場整備・播種から収穫まで一連の技術研修を実施した。</p> <p>普及対象スキームでは、IP/TP は、コアとなる研修に絞って作成した。また、SP や農協アグロノミストが研修講師を務め、デモ圃場や農家所有の圃場を用いた栽培技術研修、農協管理・ジェンダー研修、マーケット研修を実施した。</p>
5-6：各活動のモニタリング及び評価を実施する。	<p>(計画どおり実施済)</p> <p>能力強化のモニタリング・評価システムとしてプロジェクトで導入しているカークパトリック手法に基づき、各活動のモニタリング及び評価を実施した。研修への満足度（レベル 1）、ミニテストを用いた理解度（レベル 2）、質問票を用いた行動変化（レベル 3）、組織の生産性向上（レベル 4）の 4 段階に分けて実施した。モニタリング及び評価は CP や TF メンバーが実施者として行い、分析結果から達成項目と未達成項目が明確となり、その後の研修内容改善に生かされるとともに、C/P 及び TF メンバーにおける自己研鑽意識の向上に繋がった。</p> <p>なお、レベル 4 評価として実施したキャパシティアセスメントの結果（2.2.2 で後述）は TF 会議や JCC 会議において共有された。</p>

2.2 プロジェクトの達成度

2.2.1 成果及び指標

5 つの成果ごとに指標が設定されており、5 つの成果指標はすべて達成された。成果指標とされているマニュアル類は、2025 年 1 月開催の第 12 回 JCC 会議で承認された後、RAB のウェブサイトで開催されるとともに、技術検討会・普及セミナー等の教材として使用され、持続的灌漑スキーム管理アプローチの全国展開に向けて活用される予定となっている。

下表に成果ごとの指標に関する達成状況の評価を示す。

表 2.4 成果指標及びその達成状況一覧

指標	達成状況
成果 1	
IMT 実施マニュアルが JCC で承認される。	<p>(指標は達成された)</p> <p>IMT 実施マニュアルは、2023 年 2 月開催の第 16 回 TF 会議にて素案が提案・議論された。2024 年 11 月の RAB 技術承認セミナーにて内容面が最終協議され、2025 年 1 月開催の第 12 回 JCC 会議にて最終版が提出・承認された。</p> <p>IMT 実施マニュアルには IWUO マネジメントに関する灌漑管理モデルの内容も含まれている。</p>

指標	達成状況
成果 2	
IWUO 運営改善マニュアルが JCC で承認される。	<p>(指標は達成された)</p> <p>IWUO 運営改善マニュアルは、以下の 3 つの章立てで構成される。2024 年 11 月の RAB 技術承認セミナーにて内容面が最終協議され、2025 年 1 月開催の第 12 回 JCC 会議にて最終版が提出・承認された。</p> <p>(1) IWUO 組織強化マニュアル (2) 財務管理マニュアル (3) モニタリング・評価マニュアル</p> <p>これは 2023 年 1 月から 2 月にかけて、研修教材を含め各モデル地区で試行され、加えて、TF メンバーからのフィードバックを受領・反映され最終化された。</p>
成果 3	
維持管理マニュアルが JCC で承認される。	<p>(指標は達成された)</p> <p>維持管理マニュアルは、モデル地区での活動を基に、参加型灌漑管理の重要性、基礎土木技術、農道補修と言った、灌漑地区の維持管理に必要な概念及び技術に関する内容で構成される。普及対象スキームでの研修活動から得た気づきや知見を踏まえ、マニュアルや研修資料のブラッシュアップ・拡充が行われた。2024 年 11 月の RAB 技術承認セミナーにて内容面が最終協議され、2025 年 1 月開催の第 12 回 JCC 会議にて最終版が提出・承認された。</p>
成果 4	
水管理マニュアルが JCC で承認される。	<p>(指標は達成された)</p> <p>水管理マニュアルは、モデル地区での活動を基に、公平な水配分の重要性、水配分計画の策定、圃場レベルの水管理と言った灌漑地区での水管理に必要な概念及び技術に関する内容で構成される。成果 3 同様、普及対象スキームでの研修活動から得た気づきや知見を踏まえ、マニュアルや研修資料のブラッシュアップ・拡充が行われた。2024 年 11 月の RAB 技術承認セミナーにて内容面が最終協議され、2025 年 1 月開催の第 12 回 JCC 会議にて最終版が提出・承認された。</p>
成果 5	
モデル地区で選定された営農方法が実践される。	<p>(指標は達成された)</p> <p>プロジェクトの活動にて既述のとおり、モデル地区で選定された灌漑営農方法の実践に向け、IP/TP を策定し、IP/TP の実施を通じ、灌漑スキームに特化した営農活動や効果のあった栽培技術や SHEP アプローチに基づいた活動を特定できたため、それらを灌漑営農研修テキストとしてまとめた。IP/TP のうち、現状に即していなかったパーボイルドライス作成のような研修や活動は TF メンバーと合意の上実施しないこととし、IP/TP にも反映させた。成果 3 及び 4 同様、普及対象スキームでの研修活動から得た気づきや知見を踏まえ、営農研修テキストのブラッシュアップ・拡充が行われた。</p>

2.2.2 プロジェクト目標と指標

プロジェクト目標には 2 つの指標が設定されている。下表に示すプロジェクト目標の指標に対する評価を踏まえ、プロジェクト目標は達成された。

表 2.5 プロジェクト目標の指標及びその達成状況一覧

指標	達成状況
1. IMT の実施手順、IWUO の	<p>(指標は達成された)</p> <p>モデル地区の 3 つの IWUO (ンゴマ、チャルホゴ、ンギリ) 及び 1 つの SMC (ニ</p>

指標	達成状況						
支援体制（役割分担を含む）が整備され、モデル地区のIWUOの組織能力が70%以上に改善される。	ヤブヨゲラ）を対象にキャパシティアセスメントを実施した。2023年2月に実施した第2回キャパシティアセスメントの結果でも、既に全てのモデル地区において、目標値である70%が達成されている。最終となった第3回キャパシティアセスメントの結果では、それが94.8%となった。第1回から第3回までの結果及び増加率を以下に示す。						
	モデル地区	実施回 *1	合計 スコア	環境 基盤	テクニカル キャパシティ	コア キャパシティ	組織能力 *2
	ンゴマ	1回目	37.1 %	79.2 %	32.3 %	23.3 %	27.8 %
		2回目	74.1 % (+37.0 %)	41.7 % (-37.5 %)	86.0 % (+53.7 %)	79.0 % (+55.7 %)	82.7 % (+54.9 %)
		3回目	80.3 % (+43.2 %)	45.8 % (-33.4 %)	89.2 % (+56.9 %)	89.7 % (+66.4 %)	89.4 % (+61.6 %)
	チャルホゴ	1回目	38.0 %	66.7 %	23.5 %	38.3 %	30.9 %
		2回目	85.3 % (+47.3 %)	50.0 % (-16.7 %)	96.2 % (+72.7 %)	92.9 % (+54.6 %)	94.7 % (+63.8 %)
		3回目	93.7 % (+55.7 %)	75.0 % (8.3 %)	98.6 % (+75.1 %)	98.8 % (+60.5 %)	98.7 % (+67.8 %)
	ンギリ	1回目	58.3 %	79.2 %	48.9 %	49.8 %	49.4 %
		2回目	80.2 % (+21.9 %)	12.5 % (-66.7 %)	97.8 % (+48.9 %)	98.8 % (+49.0 %)	98.3 % (+48.9 %)
		3回目	91.6 % (+33.3 %)	66.7 % (-12.5 %)	98.8 % (+49.9 %)	97.6 % (+47.8 %)	98.3 % (+48.9 %)
	ニャブヨゲラ	1回目	43.6 %	79.2 %	24.2 %	48.6 %	36.4 %
		2回目	71.8 % (+28.2 %)	8.3 % (-70.9 %)	80.3 % (+56.1 %)	98.4 % (+49.8 %)	90.4 % (+52.3 %)
		3回目	76.7 % (+33.1 %)	16.7 % (-62.5 %)	87.8 % (+63.6 %)	98.4 % (+49.8 %)	92.8 % (+56.4 %)
					平均	1回目	36.1 %
						2回目	91.3 % (+55.0 %)
						3回目	94.8 % (+58.7 %)
					増加率	252 % (第2回平均/第1回平均)	
						263 % (第3回平均/第1回平均)	
	*1：第1回キャパシティアセスメントはンゴマ、ンギリ及びニャブヨゲラは2020年9月時点、チャルホゴはIWUO設立後の2021年1月時点の数値。						
	*2：組織能力はテクニカルキャパシティ（TC）とコアキャパシティ（CC）の個別の達成率の単純平均。						
	*3：括弧内、+または-の数値は第1回時の結果との差異を示す。						
	*4：ンゴマ地区、ンギリ地区、ニャブヨゲラ地区では環境基盤のスコアダウンが確認されたが、これは第1回時の回答者のIWUOに関する理解が乏しく、正しく回答できていなかったため過大評価されていたと考えられる。プロジェクト開始時は、IWUO 管理に関する政策・方針は不明瞭で、行政からのサポートもほとんどなかったため、実際の点数は0点同等といえる。これを踏まえ、第2回目のキャパシティアセスメントからは能力のレベルを正しく評価できるよう各質問に4段階の評価基準を設けた。						
2. モデル地区のIWUOの能力強化のための優先度の高い合意計画（組	(指標は達成された) COVID-19の影響によるC/PやTFメンバーのモデル地区の活動への巻き込み不足などにより多少の遅れがあったものの、技術指導フェーズの1年間の延長を経て、優先度の高い合意計画（IP/TPにおける最重要項目）は全て実践された。 評価指標における優先度の高い合意計画の考え方は本表の下にあるボックスに、						

指標	達成状況
組織運営、維持管理、水配分、営農）がすべて実践される。	各モデル地区での研修ごとの優先度（High、Midium、Low）の適用は別添 1-8 に示す。

上記指標の達成度を評価するにあたり、以下の考え方によりプロジェクト目標の指標数値を設定し、後述のとおり PDM を改訂した（第 2 回改訂）。

(Box) プロジェクト目標の指標数値設定の考え方

指標数値 1 の設定

モデル地区	スキーム調査の結果 IWUO の満足度	第 1 回キャパシティアセスメントの結果				提案	
		合計スコア	環境基盤	テクニカルキャパシティ (TC)	コアキャパシティ (CC)	組織能力 (TC&CC) の合計※1	
						現状	目標値
Ngoma	20 % <	37.1 %	79.2 %	28.1 %	23.3 %	25.9 % (25.7 %)	70 %以上
Rwamagana	N/A	38.0 %	66.7 %	23.5 %	38.3 %	30.4 % (30.9 %)	70 %以上
Ngiriyi	60 < 80 %	58.3 %	79.2 %	55.2 %	49.8 %	52.7 % (52.5 %)	70 %以上
(Nyiramageni)	N/A						-
Nyabuyogera	60 < 80 %	43.6 %	79.2 %	24.2 %	45.4 %	24.1 % (34.8 %)	70 %以上
※1 TC と CC の合計値 (45 点満点) を 100% としたときの達成率を表す。括弧内は TC と CC 個別の達成率の単純平均を示す。					平均	33.3%	70 %以上
					増加率	186%	

< 目標値設定の参考情報 >

- すべての項目が 4 段階中上から 2 段階目の評価を得る状態: TC&CC 67%
- IWUO の登録状況及び IMTA の締結条件に係る項目が 4 段階中上から 1 段階目の評価、その他すべての項目が 4 段階中上から 2 段階目の評価を得る状態: TC&CC 72%
- 典型的な灌漑地区及び優良事例地区における比較調査結果の平均は TC&CC 65% であり、そのうち優良事例地区と呼ばれる 2 地区 (Cyili と Rurambi) の結果の平均は TC&CC 76% である。
- したがって、目標値 70% 以上は、IWUO が正式に登録され、IMTA の締結条件を概ね満たし、優良事例地区として他の地区のモデルになりうる状態と言える。

指標数値 2 の設定

モデル地区	合意計画の数（※括弧内は改善計画／研修実施計画の総数）			
	成果 2	成果 3&4	成果 5	合計
Ngoma	11(12)	12(17)	11(23)	34(52)
Rwamagana	11(13)	12(16)	10(21)	33(50)
Ngiriyi	11(12)	12(17)	10(21)	33(50)
Nyabuyogera	11(12)	12(17)	11(22)	34(51)

モデル地区	指標とする最重要項目の数／合意計画の総数			
	成果 2	成果 3&4	成果 5	目標値
Ngoma	6/11	6/12	5/11	17/34 (50 %)
Rwamagana	6/11	5/12	4/10	15/33 (45 %)
Ngiriyi	6/11	5/12	4/10	15/33 (45 %)
Nyabuyogera	5/11	6/12	5/11	16/34 (47 %)

< 指標の対象となる改善計画／研修実施計画及び目標値設定の参考情報 >

- 組織運営、維持管理、水管理、営農に係る項目 (成果 2～5) を指標の対象とし、以下のクライテリアにより、指標の対象となる IWUO 能力強化のための研修実施計画を合意計画として選定する。

- (1) ルワンダ側が持続的に WAMCAB アプローチを全国展開するための「灌漑スキーム管理能力強化ガイダンス」及び「アクションプラン」のベースとなること
- (2) ルワンダ側(カウンターパート、IWUO 及び FC)が主体となって実施する項目であること
- 上記合意計画のうち、IWUO の能力強化に必須となる最重要項目(High)の全て(地区ごとに 45～50%)を実施することを指標とする。なお、各地区の状況に応じて、さらなる改善に資する項目(Medium、Low)についても取り組みを進めることとする。
 - 最重要項目(High)に該当する合意計画を下表に整理する。

S/N	テーマ	内容	備考
2-3	IWUO 構築・再構築	下部組織の設立と選挙の実施	
2-5	規約の制定	規約の作成支援、各グループの役割・責任の明確化、アクションプランの策定支援、総会における承認	
2-7	財務管理研修	水利費徴収・管理に係る研修、維持管理用の積立金	
2-8	モニタリング・評価	DISC と RAB によるモニタリング・評価システムの構築、実施	
2-9	組織運営	維持管理マニュアルの作成、スキーム運営・管理の実施、水利費(・組合員費)システムの確立	
2-10	IWUO の登録及び IMTA 締結支援	農協との Performance Contract の締結、IWUO の登録と水利権の取得、IMTA の締結	ニャブヨゲラ地区(L)を除く
成果 3・4 共通-1	維持管理/水管理基礎研修(維持管理/水管理における実施体制の構築)	水利用者チーム(WUT)、維持管理チーム(O&M Team)の組織化	
成果 3・4 共通-2,3,4	維持管理/水管理基礎研修	参加型水管理(PIM)研修、灌漑施設利用の基礎・現状課題の共有、ブロックレベルの維持管理/水管理の促進、優良地区へのスタディツアー	
成果 3・4 共通-5	モニタリングとフィードバック	水配分状況のモニタリングと水配分計画への反映	
4-7	丘陵地の維持管理/水管理基礎研修	丘陵地における効率的な水利用と灌漑に係る講義	ルワマガナ地区(M)、ンギリ地区(M)を除く
4-9	水管理基礎研修	土壌水分量・流量・水位のモニタリング、二次・三次水路設立支援、浅井戸(乾期)、足踏みポンプ、貯水タンク等の試験導入	
4-11	水管理に係る能力強化研修	年間水配分計画の策定	
5-1	営農面における実施体制の構築	農作業グループの組織化	
5-3	収益性分析	生産記録やベースライン調査等のデータに基づく作物別の収益性分析	
5-5	農協の能力強化研修	運営、ジェンダー、簿記会計等に係る農協の能力強化研修	
5-7	マーケティング研修	市場志向型農業に係る講義、市場調査・分析	ルワマガナ地区(L)、ンギリ地区(L)を除く
5-8	マーケティング研修	収益性分析に基づく作物・品種選定、作物カレンダーの作成	

キャパシティアセスメントの結果の詳細を IWUO、IWUO-SU、RAB ステーション、郡庁の順に以下に示す。

ンゴマ IWUO		
第1回 (2020年9月)		
第2回 (2023年2月)		
第3回 (2024年10月)		
<p>評価： 第3回の全体のスコアは80.3%で、第1回の37.1%に比べ大きく改善された。</p> <p>平均ECスコアは第1回、第2回、第3回の順で2.3点→1.2点→1.3点であった。 第1回時はIWUOに関する政策・方針は明瞭でIWUOの組織化に係る行政手続きは十分機能していると回答し平均スコアは2点台であったが、詳しく聞くと回答と現状に乖離があり、いずれも改善の余地ありであった。 第3回時には、IWUOの組織化に係る行政手続きが前回に比べ円滑に承認されるようになり、十分機能するようになった。しかし、IWUO担当の郡職員が交代になってから行政からの支援は限定的になっていることや、IWUOの会計士不在で人手不足に陥っていることから、IWUO支援にかかるスコアは下がった。灌漑施設は整備されているが水路の修繕がIWUOの能力を超えており対応できていないため、環境条件にかかるスコアも下がった。</p> <p>平均TCスコアは第1回、第2回、第3回の順で0.8点→2.5点→2.6点と大きく飛躍した。 第2回時で、現地活動に必須となる灌漑カレンダー、年間活動計画(O&M計画含む)は文書化され、適切に事務所に保管されるようになった。特に改善が見られたのは計画に対するフィードバックで、第1回時はなかったが、現在は年2回開催の総会で活動報告されるとともに監査委員会から監査を受け、活動の振り返り・次年の活動計画へ反映されている(TC6:内部評価)。PDCAサイクルが機能し、さらに総会を通じてメンバーへの説明責任を果たしているといえる。 一方、水利費の徴収状況は丘陵地と湿地で大きく異なり、2023年2月時点で丘陵地25~30%、湿地90%であり、これはIWUOの中で最も低い徴収率である。丘陵地で低い理由は、当時契約栽培していたチアシードの契約業者からの支払遅延により水利費の控除がタイムリーにされた</p>		

なかったこと、水利費の意義が十分に農協メンバーに理解されていないためである。シーズン C は作物栽培する農家が少ないため IWUO の収入も落ち込み、個人から徴収するシステムを取っているため、骨の折れる作業である。それを受け、2023 年のシーズン C から試行的に農協を通じた野菜の栽培・出荷及び売上金からの水利費控除の運用を開始し、水利費の徴収率の改善に努めた。その結果、2024 年シーズン C では農協主体で野菜栽培し、売上金から水利費が差し引かれ、新たな IWUO の収入源となった。

第 3 回 CA 時で改善が見られた項目は、TC4：財務管理、TC2：O&M の順であった。TC4 は、丘陵地における水利費が 25% → 40～60%に上がったこと、赤字経営だったのが過去 2 年で黒字が続いていること、がスコアアップの要因である。他方、資金の割り当てができていないため改善が必要である。

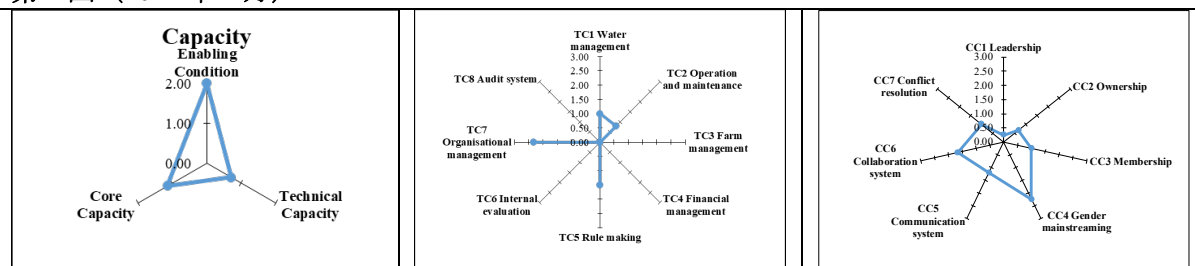
スコアダウンしたのは、TC2：水管理、TC5：内規で、下流側の慢性的な水不足により水争いは解消されていないことや、内規が全農家に認識されていないことが要因である。

平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 0.7 点→2.3 点→2.7 点で、全体的に底上げされた。第 2 回 CA 時に IWUO リーダーを務めていた方は、文書のサイン取り付けが遅延したりするなど、IWUO の活動に影響が生じ、十分な責務を果たしているとは言えない状況であった（CC1：リーダーシップ）。2024 年 10 月時点の新リーダーは WAMCAB 開始以来、IWUO に所属し、丘陵地の所有者把握にも参加していることから活動内容も熟知しており、メンバーからの信頼も厚い様子がうかがえた。実際に、CC1 は 2.6 点→3.0 点満点で、彼のリーダーシップの高さが CC のスコアアップに寄与しているともいえる。CC2：オーナーシップは、これまで農協メンバーから IWUO へのフィードバックシステムが一部のゾーンでは機能していなかったが、現在は全てのゾーンにおいてボトムアップ型で意見が届くようになり、IWUO-農協間の情報伝達システム及び協力体制が強化された。

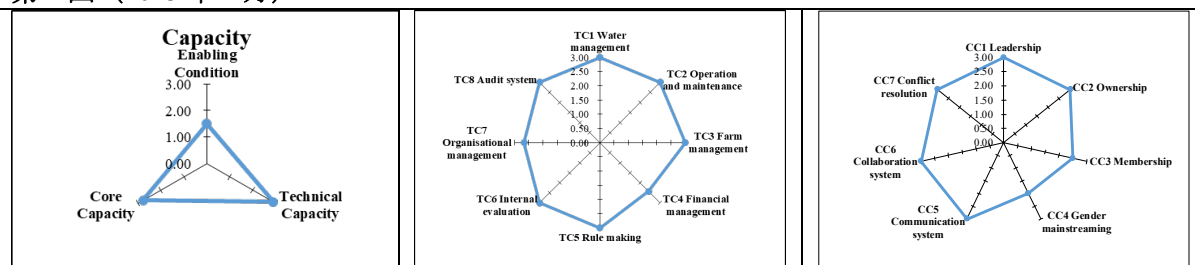
スコアダウンしたのは CC3：メンバーシップで、丘陵地のコミュニティワークの参加率が第 2 回 CA 80 以上から 40～60%に下がった。しかし、IWUO 関係者に「感覚的にはどうか」と実感値を聞くと、シーズン C で野菜栽培されるようになってから、農家の IWUO 活動に対する理解が増えコミュニティワークの参加率は上がっているとコメントした。

チャルホゴ IWUO

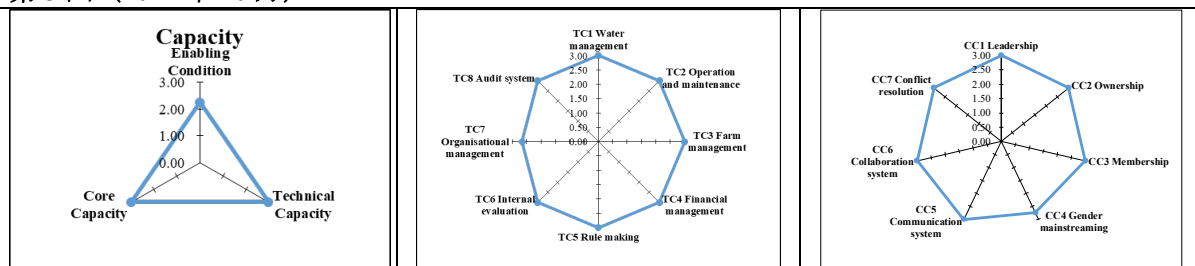
第 1 回（2021 年 1 月）



第 2 回（2023 年 2 月）



第3回（2024年10月）



評価：

第3回の全体のスコアは93.7%で、第1回の38.0%に比べ大きく改善された。

平均 EC スコアは第1回、第2回、第3回の順で2.0点→1.5点→2.2点であった。以前は地方行政からの支援が不十分であったが現在は支援体制が確立されおり、良好な関係が築かれている。また、IWUO 設立に関する法律は規定されていなかったが、現在は法的に定められ行政手続きも十分に機能するようになった。郡からのサポートは非常に手厚く、副郡長が総会に出席した実績もできた。

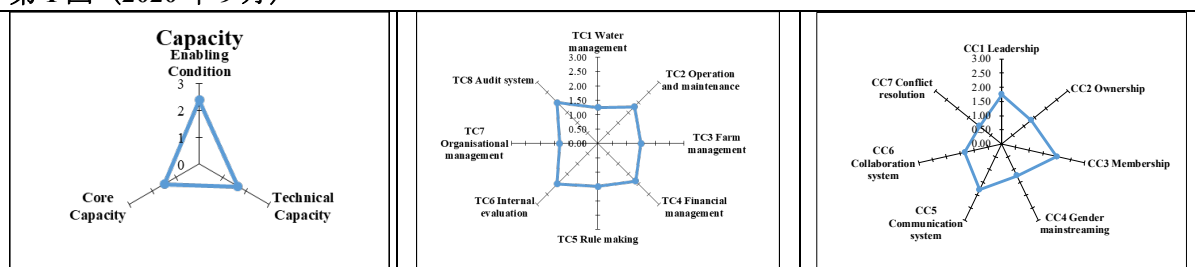
平均 TC スコアは第1回、第2回、第3回の順で0.7点→2.9点→2.9点であった。第2回時点で全体的に底上げされたが、特に大きく改善されたのは財務管理（TC4）、内部評価（TC6）、監査体制（TC8）であった。第2回時の水利費徴収率は湿地・丘陵地関わらず80%以上を維持し、さらに適切なプロセスを経て水利費の増額を実現した。第2回時から第3回時の間で見られた改善点として、第2回時は収支バランスを勘案して水利費を設定していたものの、想定外の洪水による施設の損傷などにより、計画以上の経費がかかり2022～2023年は赤字が続いていたが、2024年は水利費以外の養殖、牧草、罰金による収入が増えたことにより収支バランスは黒字が続くようになった。さらに水利費徴収率は92%まで上がり、銀行口座にアクセスできない農家には直接徴収しに行っている。また、資金（長期計画・補修用準備金）が適切に割り当てられ、制度化されていない灌漑信託拠出金も準備金に手を付けられない状態で別口座に預金されており、このような資金管理はチャルホゴ IWUO だけで確認された。その他、プロジェクト前は開催されなかった監査も現在は定期的実施されるようになった。

平均 CC スコアは第1回、第2回、第3回の順で1.1点→2.8点→2.9点であった。改善が見られたのは、CC3：メンバーシップとCC4：ジェンダーだった。第2回時は一定数の農家しか所属するゾーンや取水エリアを知らなかったが、現在は誰に聞いても答えられる状態となった。ジェンダーでは、委員会メンバーに女性の占める割合が増えたことに加え、コミュニティワークなどのIWUO活動への女性参加率が上がった。他方で、女性の研修参加の機会も改善傾向にあるが、世帯主である夫が優先される傾向にあるため参加率は依然として低い。

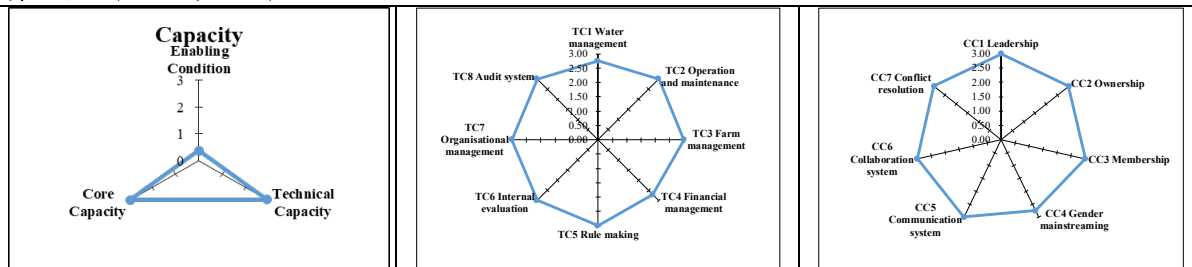
CC1：リーダーシップを示すIWUOのビジョンをリーダーに聞くと、第2回時は「農家全員に公平な水配分をする」と回答し、第3回時は「アフリカでナンバーワンのIWUO」と回答し、事務所の壁にも掲げられている。やや野心的な目標ではあるが、ホストとして他郡や他国からの視察を受け入れることで自信が付き、より高みを目指している状態である。

ンギリ IWUO

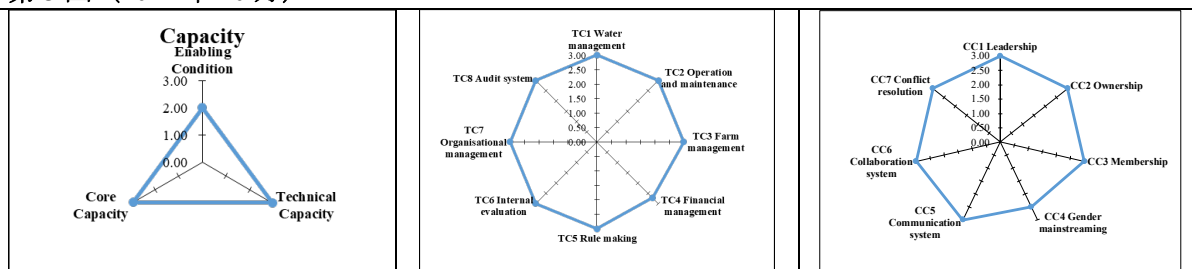
第1回（2020年9月）



第2回（2023年2月）



第3回（2024年10月）



評価：

第3回の全体のスコアは91.6%で、第1回の58.3%に比べ大きく改善された。

平均 EC スコアは第1回、第2回、第3回の順で2.3点→0.3点→2.0点であった。

第1回から第2回で2.3点→0.3点と大きく下がったが、これは第1回の過大評価によるものである。第2回から第3回で0.3点→2.0点と上がった。これは、IWUOが正式に登録されたこと、郡・RABステーションからのサポートが手厚くなったことによる。これまで郡やRABステーションに技術的な支援を要請しても対応できる人材がいなかったが、現在は両機関が真摯に対応している。例えば、堆砂や丘陵地からの土砂流出を両機関に報告したところ、RABステーションが問題提起した。特に、郡職員の責任感が強まり、サービスプロバイダーとの連携がうまく取れていると印象を受けた。

平均 TC スコアは第1回、第2回、第3回の順で1.6点→2.9点→2.9点と、第2・3回時には満点に近いスコアを獲得した。大きな改善が見られたのは水管理（TC1）で、AWD手法により灌漑不足面積の減少、過去2年で90%という高い水利費徴収率を達成したことによる。また、郡に提出する活動計画やExpense Orderには、写真付きで現状の課題が説明されており、現場に行けずとも概況が把握できる資料になるように工夫されていた（TC2：計画・設計）。2023年2月時点で収支は過去2年黒字で、これはンギリIWUOのみで達成されており、大きな成果といえる（TC4：財務管理）。

第3回時点は第2回時点のキャパシティが維持されていたが、他のIWUOには見られなかった財務管理（TC4）の工夫を確認できた。本来の活動費の承認プロセスは、IWUOが各活動にExpense orderを作成し、郡に提出・承認得るというものだが、郡とのやり取りが増え互いの労力がかかるため、承認プロセスの省力化のため、1年分のExpense Orderを郡に提出し、活動費を一括で受け取り、活動費が必要なタイミングで内部のExpense OrderをIWUO Presidentに提出し、活動費を拠出している。

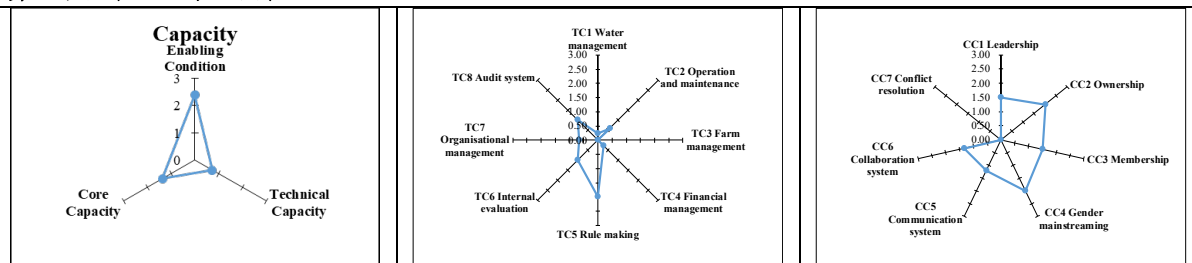
平均 CC スコアは第1回、第2回、第3回の順で1.5点→2.9点→2.9点と、第2・3回時には満点に近いスコアを獲得した。

IWUOは毎週の活動を計画し、関係者に報告している。メンバーからIWUOに要望・相談事項がある場合、IWUO宛にレターを出せば、翌週に現場を訪問してくれる。フィードバック体制が確立されていた（CC2：オーナーシップ）。シーズンCでは個人で野菜栽培している農家を把握し水利費も徴収できており、農協とIWUOの良好な関係性のもと成り立っている動きといえる（CC6：協力体制）。第3回時点も同じ状態が継続されており、他に見られた成果として、リハビリに必要な資金が足りなかったときは、農協の協力により28百万Rwfが集金された。

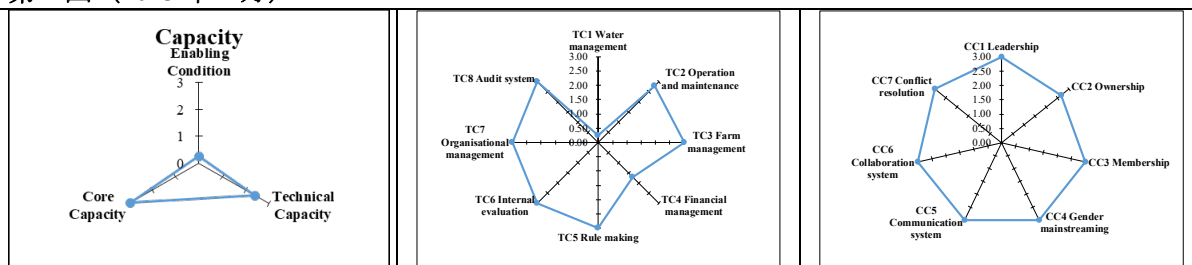
(CC2：オーナーシップ)。ジェンダーでは国の政策設定を上回る女性の参加 40%に設定しているのも特徴的である(CC4：ジェンダー主流化)。現在の収入源は、水利費と堆砂の売上金だが、近い将来バッファゾーンに植えたサトウキビの販売も予定しており、収入源の多角化も視野に入れた課題解決ができることは特筆される。

ニャブヨゲラ SMC

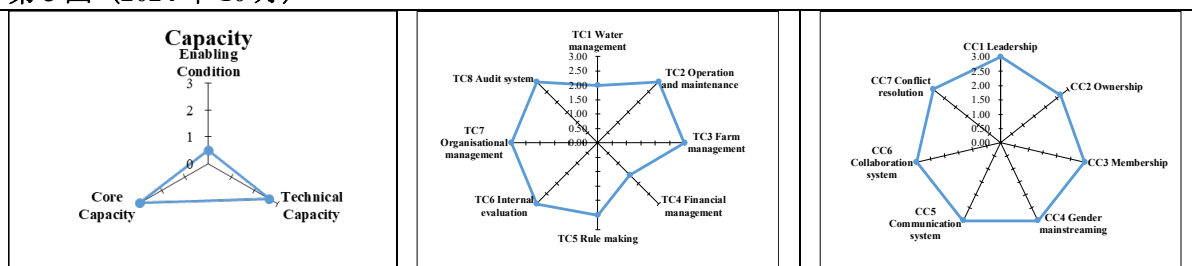
第1回 (2020年9月)



第2回 (2023年2月)



第3回 (2024年10月)



評価：

第3回の全体のスコアは76.7%で、第1回の43.6%に比べ大きく改善された。

平均 EC スコアは第1回、第2回、第3回の順で2.3点→0.2点→0.5点であった。第1回のスコアが最も高いのは過大評価によるものである。ニャブヨゲラの SMC は IWUO と異なり、農協と一体化した新しい形態の組織であることから、法律や政策・方針は定められていないため全体的に EC のスコアが低いという特徴がある。第2回から第3回に0.2点→0.5点と微増したのは、郡やステーションからのサポートが増えたことによる。

平均 TC スコアは第1回、第2回、第3回の順で0.7点→2.4点→2.6点であった。第2回時点で、平均60%の農地が水不足であったため水管理(TC2)のスコアがIWUOの中で最も低かったが、夜間貯留灌漑施設が整備されてから灌漑カレンダーが作成されるようになり、その結果、灌漑不足の面積が60%から40%に減り、水利費の値上げ(60→100 Rwf)も実現した。さらに、灌漑施設を所有することにより、農家のモチベーションを上げるきっかけとなり、第2回時は水争いが起きても解決に至らなかったが、第3回時は話合いで円満に解決できるようになった。また、O&M(TC2)は、農家の参加率が60～80%だったのが、80%以上までであった。この背景には農協とSMCが共通の内規を規定し、O&Mの参加義務・罰則を科したことによると考えられる。

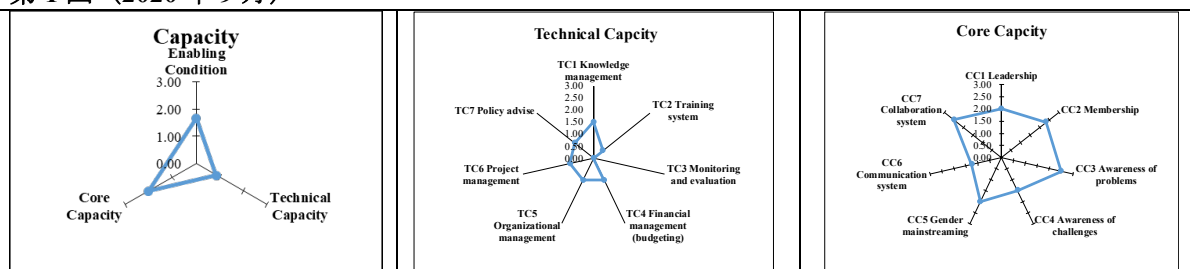
一方、スコアが下がった項目は、規定作り(TC5)と財源管理(TC4)で、農家による内規の認知が80%以上から60～80%に下がった。内規の内容はゾーンを介してアナウンスされるが、一

定数認知していない農家がいるようである。財源は、水利費を使用目的以外の支出が発覚したため、改善の余地ありと判断し、スコアが下がった。

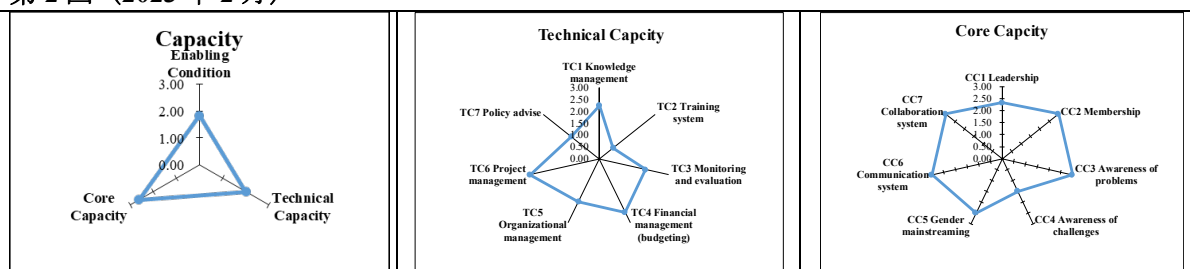
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.3 点→2.9 点→2.9 点であった。何か問題が起きた場合は、農協が中心となって農家にヒアリングし、その結果を **Management Committee** にあげ、対処法を決めている。また、ゾーンリーダーが問題解決の責任を担っており、問題が発生したら農協リーダーや **SMC** らが双方から意見を聞き解決策を提示するシステムが取られている (CC7)。総会は委任システムだが、農協役員がコミュニティワークの場合などで参加しなかった農家からも直接意見や要望を聞き取るようにしており、農協メンバーに対して積極的に信頼関係の構築に向けた動きが取られている (CC3：メンバーシップ)。

IWUO-SU

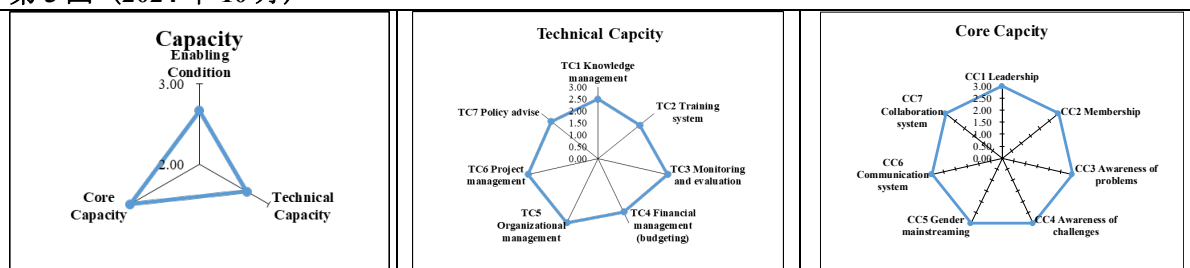
第 1 回 (2020 年 9 月)



第 2 回 (2023 年 2 月)



第 3 回 (2024 年 10 月)



※IWUO-SU はプロジェクト開始時から RAB の傘下であったが、2024 年 6 月の組織改編により SPIU の一部となった。SPIU はドナー支援によるプロジェクトを実施している組織であり比較的予算が潤沢にあることから、これまで停滞していた活動の予算が割り当てられるようになった。

評価：

第 3 回の全体のスコアは 93.9%で、第 1 回の 48.8%に比べ大きく改善された。

平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 1.6 点→1.8 点→2.6 点であった。

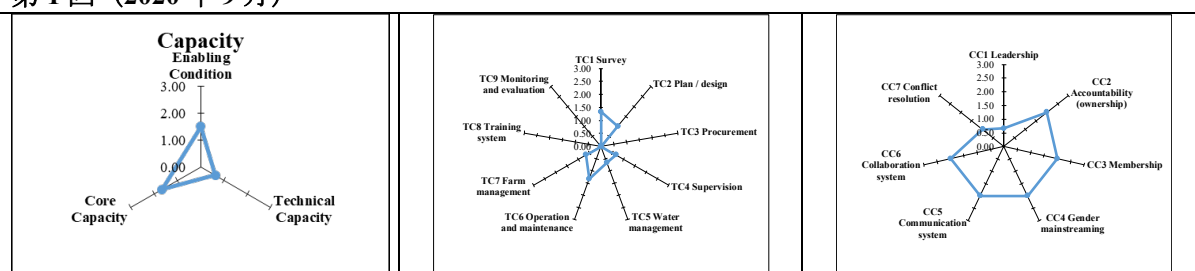
第 2 回時は IWUO に関する国家政策や戦略は文書化されていなかったが、2023 年 7 月に灌漑戦略計画の最終ドラフトが作成され、MINAGRI 大臣による承認を待つ段階である。また、IWUO の職務内容や位置づけにかかる省令はドラフト段階にあり、IWUO-SU において検討中である。RAB 所属時は活動予算に頭を抱えていたが、現在は特に大きな問題はない。

平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 0.8 点→2.0 点→2.7 点であった。IWUO 管理や水管理関連の研修システムは現地政府側で整備されておらず低いままであったが、IWUO-SU 職員はサービスプロバイダーと協働で IWUO の支援事業を手掛けており、日々業務を監督していることから個人の能力は向上した。最も点数が飛躍したのは TC3：モニタリング&評価で、サービスプロバイダーとモニタリング&評価を実施するとともに定期的に IWUO 支援業務の中間報告書を作成し、問題共有・課題解決に向けた会議の場を設けるようになった。

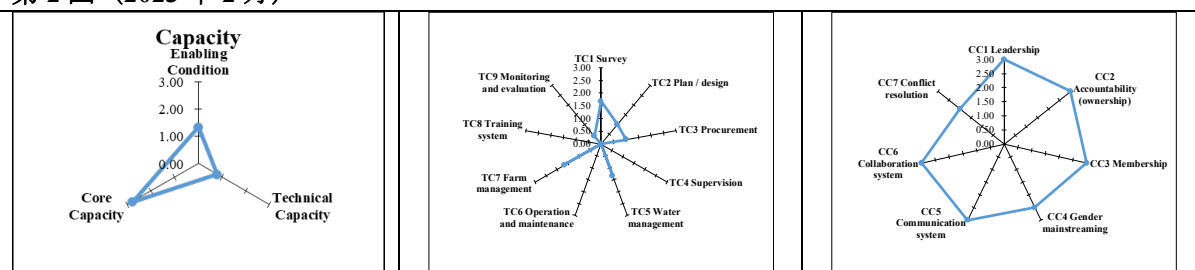
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 2.0 点→2.6 点→3.0 点であった。以前は会議の議事録は記録されていなかったが、現在は記録され、タイムリーに関係者に共有されている（CC6：連絡体制）。また、RAB 長官レベルの IWUO や灌漑スキーム管理の理解が乏しかったが、現在は理解度が上がっている（CC1：リーダーシップ）。課題の認識について、以前は RAB 傘下であったことから課題に対して必要な予算を割けなかったが、現在は改善されている。

RAB ンゴマステーション

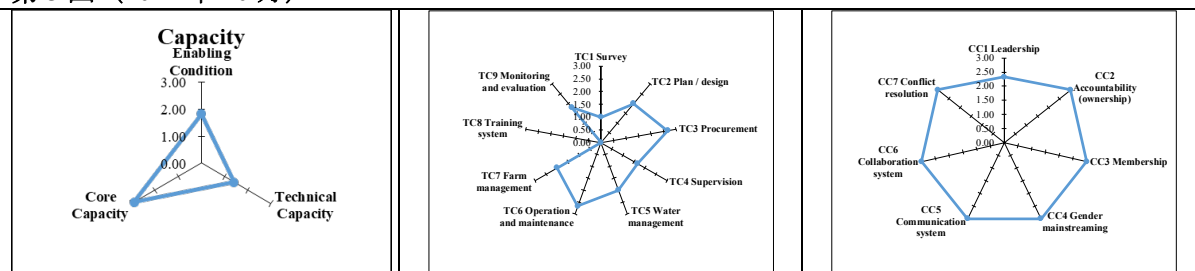
第 1 回（2020 年 9 月）



第 2 回（2023 年 2 月）



第 3 回（2024 年 10 月）



評価：

第 3 回の全体のスコアは 73.0%で、第 1 回の 38.3%に比べ大きく改善された。

平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 1.5 点→1.3 点→1.8 点であった。以前は職員数が不足気味だったが、第 3 回時には中央政府から新しいエンジニアが配置され、2024 年 10 月時点で電気機械エンジニアを含め 6 名が所属している。また、活動費の執行状況は改善され、RAB 本部に報告があがれば必要に応じて執行されるようになった。

平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 0.6 点→0.8 点→1.7 点であった。一般的に大型の調査、設計、調達、監督、水管理業務の主な実施者は委託されたコンサルタント会社であり、RAB ステーション職員はその技術サポートのみを行うことになっている。職員の能力に応じてプロジェクトのアサインが割り当てられるため、蓄積される知見や経験に個人差が生じてしま

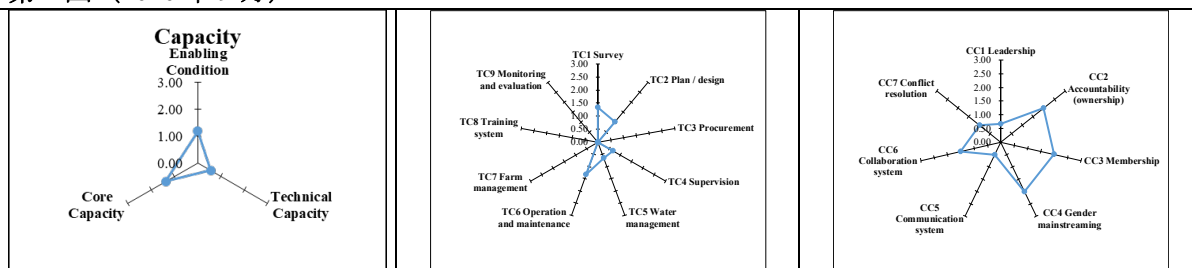
うという問題がある。政府側で技術マニュアルは準備されておらず、コンサルタント会社やドナー支援プロジェクトから提供されるものを使っている。これは他ステーションでも同様の状況である。

第2回時までは上記の状況で、平均スコアは1点未満であったが、2024年に新しくエンジニアが数人配置されたことにより、灌漑にかかる調査、設計、調達、水管理のキャパシティはやや上がった。TC5：水管理では、スキームに駐在しているRABエンジニアと連携を取りながら、農協へ技術指導が行われるようになった。

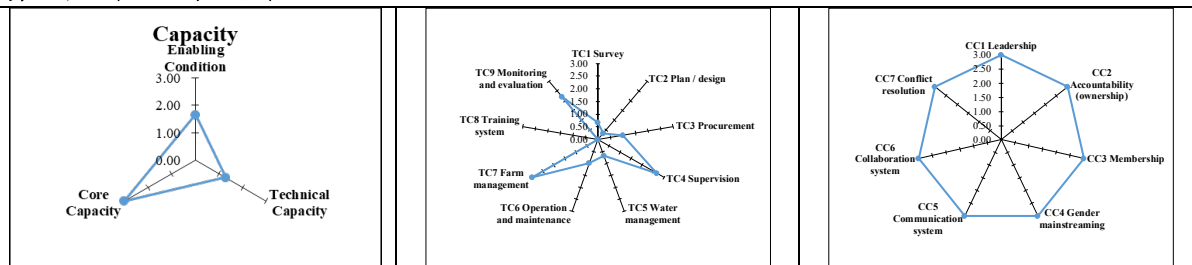
平均CCスコアは第1回、第2回、第3回の順で1.6点→2.8点→2.9点であった。特に大きな向上が見られたのはCC1リーダーシップであった。以前はRAB本部やステーション長のIWUOに対する認識や理解が薄かったが、WAMCABのJCCへの参加やTFメンバーの選出を通じて徐々に理解が深まった。CC6：協力体制は、第2回時の聞き取りでは、ステーションの人手不足により問題が生じていても迅速な対応が取られなかったが、現在は連絡網が明確され、機能するようになった。他方、CC1：リーダーシップはややスコアが下がったのは、異動したばかりの職員にIWUOや灌漑スキーム管理に関するステーションの役割が十分伝わっていないためである。

RAB ルビリジステーション

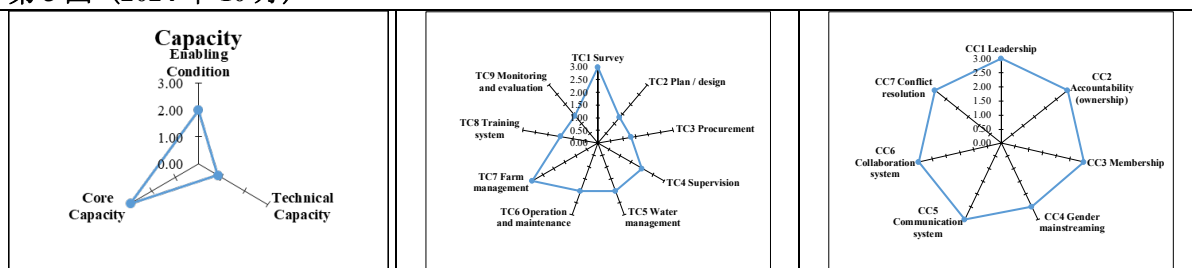
第1回（2020年9月）



第2回（2023年2月）



第3回（2024年10月）



評価：

第3回の全体のスコアは77.3%で、第1回の31.8%に比べ大きく改善された。

平均ECスコアは第1回、第2回、第3回の順で1.1点→1.6点→2.0点であった。2023年は出張旅費の支払いが遅延することがあったが、現在は改善されている。職員は十分に配置されているため深刻な人手不足には陥っていない。

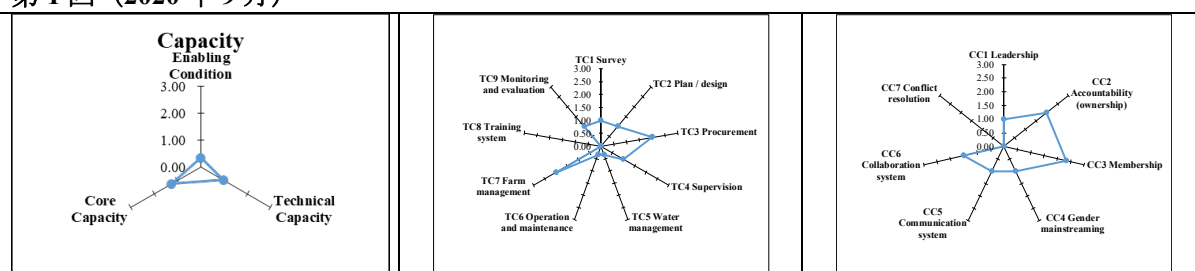
平均TCスコアは第1回、第2回、第3回の順で0.5点→1.2点→1.9点であった。大型の調査～監督業務の実施体制はンゴマステーションの記載と同様だが、小規模の業務はステーションレ

ベルで編成されたチームで実施することが多く、実際、TF メンバーの灌漑技術者は 10 個の小規模スキームの監督業務を務めている。このように小規模事業は業務の管理から技術サポートまでステーション職員が担当できるため、マネジメント能力を強化できる側面を持つ。営農業務は郡アグロノミストやセクターアグロノミストと合同チームが編成され、ステーション職員は地方行政職員のフォーカルパーソンとなり、スキームの営農指導を行っている（TC7：営農管理）。一方、TC9：モニタリング&評価は RAB 本部が全般担当しているため、専門に対応できる人材やチームはおらず、必要に応じてステーション職員がヘルプで参加している状態である。

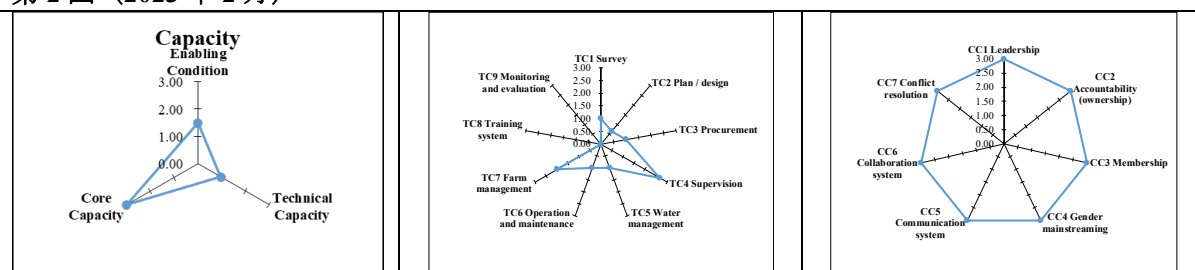
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.3 点→3.0 点→2.9 点であった。ルビレジステーションには小規模案件のフォーカルパーソンを務める職員が多く在籍するため、定期的にワッツアップで活動報告されたり、合同報告会が開催されたりするなど、地方行政との連携が強いのが特徴的である（CC6：協力体制）。

RAB ルボナステーション

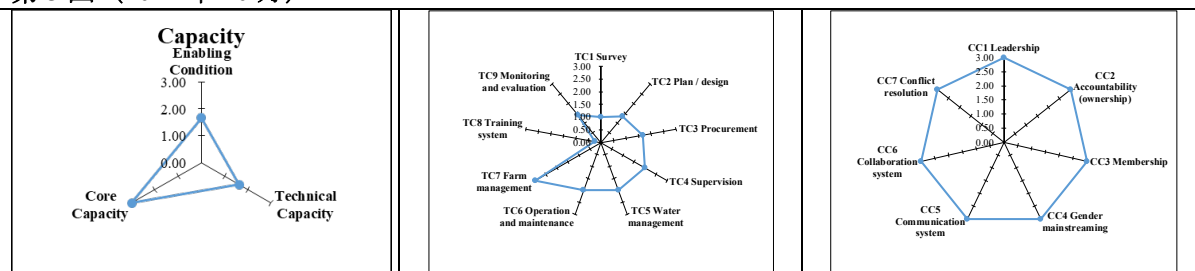
第 1 回（2020 年 9 月）



第 2 回（2023 年 2 月）



第 3 回（2024 年 10 月）



評価：

第 3 回の全体のスコアは 71.3%で、第 1 回の 32.4%に比べ大きく改善された。

平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 0.3 点→1.5 点→1.6 点であった。

第 2 回時は、予算計画の見直し時に予算カットされてしまい、交通費が支払われない状況であったが、現在は問題なく予算確保されている。他方で、全体的に人手不足で本部に人員配置を要求しているが対応が不十分である。

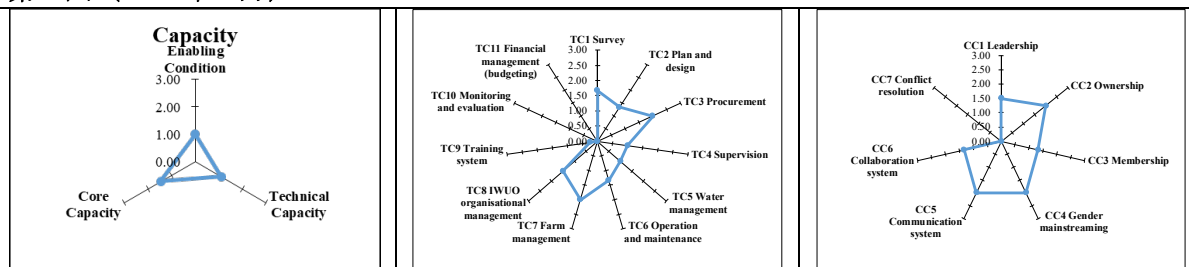
平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 0.9 点→0.9 点→1.6 点であった。唯一、ルボナステーションには設計経験のある灌漑技術者が配置されており、コンサルタント会社と設計業務に従事している（TC2：計画・設計）。TC6：O&Mに従事している技術者も多数在籍している（TC6：O&M）。TC9：モニタリング&評価は以前サービスプロバイダーに委託していたた

め 0 点であったが、現在は灌漑・営農どちらも TF メンバーが実施し、上司からフィードバックを受け、改善に向けたアクションが取られている。

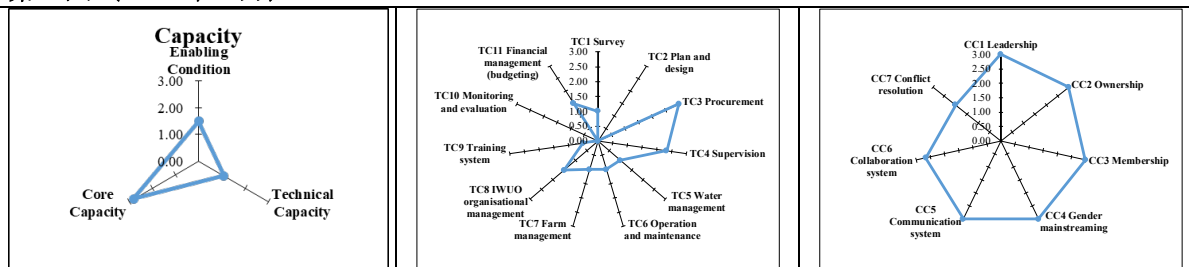
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.2 点→3.0 点→3.0 点で、全ての評価指標において満点であった。状況はルビリジステーションと大きく変わらない。

ンゴマ郡庁

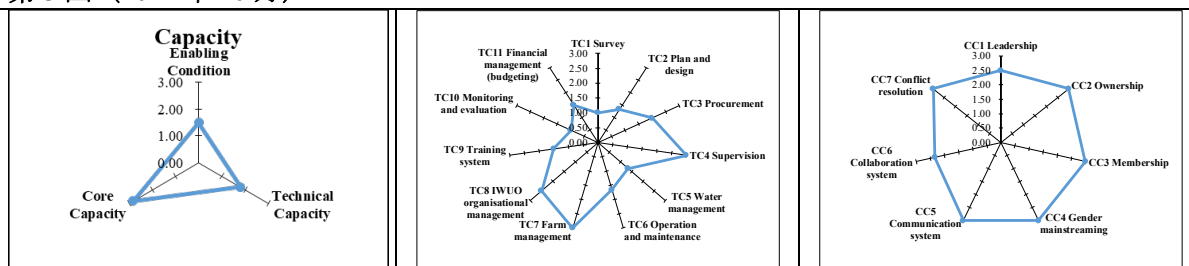
第 1 回 (2020 年 9 月)



第 2 回 (2023 年 2 月)



第 3 回 (2024 年 10 月)



評価：

第 3 回の全体のスコアは 71.1%で、第 1 回の 40.4%に比べ大きく改善された。

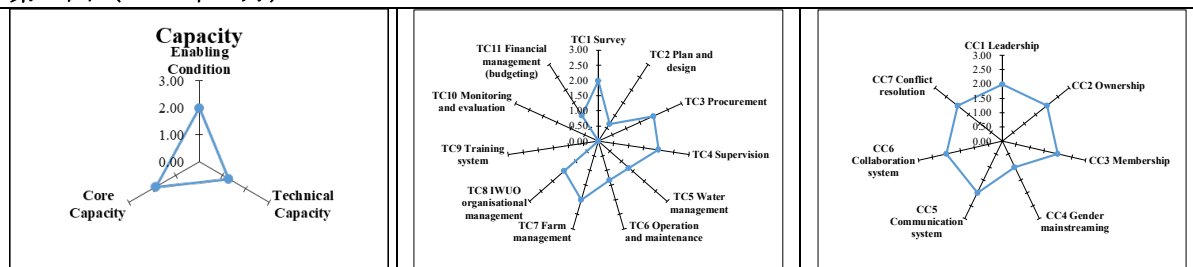
平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 1.0 点→1.5 点→1.5 点であった。依然として IWUO の関連政策・方針の認知は不十分ではあるが、IWUO 管理/スキーム管理を担う部署の位置づけは郡庁職員に認知されるようになった。

平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 1.1 点→1.1 点→1.8 点と僅かに改善が見られた。スコアが伸び悩んだ理由として、テクニカルキャパシティの項目である TC1：調査、TC2：計画・設計業務はコンサルタント会社への委託が一般的で、郡庁職員の職務内容に該当しないためである。一方、TC3：調達には郡に調達チームがあり予算申請を行っている。TC4：監督業務は RAB ステーションと同様、小規模案件のアサインが割り当てられればコンサルタント会社と合同チームを編成し、プロジェクトの監督業務を担っている。第 3 回時には、郡に DPMC (District Project Management Committee, chaired by Vice Mayor、郡プロジェクト管理委員会) が設置されプロジェクト監理の業務を担っていることが確認された。TC5：水管理、TC6：O&M の技術マニュアルは存在せず、実施は IWUO 主体で郡による技術的支援は行っていない。これは他郡も同様の状況である。最も改善が見られたのは TC11：財務管理で、郡は IWUO から提出される Expense Order や財務報告書を通して、IWUO の財政状況を把握し、郡内の関係者にも共有するようになり、IWUO 管理の職務が遂行されるようになった。

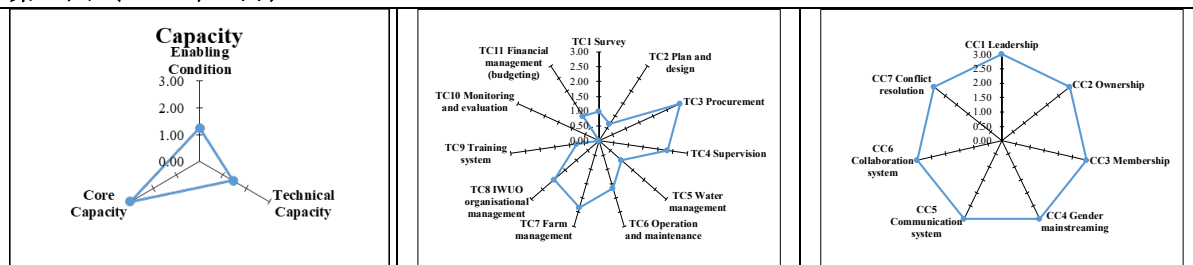
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.4 点→2.8 点→2.8 点であった。ステーション同様、WAMCAB の活動を通じて、郡長や副郡長の IWUO に対する理解が深まった（CC1：リーダーシップ）。また、郡長の代わりに TF メンバーが郡を代表して DISC に参加することもあり、郡の中で IWUO 管理の重要度が高まっていることが分かる。一方、DISC は郡側の都合により延期が重なり定期的に開催されていないのが現状である（CC6：協力体制）。

ルワマガナ郡庁

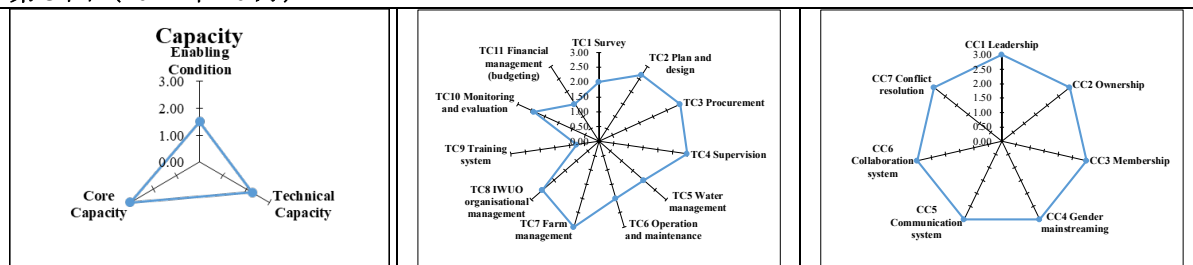
第 1 回（2020 年 9 月）



第 2 回（2023 年 2 月）



第 3 回（2024 年 10 月）



評価：

第 3 回の全体のスコアは 81.3%で、第 1 回の 51.4%に比べ大きく改善された。

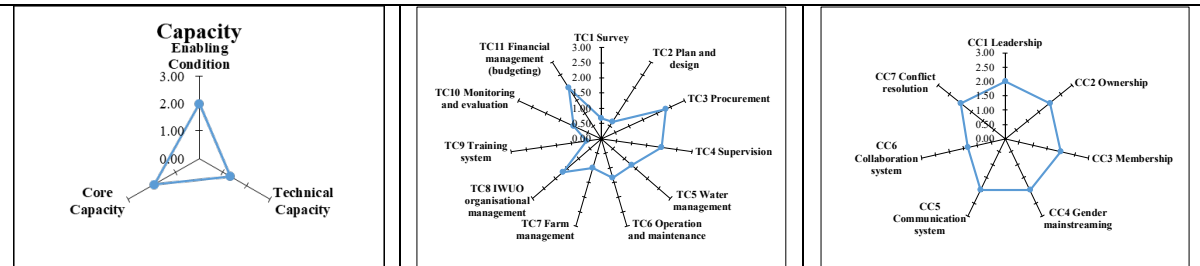
平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 2.0 点→1.2 点→1.5 点であった。第 1 回から第 2 回でスコアダウンした理由は、第 1 回時に政策・方針に対する認知が十分でなく適切に回答できていなかったためである。他方、第 3 回時には IWUO 管理を担う部署が明確になり、郡で必要な業務が適切に行われるようになり改善が見られた。

平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 1.2 点→1.4 点→2.2 点であった。第 2 回 CA 時は DISC を担当する郡庁職員の理解が追い付いてなかったことが原因で、郡庁の職務である IWUO 登録手続き支援業務が円滑に行われなかったが、現在は IWUO に対する理解が高まり同じ人数でも十分業務を遂行できるようになった（TC8：IWUO 組織管理）。個人レベルで理解が高まったといえる。DISC には灌漑エンジニアだけでなくアグロノミストも参加するようになり、人手不足である中、真摯に対応している印象を受けた。また、One Stop Centre にインフラエンジニアが配置されたことにより（設置時期は不明）、計画・設計分野のキャパシティがあがった。TC5：水管理は、マニュアルの整備はないが、WAMCAB の研修で知識や実務経験が増えた、と回答した。

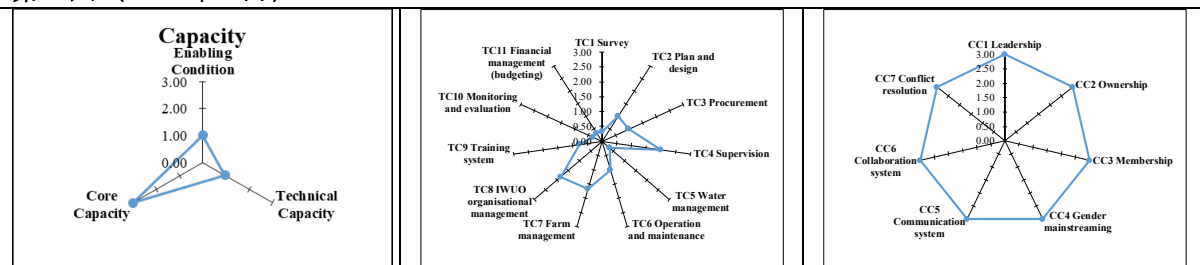
平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.8 点→3.0 点→3.0 点であった。IWUO の理解を示す CC1 リーダーシップは、TF メンバーからの WAMCAB 活動の報告を受け、理解が深まっている。問題解決能力についても、問題の規模に応じて関係者と連携しながら解決策を実行できている（例、チャルホゴスキームの不公平な水配分問題が新聞に報道された件について、RAB と調整し、RAB が現地訪問し、プロジェクトの目的を繰り返し説明するなどの措置が取られた）（CC7：内紛解決）。

ギサガラ郡庁

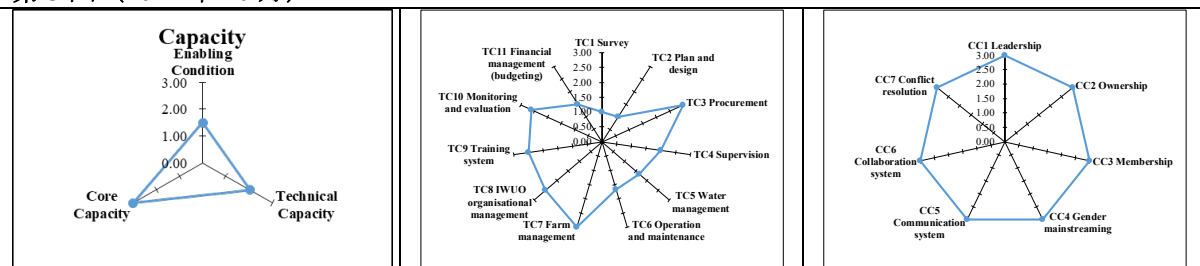
第 1 回（2020 年 9 月）



第 2 回（2023 年 2 月）



第 3 回（2024 年 10 月）



評価：

第 3 回の全体のスコアは 77.4%で、第 1 回の 53.6%に比べ大きく改善された。

平均 EC スコアは第 1 回、第 2 回、第 3 回の順で 2.0 点→1.0 点→1.5 点であった。

第 2 回時は IWUO 管理を担う部署は明確に位置づけられていなかったが現在は認知されるようになった。

平均 TC スコアは第 1 回、第 2 回、第 3 回の順で 1.3 点→1.0 点→2.0 点であった。郡に土木技術者は在籍しているが、TC1：調査、TC2：計画・設計の実務はサービスプロバイダーが担っていることからスコアは低い。

第 2 回時は、灌漑技術者が未配置だったため、TC5：水管理や TC6：O&M の専門性を持った人材が不足していたが、第 3 回時は調達、TC4：監理、水管理に特化した委員会が郡レベルで設置され、構成メンバーに郡庁職員も含まれているため、業務経験のある人材は一定数存在するようになった。また、これまで遅延気味だった IWUO の正式登録の手続きは第 3 回時にはスムーズに行われるようになり、灌漑スキームや IWUO リストも保有・更新されるようになった（TC8：IWUO 組織管理）。

平均 CC スコアは第 1 回、第 2 回、第 3 回の順で 1.9 点→3.0 点→3.0 点であった。ギサガラ郡は

事務的な手続きや DISC の参加といった必要最低限の支援だけでなく、IWUO から寄せられる緊急要請に応じて関係者を巻き込んだ技術的な支援にも対応している（例．ンギリの土砂堆積問題が起きた際、IWUO→郡へ支援要請のレターを受け、技術サポートを行った）（CC1：リーダーシップ）。また、雨期に洪水が発生した際は、現地訪問し被害状況を写真とともに RAB 等の関係者へ共有し、解決策の検討を行っている。斜面に囲まれたスキームで自然災害の影響を受けやすいエリアであるからこそ、日頃から関係者と連携しながら最善の策を講じている印象である（CC7：内紛解決）。

2.3 PDM 改訂履歴

当初 PDM について、以下のとおり段階的な変更が行われた。

2.3.1 第 1 回改訂

2019 年 11 月 15 日開催第 2 回 JCC 会議にてギサガラ郡における灌漑地区の対象地区への追加

当初 PDM 上では、東部県ルワマガナ郡とンゴマ郡のみが対象郡とされていたが、ルワンダ側の提案・要望により、2019 年 5 月に開催された第 1 回 JCC 会議において、地域のバランス、灌漑施設、関係機関の状況から、南部県ギサガラ郡も対象郡として追加承認された。なお、ベースライン調査及び各郡でのワークショップを踏まえ、2019 年 11 月に開催された第 2 回 JCC 会議において 8 つの灌漑スキームで構成される 4 つのモデル地区（ルワマガナ郡 1 地区、ンゴマ郡 1 地区、ギサガラ郡 2 地区）が承認された。

2.3.2 第 2 回改訂

2021 年 2 月 24 日調印 M/M にてプロジェクト目標の指標決定

当初 PDM ではプロジェクト目標の指標が確定されていなかったが、2021 年 2 月 24 日付の R/D 改訂により、以下のとおり具体化された。

指標 1:「IMT の実施手順、IWUO の支援体制（役割分担を含む）が整備され、モデル地区の IWUO の組織能力が 70%以上に改善される」

指標 2:「モデル地区の IWUO の能力強化のための優先度の高い合意計画（組織運営、維持管理、水配分、営農）がすべて実践される」

2.3.3 第 3 回改訂

2022 年 3 月 4 日調印 M/M にて実施期間の 1 年間延長

第 1 章で記述したとおり、COVID-19 の蔓延に起因してプロジェクト活動が十分実施できなかった期間を考慮し、2021 年 11 月 12 日開催の第 6 回 JCC 会議において 2025 年 3 月までの 1 年間のプロジェクト実施期間延長が決定された。

2.3.4 第 4 回改訂

2023 年 9 月 29 日調印 M/M にて R/D の全面的な見直しの一環としての PDM の確認

2023 年 9 月 29 日調印の M/M において、プロジェクト実施体制、JCC の構成・機能、TF の構成・機能などの変更、R/D 添付文書の修正は JCC 会議の議決に基づき修正できることなど、プロジェクト実施に係る基本文書の全面的な見直しが行われ、その一環として、PDM に関しても上記変更内容を内包した最終的な PDM として確認された。

2.4 その他

2.4.1 環境社会配慮の結果

外的要因として、2021 年 10 月から開始された同国の地方自治体選挙による影響が留意・懸念事

項として挙げられた。地方自治体（特に対象郡の郡長及び副郡長）の選挙手続きのプロセスにより、プロジェクトの責任者にあたる C/P が変更となる可能性があり、新たに選出された郡長・副郡長とプロジェクトの枠組みや活動内容を再確認し、自治体の計画・方針についての共通理解を図る必要があった。

上記地方自治体選挙の結果、プロジェクトの責任者の一部が変更された。そこで、新たに選出された C/P とプロジェクトの計画・方針についての共通理解を図るため、2022 年 2 月にプロジェクトチームは対象地区ごとに会議を開催し、IWUO の適切な運営の実現に向け、DISC 活動の活性化、IWUO の継続的なモニタリングなど自治体（郡及びセクター）による支援とフォローアップが必要な点を伝え、各自治体による支援と更なる連携を要請し同意を得た。

2.4.2 ジェンダー/平和構築/貧困削減・障害・疾病感染・社会システム・ヒューマンウェルビーイング・人権・ジェンダー平等に関する考察結果

対象地域ではジェノサイドの影響から寡婦の割合が高く、女性の農業を含む経済活動に従事する割合が高い一方、男性が農業経営に関する実権を持っている実態から IWUO 及び農協への女性の参加率は低い状況であった。このため本案件では、ジェンダー主流化研修には配偶者とともに参加することを促進するなど技術研修への参加にかかる男女の割合に配慮するとともに、国の指導により IWUO 及び農協役員の 3 割は女性とするよう配慮するなど女性農民を含めた組織運営の強化も進めてきた。

これらの結果、先進的な IWUO として国の内外から評価されているチャルホゴ地区 IWUO の理事長には女性が就任し、発想力・統率力とともに関係団体との協調に関する成果を発揮して指導力を示すなど、徐々にジェンダー平等の動きが見られてきている。

第3章 合同評価結果

3.1 DAC 評価項目による評価結果

3.1.1 妥当性

妥当性は高い。

ルワンダ政府は、WAMCAB 実施前の 2017 年に農業セクターの中期計画である貧困削減戦略文書 4 (PSTA4) を策定し、4 つの柱の 1 つに「生産性とレジリエンス」を掲げ、統合的水資源管理 (IWRM) の枠内での効率的な灌漑 (湿地灌漑、丘陵地灌漑、グリーンハウス灌漑、小規模灌漑等)、水資源開発、灌漑技術の開発 (点滴灌漑、水耕システム、アクアポリンシステム等) 等の推進が求められており、WAMCAB の活動はこれに寄与し、また、2010 年に灌漑マスタープラン (IMP) が作成され、2020 年には、灌漑技術の進化や 2013 年に策定された Water Resources Master Plan との統合の必要性を受け、新 IMP が策定された。この中で、灌漑スキームの管理は、(1) 農協・IWUO 型 (農協・IWUO が O&M ワーカーを備上)、(2) 商業農家・オペレーター型 (土地リース契約を基本)、(3) 専門運営会社型 (RAB が民間に維持管理運営 (OMM) 委託、例 HoReCo 等)、(4) 政府 (MINAGRI) による直接運営型が言及されている。また、官民パートナーシップ (Public-Private Partnership : PPP) 式灌漑として、イスラエル企業との合弁事業である Gabiro Agri-Business Hub (GABH) が注目されている。WAMCAB はこの流れに沿った活動を実施しており、妥当性は高い。

3.1.2 整合性

整合性は高い。

事前評価時点において、ルワンダ政府は、国家長期開発計画「Vision 2020」にて 2020 年までに中所得国家になることを目指し、目標達成のための重要な柱として農業改革を掲げ、第二次経済発展貧困削減戦略 (Economic Development and Poverty Reduction Strategy II : EDPRS II) にて、農業農村開発を国の経済発展及び貧困削減を牽引する最重要分野と位置付けている。EDPRS II の戦略に基づく農業セクターの中期計画である貧困削減戦略文書 3 (PSTA3) では、農業近代化を図るべく 4 つの重点プログラム「1. 持続可能な生産システムの強化と開発」「2. 生産者の専門化への支援」「3. 商品チェーン化及び 農業ビジネスの開発」「4. 制度・組織機構の開発整備」を定めており、WAMCAB は同重点プログラム 1.及び 4.に位置付けられている。また、上述の PSTA4 及び IMP、新 IMP の流れに沿った活動を WAMCAB は実施しており、整合性は高い。

3.1.3 有効性

有効性は高い。

第 2 章で述べたとおり、5 つの成果及びプロジェクト目標の全指標を達成しており、有効性は高い。

3.1.4 効率性

効率性は中程度である。

事前評価表では、日本側投入について、5年間で合計100人月程度（年間約20人月換算）の投入が言及されていたが、実際には延長期間を含めた6年間で合計126.28人月であり、日本側の効率性は若干低い。一方、ルワンダ側投入について、プロジェクト目標の外部条件である「郡や農業、灌漑、農協のサブセクターの職員配置に極端な変化がない」に関し、コア C/P と呼ばれる中央レベルの職員である RAB の5名の職員が実質3名に減少する中で、それも補完する形で、他 C/P の投入を最適化し、職員減少の中でも結果として期待された成果が出せたことから、ルワンダ側の効率性は高い。

日本側投入が高まった主な理由は、後述の COVID-19 対応と中間モニタリングを踏まえた灌漑戦略書作成支援であり、業務上実施上不可欠であった。

3.1.5 インパクト

インパクトは高い。

後述するプロジェクト目標を踏まえた上位目標の達成見込みの高さからインパクトは高い。プロジェクト実施段階の第3期である普及準備フェーズとして、C/P に加え多様なステークホルダーを巻き込みながら、具体的な普及展開の手法を協議・決定・実践した。また、上位目標とは別に、他開発パートナー（Development Partners：DP）である IFAD が実施中の案件で、WAMCAB アプローチの主要な要素である組織強化手法や FC の採用を志向し、WAMCAB モデルが導入されつつあり、上位目標を超えた波及効果も確認されている。

3.1.6 持続性

持続性は中程度である。

2021 年 11 月に実施された中間モニタリングでの要請を踏まえた灌漑戦略計画に関し、案は MINAGRI に提出し DP を交えた会議での議論は終了しているが、灌漑戦略計画策定が開始条件となっていた他ドナー事業が計画（案）作成により開始となったこと等により、MINAGRI 内での本件に関する熱意が低下し、承認に時間を要していることから、同戦略計画で言及されている WAMCAB アプローチが全国的な規模でルワンダ側行政に取り込まれる具体的なロードマップは策定されていない。

また、成果1の政策提言で言及している中央レベルでの灌漑水管理に関する部局の創設は、ルワンダ側高官からの理解は得られるものの、小さな政府を推進するルワンダ側政策を踏まえ、RAB の当該部局（土地管理灌漑革新技術移転局 Land Husbandry Irrigation Innovation and Technology Transfer Department：LII-TT）の機能強化が志向されており、中央レベルでの組織的な体制は未だ強化の途中である。

上位目標の達成見込みにも関係し、地方分権化の中で、郡行政が担う役割が大きく、逆に言えば、各地方行政の関与次第で灌漑スキームごとの持続性に幅がある。対象3郡のうち、ルワマガナ郡

及びギサガラ郡では高く、ンゴマ郡では中程度である。

3.2 実施及び成果に影響する主要因

3.2.1 新型コロナウイルス感染症の影響

新柄新型コロナウイルス感染症（COVID-19）の世界的な流行を受け、JICA が 2020 年 3 月 3 日付で渡航延期の方針を示し、WAMCAB の日本側専門家の現地派遣も当面延期となった。当時、先行きが不透明な状況下において、JICA の方針に従い 3 月、5 月及び 9 月の計 3 回事業継続計画書を作成・更新した。その際、活動で既述したような遠隔で事業を進め、付加価値をも生む対策（ラジオ研修番組の作成・放送支援、日本からのウェビナー、モデル地区へのオンラインスタディーツアー）を検討・実施してきた。また、日本側専門家不在の事業実施を補完するため、現地技術者や遠隔での会議用設備（カメラ、スピーカー、スキャナー、プロジェクター、マスク等衛生用品）の追加充足も行った。2020 年 11 月 24 日のルワンダ国への渡航再開を踏まえた事業計画の変更では、日本側専門家の現地業務で想定される追加作業や付加価値向上に向けた業務を更に検討し、現地業務を再開した。

このように日本側専門家が現地不在であっても遠隔で業務を継続するための方策を採用したものの、プロジェクト・ダイレクターや副郡長等高位の C/P とのコミュニケーションが現地傭人等を通じては不十分であったこと、各成果の活動ではなく成果横断的な活動や有機複合的な研修については遠隔では効果発現が不十分なことが明らかとなったため、その対応も含め各モデル地区での状況と強化に向けた考え方を再整理し、新たに実施した。

加えて、2021 年 1 月からの日本側専門家による現地業務については、COVID-19 の罹患リスク回避の観点から最低 2 名が現地に同時滞在することや滞在期間を最小化すること等の対策も講じた。

以上の対応をしたものの、COVID-19 蔓延の影響を大いに受け、活動進捗や成果発現にも影響があったことから、前述のように実施期間を 1 年間延長するなど、業務の効果的実施及びリスク管理に鑑み現地の状況に臨機応変に対応してきた。

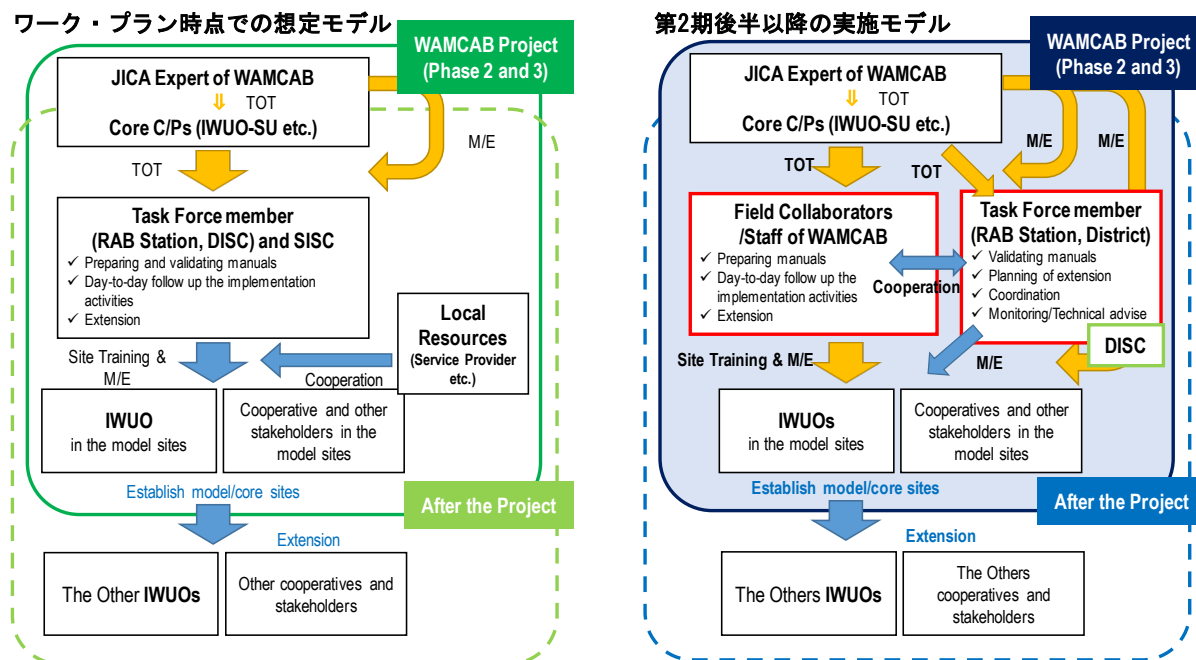
3.2.2 ルワンダ側実施体制

第 1 章でも述べたとおり、プロジェクト開始時点で想定していた RAB 本部から郡を通じたカスケード方式の技術移転が現地の実態を十分反映していなかったことから、プロジェクト開始後 1 年の段階で技術移転を修正し、IWUO や農協に配置した FC にまず技術を移転し、彼らが主体となって実施する方式に変更した（図 3.1 参照）。

日本側専門家や TF メンバーが IWUO や農協の職員である FC に直接技術移転し、IWUO や農協メンバーである個々の農家に対しては FC から技術普及されることになる。このため、研修を受講する農家にとっては、身近な存在である FC から気兼ねなく説明を受けることができるとともに、自分と大きく変わらない素養を持つ FC が習得している技術を模倣することで、必要技術の定着効果が得られている。

なお、上述の COVID-19 発生以降、ルワンダ側の財政が圧迫されたことから、RAB 及び郡庁から選出された TF メンバーを含む C/P の活動参加に対するルワンダ側の日当・交通費負担も困難と

なり、2021 年 7 月、2022 年 4 月、2023 年 7 月の両国確認に基づき、日本側で案件終盤まで負担することとなった。これは緊急避難的な対応ではあったが、C/P の活動参加に対する日当・交通費の支出が迅速に行われることとなり、結果的に C/P の意欲を向上させ参加を促進させるといった副次的な効果が見られた。



橙矢印：日本側専門家の直接の関与有、青矢印：日本側専門家の直接の関与無

図 3.1 業務実施体制

3.2.3 市場志向型農業の影響

ンゴマ郡のモデル地区では、他プロジェクトによる契約栽培支援を含む市場志向型農業振興に対する指導、先行事例に触発された農家の機運の盛り上がりもあり、2020 年から 2022 年にかけて、チアシードの栽培規模が作期を迎えるごとに急激に拡大した。先行農家の成功体験を身近に観察した農家自身の発意による選択ではあったが、最終的には、国際市場への展開を狙う買取業者の不正行為等により契約栽培は破綻し、ルワンダ政府及び郡が買取業者に対する行政指導を行うなど事後処理に介入する事態となった。

これらの反省の上に立ち、郡長から支援要請を受けた WAMCAB は C/P と協力し、契約栽培の選択に当たっての郡庁等地方行政による指導・モニタリングに関する介入、農家側が不利とならないような契約書類の整備、契約栽培のみに頼らない多角的な農業経営によるリスク管理等を推奨しているところである。

3.3 プロジェクト・リスク・マネジメントの結果に関する評価

本事業の事前評価では、他案件から本事業への教訓として「灌漑・排水施設の整備を実施する場合、受益地区内で農家が灌漑農業を実施することにより、維持管理費用をねん出できるだけの利益を上げられるようになることが、施設の維持管理の観点からも重要である。このため、インフラに対する支援と併せて水利組合の運営能力強化及び営農支援を実施することが効果的である。

本事業は、実施中の小規模農家市場志向型農業プロジェクトと連携した営農支援を行うこととする。」と言及されていた。

これについては、主体となるステークホルダーの現情を考慮し、IWUO と農協との関係強化を最優先すること、長期間のアクションプランに基づいた関係者の合意により水利費を適正価格に設定すること、透明性をもって IWUO 及び農協の活動内容・予算執行状況を開示すること、耕作面積の拡大・収量の安定化など灌漑の効果を実感させることなどの具体的な方策を通じ、WAMCAB アプローチの有効性・優位性を浸透させることにより、当初計画を改善する形で実現した。

前歴事業である小規模農家市場志向型農業プロジェクト（SMAP）との連携については、成果 5 において SMAP で作成したマニュアル等を活用し、さらに本プロジェクトにおける主要課題である持続的灌漑農業の実現のため、灌漑水管理の観点を加えテキストとして再整理して併用するなど、連携した営農支援を実施した。

3.4 教訓

COVID-19 の影響による日本側専門家不在時に、成果を有機的に結びつけることができず、統一感を持ったプロジェクト実施ができなかったことから、日本側専門家の渡航が再開してからは、日本側専門家が触媒となって後方支援を行い、各成果に関係する C/P や NS が担当する政策、組織強化、維持管理、水管理及び営農分野の範囲を超えて相互に活動し、その結果として成果横断的な活動を実現し、ルワンダ側行政のみならず、他の DP も興味を持つ WAMCAB アプローチを策定できたことは特筆すべき事項である。

プロジェクト実施の観点からは、当初 RAB ステーションにおける TF メンバーだった技術者が、事業後半段階でプロジェクト・マネージャーのポストに就任し円滑なプロジェクト運営に貢献したこと、同じく当初プロジェクトインプリメンターだった IWUO-SU 職員がプロジェクトから離れ IFAD プロジェクトのスタッフに異動したが、結果的には IFAD プロジェクトへの WAMCAB アプローチの導入に尽力してくれた事例があった。このように予算・人材とも限度があるルワンダ側の事業実施体制ではあるが、プロジェクトで育成した人材が異なる立場からプロジェクトの推進に貢献できたことは、大きな教訓であった。

前述のとおり、日本側専門家の現地派遣が制限される中、高位の C/P とのコミュニケーションに課題は見られたが、日本側とルワンダ側とのコミュニケーションは概ね良好であり、上記の事例はその結果得られた教訓とも言える。

上記に加え、具体的な教訓を「ルワンダ側の事業計画と実施体制」「ルワンダ側への提言」として第 4 章で記述する。

3.5 パフォーマンス

前述のとおり、大きな影響を生じさせた COVID-19 に対し、計画・実施体制を改善しながら対応した。灌漑スキームでは、末端の施設である取水口ごとに設置した灌漑ユニットを基本単位として、幹線水路、分水堰、灌漑スキーム全体に至るボトムアップでの組織整備を行いながら、階層ごとの組織が受け持つ具体的な維持管理、水管理及び営農に関する役割を認識し、能力強化を実

現する必要がある。このためには、IWUO と農協が互いの役割・活動を理解し、信頼関係を構築することが不可欠である。WAMCAB では、能力強化研修の対象を IWUO に限らず、農協も加えて合同では実施し、共通理解の形成に努めた。これらの成果を踏まえ、いくつかの IWUO からは WAMCAB に対表彰するなどの感謝が示された。

プロジェクト対象地域の中でも、ルワマガナ郡のチャルホゴ地区、ギサガラ郡のンギリ地区は、灌漑スキームの運営状況（効率性、透明性、説明責任、財務状況など）及び営農の改善状況（耕作面積拡大、生産量の拡大、自主的な品種選定など）に加え、IWUO と農協の協調、各レベルの行政との連携等から全国でも模範的な持続的灌漑スキーム管理のモデル地区として認識されている。特に行政側の観点からは、IWUO と農協が一体となった主体的・自発的な灌漑スキーム運営が評価される一方、受益農家からは、活動面・財政面における透明性を持った組織運営と地域の一体化が高く評価されている。

なお、WAMCAB の活動を通じてチャルホゴ地区での持続的灌漑スキーム管理アプローチの実践が広く知られるようになり、地元東部県に限らず、南部県からも IWUO や農協など多くの見学者を迎えているとともに、プロジェクト終盤の 2024 年には、ブルキナファソ、ケニア、日本といった海外からも見学者を迎え、それがチャルホゴ地区の熱意を高めるという好循環をもたらしている。

また、普及対象スキームにおいても、実質的には 1 年間の活動期間ではあったが、組織運営、維持管理、水管理、市場志向型営農、農協との連携など多面的な改善がみられ、ルワマガナ郡のルゲンデスキームではチャルホゴ地区とともに灌漑農業の改善に関するキャンペーンソングを作るなど積極的なパフォーマンスが知られている。

3.6 付加価値

前述のとおり、COVID-19 による影響を緩和し、さらに付加価値を生み出す活動とするため、本事業では、ラジオ研修番組の作成・放送支援、日本からのウェビナー、モデル地区へのオンラインスタディーツアーを検討・実施してきた。これに加え、以下のような付加価値を生む活動を実施した事例を報告する。

3.6.1 栄養借款・灌漑戦略への貢献

WAMCAB の付加価値発現に関し、別途実施された「農業変革を通じた栄養改善のための分野別政策借款（栄養借款）」のフォローアップとしての灌漑スキームにおける作物カレンダーの作成支援や、中間モニタリングでルワンダ側から協力要請のあった灌漑戦略計画の作成支援は、WAMCAB に対する MINAGRI 及び RAB からの評価を高めるとともに、多角的な効果の発現及び効果的なプロジェクトマネジメントの観点からの相乗効果も高く、日本の協力の価値と援助協調における存在感を高めた。

(Box) 栄養借款への貢献に向けた経緯と貢献内容

(1) 背景

日本・ルワンダ両国政府は、2019 年 8 月に「農業変革を通じた栄養改善のための分野別政策借款」を対象として 100 億円を限度とする円借款貸付契約に調印した。同借款の概要を下表に示す。

栄養政策借款	内容
事業目的	政策対話及び財政支援を通じて栄養改善における優先順位の高い政策等の実行を支援することにより、栄養価の高い食料の安定的な供給、アクセスの改善及び摂取の促進を図り、経済の安定及び社会開発の促進に寄与するもの
プロジェクトサイト	ルワンダ全国。但し、ルワンダ全 30 郡のうち、Stunting が特に深刻な郡の中で、農業を中心とした栄養改善活動が比較的少ない郡を当事業の農業関連活動の主要対象郡を選定
事業内容	合計 27 の政策アクションを設定し、その政策アクションの達成状況を評価した上で、一般財政支援の形態で資金供与を行う。
総事業費	10,000 百万円
事業実施期間	財政支援開始 2019 年 7 月、貸付完了 2021 年 10 月
事業実施機関	農業・動物資源省(MINAGRI)、ルワンダ農業・動物資源開発庁(RAB)、ジェンダー・家族省傘下の国家 EDC プログラム(National Early Childhood Development Program: NECDP)、保健省傘下のルワンダ・バイオメディカル・センター(Rwanda Biomedical Center: RBC)

出典: JICA ウェブサイト: https://www2.jica.go.jp/ja/evaluation/pdf/2019_RW-C1_1_s.pdf をもとに作成

全体で 27 ある政策アクション(Policy Action: PA)の中には、PA(21):「農業セクターにおける栄養主流化のためのガイドライン(Nutritional Sensitive Agriculture Mainstreaming Guidelines: NSA Guidelines)に基づき、灌漑スキームにおいて作物カレンダー作成される」といったアクションが含まれており、実施機関の MINAGRI/RAB と WAMCAB の連携が期待された。

(2) 活動内容

1) 栄養改善に配慮した作物カレンダーの作成

JICA ルワンダ事務所及び MINAGRI、RAB からの協力要請により、上記 PA の NSA に基づいた灌漑スキームにおける作物カレンダーの作成を支援した。同活動を担当する C/P は、栄養改善活動と親和性の高い成果 5 担当の RAB シニアアグロノミストが兼任することとなった。

2) 営農を通じた栄養に係る基礎情報収集

作物カレンダーで判明した栄養摂取状況を現場レベルで把握するため、高栄養価作物(Nutrition Dense Food: NDF)に対する栽培意欲、栽培環境等に係る営農活動を通じた基礎的な情報収集を行った。調査概要を下表に示す。

調査方法	作物カレンダーを作成した灌漑スキームの農協メンバーを対象に質問票調査を行った。質問票の質問項目は①一般情報(性別、年齢、家族人数)、②営農活動(従来作物及び NDF の栽培状況・栽培意欲)、③食生活(食事回数、普段消費している食材等)の 3 部構成とした。質問票の内容はカウンターパート機関の担当者と協議しながら最終化し、調査は現地傭人の協力のもと実施した。
日付	2021 年 6 月下旬～7 月上旬
調査対象エリア	ンゴマ地区(以下、Ngoma 22)及びニャブヨゲラ地区(以下、Nyabuyogera) カッコは灌漑スキーム名
調査実施者	Ngoma 22: 日本側メンバー、現地傭人 Nyabuyogera: 現地傭人(COVID-19 行動制限によるギサガラ郡滞在期間短縮により)
調査対象者	調査対象エリアの農協メンバー 41 人(Ngoma 22: 20 人、Nyabuyogera: 21 人) 収穫等で集団作業していた倉庫や農協事務所付近で実施した。

3) 食事多様性調査

営農活動を通じて明らかとなった栄養摂取傾向について、食事多様性調査(Household Dietary Diversity Survey)を通じて食品摂取状況の把握を行った。調査概要を下表に示す。

調査方法	作物カレンダーを作成した灌漑スキームの農協メンバーの世帯を対象に食事多様性調査を行った。質問票の質問項目は①食事準備及び食事回数、食事の購入及び準備の意思決定者、②24 時間以内に摂取した食品摂取状況、③食料不安経験、④栄養に係る知識の 4 部構成とした。その他に所有栽培面積や栽培作物の聞き取りを行った。
日付	2022 年 1 月中旬～2 月上旬
調査対象エリア	基礎情報収集と同様
調査実施者	日本側メンバー、現地傭人、FC
調査	調査対象エリアの農協メンバー 40 世帯(ンゴマ地区: 20 世帯、ニャブヨゲラ: 20 世帯)

対象者	調査単位は世帯とし、各家庭を訪問して調査を実施した。
参考資料	- Guidelines for measuring household and individual dietary diversity (FAO, 2010) - ザンビア国市場志向型稲作振興プロジェクト (JICA, 2019-2024)

調査方法の②24 時間以内に摂取した食品摂取状況については、対象者の調査前日の朝から夜の食事内容を聞き取り、食事記録に基づいて、16 食品群の摂取の有無を確認した。FAO の Dietary Diversity Score のガイドラインに従って、下表のように 16 品目から 12 品目に集約し、世帯レベルの食事摂取多様性スコア (Household Dietary Diversity Score: HDDS) を評価した。

4) SMAP 栄養プロジェクトのフォローアップ調査

ルワンダ国小規模農家市場志向型プロジェクト (Smallholder Market-oriented Agriculture Project in Rwanda: SMAP) では、2019 年から 2021 年にかけて栄養改善に係る活動や普及実施の支援が RAB や郡に対して行われた。具体的には、予算申請支援、デモ圃場における NDF の試行栽培、料理講習会、栄養改善研修教材の作成が実施されてきたが、そのうち WAMCAB の成果 5 と最も親和性の高い NDF の試行栽培について、技術の定着及び普及度を把握するべく当時の関係者や支援先に聞き取り調査を実施した。調査対象エリアは SMAP が RAB の活動を直接支援した郡のうち、作物カレンダー作成の対象エリアに隣接するンゴマ郡及びニヤマガベ郡とした。

(3) 農業案件における栄養改善活動の進め方の提案

1) 栄養改善に配慮した作物カレンダーの活用

栄養借款で作成した作物カレンダーの主な趣旨は NDF を適切な時期に栽培し、自家消費することにより栄養摂取状況を改善し、さらに市場での価値を高めることであった。調査サンプル数は限定的であったが、作物カレンダーで判明した偏った栄養摂取状況 (エネルギー過剰摂取でミネラル不足) は基礎情報収集調査や食事調査の結果とほぼ一致していたため、農家一世帯あたりの栄養摂取状況を把握するには有益なツールといえる。作物カレンダーのユーザーは関連中央政府職員に限らず、日頃から圃場にて技術指導を行っている地方行政の郡職員やセクター職員がこれらのツールを駆使し、NDF 栽培のモニタリング評価や農家の栄養摂取状況を評価するなどして日常業務に取り入れることが可能である。また、現在 JICA 経済開発部が開発中のアプリ版では、簡単な操作で必要情報を入力できるため、栄養関連のプロジェクトのベースラインやエンドライン調査でも活用されると推察される。

2) デモ圃場における NDF 栽培

ルワンダにおいて農業活動を円滑に進めていくには農協や地方行政職員の存在が重要となってくる。農業投入材の共同購入や生産物の共同出荷を行う際は、栽培記録や出納簿などの作業はもちろん、持続性担保のためには農協リーダーのリーダーシップや農協メンバーのオーナーシップが不可欠である。成果 5 では SHEP アプローチの一環として農協管理・ジェンダー研修を実施してきたが、営農活動に限らず、栽培技術研修と並行して行い、組織強化を図るべきである。またデモ圃場における栽培及び栽培技術研修を行う際は農協の役割を明確化し、研修には日頃から現場レベルで活動している郡アグロノミストやセクターアグロノミストの参加を促し、プロジェクト後の担い手として育成していくことが望ましい。

ルワンダ政府は他国ドナーと協働で NDF の種子供給や栄養補強食品の配布といった栄養改善に係る支援を広域で行っていることもあり、農家の NDF に対する関心や栽培意欲度が高いことが今回の基礎情報収集調査で明らかとなった。そのため栽培特性に加え、栄養問題を認識し、栽培の意義を理解した上で、適切な NDF を選択していくことで、より効果的な活動となる。末端農家への技術普及の観点を考慮すると、圃場の代替となるキッチンガーデンの作り方や管理方法もレクチャーすることで学んだ技術が活かされやすいだろう。また RAB ステーションでは NDF の品種改良が行われており²、対象郡に設置されたデモ圃場において栽培試験が実施されている。このような場を有効活用し、RAB 職員と農家間の情報共有が行われることも NDF 推進につながると考えられる。

3) 動物性タンパク質の摂取改善

マメやダイズは比較的多く消費されているため植物性タンパク質の摂取は確認できたが、鉄分や必須アミノ酸を含む動物性タンパク質の摂取改善については課題が多く残る。ルワンダは近隣諸国に比べ国民一人あたりの動物性タンパク質の摂取が極めて少ない傾向にあり、今回の食事調査においてもその傾向が明らかとなった。それは運送や冷蔵などのサプライチェーンが未発達のため市場での入手可能性が低く、また販売されている魚類や肉類は高価であるため、農家の食卓に並ぶことは少ない。さらに牛や豚などの家畜を飼育する農家も少ないため必然的にこれらの消費が少なくなっている。考えられる解決策としては鉄強化マメの消費で鉄分を補うほか、牛や豚に比べコストを抑えられる小型家畜 (ヤギ、ヒツジ、ニワトリ等) を飼育し、自家採取したミルクや内臓肉を消費することである。ただし後者については初期投資が必要のため政府側の援助やプログラムの活用が現実的である。

² ANNUAL REPORT 2020-2021, Ministry of Agriculture and Animal Resources

特に灌漑戦略計画に関しては、推奨する持続的灌漑スキーム管理の具体例として本プロジェクトで構築した WAMCAB アプローチが提示されるなど、相互の取り組みが有機的に作用した好事例である。

(Box) 灌漑戦略計画策定への貢献に向けた経緯

(1) 背景

ルワンダ政府は 2018 年に農業セクターの中期計画である第 4 次農業改革戦略計画 (Strategic Plan for Agriculture Transformation、仏語で Plan Stratégique de Transformation Agricole: PSTA4) を策定し、4 つの柱の 1 つに「生産性とレジリエンス」を掲げ、統合的水資源管理 (Integrated Water Resources Management: IWRM) の枠内での効率的な灌漑、水資源開発 (湿地灌漑、丘陵地灌漑、グリーンハウス灌漑、小規模灌漑等)、灌漑技術の開発 (点滴灌漑、水耕システム、アクアポリンシステム等) 等の推進が求められている。また、2010 年に灌漑マスタープラン (Irrigation Master Plan: IMP) が作成され、2020 年には、灌漑技術の進化や 2015 年に策定されたルワンダ国家水源開発計画との整合の必要性を受け、新 IMP が策定された。この中で、灌漑スキームの管理は、(1) 農協・IWUO 型 (農協・IWUO が維持管理運営 (Operation, Maintenance and Management: OMM) ワーカーを備上)、(2) 商業農家・オペレーター型 (土地リース契約を基本)、(3) 専門運営会社型 (RAB が民間に OMM 委託、例: HoReCo 等)、(4) 政府 (MINAGRI) による直接運営型、が言及されている。また、官民パートナーシップ (Public-Private Partnership: PPP) 式灌漑として、イスラエル企業との合弁事業である Gabiro Agri-Business Hub (GABH) が注目されている。

(2) ルワンダ全国を視野に入れた灌漑セクターへの貢献経緯

日時	動き
2021 年 3 月 24～25 日	開発パートナーリトリート (Development Partners Retreat: DPR) が開催され、後に財務・経済計画省 (MINECOFIN) により削除されたものの、DPR の提言として、農業セクターに関する以下のアクションが示され、日本及びオランダが開発パートナー (Development Partners: DP) 共同代表として提案した。 <ul style="list-style-type: none"> ➢ Apply rigorous cost-benefit analyses, accelerate market-based approach to production programs, and test cost-sharing/recovery and community-based maintenance approaches to irrigation investments.
5 月 11 日	MINAGRI 事務次官 (PS) と JICA ルワンダ事務所所長との面談において、PS が持続性の高い Farmer-Led Irrigation に興味を示し、JICA が調査・分析の費用負担を含め支援できないかとの打診を受けた。また、その際 PPP も言及された。PSTA4 にも灌漑マネジメントメカニズムの必要性が言及されているが、具体的な例は示されていない。
8 月 6 日	2022 年 3 月までに実施可能な費用便益分析を WAMCAB が対応する可能性を前提に、同月 6 日に所長が再度 PS と面談したところ、以下の内容が確認された。 <ul style="list-style-type: none"> ➢ 費用便益分析であれば通常は灌漑スキーム工事前に実施されており、そのような狭義的な費用便益分析ではなく、「持続可能な灌漑モデル」の分析が必要である。 ➢ 現在のところ、欧州連合 (EU) の支援で実施する Technical Assistance to Enhance the Government of Rwanda's Capacities in the Agriculture Sector for the Sustainable Use of Land and Water Resources, Value Creation and Nutrition Security (TECAN) が持続可能な灌漑モデル分析について業務指示書 (Terms of Reference: TOR)、コンセプトノートを作成済みである。 ➢ 一方、TECAN には予算がないことが課題であり、DP から広く資金提供を募る必要がある。 ➢ MINAGRI 内では TECAN 担当は農業バリューチェーン管理・貿易総局の総局長 (DG) である。 ➢ JICA からの提案を踏まえ、上記モデル分析のうち調査・分析を切り分け、2022 年 3 月末までに必要な部分について、JICA 及び WAMCAB での支援を検討する。 一方、以上とは別の農業近代化総局のラインで、MINAGRI 省内にて、「灌漑政策と戦略 (2014.1)」と「IMP (2020)」のギャップを埋めるべく「灌漑戦略」部分の見直しを予定しているとの情報が、省内の JICA アドバイザーから提供された。
8 月 26 日 及び 9 月 7 日	JICA 事務所及び JICA アドバイザーから提供された TECAN が実施予定の持続可能灌漑モデル分析の TOR 及び MINAGRI が作成した灌漑戦略見直しに向けた TOR 案を踏まえ、MINAGRI の農業バリューチェーン管理・貿易総局総局長及び農業近代化総局総局長代理、TECAN、JICA アドバイザー、JICA 事務所及び WAMCAB で協議を実施し、以下の内容が確認された。

	<ul style="list-style-type: none"> ➤ TECAN が実施予定の活動は持続可能な灌漑モデル分析ではなく、灌漑、灌漑スキーム、収穫後処理、園芸作物、畜産及び機械化の 6 つの分野に係る農業関連施設のインベントリー作成である。このうち、灌漑と収穫後処理に関する施設整備は、農業の中では大きな費用負担となり、この 2 点を中心にインベントリーを作成したい。収穫後処理については EU 主導でインベントリー作成済みである。 ➤ 灌漑施設のインベントリー作成と灌漑戦略の見直しへの貢献を JICA にお願いしたい。2022 年 3 月を期限に、全体ではなく一部分となっても JICA が貢献することは MINAGRI にとって有益となる。 ➤ 灌漑分野の主要な課題は、灌漑施設の管理とそれが特に零細農民にどうすれば有益となるかということである。
9 月 9 日	<p>JICA 事務所と WAMCAB で検討した結果、JICA が WAMCAB の協力の下、灌漑施設のインベントリー作成を視野に、灌漑マネジメントメカニズムの特定に向けたサンプル調査を含めた灌漑スキーム分析調査を行い、その手法の試行・検討をもって灌漑戦略の見直しに貢献することが、ルワンダの今後の灌漑政策の現場レベルでの推進を支援する上でも重要であることが合意された。</p> <p>一方、灌漑戦略の見直しへの貢献における WAMCAB の主な関与は 2022 年 3 月を期限とする上記灌漑スキーム分析調査とし、4 月以降は JICA 事務所または JICA アドバイザーで予算確保し、それを技術面から可能な範囲で WAMCAB が支援する方向となった。</p>
10 月 14 日	JICA 事務所及び JICA アドバイザーが PS と面談し、上記灌漑スキーム分析調査に対する了承を得た。
11 月 2 日	MINAGRI 及び RAB と灌漑スキーム分析調査に関するキックオフミーティングを行い、WAMCAB から調査手法を説明するとともに、MINAGRI からの必要な支援を依頼した。
11 月 11 日	<p>前述の中間モニタリングミッションによる MINAGRI との協議の中で、PS から改めて「灌漑戦略計画」及び「持続的農業インフラ管理計画」策定に対する JICA の貢献が依頼された。</p> <p>協議の結果、前者については、9 月 9 日で合意した支援の方向と異なり、2022 年 4 月以降の再委託業務の管理を含む灌漑戦略計画の取りまとめを WAMCAB が再委託業務を活用して実施し、計画の打ち込みを JICA アドバイザーが支援することで基本的に合意した。後者の対象となるインフラ施設は灌漑とポストハーベストに区分され、ポストハーベスト施設は TECAN で取りまとめ、灌漑施設は WAMCAB が 30 カ所程度の灌漑スキームに対するサンプル調査を灌漑スキーム分析調査として実施し、その手法を MINAGRI が活用することで整理された。</p>
11 月 12 日	第 6 回 JCC 会議にて、前述の中間モニタリングチームからの提言の 2 つ目と 3 つ目にて、上記 2 つの依頼・合意が言及され、JCC 参加者からの合意を得た。

対象地区内の灌漑マネジメントは、そのメカニズムの検討を含めモデル地区にて試行中であった。ルワンダにおける過去の既存情報を踏まえた机上調査や追加的な灌漑スキームへの現地調査を行い、灌漑マネジメントを含むインベントリー作成に向けた灌漑スキーム分析調査の手法を試行・検討することや灌漑戦略計画の作成支援に貢献することが、WAMCAB で確立される灌漑マネジメントの対象地域外への展開を下支えするとともに、成果 1 である灌漑政策への提言となると考えられた。

(3) 灌漑戦略計画の作成支援

前述の中間モニタリングミッションによる MINAGRI との協議において、PS から JICA アドバイザーに対し、早急に MINAGRI 及び RAB 含む TF を組織し、再委託業務の TOR を作成するよう依頼があった。TF のまとめ役は MINAGRI 農業近代化総局長が担うこととなった。

一方、灌漑戦略計画の作成に至る経緯を整理する中で、世界銀行(WB)が類似業務を計画していたことが判明し、WB から PS への申し出により、同年 11 月 19 日に MINAGRI、RAB、SPIU、WB、JICA 関係者でオンライン打合せを行った。WB が実施予定の Commercialization and De-Risking for Agricultural Transformation Project (CDAT)に含まれる技術アシスタント(Technical Assistant: TA)において、「Rwanda Irrigation Water Governance and Institutional Arrangements」の業務発注を行う予定であったことから、上記 TA 業務の TOR をレビューしつつ、灌漑戦略計画策定の TOR に統合し、WB、JICA を含む DP で検討することとなった。

CDAT は、3 億 USD の有償事業であり、現在締結に向けた準備が行われているとのことである(下表参照)。

項目	内容
目的	灌漑利用やバリューチェーンにより支援された商業化、生産者やアグリビジネス企業の金融サービスへのアクセスを増やす
コンポーネント (予算規模)	(1) バリューチェーンとインフラの整備(2 億円 1 千万 USD) (2) 農業金融と保険(7,500 万 USD)

	(3)緊急対応(予算は状況次第)
	(4)プロジェクト管理(1,500 万 USD)

2021 年 12 月から 2022 年 1 月にかけて、MINAGRI の JICA アドバイザーを通じて「灌漑戦略計画」策定に係る目次案と策定に向けた TOR 案の作成支援を行った。また、1 月 28 日に JICA アドバイザー及び JICA 事務所担当との打合せを再度行った。その後、1 月 30 日に WB の CDAT 担当者と WAMCAB とでオンライン会議を行って TOR 案に対する WB 側の考えとをすり合わせ、その結果を踏まえた TOR 修正案を JICA アドバイザーに送付した。

2 月 11 日に MINAGRI を中心とする灌漑戦略計画策定の TF メンバー(MINAGRI、RAB、SPIU 及び RWB が構成員)で TOR 案が検討され、その後の技術的な検討を踏まえ、世銀の CDAT 及び WAMCAB を含めた関係者での打合せが実施されることとなった。TOR 案は 3 月下旬に最終化された。

(4) インベントリー作成を視野に入れた灌漑スキーム分析調査の手法の試行・検討

前述のとおり、11 月 2 日に MINAGRI 関係者とのオンライン打合せを行い、WAMCAB による調査の概要説明、調査対象の灌漑スキームの選定基準に関する協議、MINAGRI を通じた必要な情報収集依頼を行い、MINAGRI も了承した。一方、11 月 17 日に MINAGRI の紹介により、MINAGRI の SPIU と協議したところ、SPIU で保管していると言われていたインベントリー作成の基礎となるべきデータベースが実際にはないことが確認された。また、灌漑スキームに関する設計・計画書、工事履歴、灌漑スキーム運用に向けたマニュアルの有無、水管理関連文書等はほとんど入手することはできず、ソフトデータで提供されたのは 13 の灌漑スキームに関する維持管理マニュアルや印刷物としてのフィジビリティスタディ報告書のみであった。

上記のとおり、情報収集・整理に時間を要し、調査対象スキーム選定のクライテリア設定が困難なことから、JICA アドバイザーと再度意見交換を行い、既存情報を有する地区を中心に現地調査を開始することとした。

(5) インベントリー作成に向けた留意事項

灌漑スキームに対するサンプル調査について、東部県及び南部県を拠点とした現地傭人の調査員チームにより、WAMCAB のモデル地区や対象スキーム近傍のため追加したスキーム、MINAGRI が直接灌漑開発を実施したスキームを含め 50 の灌漑スキーム(IWUO:計 51、農協:計 64)が完了し、当初想定 of サンプル数よりも多く対応できた。SPIU から入手したリストには、RSSP、LWH 及び農村コミュニティ支援プロジェクト(Rural Community Support Project: RCSP)で支援済み灌漑スキームが 50 カ所記載あったが、現地調査を踏まえ、43 カ所と再整理できた。このうち、38 カ所での現地調査が完了した。現地調査の対象とならなかった灌漑スキームは、RSSP1 や RSSP2 等比較的古い時期に開発が行われたと示されている灌漑スキームである。また、SPIU から入手したリスト記載の灌漑スキーム以外には 12 の灌漑スキームでの現地調査が完了した。内訳は、WAMCAB のモデル地区の 7 つの灌漑スキーム(ルワマガナ地区は 4 つ、その他地区は各 1 つ)に加え、参考として政府予算(Government Fund Irrigation Project: GFI)等で開発された 5 つの灌漑スキームである。

上述のとおり、MINAGRI にはインベントリー作成の素地となるべき過去の調査を踏まえたデータベースはなく、今後インベントリー作成を行うためには以下を考慮し対応する必要があると思われる。

- SPIU 提供リスト記載の灌漑スキーム名は、実態として事業名であり、裨益者である IWUO 及び農協は認識していないことが多く、郡行政含め、同リストとは異なる名称で呼んでいる場合がある。
- 事業名であることから、記載の灌漑スキーム名は 1 つの灌漑スキームを表しておらず、複数の灌漑スキームであったところも見られた。
- SPIU 提供リストの灌漑スキームが全く存在しない場合があり、それについては郡も把握していない。
- 多くのスキームが複数の郡・県に広がって存在する。その場合、複数県で組織登録を行っている IWUO も見られ、この整理が必要である。
- 農協が複数あるスキームは多くのスキームで見られたが、IWUO が複数あるスキームも見られた。
- ほぼ全ての農協が灌漑スキームのデザインや実態を把握しておらず、同じようにほぼ全ての IWUO が営農活動を把握していない。灌漑スキームに対する双方への確認は必要である。
- 多くの IWUO 及び農協は、事業実施当時の灌漑スキームの地図等情報を有しておらず、MINAGRI 側だけではなく、現場側でも情報を確認することは非常に困難である。
- 商業農家・オペレーター型や GABH のような民間企業が運営・維持管理を行う灌漑スキームは見られなかった。
- 上述のとおり、SPIU を通じて MINAGRI から入手した情報に不備が多かったが、MINAGRI の JICA アドバイザーを通じて入手した MINAGRI から各郡に派遣される DASI のリスト(全国 30 郡のうち、24 郡分が記載)が、各郡の担当者情報を入手する際に有益であり、サンプル調査の実施面で有効であった。

3.6.2 大学との連携

今後のルワンダにおける灌漑水管理人材の育成に向け、JICA ルワンダ事務所の立会いの下、2023 年 10 月 3 日付でルワンダ大学農学部・RAB・WAMCAB が協力覚書（MoC）を締結した。チャルホゴ地区、ンゴマ地区などモデル地区のいくつかではルワンダ大学農学部の教師及び学生による現地実習に関する受入・指導を開始しているとともに、2024 年 6 月には WAMCAB メンバーがルワンダ大学において講義を行うなど、相互の連携活動が行われている。現地実習の受入・指導の主体は、WAMCAB 側から IWUO・農協側に移行しつつあり、灌漑政策の実施機関である RAB が署名者の一員となっている意義は、プロジェクト終了後において、IWUO・農協のみならず、郡等の地方行政機関を巻き込むことによる持続性確保のためとも言える。

3.6.3 他の協力スキームとの連携

(1) 草の根無償資金協力事業の活用

ルワマガナ郡のチャルホゴモデル地区 4 スキームのうち、Cyaruhogo 以外の 3 スキームでは日本の無償資金協力事業によりダムの改修・新設が行われたが、Cyaruhogo スキームにおいては WAMCAB 開始当初より安定的な水源施設の整備が要望されていた。このため、ルワマガナ郡庁とプロジェクトとの間で、スキーム中央を流下する幹線排水路から灌漑用水を取水する案が議論され、4 スキーム一体となった灌漑管理の実現に向け、一部の小規模施設については住民参加による建設が試行されてきた。

上記の議論等を踏まえ、2022 年 6 月 27 日にルワマガナ郡庁から在ルワンダ日本国大使館に対し、チャルホゴ地区の取水堰、用水路等の建設を目的とした人間の安全保障・草の根無償資金協力事業の申請がなされた。その後、日本側関係機関において案件の妥当性が確認され、2023 年 3 月 14 日に日本国大使とルワマガナ郡長により贈与契約書への署名が行われた。2025 年 2 月現在、主要工事が完了した段階であり、チャルホゴモデル地区 4 スキームが一体となった灌漑管理が実現されることが期待されている。

(2) JICA 海外協力隊との連携

ルワンダには 2024 年 1 月末時点で 40 名の海外協力隊員（JOCV）が派遣されている。JOCV（特に農業・灌漑に関連するコミュニティ開発、野菜栽培隊員）に対し、赴任国で実施されている JICA 技術協力プロジェクトの内容、C/P や受益者との連携への理解を深め、農業農村開発に向けた構想策定にも資するため、JICA 事務所担当者と連携し、JOCV 及び C/P のプロジェクト活動への参加を促してきた。これらの働きかけにより、JOCV の各任地において持続的灌漑スキーム管理モデルの普及に関する議論が進むことを期待する。

また、WAMCAB で実証している持続的灌漑スキーム管理モデルの普及・定着に向け、プロジェクト終了後の持続性確保にも寄与できる方法として、プロジェクトと対象 3 郡との間で新規 JOCV 要請について議論を進めてきた。この結果、2022 年 6 月にルワマガナ郡庁から JICA ルワンダ事務所に対し JOCV 派遣に係る要請書が提出され、2024 年 8 月に農業土木隊員がルワマガナ郡庁に派遣された。

ルワマガナ郡においては WAMCAB モデル地区であるチャルホゴ地区の IWUO が全国でも有数の先進的な組織として認知され、郡外及び国外からの見学者も多いことから、農業土木隊員としての郡内での活動にとどまらず、WAMCAB 後継プロジェクトと連携した WAMCAB アプローチの全国普及に向けた役割も期待される。

第4章 事業実施後の上位目標達成に向けて

4.1 上位目標達成の見通し

上位目標はプロジェクト終了後3年から5年以内に達成されることを想定しており、プロジェクト実施期間中に、その達成に向けた制度・体制作りを進めるとともに、可能性ある普及スキームを特定し、IWUO 管理モデルの試行を行うこととした。また、WAMCAB の活動の再現や普及を視野に、灌漑スキーム管理能力強化ガイダンスやプロジェクトモデル普及アクションプランも作成し、最終 JCC 会議となった 2025 年 1 月開催の第 12 回 JCC 会議にて、ルワンダ側に提出・受理された。

上位目標には 1 つの指標が設定されている。下表に示す上位目標の指標に対する評価を踏まえ、上位目標の達成見込みは高い。

表 4.1 上位目標の指標及びその達成状況一覧

指標	達成状況
ターゲット郡において、少なくとも 1 地区で灌漑管理システムに従った (IWUO による) 管理が実施される。	(達成見込みは高い) 上位目標を視野に活動を展開する普及対象スキームでは、IWUO による管理を含め、WAMCAB が技術指導フェーズで確立した各種手法が、裨益者から求められていた。2024 年 2 月に WAMCAB アプローチの要である 9 ステップに係る成果 2 に関するマニュアルの説明ワークショップを開催したが、それには RAB の指示により WAMCAB アプローチの全国展開に当たって重要な担い手となる SP を参加させ、各担当スキームへの展開を促した。モデル地区での知見を踏まえ整備されたマニュアル類は、普及対象スキームの状況に適応させつつ試行され、各普及対象スキームにおいても IWUO の体制強化、灌漑スキーム管理効率化の成果が現れてきている。

4.2 上位目標達成に向けたルワンダ側の事業計画と実施体制

4.2.1 ルワンダ側の事業計画

(1) 総論

前述のとおり、ルワンダでは 2010 年に IMP が策定され、2020 年には Water Resources Master Plan との統合の必要性等を受け新たな IMP が取りまとめられた。新 IMP の中では、新規灌漑開発及び既存灌漑地区改修が提案されるとともに、灌漑スキーム管理に関しても IWUO 型をはじめとした多様な手法が提案されている。しかしながら、新 IMP の実行が遅れていること等に鑑み、MINAGRI は具体的な方策を盛り込んだ灌漑戦略計画の策定を企画し、2021 年 8 月に戦略計画案の作成を JICA に要請した。

上記を受け、JICA の指示により WAMCAB が灌漑戦略計画 (案) を作成し、同案を基に MINAGRI が最終化の手続きが進めているところである。同戦略計画には、持続的灌漑スキーム管理の代表的なモデルとして、当プロジェクトで実証した WAMCAB アプローチを全国的な規模で普及することも提案されており、上位目標の達成及び今後の灌漑政策実現に向けた指針となることが期待されている。

(2) 普及準備フェーズ等の経験活用

2023年3月に就任したRAB長官は、2023年6月に開催された第9回JCC会議以降、スピード感を持ったWAMCABアプローチの全国展開を指示している。これを受けWAMCABでは、同JCC会議で承認された普及対象スキームにおいて、第3フェーズ（制度化・普及準備フェーズ）の活動として、第2フェーズ（技術指導フェーズ）までに取り組んできた持続的灌漑スキーム管理モデルの有効性を確認し、同モデルを普及するためのマニュアル・テキストの実効性の評価を進めてきた。

これらの活動を2024年6月まで継続し、それ以降はスキーム管理モデルの有効性の評価とマニュアル・テキストの現地適応性評価に基づく同文書の改訂・最終化を進めてきた。また、対象3郡において作成したアクションプランの中で、モデル普及に向けた具体的な実施方針、作業内容の取りまとめを行った。

これらの実績により、スピード感を持ったWAMCABアプローチの普及が可能であることが実証されつつあるが、そのためには、①モデル地区での成功体験の共有、②普及対象スキームにおける意欲あるリーダー・担い手の確保、③普及を担当する実務的な指導者の確保、④普及をモニタリング・支援するRAB・郡・セクターの体制整備、が必要であることも明らかになっている。

なお、プロジェクトで実施した研修の中には農家の理解度が低いものもあるが、それらに関しては、日常活動の中でNS等の指導の下で研修で習った技術を実践し、うまくいかなかった内容について再度研修を実施するなどの工夫を行った。また、普及対象スキーム向けの研修において、モデル地区のFC等が講師補助を行うことにより、現地語による指導、経験に基づく指導がなされ、対象スキームにおけるIWUO等への技術移転、能力強化に大きく寄与した。さらに、研修参加者が多い場合は複数回に分割して行うなど、参加者一人一人がしっかり研修の関われるように配慮した。

また、成果5の栽培技術研修では、デモ圃場において苗づくり・移植・施肥・収穫といった営農活動をシリーズ化して実施したが、農家によって栽培の経験、スキル、やる気が異なっていたため、内容を理解し実践できる農家もいれば、研修後のアクションが見られない農家など様々なレベル感の農家がいた。これに対しては、研修後に農協アグロノミストやNS等が圃場をモニタリングし、改善が必要な農家及び技術を特定して補完研修を実施した。補完研修は改善が必要な技術のみに注力し、デモ圃場ではなく実際に改善が必要な農家の圃場を使用することで農家のモチベーションアップを図った。

(3) 灌漑マスタープランの実現

前述のとおり、IMP実現のためには、その方針を具体的なプロジェクトに落とし込む灌漑戦略計画が不可欠であると認識されている。WAMCABにおいて2022年6月以降策定を進めてきた灌漑戦略計画については、2022年12月20日に戦略計画（案）がMINAGRIに提出され、ルワンダ政府及びドナーで構成される作物分野会議での議論が2023年1月20日に行われ、コメントに基づく修正の後、3月15日に開催された農業セクターワーキンググループで最終案が審議されたが承認には至らなかった。しかし、その後のMINAGRI内での議論において、戦略計画の最終化には

大臣が参加する幹部会議での承認が必要となり、2025年2月末時点で最終化に至っていない。

今後速やかに灌漑戦略計画を承認し、ルワンダ政府による灌漑政策の具体化をはじめ、各ドナーによるプロジェクト実施の際にも、IMPの実現を目標とし、統一感を持ち整合の取れた施策が実施されることが求められている。

(4) RAB 職員の能力強化

2023年6月に開催された第9回JCC会議において、プロジェクト・ダイレクターであるRAB長官からWAMCAB成果の他スキームへの早期展開に対する期待が表明され、その第一歩として全国のRAB技術系職員を対象とし灌漑スキーム管理に係る技術移転を目的としたワークショップ（WS）の開催が提案された。

同WSは、2022年8～9月に本邦で実施された課題別研修「農民主体型用水管理システム（A）」に参加したチーフ・インプリメンターのアクションプランでも提案されているものであり、JICAルワンダ事務所の予算手当も受け、2023年中の開催が求められていた。

WSは2023年11月28～29日にルワマガナ郡で開催され、RAB LII-TT 局長、ルワマガナ郡副郡長、JICAルワンダ事務所長、日本国大使館書記官等も参加して、28日にはWAMCABアプローチの紹介と参加者が関与するスキームでのモデル展開に係るグループワーク、29日にはBuguguスキームを会場にIWUO及び農協関係者による概要説明と質疑応答が行われた。

19名の参加者のほとんどはRAB採用後間もない土木工学出身の若手職員であり、灌漑事業の基礎知識から学ぶ必要があったが、同WSを契機に研鑽を積み、RAB長官が提唱するWAMCABアプローチの早期全国展開への寄与が期待される。また、持続的灌漑スキーム管理モデルの全国普及に関係するRAB職員に対し同様の研修機会を広く提供し、個々の職員の能力強化とともに、RAB自体の組織強化にも取り込むことが重要である。

(5) イミヒゴとの整合性の確保

ルワンダ政府職員は中央・地方を問わず、職員ポストごとに年度当初に所属機関との間でイミヒゴ（Imihigo：年間実行契約）が設定され、年度末の査定を踏まえ、目標の達成度に応じた人事評価がなされる。このため、イミヒゴに関わらない活動の実施については消極的な姿勢を示すことが散見されている。したがって、上位目標の達成に関係する職員のイミヒゴに持続的灌漑スキーム管理モデルの普及に関する活動を位置づけ、モチベーションの確保に留意することが必要である。

上位目標の達成に関係する職員、特に郡庁においてDISCに関わる職員が、プロジェクト期間だけの業務ではなく、自身の本来業務として管理モデルの普及に取り組んでいく必要があり、組織及び個人のイミヒゴと連携した活動の取り込みや予算の確保等が課題となっている。

WAMCABにおいては、プロジェクト開始直後にRAB長官と協議し、2019/20予算年度以降のRAB職員のイミヒゴにWAMCAB関係業務を記載するとともに、灌漑技術者に関しては2021/22予算年度において灌漑スキーム評価の項目も追加された。一方、郡職員のイミヒゴにWAMCAB関係の指標を記載するためには、活動に必要な予算を記述するなど複雑な手続きが必要となるこ

とから、2021 年 11 月に実施された中間モニタリングでの提言も受けて第 6 回 JCC 会議において議論し、イミヒゴの下位に位置するアクションプランへの記載として対応した。

なお、RAB ステーション職員のイミヒゴは各職員の本来業務（コメプログラムや小規模灌漑技術（Small Scale Irrigation Technology : SSIT）プログラム等）に沿って、MINAGRI 及び RAB の政策執行に沿って活動が構成されるのに対し、郡職員のイミヒゴについては、中央政府や郡の施策に合致させるだけでなく、下位の行政機関であるセクターやセル、村レベルからのニーズの積み上げにより活動が構成されることが多いため、これら行政の仕組みや施策の背景についても留意しながら取り組む必要がある。

(6) 予算の確保

COVID-19 の影響により、2020-21 会計年度以降、RAB の予算は大幅に減額されていたが、近年ようやく COVID-19 以前の状況に戻ってきている。

他ドナーが拠出するプロジェクトの多くでは、灌漑スキーム管理に関係する職員・農家の能力強化に必要な研修・スタディツアー等への参加費等のローカルコストをプロジェクトで負担している例がみられるが、プロジェクト終了後の持続性確保やプロジェクト実施地区以外への展開を考えると、JICA が拠出するプロジェクトで採用しているように、最低限の現地活動予算はルワンダ側で手当てすることが必要であると考えられる。

ただし、地方分権が進んでいるルワンダ国の実情を踏まえると、MINAGRI や RAB 等の中央政府予算だけでなく、地方行政機関である県、郡、セクター等の予算も総点検し、灌漑改善の目的に適合し支出可能な予算を有効活用することが求められている。

WAMCAB においては、自然災害によって破損した施設の復旧に当たり、当事者である IWUO が積み立てていた財源だけでなく、地域での営農に関係する農協や灌漑システムの有効活用に関し支援を行う郡庁からの財政支援を受け、通常より迅速に施設普及を果たした実績を持っている。これらの支援により、結果的に地域営農が早期に復旧され、農業生産の確保や水利費徴収の正常化に繋がり、地域経済への波及効果も生まれることになったことは、地域政策としてだけでなく、国策としても有効であったものと評価できる。

4.2.2 ルワンダ側の実施体制

(1) 総論

従来 RAB では、現場を基本とし農家への直接支援を行うための研修方法である近接コーチング（Proximity Coaching）に焦点を当てた IWUO 能力強化のためのさまざまなアプローチを実施してきた。当初は RAB 本部職員により IWUO の組織化と能力強化に向けた近接コーチングを実施したが、IWUO 担当職員が本部から各ステーションに配置換えされたことで、本部職員に代わりステーション職員が近接コーチングを実施することとなった。しかし、人員不足による業務多忙により十分な活動ができず、灌漑スキームへの近接コーチングとして民間セクターを巻き込み始めたが、実施主体であるサービスプロバイダーの専門知識・経験が不十分なことから、想定していた効果の発現が果たせない状況であった。

本プロジェクトにおいても、当初想定していた実施体制は、RAB 及び郡庁職員に TOT を実施し、それら職員が IWUO・農業の能力強化を行い、持続的灌漑スキーム管理を実現することを想定していた。しかしながら、第 1 フェーズでの経験を通じて、RAB 及び郡庁職員からなる TF メンバーが多忙なため個別スキームの能力強化を担える状況ではないことが判明し、第 2 フェーズ以降の活動を実質的に進めるため、以下のとおり、各スキームの IWUO または農協に配置された FC を実施主体とし、TF メンバーが評価・モニタリングを行う研修実施体制を構築し実践してきた。

1. 研修の実施については、当初想定していた政府職員に期待したカスケードスタイルによる取り組みではなく、プロジェクト終了後に IWUO または農協の職員としての雇用が想定される FC に TOT を実施し、彼らを核とする実施体制とする。
2. TF メンバーは日常業務が多忙であるとともに活動費も乏しく、連続した現場業務が困難なことから、FC 等が実施する研修の評価・モニタリングを担い、受益者である IWUO や農協メンバーの理解度を考慮した上で、FC・IWUO・農協等に対し必要なフォローアップを行う。
3. 本来 IWUO への指導・能力強化を担う DISC の活動が停滞している現状を改善し、質量ともに活性化させることにより、IWUO 間での優良事例の共有を促し、農協との関係を円滑化し、郡等からの必要な支援・指導を行うことにより、能力強化を図る。

(2) RAB の役割

WAMCAB の成果発現のためには、TF メンバーをはじめとする RAB 及び郡庁職員等が、それぞれの立場から現地調査、研修、評価・モニタリング、各種会議に能動的に参加することが必要になる。その前提として、各メンバーがそれぞれの役割と費用分担を明確にし、確実に担当する業務を実施する体制を確保することが重要であった。このため、2019 年 10 月から 11 月にかけて RAB、関係郡庁、WAMCAB の三者でそれぞれの役割と費用の支出分担について協議を進めた結果、2019 年 11 月に開催した第 2 回 JCC 会議において了解覚書（Memorandum of Understanding : MOU）に署名し、基礎条件を整えることができた。

RAB は MINAGRI に代わってルワンダにおける灌漑行政を促進する立場にあり、IMP、灌漑戦略計画を受け、具体的な灌漑開発及びスキーム維持運営管理への指導・助成が求められている。実質的な灌漑部門の統括組織としては、RAB LII-TT が担っているが、前述のとおり、組織・人材・予算の面で不十分であることから組織の強化、人材の育成が必要とされている。

なお、RAB 長官は WAMCAB による持続的灌漑スキーム管理モデルを評価しており、JCC 会議等において早期の全国展開を指示している。また、灌漑技術者である RAB LII-TT 局長は RAB 職員の専門性が未熟であることを認識しており、全国展開に向け職員の能力強化の重要性について発言している。

(3) 郡庁の役割

各郡において副郡長が議長を務める DISC が IWUO の組織・技術両面の能力強化を担っていることから、DISC の活性化と郡幹部の IWUO に関する理解促進を図る必要がある。郡長・副郡長等との面会を通じて郡庁との関係強化に努め、各郡の TF メンバーと協力し、DISC の活性化及び DISC と各灌漑地区との関係強化を図ることが効果的である。

WAMCAB の活動を通じ、プロジェクト開始前は不定期に開催されていた DISC の年間 2 回開催

が定着し、IWUO からの報告や課題解決に関する議論が活発化するなど実質的な能力強化につながっている。さらに、2024 年 1 月に就任したルワマガナ郡の副郡長は IWUO の重要性を認識し、IWUO の総会に出席したり、DISC 会議の年間 4 回開催を提案するなど、プロジェクトの想定を上回る動きもみられている。

また、後述する IMT の合意書締結に当たっては、持続的灌漑スキーム管理における郡庁の役割を明確に規定するため、MINAGRI と IWUO の二者合意書から郡庁を含めた三者合意書への変更が検討されるなど、一部ではあるが郡庁の積極的な動きがみられている。

(4) IWUO 等の主体的な活動

IP/TP の具体的な実施体制に関し、現地における研修実施を担当する FC を雇用している。FC はプロジェクト終了後を見据え、IWUO や農協の職員・技術者として残る現地人材であることを条件とした上で、WAMCAB と IWUO または農協との間で給与負担を分担している（別添 1-5 参照）。FC 雇用開始時には WAMCAB が全額を負担していたが、その後の IWUO・農協との協議により負担率が減少し、2022 年 12 月までの時点で IWUO についてはコストの 50%を負担する状況であったが、2023 年 1 月以降はンゴマ、チャルホゴ、ンギリの 3 地区において 75%まで負担額を引き上げることで合意した。ニャブヨゲラ地区については、FC が所属する SMC の上位組織である農協との間でコスト分担を行っている。

IWUO・農協によるコスト負担が進んでいる要因として、FC の貢献により各組織の活動計画、予算・決算が明確化・透明化し、IWUO 組合員のニーズに応える活動が可能になるとともに、予算支出に関する組合員農家の信頼度が増進し、共同活動への参加率、水利費徴収率が向上することにより、FC への給与負担が可能になっていることが挙げられる。また、水利費徴収率の向上以外にも、IWUO でいえば鉱業等の水利用者からの水利費徴収、内水面養殖・ダム下流斜面の草の牧草利用・流入土砂の販売等による副収入確保、農協でいえば農業投入財の販売機関としての認可取得による販売収入等より、各組織の財政が健全化してきたことも要因の一つである。

(5) 他ドナーとの連携

ルワンダでは、過去 10 年以上にわたり世界銀行（WB）や国際農業開発基金（IFAD）等が実施するプロジェクトの中で、灌漑開発のほか IWUO の設立支援や能力強化の活動が実施されてきた。WAMCAB では、プロジェクト開始当初から事業終了時点まで広く関係機関との協議・情報交換を行い、本プロジェクトの位置付けを明確にしてきたところであるが、今後とも将来的な普及を見据えた活動を進めていく必要がある。

WB や IFAD が拠出するプロジェクトは、RAB に設置された SPIU（Single Project Implementation Unit）が実施管理を行っており、WAMCAB のキガリ駐在事務所と同じ建物に位置している。WAMCAB が SPIU と調整することにより、ほとんどの関連プロジェクトとの連携が可能になり、ンゴマ地区では WB が支援する SAIP（Sustainable Agricultural Intensification and Food security Project）との間で、主に営農、圃場灌漑、施設整備に関し重複を避けつつ連携して活動を進めている。また、IFAD が支援する KIIWP（Kayonza Irrigation and Integrated Watershed Management Project）では WAMCAB アプローチの主要な要素である組織強化手法（9 ステップ）や FC を導入する方向であ

り、本プロジェクトとして専門家の派遣、農家視察の受け入れ等を行っている。

上位目標の実現、さらには全国展開のためには、RAB の自助努力のみならず、これら他ドナーの拠出によるプロジェクトとの連携による WAMCAB アプローチの展開が大きな要素となる。

4.3 ルワンダ側への提言

上位目標「ターゲット郡において、少なくとも 1 地区で灌漑管理システムに従った（IWUO による）管理が実施される」の実現に向け、プロジェクト成果の継続と展開を念頭に、持続的灌漑スキーム管理の実現に向けた制度化・普及準備を進め、最大限の効果発現を図る観点から、以下のとおり提言する。

4.3.1 政策提言の具体化

これまでのプロジェクト活動の成果も踏まえて、2021 年 6 月に政策提言（案）として以下の内容を取り纏め、MINAGRI 事務次官、RAB 長官、関係副郡長等と意見交換を進めてきた。

1. 農業省令に基づく適正かつ有効な IWUO の登録と IMT の促進
2. 末端レベルから機能的に組織された IWUO の形成
3. 灌漑スキームに存在する IWUO と農協の連携強化
4. IWUO に対する政府及び IWUO 連合体からの支援
5. IWUO 及び IMT に係る法体系の整備

この中で、中心的な課題である灌漑スキームの持続的管理を担う IWUO の機能強化に関しては、現状では中央及び地方政府からの技術・管理両面からの支援が不可欠であるが、将来的には外部からの支援に頼らない自立的な能力向上の仕組みが必要であり、有効かつ実績のある取り組みとして、IWUO が県レベル・全国レベル等で連合体を組織し、それら連合体が構成員である個々の IWUO を指導・支援していく方策を提案している。

また、MINAGRI から IWUO に灌漑スキームの維持管理が移管される手続きである IMT に当たっては、現在の農業省令では MINAGRI と IWUO が合意書を取り交わし、それに郡庁が立会する形式となっているが、持続的灌漑スキーム管理における郡庁の役割を明確に規定するため、上記の二者合意書から、郡庁を含めた三者合意書への変更を検討することが大きな一歩となるものとして期待される。

4.3.2 WAMCAB アプローチの定着と展開

前述の灌漑戦略計画最終案には、以下の内容からなる IWUO による灌漑スキーム管理モデルが WAMCAB アプローチとして紹介されている。本モデルは WAMCAB における政策提案の主要な要素ともなっており、ルワンダ国での持続的灌漑スキーム管理モデルの実現に向け、RAB が中心となり、組織・人材・予算を集中して全国的な展開を図ることが望まれている。

1. 農業省令を実現するマニュアルの整備
2. FC 制度の導入
3. 持続的スキーム管理に必要な組織の適正規模化

4. 管理システムに適応した多様な組織の許容
5. 中央・郡政府など関係者からの支援
6. オーナーシップ醸成のため農家自ら参加する補修作業
7. 長期的な視野で見た IWUO の能力強化支援

WAMCAB アプローチは、本プロジェクトの第 2 フェーズにおけるモデル地区での実績に基づいて構築され、第 3 フェーズにおいて普及対象スキームへの展開が実証されている。特に、チャルホゴ・ンギリ地区等の低湿地水田、ニャブヨゲラ地区等の低湿地畑地での親和性・有効性が高く、効率的な組織運営、維持管理、水管理の実現により、農業生産の安定化、生産面積の拡大、収入の増、水利費徴収率の向上と透明性のある予算支出に繋がっている。

一方、丘陵地畑地であるンゴマ地区では、後述するように、低湿地とは異なる立地条件、営農条件から多くの課題を内包しており、スキーム管理モデルの構築に向け、継続した実証作業が必要と思われる。一方、同じ丘陵地灌漑であっても、小規模タイプの Mutenderi スキームでは、パイプライン網の補修、ボトムアップの組織整備、維持管理に係る能力強化。市場志向型農業の導入等により栽培面積の増、農家収入の増などの好循環が生まれている。各スキームに適合した最小限必要がインフラ整備とソフト対策の有機的組合せにより、丘陵地畑作灌漑地区であっても持続的なスキーム管理が実現できる道が開けたものと評価している。

4.3.3 丘陵地灌漑スキーム管理モデルの構築

WAMCAB においては、低湿地水田、低湿地畑地とともに、丘陵地畑地における灌漑スキーム管理手法の確立のため、ンゴマ地区をモデル地区として技術実証が進められてきた。この結果、以下のような課題が明らかになってきている。

1. 丘陵地畑地に適合した導水システムの導入

ンゴマ地区での末端灌漑システムはパイプラインでの圧送であるが、そこに至る幹線水路系の上流部分が開水路となっており、水源地点でポンプアップした水圧が十分生かされていない構造となっている。工事費増嵩との兼ね合いになるが、幹線水路のパイプライン化についても検討の余地がある。

2. 省力的な圃場灌漑手法の導入

ンゴマ地区での圃場灌漑手法は、給水栓から 50m の範囲を手持ちのホースで灌漑することとなっている。圃場土壌の浸透性が高く、畝間灌漑が採用できない自然条件ではあるが、営農形態に対応した省力的な圃場灌漑手法の導入が求められており、SAIP によりスプリンクラー灌漑、点滴灌漑が試行されている。

3. 営農形態の制約と市場志向型農業の活用

年間 3 回の営農シーズンのうち、天水栽培が可能なシーズン A～B は、政府の方針により CIP（穀物集約化プログラム）作物であるメイズやマメ類の栽培が推奨され、各郡で指定された推奨 CIP 作物のシーズン毎の栽培面積・生産量目標値が設定されている。これらの達成状況は郡庁やセクター職員の人事評価にも影響するため、広大な最大面積をもつ灌漑スキームは CIP 作物の栽培エリアとしてターゲットにされやすい。また、ンゴマ地区の農家を対象にヒアリング

した際、農協のリーダーの全員が「たとえ野菜の方が儲かっても自家消費できるメイズを栽培したい」と回答したことから、農家の傾向として換金作物の栽培より自家消費用の作物を優先させたい意識が強い印象を受けた。そのため、換金作物の栽培環境が整ったとしても一程度は従来作物の栽培を選択する農家がいる可能性がある点は留意しておく必要がある。他方で、灌漑期であるシーズン C においては市場のニーズに立脚した各農家の自主的な営農が可能であり、バランスの取れた営農形態の実現が求められている。以上より、中・大規模灌漑スキームで市場志向型農業を導入する場合は、農協管理を担う郡庁・セクター職員との事前協議、農家の意向調査結果などを踏まえ、現状に即した営農形態の推進が求められる。

4. 効率的な水管理に寄与する畑作の団地化

丘陵地では個人に農地の所有権があり、最終的な作物選定・営農形態は農家の意思に委ねられている。このため、導入作物・作付時期・耕作エリアがバラバラで、畑地灌漑を行う配水システムや給水栓の構造・配置にマッチしていないため、配水に伴う無効放水ロスが大きい。施設面からの対応には限界があるため、農家ニーズを踏まえつつ、農協等の主導により導入作物の集団化などの検討が必要と思われる。

5. 畑作営農に順応した水利費徴収システムの構築

畑作は営農実態に合わせて水利費の徴収も個別に行っており、徴収経費がかさむとともに、共同出荷している水田地帯と比較して徴収率を上げることが困難である。このため、農協単位で共同出荷をし販売価格から水利費を直接徴収する方法、畑作農家が営農している水田から畑作用・稲作用の水利費をまとめて徴収する方法など、地域に適合した水利費徴収システムの構築が必要である。

6. 自然災害を克服する施設管理

丘陵地では、毎年のように土砂災害や浸食による灌漑施設への被害が発生しやすく、施設の維持管理に低湿地灌漑地区よりも比較的大きな予算を必要としている。このため、幹線水路システムをパイプライン化する、山地からの降雨流出をスムーズに幹線排水路に導く排水システムを整備する、道路・市街地等からの流出を灌漑システムに影響させないようにする、などの総合的な対策を検討することが必要である。

これらを踏まえ、低湿地でのモデルとは異なる丘陵地における灌漑スキーム管理モデルの構築が必要である。

4.3.4 IWUO と農協との連携強化

ルワンダにおける灌漑施設の維持管理及び水管理については、従来農協が実施しているスキームが一般的であった。これに対し、2011 年に IWUA（現在の IWUO）設置に係る農業省令が交付され、IWUA を「該当の灌漑スキームにおけるすべての水利用者により構成される協会」とするとともに、「IWUA は MINAGRI 及び郡と IMTA を結ぶことが許されている唯一の組織であるとともに、MINAGRI に代わって灌漑スキームの維持管理を担う」と定義し、ルワンダ国内のすべての灌漑スキームに IWUA を設立することが明記された。

以来、IWUO は関係する農協からの要請に基づいて灌漑用水を供給するという用水供給者として

の役割を担ってきた。さらに、IMTA を締結するに当たっては、IWUO と農協との間で履行契約を結ぶことが義務付けられている。本来であれば履行契約に基づき、農協組合員が必要とする灌漑水量が IWUO から供給されることになっているが、実態としては灌漑施設の不備、不十分な施設維持管理、不適切な水管理等に起因して計画どおりの適正な用水供給ができず、農協サイドに不満が生じているケースも散見される。

このため、問題の実態及び背景を踏まえ、DISC を中心に関係機関の連携を進め解決策の実施と関係改善を進めることが課題となっている WAMCAB における実践からの教訓としては、持続的な灌漑スキーム管理実現のためには IWUO と農協の信頼醸成が鍵となる。まずは、双方の総会における適正な活動報告・決算報告・活動計画・予算案の公開などを通じて各組織の活動内容に関する透明性を確保し、それぞれの総会に IWUO と農協が相互に参加して組織運営の実態を理解することが基本となる。その上で、双方の共通目標である農業生産の拡大・近代化に即した共同活動（先進地視察、研修への共同参加など）を通じて意見交換・議論を進めることが効果的である。なお、特に課題がある地区に関しては、第三者である郡庁等が介入し、双方が抱える問題点を明確にし、冷静に議論できる場を提供するとともに、DISC 等を通じた継続的なモニタリング・支援の実施が効果的であることが明らかとなっている。

また、組織面の課題として、ニャブヨグラ地区においては、地区共同で管理すべき貯水池等の主要灌漑施設が存在せず、灌漑水量が不足し灌漑依存度が低いことから、現実的な提案として、独立した IWUO を設立するのではなく、農協の下部組織として SMC を設置し、水管理・維持管理の業務を担う活動を試行している。このように、地区ごとの用水利用の実態及び持続的なスキーム管理体制確立の観点から、各地区に対応した管理体制を検討し、実現に向け関係機関との協議を進めることが望まれる。

4.3.5 サービスプロバイダーの巻き込み強化

WAMCAB の実施に当たっては、RAB 本部・ステーション及び郡庁に所属する TF メンバーの現場活動が物理的予算的な制限から限定される中で、前述のとおり、プロジェクト終了後の持続的な活動計画（Plan of Operation : PO）を見据え、将来 IWUO または農協の職員としての雇用が想定される FC を核とする実施体制とした。

しかし、FC を雇用した初期段階においては、外部からの技術支援が必要なため、それを補完する方策として、小さな政府を志向する国の政策に基づいて RAB が契約し各灌漑スキームに配属している SP の活用について RAB と議論を進めてきた。具体的には、モデル地区または近隣地区で近接コーチングを実施中の SP と連携した IWUO・農協職員の能力強化を進め、さらには両者の協働により灌漑スキームにおける活動を強化・スケールアップしてきた。

また、2023 年 10～11 月に実施された SHEP アプローチに関するオンライン研修への参加者を広くルワンダ国内で募ったところ、参加 7 名中 5 名が SP 職員であり、うち 1 名はルワンダで唯一フルに参加した研修員となった。彼は研修後も WAMCAB との関係を保っており、このように様々な機会を通じて連携を強化することが、長い目で見て灌漑農業の発展に寄与することになるものと考えられる。

プロジェクト最終段階において、WAMCAB アプローチを対象 3 郡における他の灌漑スキームに普及するためのアクションプランを作成しており、その作業への支援も含め、SP が派遣されている灌漑スキームにおいて WAMCAB アプローチを普及するよう、RAB が契約している SP3 社（HoReCo、Yalla Yalla、YEAN）に対し、2024 年 2 月 8 日付で RAB 副長官から協力要請レターが発出されている。

同年 2 月 12 日には SP を対象とした WS を開催し、WAMCAB 事業の概要を説明するとともに、アクションプラン作成への積極的な参加について協力要請したところであり、今後とも協力関係構築を図ることが望まれる。

4.3.6 大学等教育機関との連携強化

RAB の若手灌漑技術者の多くは大学等で土木技術を履修した技術者であり、灌漑分野における技術的基礎及び経験に乏しいことが実態である。このため、前述のとおり全国の RAB 技術者を対象とし灌漑スキーム管理に係る技術移転を目的とした WS が 2022 年 11 月に開催された。同 WS には、RAB LII-TT 局長も参加し、RAB としての灌漑技術者育成への熱意が感じられた。なお、RAB 灌漑技術者の中にはルワンダ大学農学部（UR-CAVM）において修士課程を履修している職員もいる。

WAMCAB において実証を進めている持続的灌漑スキーム管理に関する連携とお互いの能力強化のため、UR-CAVM、WAMCAB、RAB の三者は JICA ルワンダ事務所を立会人として、2023 年 10 月 3 日付で以下を内容とする MoC を締結した。

1. UR-CAVM の責務

WAMCAB と協力した研究・技術移転・普及と技術支援
関係者への研修の実施
技術普及に向けた専門家の派遣

2. WAMCAB の責務

UR-CAVM 専門家による合同研究への支援
UR-CAVM 学生による現地視察・インターンの受け入れ
UR-CAVM での講義
必要なデータ・情報の提供

3. RAB の責務

スタディツアーへの協力
UR-CAVM 学生への経験・研修マニュアルの提供
UR-CAVM 学生へのインターン情報の提供

これらの活動を通じ、灌漑スキーム関係者の能力強化を図るとともに、UR-CAVM での研究・教育・就職活動を促進させ、しいては RAB 職員の能力強化を通じて RAB 自体の行政能力の強化も図ることが期待されている。

4.4 プロジェクト完了から事業評価までのモニタリング計画

前述した事業計画と実施体制が整備されることで、プロジェクト完了後に上位目標が達成される

ことが、より強く担保されることとなる。

2024 年 11 月開催の第 20 回 TF 会議にて TF メンバーに対し、2025 年 1 月開催の第 12 回 JCC 会議にて JCC メンバーに対し、組織としての所掌や個人のイミヒゴに沿ったモニタリング計画の策定を依頼し、合意を得たところであり、これらルワンダ側の自助努力に期待するとともに、JICA ルワンダ事務所が定期的に進捗をフォローアップすることが望まれる。

Annex 1: Results of the Project

ANNEX 1: Results of the Project

ANNEX 1-1: List of Dispatched Experts

(1) Long-Term Experts			
No	Name of Expert	Title	Duration
1	Mr. KUNIYASU Norio	Chief Advisor/ Irrigation Policy	21 April 2019 ~ 17 May 2019 22 October 2019 ~ 17 November 2019 15 August 2021 ~ 30 August 2021 31 October 2021 ~ 29 November 2021 31 January 2022 ~ 2 March 2022 23 May 2022 ~ 15 June 2022 11 November 2022 ~ 4 December 2022 6 February 2023 ~ 26 February 2023 19 May 2023 ~ 11 June 2023 10 November 2023 ~ 3 December 2023 3 June 2024 ~ 21 June 2024 26 October 2024 ~ 10 November 2024 8 January 2025 ~ 3 February 2025 57 days in Japan during a period from 1 April 2019 ~27 February 2025
2	Mr. TAKIGAWA Eiichi	Deputy Chief Advisor/ Irrigation Policy	5 August 2019 ~ 1 September 2019 26 January 2020 ~ 17 February 2020 21 January 2021 ~ 14 February 2021 1 June 2021 ~ 30 August 2021 1 July 2021 ~ 14 July 2021 22 August 2021 ~ 11 September 2021 14 November 2021 ~ 12 December 2021 24 January 2022 ~ 2 March 2022 22 January 2023 ~ 11 February 2023 6 June 2023 ~ 14 July 2023 19 October 2024 ~ 10 November 2024 52 days in Japan during a period from 11 May 2019 ~27 February 2025
3	Dr. ANDETA Shemsu Kemal	IWUO Management	31 March 2019 ~ 29 April 2019 5 July 2019 ~ 2 August 2019 15 January 2020 ~ 17 January 2020 25 January 2020 ~ 4 March 2020 15 January 2021 ~ 4 April 2021 15 August 2021 ~ 3 December 2021 24 January 2022 ~ 2 March 2022 29 April 2022 ~ 15 June 2022 8 July 2022 ~ 12 August 2022 12 October 2022 ~ 10 December 2022 18 January 2023 ~ 8 March 2023 14 July 2023 ~ 21 August 2023 18 January 2024 ~ 19 February 2024 4 May 2024 ~ 14 June 2024 4 August 2024 ~ 21 August 2024 10 January 2025 ~ 5 February 2025
4	Mr. UENO Shingo	O&M/ Water Management	21 April 2019 ~ 17 May 2019 9 November 2019 ~ 23 November 2019 6 May 2023 ~ 14 June 2023 30 October 2023 ~ 26 November 2023 6 November 2024 ~ 14 November 2024 8 January 2025 ~ 3 February 2025
5	Dr. KOBAYASHI	O&M/ Water Management/	31 March 2019 ~ 29 April 2019

	Yukimitsu	Capacity Development	19 October 2019 ~ 17 November 2019 10 March 2021 ~ 25 April 2021 1 June 2021 ~ 3 June 2021 & 20 June 2021 ~ 14 July 2021 28 August 2021 ~ 27 September 2021 27 November 2021 ~ 9 January 2022 31 January 2022 ~ 2 March 2022 15 April 2022 ~ 27 May 2022 22 August 2022 ~ 5 September 2022 & 17 October 2022 ~ 16 November 2022 14 December 2022 ~ 13 January 2023 7 August 2023 ~ 13 September 2023 31 January 2024 ~ 10 March 2024 7 August 2024 ~ 2 October 2024 10 January 2025 ~ 5 February 2025 119 days in Japan during a period from 1 May 2020 ~ 8 February 2023
6	Mr. SENDO Shohei	Farm Management	26 May 2019 ~ 29 June 2019 27 October 2019 ~ 4 December 2019 3 February 2020 ~ 16 February 2020 10 March 2021 ~ 4 April 2021 1 February 2022 ~ 2 March 2022 19 August 2024 ~ 8 September 2024
7	Ms. MOCHIZUKI Saki	Nutrition-sensitive Farm Management	14 June 2021 ~ 15 July 2021 7 January 2022 ~ 20 February 2022 31 July 2022 ~ 28 August 2022 22 January 2023 ~ 26 February 2023 19 May 2023 ~ 13 June 2023 19 January 2024 ~ 18 February 2024 14 October 2024 ~ 10 November 2024
8	Mr. UENO Shingo	Support for Irrigation Strategic Plan	29 April 2022 ~ 10 June 2022 20 November 2022 ~ 10 December 2022
9	Ms. MATSUDA Ayaka	Coordination / Training	21 April 2019 ~ 4 June 2019 21 July 2019 ~ 1 September 2019 15 January 2020 ~ 28 February 2020 10 March 2021 ~ 25 April 2021 14 June 2021 ~ 14 July 2021 9 August 2021 ~ 30 August 2021 17 October 2021 ~ 18 November 2021 7 January 2022 ~ 23 February 2022 16 May 2022 ~ 15 June 2022
10	Ms. IKEDA Ayako	Coordination / Training	22 days in Japan during a period from 29 August 2022 ~ 27 February 2025
11	Ms. SHINOHARA Yukari	Coordination / Training	19 May 2023 ~ 11 June 2023 10 November 2023 ~ 3 December 2023
12	Mr. TAKAHASHI Kenta	Coordination / Training	8 days in Japan during a period from 2 April 2024 ~ 27 February 2025
13	Prof. SATOH Masayoshi	Support for IMT Promotion	14 November 2019 ~ 29 November 2019 15 August 2021 ~ 30 August 2021 7 days in Japan during a period from 1 April 2019 ~ 1 April 2024
14	Prof. MATSUNO Yutaka	Support for IMT Promotion	10 October 2024 ~ 14 November 2024
15	Ms. MATSUDA Ayaka	Training Operational Management	10 days in Japan during a period from 24 April 2020 ~ 24 March 2022
16	Mr. MIURA Saitaro	Training Operational Management	10 days in Japan during a period from 24 April 2020 ~ 24 March 2022

ANNEX1-2: List of National staff and Field Collaborator

(1) National Staff			
No	Name of National Staff	Title	Duration
1	Mr. Fidele URIMUBENSHI	Local Coordinator / IWUO Officer	25 April 2019 ~ 27 February 2025
2	Mr. NIYONGABIRE Janvier	Irrigation Engineer	1 May 2019 ~ 27 February 2025
3	Mr. Edouard UFITINEMA	Agronomist	1 May 2019 ~ 27 February 2025
4	Ms. Geraldine BENINKA	Logistic / Monitoring and Evaluation Officer	11 April 2019 ~ 27 February 2025
5	Ms. Angelique MUKESHIMANA	Assistant IWUO Officer	1 November 2019 ~ 27 February 2025
6	Mr. Boniface Youssouf KABENGERA	Coordinator of Field Collaborators	1 November 2020 ~ 27 February 2025
7	Mr. Jean Fidele IRANDAMIYE	Irrigation Engineer	22 June 2020 ~ 27 February 2025
8	Mr. Flugence MBARUSHIMANA	Agronomist	1 July 2020 ~ 27 February 2025
(2) Field Collaborator			
No	Name of Field Collaborator	Title	Duration
1	Mr. Jean KAMUHANDA	IWUO Manager in Cyaruhogo site	1 April 2022 ~ 27 February 2025
2	Mr. Johnathan TUYAMBAZE	IWUO Manager in Ngoma site	20 June 2020 ~ 27 February 2025
3	Mr. Jean de Dieu MUSHUMBA	IWUO Manager in Ngoma22	1 October 2021 ~ 27 February 2025
4	Ms. NYIRAHABIYAREMYE VENANTIE	SMC Manager in Nyabuyogera site	1 January 2024 ~ 27 February 2025
5	Mr. Vincent Ndindiriyimana	IWUO Manager in Ngiryi site	2 September 2020 ~ 27 February 2025
6	Mr. Thomas Habanabakize	IWUO Manager in Gitinga site	1 January 2024 ~ 27 February 2025
7	Mr. Richard Miganbi	SMC Manager in Nyabuyogera site	18 January 2021 to 30 Sept 2023

ANNEX 1-3: List of Counterparts and TF members (As of September 2024)

No.	Name	Title in Government	Title in the Project	Period
1	MPORANA Jules	IWUO Specialist	Chief Implementer	From June 2019 up to Feb 2025
2	MUSABYIMANA Emmanuel	IWUO Specialist	Chief Implementer	From June 2019 up to May 2021
3	SHYIRAMBERE Oswald	Senior Agronomist	Farm Management	From June 2019 up to Feb 2025
4	UWITONZE Théogène	Senior Rural Engineer	O&M	From June 2019 up to Nov. 2020
5	MUKAMUSONI Jacqueline	SSIT District Irrigation Engineer, Ngoma Station	Water Management	From January 2022 up to Feb 2025
6	Carvalho Ananias Sylvestre	Electromechanical Engineer, Ngoma Station	O&M	From September 2021 up to February 2024
7	Carvalho Guillaume	Electromechanical Engineer, Ngoma Station	O&M	From February 2024 up to Feb 2025
8	CYUBAHIRO Edouard	Rice Program Extensionist, Ngoma Station	Farm Management	From June 2019 up to Feb 2025
9	MUKABARISA Justine	SSIT District Irrigation Engineer, Rubirizi Station	Water Management	From June 2019 up to Feb 2025
10	KANAMUGIRE Egide	SSIT District Irrigation Engineer, Rubirizi Station	O&M	From June 2019 up to Feb 2025
11	ABANDIBAKOBWA Charlotte	Twigire Muhinzi Field Coordinator/ Extension, Rubirizi Station	Farm Management	From June 2022 up to Feb 2025
12	FEZA Clementine	SSIT District Irrigation Engineer, Rubona Station	IWUO Management	From June 2019 up to Sept 2023
13	MUKAKALISA Zahara	Irrigation Engineer, Rubona Station	O&M (Water Management)	From June 2019 up to January 2023
14	KALANGWA Tom	Irrigation Engineer, Rubona Station	O&M (Water Management)	From January 2023 up to Feb 2025
15	MANIRAGUHA Jean Baptiste	Crop Production Technician, Rubona Station	Farm Management	From June 2019 up to Feb 2025
16	UWONKUNDA Ines	SSIT District Irrigation Engineer, Ngoma Station	IWUO Management	From June 2019 up to January 20
17	UMULISA Jeanne	In charge of irrigation, Ngoma District	IWUO Management	From February 2021 up to October 2021
18	MUDAHHEMUKA Innocent	Director of Agriculture & Natural Resources, Ngoma District	IWUO Management	From October 2021 up to Feb 2025
19	KAYIGIRE Fidele	District Infrastructure Officer, Ngoma District	O&M	From June 2019 up to Feb 2025
20	HAKIZIMANA Wellars	Electromechanical Engineer, Ngoma Station	O&M	From June 2019 up to September 202
21	UWIRAGIYE Vénant	District Cash Crop, Ngoma District	Farm Management	From January 2022 up to Feb 2025
22	BIKORIMANA Félicien	District Cash Crop Officer, Rwamagana District	IWUO Management	From June 2019 up to Feb 2025
23	NDAYISHIMIYE Alfred	Irrigation Officer, Rwamagana District	O&M	From June 2019 up to Feb 2025
24	UKIZURU Innocent	District Agronomist, Rwamagana District	Farm Management	From June 2019 up to Feb 2025
25	NGABONZIZA Jean Bosco	District cooperative Officer, Gisagara District	IWUO Management	From June 2019 up to Feb 2025

No.	Name	Title in Government	Title in the Project	Period
26	BIKORIMANA Lambert	District Properties Management and Infrastructures engineer, Gisagara District	O&M (Water Management)	From June 2019 up to Feb 2025
27	MUNEZERO Clarisse	District Agronomist, Gisagara District	Farm Management	From June 2019 up to June 2022
28	UWIZEYE Justin	District Agronomist, Gisagara District	Farm Management	From June 2022 up to Feb 2025

ANNEX 1-4 : FC Salary Cost Sharing

Model Scheme/Post	Cost Sharing up to Dec 2020 (RWF/month)			Cost Sharing up to Dec 2021 (RWF/month)			Cost Sharing up to Dec 2022 (RWF/month)			Cost Sharing up to Dec 2023 (RWF/month)			Cost Sharing up to Dec 2024 (RWF/month)		
	Salary	Cost covered by IWUO/Coop	Cost covered by WAMCAB	Salary	Cost covered by IWUO/Coop.	Cost covered by WAMCAB	Salary	Cost covered by IWUO/Coop.	Cost covered by WAMCAB	Salary	Cost covered by IWUO/Coop.	Cost covered by WAMCAB	Salary	Cost covered by IWUO/Coop.	Cost covered by WAMCAB
Ngoma IWUO /Manager	120,000	0	120,000	120,000	90,000	30,000	120,000	60,000	60,000	120,000	90,000	30,000	120,000	120,000	0
		%	100%		-75%	-25%		50%	50%		75%	25%		100%	0%
Ngoma Cooperative /Agronomist	120,000	0	120,000	120,000	120,000	0,000	120,000	84,000	36,000	120,000	108,000	12,000	120,000	120,000	0
			-100%		-100%	0%		70%	30%		90%	10%		100%	0%
Cyaruhogo IWUO /Manager	150,000	0	150,000	150,000	150,000	50,000	150,000	75,000	75,000	150,000	112,500	37,500	200,000	150,000	50,000
		0%	100%		-100%	-25%		50%	50%		75%	25%		100%	Top up (special case)
Ngirya IWUO/Manager	100,000	0	100,000	100,000	75,000	25,000	100,000	50,000	50,000	100,000	75,000	25,000	100,000	100,000	0
		0%	100%		-75%	-25%		50%	50%		75%	25%		100%	0%
Nyabuyogera Cooperative/SM C Manager	100,000	0	100,000	100,000	75,000	25,000	100,000	50,000	50,000	100,000	50,000	50,000	100,000	75,000	25,000
			-100%		75%	25%		50%	50%		50%	50%		75%	25%
Gitinga IWUO/Manager	0	0	0	0	0	0	0	0	0	80,000	0	80,000	100,000	50,000	50,000
											0%	100%		50%	50%

ANNEX: 1-5 Input by the Japanese side

Planned		Actual	
(1)	Dispatch of Experts i) Chief Advisor/Irrigation Policy ii) IWUO Management iii) O&M/Water Management iv) Farm Management v) Coordination/Training 2) Short-term Experts	(1)	Dispatch of experts i) Chief Advisor/ Irrigation Policy 1 ii) Deputy Chief Advisor/ Irrigation Policy 2 iii) IWUO Management iv) O&M/ Water Management v) O&M/ Water Management/ Capacity Development iv) Farm Management vi) Nutrition-sensitive Farm Management vii) Support for Irrigation Strategic Plan viii) Coordination/ Training ix) Support for IMT Promotion x) Training Operational Management
(2)	Counterpart training (Japan and Third countries)	(2)	Counterpart Training (Japan): 5 people
(3)	Provision of Equipment (Equipment necessary for project implementation)	(3)	i) Copy machine ii) Laptop PC iii) Tensio meter iv) Data display v) Flow meter vi) Winnowing machine

ANNEX 1-6-1: List of participants of training in Rwanda

Summary of training results				Classification by target district											
Output	Period	Period	Title of training	Number of Participants											
				Farmer		C/P and TF member		SP		Sector agronomist		Total	By districts	Total	By districts
				Total	By districts	Total	By districts	Total	By districts	Total	By districts				
Output 1	2020/10/23-2021/11/25	1 day to 1.5 day	Webinar			0	70		0		0			0	0
Output 2	2020/8/10-2024/2/8	1 days to 5 days	IWUO Strengthen training	1254	I-1	291	112	I-1	12	18	I-1	1	29	I-1	1
					I-2	105		I-2	9		I-2	5		I-2	0
					II-1	423		II-1	16		II-1	0		II-1	2
					II-2	91		II-2	11		II-2	8		II-2	13
					III-1	239		III-1	12		III-1	0		III-1	5
					III-2	105		III-2	5		III-2	4		III-2	8
					IV	0		IV	47		IV	0		IV	0
Output 3	2020/7/27-2024/9/5	1 day to 20 days	Civil work training and O&M Training	610	I-1	168	54	I-1	7	9	I-1	0	0	I-1	0
					I-2	40		I-2	3		I-2	3		I-2	0
					II-1	145		II-1	5		II-1	0		II-1	0
					II-2	34		II-2	3		II-2	4		II-2	0
					III-1	134		III-1	0		III-1	0		III-1	0
					III-2	33		III-2	2		III-2	2		III-2	0
					IV	56		IV	34		IV	0		IV	0
Output 4	2020/8/31-2023/11/20	1 days to 5 days	Water management training	417	I-1	117	10	I-1	4	6	I-1	0	0	I-1	0
					I-2	0		I-2	0		I-2	0		I-2	0
					II-1	172		II-1	3		II-1	0		II-1	0
					II-2	30		II-2	0		II-2	2		II-2	0
					III-1	55		III-1	2		III-1	0		III-1	0
					III-2	43		III-2	1		III-2	4		III-2	0
					IV	0		IV	0		IV	0		IV	0

Summary of training results				Classification by target district											
				I-1 Model Site in Ngoma district: Ngoma (Ngoma22, Mwanbu)											
				I-2 Extension Scheme in Ngoma district: Gitinga, Gisaya, Mutenderi											
				II-1 Model Site in Rwamagana district: Cyaruhogo (Bugugu, Gashara, Cyimpima, Cyaruhogo)											
				II-2 Extension Scheme in Rwamagana district: Rugende											
				III-1 Model Site in Gisagara district: Ngiri, Nyabuyogera											
				III-2 Extension Scheme in Gisagara district: Gatare, Cyili											
				IV Cross-district: training related to more than one district											
Output	Period	Period	Title of training	Number of Participants											
				Farmer		C/P and TF member		SP		Sector agronomist					
				Total	By districts	Total	By districts	Total	By districts	Total	By districts				
Output 5	2020/6/29-2024/1/26	1day to 8 days	Farming practice training	3299	I-1	569	64	I-1	6	20	I-1	1	63	I-1	16
					I-2	272		I-2	4		I-2	7		I-2	11
					II-1	759		II-1	10		II-1	0		II-1	13
					II-2	320		II-2	19		II-2	8		II-2	6
					III-1	1141		III-1	7		III-1	0		III-1	13
					III-2	230		III-2	7		III-2	4		III-2	4
					IV	8		IV	11		IV	0		IV	0
Complex	2020/12/27-2023/8/17	1 day-4days	Output complex training	112	I-1	21	54	I-1	8	3	I-1	1	8	I-1	3
					I-2	0		I-2	0		I-2	0		I-2	0
					II-1	18		II-1	0		II-1	0		II-1	0
					II-2	11		II-2	6		II-2	2		II-2	3
					III-1	55		III-1	4		III-1	0		III-1	0
					III-2	7		III-2	6		III-2	0		III-2	2
					IV	0		IV	30		IV	0		IV	0
			Subtotal	5692		364		56		100					
			TOTAL											6212	

※ As of September 2024
 ※ Target for Output 1 is TF member only.

ANNEX 1-6-2: List of participants of training (Training in Japan)

Training name	Period	Name	Office	Position
➤ Participatory Irrigation Management System for Paddies (A)	2022/08/05～09/23	Mr. MPORANA Jules	RAB	IWU Specialist
➤ Participatory Irrigation Management System for Paddies (A)	2023/05/21～6/27	Mr. NDAYISHIMIYE Alfred	Rwamagana District	Irrigation Officer
➤ Maintenance, Operation and Management of Irrigation Facilities	2023/06/14～07/26	Ms. MUKAMUSONI Jacqueline	RAB Ngoma Station	SSIT District Irrigation Engineer
➤ Market-Oriented Agriculture Promotion (Planning and Management) (A)	2024/04/25～05/25	Mr. GATETE Aimable	RAB	Coordinator for Horticulture Center of Excellence
➤ Participatory Irrigation Management System for Paddies (A)	2024/05/12～06/25	Ms. MUTONI Lilian	RAB Nyagatare Station	Small Scale Irrigation Technology Engineer

貸与物品リスト
List of Property Lending

業務名称 (Name of Project) : 灌漑水管理能力向上プロジェクト (Project for Water Management and Capacity Building in Rwanda)

対象国 (Country) : ルワンダ国 (The Republic of Rwanda)

(2025年2月現在)
(As of February 2025)

事業担当部課 (Division in Charge) : 経済開発部 (Economic Development Department)

物品名称 (Name of Property)	規格・品番 (Standard, Part Number)	個数 (Quantity)	取得価格 (Purchase Price)			検査合格日 (Date of Inspection Passed)	配置場所 (Location)	現況 (Current State)	備考 (Remarks)	事業終了後の 取扱い (After Completion of Project: Handover/Return)
			取得価格 (Purchase Price)	通貨 (Currency)	日本円換算 取得価格 (In Japanese Yen)					
コピー機 (Copy machine)	Canon IR2520+ADF	1	1,360,000	RWF	169,252	11-Apr-19	プロジェクトオフィス (Project Office)	稼働中 (in operation)		実施機関に1月20日譲与 (Handover)
ラップトップPC (Laptop computer)	HP15	4	490,000	RWF	243,922	29-Apr-19	プロジェクトオフィス (Project Office)	稼働中 (in operation)		実施機関に1月20日譲与 (Handover)
流速計 (Current meter)	VR-301	1	262,000	円	262,000	Pre-inspection: 20-Jan-21 17-Feb-22	プロジェクトチーム (Project Team)	その他 (other) 使用可能な状況を現地でC/Pと確認した (The situation in operation was confirmed on site by the C/P.)		実施機関に1月20日譲与 (Handover)
テンシオメーター (Tensiometer)		4	369,550	円	369,550	Pre-inspection: 20-Jan-21 20-Aug-21	プロジェクトオフィス (Project Office)	その他 (other) 使用可能な状況を現地でC/Pと確認した (The situation in operation was confirmed on site by the C/P.)		実施機関に1月20日譲与 (Handover)
テンシオメーター データ表示器 (Tensio meter display)		1	93,100	円	93,100	Pre-inspection: 20-Jan-21 20-Aug-21	プロジェクトチーム (Project Team)	代替品調達済み。2025年1月渡航時に持参し、C/Pに譲与済み。 (The device has been repurchased and was delivered to Rwanda for handover in January 2025.)		実施機関に1月20日譲与 (Handover)
唐箕機 (Winnow machine)		2	1,400,000	RWF	186,774	Pre-inspection: 20-Aug-22 21-Aug-22	ガタレ農協の倉庫 (Storage in Gatare cooperative)	農協の意向により、ンギリ地区からガタレ地区に移設、ガタレ地区にて保管中 (shifted from Ngiriyi to Gatare because of the request of cooperatives and now in storage in Gatare) 収穫時期の2022年12月上旬から稼働中 (Operation started from the beginning of December 2022, the harvest season)		対象モデルスキームの農協に1月20日譲与 (Handover)

Progress Summary of Improvement Plan / Training Plan (Agreed Plans)

As of 28th February 2025

*Red-highlighted parts indicate the updated activities of the month.

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb	
2-1	○	2	M	M	M	M	Understanding the scheme	[Step 1] • Undertake preliminary survey and define the scheme service area	Phase 1: completed	Phase 1: completed	Apr 2020: completed	Apr 2020: completed *supplemental survey is ongoing	IWUO members
2-2	○	2	M	M	M	M	Database organization	[Step 2] • Database preparation and organizing the management structure	Phase 1: preparation of basic scheme information 15-26 Jun 2020: completed	Phase 1: completed	Apr 2020: preparation of basic scheme information	Apr 2020: Completed *supplemental survey is ongoing	IWUO members
2-3	○	2	H	H	H	H	Reorganization of IWUO and election of leaders	[Step 2] • Database preparation and organizing the management structure	Phase 1: preparation of organization structure 15 Jun 2020: completed	2-16 Jul 2020: completed June 2023, general assembly meeting conducted and a new IWUO leadership is formed for the coming three years	Aug 2020: Completed (properly installed infra was absent) Nov 2020: Overall IWUO was established Aug 2021: re-election of IWUO members were done	Sep 2020: Completed (properly installed infra was absent) SMC (Special committee) was established under cooperative structure No IWUO is required for such scheme	IWUO members Note: The introductory training and explanation on IWUO reorganization is conducted in all the extension sites in the three districts
2-4	○	2	M	M	M		Explanation of scheme layout to IWUO	[Step 3] • Conduct initial training and explain the scheme layout and how IWUO is organized	19-30 Jun 2020: completed	2-16 Jul 2020: completed	Due to lack of properly installed infrastructure, this activity was not yet done but planned to be implemented in the future.		IWUO members
2-5	○	2	H	H	H	H	Establishment of Internal Regulation	[Step 4] • Prepare the Rules and Internal Regulations (by-law) • Prepare role and responsibility of stakeholders [Step 5] • Hold general meeting for approval of the Rules and Internal Regulations and Action Plan • Prepare future Action Plan	19-15 Jun 2020: preparation of draft internal regulations Aug-Sep 2020: discussion with IWUO members, and finalization Dec 2020 - Jan 2021: preparation of draft internal regulations for hillside Sep 2021: discussion with IWUO leadership for organizing GA meeting 29 Oct: General Assembly was held. Action Plan was presented and the amendment of Rules and Internal Regulations was approved. Zonal structure is set under IWUO of Gitinga Scheme (Extension Site) Workshop was conducted to explain the situation of the scheme and way forward is agreed with Cooperativ leaders and IWUO leaders including local leaders (Sector and District): Such as mobilization of collection of water fee	2-16 Jul 2020: preparation of draft internal regulations Aug-Oct 2020: discussion with IWUO members, and finalization Oct 2020: preparation of the Performance Contract Agreement, the first IWUO and Coop. meeting 12 Nov 2020: General Assembly meeting to approve the internal regulations 31 Dec 2020: Performance Contract Agreement was signed. In July 2023 Workshop was held to explain the existing situation of the scheme @ Rugende extenstion site As the result of the workshop the leadership begin to apply rules and regulation on irrigation rotation and water managment at the Dam Zonal leaders were selected as lower level IWUO structure The GA was conducted The Internar Regulation is being updated with the	Dec 2020 - Jan 2021: preparation of draft internal regulations 17, 18 Feb 2021: General Assembly meeting about merging two IWUOs (Ngiriyi and Nyiramageni) Jul 2020: Draft internal regulation is being prepared focusing only Ngiriyi scheme. Sep 2021: discussion with IWUO leadership for organizing GA meeting Mar 2022: GA meeting preparation is undergoing. Apr 2022: Rehabilitation of IWUO office is at 90%. In July 2023 Workshop was held to explain the existing situation of the scheme @ Gatare and Cyili extenstion site As the result of the workshop the leadership begin to apply rules and regulation on irrigation rotation and water managment at the Dam Zonal leaders were selected as lower level IWUO structure at Gatare scheme. The internal Regulation is being updated after request during GA meeting	Dec 2020 - Jan 2021: preparation of draft internal regulations Aug 2021: General Assembly meeting was planned, but postponed due to COVID-19. Sep 2021: discussion with SMC and Cooperative leadership for organizing GA meeting Mar 2022: GA meeting of the cooperative was conducted.	IWUO members
2-6	○	2	H	H	H	H	Strengthening of IWUO	[Step 6] • Capacity development on Leadership • Promotion of participation • Transparency and accountability • Conflict management • Preparation of Action Plan	Nov 2020: An office was secured at Ngoma 22 inside a storage built by WB project 8-12 Mar 2021: IWUO strengthening training For the first time Hillside farmers start to pay water fee from Chia seed sale by Kotungo 2 Nov 2021: The first General Assembly was held, and approval of Action Plan, Rules and Internal Regulations. Feb 2022: A solar power was set at the office of IWUO and Kotungu cooperative. Apr 2022: IWUO GA meeting was organized. Discussion with SAIP local coordinator on the activity sharing on the intervention for hillside irrigation Training on Office Managment is conducted Training of WUT leaders of Marshland scheme was conducted July 24-25 WUT leader training on role and responsibility and sentisization of the irrigation scheme, O&M, layout of the scheme etc Sensitization of WUT leaders of marshland scheme was conducted Support for General assembly Feb 2023: Training by TF member conducted April 2023: The election of a new Executive member done during the General Assembly Meeting Simple explanation and short training is given to the newly elected Executive member by NS staffs June 2023: New IWUO leadership is elected	Nov 2020: An office was secured at Ngoma 22 inside a storage built by WB project 8-12 Mar 2021: IWUO strengthening training For the first time Hillside farmers start to pay water fee from Chia seed sale by Kotungo 2 Nov 2021: The first General Assembly was held, and approval of Action Plan, Rules and Internal Regulations. Feb 2022: A solar power was set at the office of IWUO and Kotungu cooperative. Apr 2022: IWUO GA meeting was organized. Discussion with SAIP local coordinator on the activity sharing on the intervention for hillside irrigation Training on Office Managment is conducted Training of WUT leaders of Marshland scheme was conducted July 24-25 WUT leader training on role and responsibility and sentisization of the irrigation scheme, O&M, layout of the scheme etc Sensitization of WUT leaders of marshland scheme was conducted Support for General assembly Feb 2023: Training by TF member conducted April 2023: The election of a new Executive member done during the General Assembly Meeting Simple explanation and short training is given to the newly elected Executive member by NS staffs June 2023: New IWUO leadership is elected	Dec 2021: IWUO office space is provided by Cooperative with the concent of District. The rehabilitation of the office is being processed (BoQ is being prepared). Feb 2022: The preparation for rehabilitation of office was continued. IWUO executive committee held a meeting to approve the covering the labor cost for the rehabilitation of the office. The rehabilitation of office is completed 23 Mar 2022: IWUO GA meeting was organized. Activation of Lower level IWUO structure is initiated. Seasonal Water Distributors were identified and given the task of irrigating (water distribution) for each plots in the field. As initiative each farmers will give them one kg of rice per plot. This trial shall be applied to other model sites if successful General assembly was conducted to approve the action plan and increase of water fee to 400RwF/are. Training on office managment is conducted, Sept 2022. A ten year IWUO budget expense plan is prepared and presented in the workshop, Nov 2022. Presently the IWUO and the community are eager to construct new weir on their own fund for expanding the paddy feild area and requesting WAMCAB to prepare a design of weir and its BoQ. Feb 2023: Training by TF member conducted Apr 2023: Successful implementation of SWD with little incentive (1kg per plot). This approach has gained momentum and will be applied to other model sites For the firsrt time Nyigiri irrigation scheme has been awarded the best perform in the District and become a model site for other scheme to learn from Started to be visited by other IWUO from Huye District OMM manual is being prepared as requested by TF during the	8-12 Feb 2021: financial management training 22-26 Feb 2021: IWUO strengthening training A system of water fee collection was discussed among zonal leaders of the scheme. Dec 2021: Rehabilitation of office provided by District is completed. Solar powet is also set for office activity 29 Mar 2022: Cooperative GA meeting was organized. Training on office managment is conducted in Sept 2022. A ten year IWUO budget expense plan is prepared and presented in the workshop, Nov 2022. Jan 26-27 TF member conducte training on Strengthening of IWUO to Cooperative as part of finilization of manual. Feb 2023: Training by TF member conducted Apr 2023: The community are preparing to construct additional night storage by themselves July 2023: Excavation and compaction of embankment work are on going for the night reservoir. Workshop was conducted for FC of all site to share good experiance and learn each other problem as capacity building of the managemnt of scheme	IWUO members Cooperative

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb	
2-7	○	2	H	H	H	H	Financial Management	[Step 6] • Outline of financial management • Establishment of the O&M fund • Establishment of the O&M fee management mechanism	21-25 Sep 2020: financial management training Sep 2020: the first IWUO and Coop. meeting about the roles and responsibility of each entity and the Performance Contract Agreement to be signed between them Oct 2020: preparation of draft book-keeping format Apr-May 2021: The first financial statement is being prepared May 2021: Financial statement was prepared. A system of expense order is created to create a controlling mechanism of income and create a link with DISC (it has never been implemented) Jul 2021: Financial statement from Jan up to Jul 2021 is being prepared. Feb 2021: Executive committee meeting has decided to the cost sharing of the FC beginning of April. They also want to hire two support staff that help the FC in collecting data for water fee collection since the scheme is big and can't be covered by one person alone. Mar 2022: Water fee collection of 2022 Season B for marshland was done. Water fee collection in hillside is undergoing. May 2022: Internal auditing was conducted and found out that mismanagement of fund by IWUO leadership. District is requested to conduct an external auditing (date not yet fixed) Feb 2023: Training by TF member conducted Apr 2023: In the process of hiring new staff (Accountant) IWUO pays the entire bill for electricity that has been covered by RAB until 2021 Financial statement is being prepared, the summary of the financial report will be finalized soon	16-20 Nov 2020: financial management training Additional source of fund (fish farming) is being initiated. Book keeping material and format is prepared and submitted to be used by IWUO. Apr-May 2021: The first financial statement is being prepared. Jul 2021: Financial statement from Jan 2021 up to April 2021 was prepared and it will continue to be updated. The scheme is in good condition. Oct 2021: Auditing of IWUO was done. Feb 2022: Collection of water fee from hillside farmers is designed in such a way, the responsibility shall be given to volunteer farmers who shall receive 10% of what is collected from the farmers. The trial shall be done starting from March 2022. Apr 2022: IWUO has started to hire its own manager (FC) by cost-sharing with WAMCAB (50% of each) through official recruitment procedures in collaboration with District and Cooperative. Apr 2022: RAB provided and released fish fingerlings in three reservoirs for fish farming, which can be an additional income source of IWUO. Workshop on water fee adjustment is held and the participant agree to increase water fee from 200 to 300RwF per season Feb 2023: Training by TF member conducted Apr 2023: New accountant is hired by IWUO Fish harvesting and selling is continued Discussion with mining company on the adjustment of payment of water fee conducted IWUO increase its source of income by selling fishes from the dam Financial statement is being prepared, the summary of the financial report will be finalized soon	May-June 2021: The financial statement is being prepared. Dec 2020: financial management training Jul 2021: Financial statement from Jan up to Jul 2021 is being prepared. Sep 2021: Short training given to FC on how to prepare financial statement using Excel. Oct 2021: Auditing of IWUO was done. Feb 2022: A meeting was conducted with the executive committee to discuss on the cost sharing of FC which was agreed during the GA of Nov 2021. Due to unexpected flood in the production of this season, they failed to pay from Jan 2022. Now the committee has agreed to start the cost sharing of FC from April 2022. WAMCAB helps IWUO to speed-up the aproval of expense order by Sector/District so that the rehabilitation of office and other irrigation facilities can start asap before the end of preparation for the next season. Water fee rate is increased from 200 to 400RwF per are Feb 2023: Training by TF member conducted Mar 2023: Training by TF member conducted Apr 2023: Unpaid water fee from some farmer is found by the President of IWUO, it is under investigation	May-June 2021: The financial statement is being prepared. Feb 2021: Financial management training Jul 2021: Financial statement from Jan up to Jul 2021 is being prepared. Sep 2021: Short training given to FC on how to prepare financial statement using Excel. Oct 2021: Auditing of Coopeartive was done. Feb 2022: A meeting was done with the executive member to discuss about the failure to pay for FC half of his salary as agreed during GA meeting. With simple estimation on water fee collected and expected expenses in a year, we have found that the financial capacity of the scheme is unable to cover salary of any supporting staff. The main reason is that the water fee rate agreed by GA is so small (70RwF per are, one third of the minimum paid by other scheme) due to lack of any irrigation structure in the scheme that help in distribution or managment of water source. This shows that without properly designed and installed irrigation structure in the scheme that help achieve proper distribution of water to all farm land the beneficiaries are not willing to pay for water fee Feb 2023: Training by TF member conducted Mar 2023: Training by TF member conducted	IWUO members Cooperative
2-8	○	2	M	M	M	M	Monitoring and Evaluation Method by DISC & RAB	[Step 6] • Role and function of M&E • Establishment of M&E system • Implementation of M&E	Feb 2022: Although M&E system is not yet established, for the first time local leaders at village and cell level have started to involve in the activity of IWUO through helping in the collection of water fees. Manual for Participatory Monitoring and Evaluation of Irrigation Scheme is finalized to be applied by IWUO, District, RAB etca Training of trainer (TF member) was conducted. The training of IWUO and Cooperatives will be done in Dec or Jan by TF member Feb 2023: Training by TF member conducted Monitoring team formed including Sector Agronomist	Jan 2022: In Rwamagana, a technical team was formed to monitor the activity of the IWUO and Cooperatives and to solve the issue of misunderstanding between the two. The team includes Sector Agronomist, District officials and leaders of the IWUO and Cooperatives. Feb 2022: The first technical team meeting was held and the activity progress agreed in Jan 2022 by each stakeholder were discussed. Very encouraging involvement from the District and other stakeholdres (Sector, Cooperative, etc.) can be seen. As part of monitoring excercise, technical meeting was conducted to check the progress of season preparation and problem ocured during the previous season. District, Sector, Cooperative and IWUO participated DISCT meeting was held on September 2022 Manual for Participatory Monitoring and Evaluation of Irrigation Scheme is finalized to be applied by IWUO, District, RAB etc Training of trainer (TF member) was conducted. The training of IWUO and Cooperatives will be done in Dec or Jan by TF member Feb 2023: Training by TF member conducted Monitoring team formed including Sector Agronomist	28 Sep: Gisgara DISC meeting was held as part of monitoring and evaluation. DISCT meeting was held on September 2022. Manual for Participatory Monitoring and Evaluation of Irrigation Scheme is finalized to be applied by IWUO, District, RAB etc Training of trainer (TF member) was conducted. The training of IWUO and Cooperatives will be done in Dec or Jan by TF member. Jan 17-18 TF member conducte training in Participitory M&E for IWUO, Cooperative and Sector agronomist and M&E team is created. Feb 2023: Training by TF member conducted Monitoring team formed including Sector Agronomist	28 Sep: Gisgara DISC meeting was held as part of monitoring and evaluation. DISCT meeting was held on September 2022 Manual for Participatory Monitoring and Evaluation of Irrigation Scheme is finalized to be applied by IWUO, District, RAB etc Training of trainer (TF member) was conducted. The training of IWUO and Cooperatives will be done in Dec or Jan by TF member. Jan 19-20 TF member conducte training in Participitory M&E for IWUO, Cooperative and Sector agronomist and M&E team is created. Feb 2023: Training by TF member conducted Monitoring team formed including Sector Agronomist	The preparation of training manual is being processed, Targeting C/P, District staffs and TF
2-9	○	2	H	H	H	H	Commencement of the scheme activity	[Step 7] Commencement of scheme • Prepare and provide O&M manual • Start the scheme operation and management activities • Establish the system of collection water fee and member fee • Prepare financial management system • Establish performance agreement between IWUO and cooperative or other water users	Jan 2021: Office arrangement is being strengthening. Scheme operation for Season B is being discussed. Office of IWUO is secured and arranged. Scheme operation and the activity of IWUO have started. Feb 2021: For the first time since the establishment of IWUO, water fees from hillside farmers that are member of Kotungo cooperative were collected. A differnet method is being designed to collect the remaining water fees from non-member farmers. Feb 2022: The planned DISC meeting was postponed twice. There is a need to discuss the importance of DISC meeting with the District official in collaboration with C/P. Held SISC meeting to discuss the issue of IWUO with local leader (Remera side by the initiative of Sector Agronomist). Its first kind to held such a meeting. Conduct study tour to Gacaca scheme to share experience on water fee increase. Prepared financial statment and financial record as part of OJT to the Field Collaborator. IWUO has started paying electricity bill of Hillside scheme (Ngoma 22). RAB appreciated the change and also agree to settle the unpaid bill until July 2022.	Dec 2020: the operation of the scheme has begun. Jan 2021: Discussion on financial management system is done. After Jan 2021: The involvement of other water users of the scheme such as mining, car wash and hillside irrigator is conducted. Scheme operation has already started, IWUO members are increasing by day. Other water users are registering and paying water fee according to the internal rules and regulations. Feb 2022: DISC meeting was held. A proposal to create coordinating committee is proposed by the District, but the detailed role and responsibility will be discussed in the future. Prepared financial statment and financial record as part of OJT to the Field Collaborator. Preparation of workshop to discuss about increasing water fee. 10year action plan of IWUO that will be the guide used in increasing the fee (Convincing method of Cooperatives and farmers). Technical advise in the preparation of gates in applying irrigation rotation. General assembly of the four cooperative was held, A new leadership is elected, A new Water fee rate is approved (Increase from 200 to 300RwF/are/season) The IWUO has hired additional 3 irrigator (Seasonal worker) to support the irrigation rotation of the system (a total of 10 support staffs hired by IWUO). July 2023 a new and active IWUO leadership has begin its activity ☐Around 3 million RwF was collected from fish farming from all three dams ☐Car washing on the main canal (Cyimpima site) was shifted to other location outside the scheme (The previous leaders have tried many times but failed). The sector allocate an open space outside of the marshland ☐Three investors (farmers themselves) have won the tender for fishing at the dam as follow: ☐One investor will harvest Cyimpima (460,000RwF per month) and Gashara (420,000RwF per month) ☐Another will harvest Bugugu (300,000RwF per month) ☐They are planning to the greening of the area around their office, planting trees around the catchment area and more ☐They had a plan to purchase a motor bike and install electricity to the office (In the morning time there is no electricity). IWUO wanted to purchase motorbike and install electricity to its office, however due to delay in registration the District didn't approve the budget	IWUO is actively implementing activities related to the scheme Sand extraction as a source of additional income has given to a private company Broken intake structures are being fixed by IWUO own fund. Give advise to IWUO on New office arrangement. Technical advise in financial planning in rehabilitating an old weir. Prepared financial statment and financial record as part of OJT to the Field Collaborator. The general assembly has approved New water fee rate (from 200 to 400 RwF/are/season). The beneficiaries are eager to install new wier by themselves, the good result of WAMCAB project	The organized Scheme Management Committee under the cooperative has began its activity related to scheme management. Apr-Jul 2021: Community mobilization for night storage has been conducted. Advising the IWUO to use its fund to construct additional night storage (Technical advise given). Prepared financial statment and financial record as part of OJT to the Field Collaborator.	

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb	
2-10	○	2	H	H	H		Support in the registration of the organization and IMTA agreement	<ul style="list-style-type: none"> [Step 8] <ul style="list-style-type: none"> Apply for registration of IWUO and water permit Registration and performance contract agreement [Step 9] <ul style="list-style-type: none"> IMTA and M&E system Prepare a follow up mechanism IMTA with MINAGRI Routine Training 	<p>Jan 2021: Hillside database is being prepared, and performance agreement both with rice coop and horticulture coop for 2020-21B was signed.</p> <p>June 2021: Performance Agreement both with rice coop and horticulture coop for 2021A was signed.</p> <p>Jul 2021: Collaboration letter from the District is being prepared as registration process.</p> <p>Sep 2021: Collaboration letter from the District is collected and sent to RAB for Registration Process.</p> <p>The necessary document for rigistration of IWUO is prepared and submitted</p> <p>To prepare the necessary document for resubmission the New Leadership has to be set as the mandatre of the previous leadres will expire soon</p> <p>On Feb 14 2024, thee application for Registration at RAB has been accepted after preparing all the necessary Document</p>	<p>June 2021: Performance Agreement with 4 coops for 2021A was signed.</p> <p>Jul 2021: Performance agreement with private hillside farmers has been signed.</p> <p>Jul 2021: Registration process has started, application is already made to RAB.</p> <p>Jul 2021: Document for the application of water permit is being processed.</p> <p>Mar 2022: All document for legal status is prepared and application is made at RGB.</p> <p>RGB requested the application be submitted again and the document is being prepared.</p> <p>RAB congctacted RGB to speed up the process of regisration</p> <p>The registration of IWUO is finalized and recieved from RGB</p> <p>Application has been made at RGB website after re-submitting the necessary documents</p> <p>Official registration Certificate was obtained in Feb 2024</p> <p>Process of IMTA agreement is being prepared</p>	<p>June 2021: Performance Agreement with rice coop for 2021A is being prepared.</p> <p>Sep 2021: Support for the Registration of IWUO is requested by the president and WAMCAB start to follow the status of the application at RDB.</p> <p>The process of registration is still under RGB, It will soon be confirmed</p> <p>Registration is completed in Jan 2023 (to be confiremd)</p> <p>Signing of IMTA not important as there is no good structure to sign to</p> <p>On March 2024, the official legal personality is recieved from RAB</p>		
2-11		2		M			Construction of secondary canal in Rwamagana	Support for the construction of secondary canal in Rwamagana					IWUO members
2-12		2	M	M	M	M	Make TF understand How the lower level IWUO is formed		4 Nov. 2021: Training on IWUO management model was conducted for TF members.	Same as on the left	Same as on the left	Same as on the left	
2-13	○	2	M	M	M	M	To improve the draft manuals	Discussion and updating the manuals	Draft Manuals (IWUO strengthening, financial management and M&E) are prepared. Nov 2022 workshop is conducted to validate the draft training manuals of > IWUO Management Model > IWUO Strengthening > Financial Management > Participary Monitoring and Evaluation (M&E)	Same as on the left	Same as on the left	Same as on the left	
3&4-1	○	3,4	H	H	H	H	Establishment of implementation structure for O&M and water management at the scheme level	<ul style="list-style-type: none"> To organize the O&M Team and Farmers' Repair Team To organize the Water Users Team 	27-31 Jul 2020: basic civil work training, 10-12 Aug 2020: follow-up training	14-17, 21-24 Sep 2020: basic civil work training	14-18 Sep 2020: basic civil work training	20-24 Oct 2020: basic civil work training	Farmer's Repair Team, O&M Team
3&4-2	○	3,4	H	H	H	H	O&M and Water Management Basic Training	<ul style="list-style-type: none"> Sharing the basics and current issues of irrigation facility utilization PIM (Participatory Irrigation Management) training To promote activities of water management and O&M at block level Study tour to good practice schemes 	<p>31 Aug-2 Sep 2020: water management training & hydrant repair training (3-6, 4-7)</p> <p>25-26 April 2022: Sensitization workshop to lower level of local government on Operation and maintenance of irrigation facilities and its security in Ngoma 22 hillside</p> <p>10-11 Nov. 2022: Workshop and Training on O&M of pipeline system in Ngoma 22 hillside</p> <p>30 Nov. 2022: Study tour was conducted to Muanza irrigation scheme in Rulindo district</p>	17-19, 24-26 May 2021: water management training for IWUO leaders was conducted. 31 May 2021: water management training for WUT leaders has been started.	31 August 2022: PIM training using draft manual	19 October 2022: PIM training using draft manual 29 Nov. 2022: Study tour was conducted to Bishenyi irrigation scheme in Kamonyi district	Farmer's Repair Team, O&M Team
3-3	○	3,4	M	M	M	M	O&M Training 1 (lecture)	Basic training on O&M to foster the ownership	27-31 Jul 2020: basic civil work training, 10-12 Aug: follow-up training	14-17, 21-24 Sep 2020: basic civil work training	14-18 Sep 2020: basic civil work training Aug 2021: 3 turnouts were repaired by IWUO with support from WAMCAB.	20-24 Oct 2020: basic civil work training	Farmer's Repair Team, O&M Team
3-4	○	3,4	M	M	M	M	Survey / inspection and analysis of current facility condition	<ul style="list-style-type: none"> To prepare irrigation and drainage system map in the scheme To prepare Irrigation scheme map Facility inspection to grasp the current condition 	<p>Mar 2021: Draft map has been prepared</p> <p>Apr 2021: Facility Survey for pipeline was started in Ngoma22</p> <p>Nov. 2021: Facility inspection for repair work was conducted</p> <p>May 2022: Facility inspection was conducted for secondary pipeline and Hydrants</p>	<p>Mar 2021: Draft map has been prepared</p> <p>14-16 September 2022: Facility inspection training using draft manual</p>	<p>Nov 2021: Facility map in Ngiryi was prepared</p> <p>11-20 Nov 2020: Trial of Facility check was conducted by WAMACAB engineer</p> <p>15-16 Mar 2021: Facility check was conducted in Nyiramageni.</p> <p>3 August 2022: Facility inspection training using draft manual</p>	<p>Mar 2021: Draft map has been prepared</p> <p>Oct 2021: Function of weir was tested.</p> <p>Nov. 2021: Inspection of flood damage was conducted</p>	
3-5	○	3,4	M	M	M	M	O&M Training 2 (lecture)	<ul style="list-style-type: none"> To prepare the annual O&M plan of IWUO To evaluate and consider the appropriate water fee setting 	<p>Feb. 2022: training for formulation of O&M plan was conducted to TF members.</p> <p>May 2022:Workshop for draft manual for T/F member and FC was held</p>	<p>Feb. 2022: training for formulation of O&M plan was conducted to TF members.</p> <p>May 2022:Workshop for draft manual for T/F member and FC was held</p> <p>29-30 September 2022: O&M plan formulation training using draft manual</p>	<p>Feb. 2022: training for formulation of O&M plan was conducted to TF members.</p> <p>May 2022:Workshop for draft manual for T/F member and FC was held</p> <p>24-25 August 2022: O&M plan forumulation training using draft manual</p>	<p>Feb. 2022: training for formulation of O&M plan was conducted to TF members.</p> <p>May 2022:Workshop for draft manual for T/F member and FC was held</p> <p>13-14 October 2022: O&M plan forumulation training using draft manual</p>	

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target	
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb		
3-6	○	3,4	M	M	M	M	O&M Training 3 (field practice) Basic / Advanced level	•Basic civil work (masonry, plain concrete) •Advanced civil work (Reinforced concrete) •Participatory simple maintenance and cleaning activity •Countermeasures against soil erosion •Maintenance of hydrants/pipe/valve •Demonstration on typical facility maintenance and repair •Farm road repair	27-31 Jul 2020: basic civil work training, 10-12 Aug 2020: follow-up training 31 Aug-2 Sep 2020: water management training & hydrant repair training (Common 2, 4-7) 28 Sep-2 Oct 2020: farm road repair training in collaboration with Core Rwanda Sep 2021: Water management training & hydrant repair training Nov. 2021: Countermeasure for for Slope collapse was conducted. 27, 29 Apr 2022:Training on installation of valves for secondary canal in Ngoma 22 hillside Feb-Mar 2023: Conducting countermeasure for entering road runoff to main canals	14-17, 21-24 Sep 2020: basic civil work training 22-27 Feb 2021: Advanced civil work training 1-12 Mar 2021: Road repair training including prevention of erosion 19-23 Jul 2021: Canal repair work was conducted. 20 Apr 2022: Establishment of road drainage by community work in Cyimpima scheme. On July 23 the establishment of weir at Cyaruhogio scheme is commenced through the participation of O&M team (as part of training)	14-18 Sep 2020: basic civil work training 27-30 Oct 2020: farm road repair training 11 Dec 2020: Field visit with Musha sector agronomist 23 Dec 2020: Field practice for maintaining secondary canal Oct 2021: Canal cleaning was conducted Feb-Mar 2023: Rehabilitation of upstream weir June 2023: Rehabilitation of upstream weir July 2023: Weir repair has been completed	20-24 Oct 2020: basic civil work training 14 Dec 2020: Field visit to confirm the situation 24 Dec 2020: Field practice for maintaining main canal Sep 2021: farm road repair training Nov. 2021: Rehabilitation of irrigation canal was conducted Jan. 2022: Advanced civil work training was conducted for repair work of canal crossing drain.	Farmer’s Repair Team, O&M Team	
4-7	○	3,4	H	M	M	H	Water management training 1 :Basic knowledge on irrigation (lecture)	•Lectures on efficient water use and irrigation methods mainly for hillside irrigation	31 Aug-2 Sep 2020: water management training & hydrant repair training (Common 2, 3-6) Apr 2021: Three tensiometers were installed at demo plot in Ngoma 22.	17-19 &24-26 May 2021: Water management rtraining was conducted to O&M team and FRT	31 August 2022: Water managemnet training (Lecture) was conducted	May to July 2022: Demonstration of furrow irrigation in the demo plot.		
4-8	○	3,4	M	M	M	M	Water management training 2 :water resources monitoring in irrigation scheme (lecture / field practice)	•Lectures on efficient water use and irrigation methods •Monitoring of the amount of available water resources and water use •Water management at the time of drought •Measurement of discharge and water level at dam reservoir •Rainfall observation by using simple rain gauge •Measurement of water consumption rate in paddy field	Jan 2021: Simple rain gauge was procured and it will be installed for each dams soon.	17-19, 24-26 May: water management training for IWUO leaders (O&M Team and Farmers’ repair team) was conducted. 31 May-3 Jun: Water Management training for WUT leaders has been started. Jan 2021: Simple rain gauge was procured and it will be installed for each dams soon. Apr 2021: Measurement trial was started at demo plot.	Apr 2021 Measurement trial was started at demo plot	Feb 2020: Measurement of rainfall and spring discharge has been started.		
4-9	○	3,4	H	M	M	H	Water management training 3: Practice for Hillside irrigation (lecture / field practice)	On-farm water management and water use mainly for hillside irrigation •Appropriate irrigation using soil moisture monitoring data •Trial of treadle pump Water distribution using Night Reservoir (•Trial installation of shallow well for dry season) (•Trial of foot pump) (•To install water storage)	Jan 2021: Four tensiometers were procured. Apr 2021: Three tensiometers were installed and the measurement of soil moisture has been started. Oct 2021: Explanation of demo plot was done to O&M team and FRT June 2022: Three tensiometers were installed and the measurement of soil moisture has been started. August 2023: Traial for shower head application for hillside irrigation was started.	9 Nov-4 Dec 2020: Secondary canal creation 29-30 Dec 2021: Explanation and pratctice for on-farm water managemnet	11-20 Dec 2020: Field practice for installing secondary canal 30 Dec 2021: Explanation and pratctice for on-farm water managemnet 2 September: On-farm water management training using draft manual	April to June 2021: Construction of night treservoir June 2022: Field practise for utilization of small irrigation pump. August 27 2024: Technical guidance for water distribution of night storage was conducted		
4-10	○	3,4	M	H	H	M	Field practice of on-farm level water-saving irrigation for marshland scheme	On-farm water management and water use mainly for marshland irrigation •Land levelling of the plot •Maintenance of levee at the leakage point and improvement of ridge preparation method •Installation of on-farm drainage (improvement of drainage condition) •Trial of water saving method for paddy rice (AWD: Alternate Wetting and Drying) •Adjustment of irrigation according to the growing stage •To promote the installation of secondary/tertiary canal	June to August 2022: Planned irrigation schedule was applied in the demo plot based on the calculated water requirement	14-16 Dec: Preparation for hand leveler and AWD tube Oct 2021: Training for water saving irrigation. Jan-Mar 2023: Promoting the establishment of terminal canals for improved water management and monitoring of its utilization were conducted.	14-16 Dec: Preparation for hand leveler and AWD tube Feb: Monitoring of the progress Oct 2021: Training for water saving irrigation Jul 2022: Technical assistance for establishment of on-farm canal and appointment of SWDs	May to July 2022: Demonstration of furrow irrigation in the demo plot.		
4-11	○	3,4	H	H	H	H	Water management training 4 (lecture / field practice)	•To prepare annual water distribution plan •To evaluate and consider the appropriate water fee setting	Feb. 2022: training for formulation of water distribution plan was conducted to TF members. May 2022:Workshop for draft manual for T/F member and FC was held	Jan. 2022: training for formulation of water distribution plan was conducted. Feb. 2022: training for formulation of water distribution plan was conducted to TF members. May 2022:Workshop for draft manual for T/F member and FC was held	Feb. 2022: training for formulation of water distribution plan was conducted to TF members. May 2022:Workshop for draft manual for T/F member and FC was held 4 August 2022: training for formulation of water distribution plan was conducted using draft manual	Feb. 2022: training for formulation of water distribution plan was conducted to TF members. May 2022:Workshop for draft manual for T/F member and FC was held 20 October: Training for fair water distribution was conducted using draft manual 10 Nov 2022: Training for fair water distribution was conducted using draft manual		
3&4-12	○	3,4	H	H	H	H	Monitoring & Feedback	Monitoring and feedback on the implementation of the O&M plan (3-5) and water distribution plan (4-11)	June 28 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11) September 18 2024: Monitering and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	June 26 2024: Monitering and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11) August 13 2024: Monitering and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	June 27 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11) September 23 2024: Monitering and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	To be continued and will be updated in the next year’s plan based on the results of monitoring.		
3-a		3,4	yes	yes	yes	yes	Others	Support for the development/ rehabilitation plan of irrigation scheme, incorporating an O&M perspective from the planning stage						
3-b		3,4	H	H	H	H	Daily technical guidance on O&M 1	Facility O&M	May 2022: Installation of valves for secondary canal was conducted by O&M Team and FRT in Ngoma 22 hillside	7-24 Dec 2020: Handover stop log Apr 2021: Trial for improving stop log was practiced.	Sep 2020: main canal was repaired Oct 2020: farm road was repaired	Dec 2020: Main canal was maintained Sep 2021: farm road was repaired Nov. 2021: irrigation canal was rehabilitated Jan. 2022: Canal crossing drain was constructed		
3-c		3,4	H	H	H	H	Daily technical guidance on O&M 2	Practice of O&M along the plan (3-5)	June 28 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	June 26 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	June 27 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)	August 27 2024: Technical guidance for operation and maintenace of night storage was conducted		
3-d		3,4	Yes				Repair/rehabilitation work	Dredging of Chinese old dam at Mwanbu and utilization of borrow materials						Farmer’s Repair Team, O&M Team

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb	
3-e		3,4		H			Construction	<ul style="list-style-type: none"> Intake structure at Cyaruhogo scheme Night Reservoir at Nyabuyogera scheme 		<p>June to August 2022: New Intake structure was constructed</p> <p>Some other new structures will be constructed in 2023 by Grass root Grant aid project and WAMCAB will assist them.</p>		<p>Apr-Jul 2021: complementary lining work is on going. Aug-Sep 2021: supplemental correction work was conducted.</p> <p>30 Jan -7 Feb 2023: Construction for another new night reservoir was started. (construction for intake weir).</p> <p>June 2023: Construction for another new night reservoir was started. (Site preparation).</p> <p>August 2023: Excavation work for night reservoir is almost finished. Remaining work for construction of outlet facilities and leading canals will continue.</p> <p>September 2023: Construction of outlet facility and leading canal was completed.</p>	
4-f		3,4			M	M	Daily technical guidance on water management 1	Installation and operation of intake structure			2021-2022: More than 5 intake was rehabilitated and newly constructed	Currently the canal network is not functioning and it is difficult to rehabilitate the entire canal network, in which case construction or rehabilitation of specific intake structure is unlikely to be effective. If infrastructure rehabilitation progresses in the future with the support of CDAT, the possibility of implementing the activity will be considered again.	
4-g		3,4	H	H	H	H	Daily technical guidance on water management 2	Practice of water distribution along the plan (4-11)	<p>June 28 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)</p>	<p>June 26 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)</p> <p>August 13 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)</p>	<p>June 27 2024: Monitoring and evaluation of IWUO action plan related to the O&M plan (3-5) and water distribution plan (4-11)</p>	<p>August 27 2024: Technical guidance for water distribution of night storage was conducted</p>	
5-1	○	5	H	H	H	H	Establishment and reinforcement of Cooperative organizational structure	To establish the implementation structure for farm management at scheme level	<p>18-21, 24-29 Aug 2020: Reorganization of hillside cooperative & preparation of internal regulation</p> <p>Jul 2021: Cooperative has started hiring an accountant.</p>	Well organized	Well organized	<p>Sep 2020: Reorganization of cooperative & preparation of internal regulation</p>	Cooperative
5-2		5	M	L	L	M	Soil improvement	<ul style="list-style-type: none"> Conducting soil analysis in the schemes Compost training 	<p>Jul-Aug 2020: compost training & follow-up</p> <p>Apr 2021: compost training</p>	Jul-Aug 2020: compost training & follow-up	Jul-Aug 2020: compost training & follow-up	<p>Apr 2021: compost training & follow-up</p>	Cooperative
5-3	○	5	H	H	H	H	Profitability analysis	To analyze the profitability of each crop based on production record and BLS	Sep 2020: Preparation of documents	Sep 2020: Preparation of documents	Sep 2020: Preparation of documents	Sep 2020: Preparation of documents	
5-4		5	H	M	M		Relationship with IWUO	Consideration of performance contract with IWUO	<p>29 March 2021 : Performance Contract Agreement was signed for season 2021A</p> <p>06 July 2021 : Performance Contract Agreement was signed for season 2021B</p> <p>03 Jan 2022 : Performance Contract Agreement was signed for season 2022A</p>	<p>31 Dec 2020: Performance Contract Agreement was signed.</p> <p>19 Dec 2022 : Performance Contract Agreement was signed for 2023A.</p>	<p>16 Feb 2022 : Performance Contract Agreement was signed for Season B 2022</p> <p>9 Aug 2022 : Performance Contract Agreement was signed for season A 2023</p>		
5-5	○	5	H	H	H	H	Coop management training	Training on strengthening Coop management, gender main streaming, and accounting	<p>17-18 Nov 2020: coop management and gender mainstreaming training</p> <p>14-15 Feb 2022: coop management and gender mainstreaming training (with partner, invited woman trainer)</p>	<p>9-12 Nov 2020: coop management and gender mainstreaming training</p> <p>13-17 Dec 2021: coop management and gender mainstreaming training</p>	<p>5-6 Nov 2020: coop management and gender mainstreaming training</p> <p>23-24 Feb 2022: coop management and gender mainstreaming training (with partner, invited woman trainer)</p>	<p>22-23 Oct 2020: coop management and gender mainstreaming training</p> <p>9-10 Aug 2021: Workshop on rules and internal regulations</p> <p>23-24 Nov 2021: coop management and gender mainstreaming training</p> <p>22-23 Aug 2022 : coop management and gender mainstreaming training for new executive committee and audit committee</p> <p>1-2 September: coop management and gender mainstreaming training for new FPG leaders</p>	Cooperative
5-6		5	M	M	M	M	Coop management training	Study tour to good practice cooperatives	<p>31 Jul 2020: study tour to Nasho irrigation scheme in Kirehe District to learn about contract farming</p>	22-23 Nov 2022: The workshop of introducing 15 rice varieties	<p>9 Feb 2023 : Study tour to Nyaburiba cooperative in Bugesera District</p> <p>February 2023 : Study tour to Nyaburiba cooperative in Bugesera District</p>	<p>30-31 Aug 2021: study tour to Ngoma22 irrigation scheme to learn about contract farming in cooperation with C/Ps</p> <p>29 Nov 2022: study tour to Bishenyi in Kamoni District to learn about respecting crop & irrigation calendar</p>	IWUO members Cooperative
5-7	○	5	H	L	L	H	Marketing training	→Training on marketing and market-oriented agriculture →Training on market research and analysis	<p>9-10 Dec 2020: Marketing</p> <p>22-23 June 2022 : Market survey and interviewing companies/investors in Kigali by cooperative</p> <p>8-9 July 2022 : Interviewing companies and have linkage between companies and cooperative in Agri-show</p>	<p>7 May 2021: rice variety workshop (visit to Indatwa Kayonza coop)</p>	<p>2 Dec 2020: rice variety workshop (visit to RAB demo farm)</p>	<p>25-26 Nov 2020: Marketing training</p>	
5-8	○	5	H	H	H	H	Marketing training	→Selection of crop/variety based on the analysis of profitability, making crop calendar	<p>Jan 2021: Done with cooperative</p> <p>22 Sep 2021: Making crop calendar</p> <p>24-25 Aug 2022 : SHEP WS (ToT)</p>	<p>7 May 2021: Selection of the varieties</p> <p>17-18 Aug 2022 : SHEP WS (ToT)</p>	<p>2 Dec 2020: Selection of the varieties</p> <p>11-12 Aug 2022 : SHEP WS (ToT)</p>	<p>Jan 2021: Done with cooperative</p> <p>24 Sep 2021: Making crop calendar</p> <p>11-12 Aug 2022 : SHEP WS (ToT)</p>	
5-9		5	L	L	L	L	Rice cultivation and Horticulture training	Management of demonstration plots in the schemes	From Dec 2020 to Feb 2023	From Dec 2020 to Feb 2023	From Dec 2020 to Feb 2023	From Dec 2020 to Feb 2023	
5-10	○	5		M	M		Rice Cultivation training 1 (FFS)	→1: Field training on nursery sowing practice and soil improvement		<p>11, 14-16 Dec 2020: sowing and nursery preparation</p> <p>7-8 Jul 2021: sowing and nursery preparation</p> <p>11 Jan 2022 : Nursery preparation and sowing</p>	<p>29-31 Dec 2020: sowing and nursery preparation</p> <p>29-30 Jun 2021: sowing and nursery preparation (second time)</p>		

S/N	Agreed Plans	Output	(After) Priority for model sites				Contents of activity / training	Details	Progress				Target
			N22	Rw	Nr	Nb			N22	Rw	Nr	Nb	
5-11	○	5		M	M		Rice Cultivation training 2 (FFS)	→2: Field training on transplanting		19-22 Jan 2021: Land leveling and transplanting training (only for land owner due to covid-19 prevention) 4-5 Aug 2021: training on transplanting 4 Feb 2022: training on land leveling and transplanting 27-30 June 2022 : training on land preparation for beginners who started cultivation of paddy rice	4-8 Jan 2021: Land leveling and transplanting training (only for land owner due to covid-19 prevention) 26-30 Jul 2021: Land leveling and transplanting		
5-12	○	5		M	M		Rice Cultivation training 3 (FFS)	→3: Field training on fertilization and pest control	30 Nov 2021 : Disease and pest control	18-19 Feb 2021: Field training on fertilization and pest control 24 Mar 2021: 2nd Top dressing 8-9 Sep 2021: Training on top dressing and weeding 22-Oct 2021: Training on 2nd topdressing 16-17 May 2022 : Training on disease and pest control by TF member	2-Feb 2021: Field training on fertilization and pest control 18-19 Aug 2021: Training on top dressing and weeding 19-20 May 2022 : Training on disease and pest control by TF member		
5-13	○	5		M	M		Rice Cultivation training 4 (FFS)	→4: Field training on harvesting and post-harvesting		25-26 May 2021: Harvesting 15 June 2023: Training on winnower machine operation and maintenance	5 May 2021: Harvesting 13 Dec 2021: Harvesting 30 Nov 2022: Training on winnower machine operation and maintenance		
5-14	○	5	M			M	Horticulture training 1 (FFS)	→1: Field training on seed sowing and seedling preparation	10 Feb 2021: sowing and nursery preparation 28 Sep 2021: sowing maize and chia seed and nursery of tomato, cabbage and beetroot			4 Feb 2021: sowing and nursery preparation 29-30 Sep 2021: sowing preparation of maize and chia seed 22 Mar 2022: sowing soybean and applying rhizobium 23 Sep 2022: spacing and fertilizer application of maize	
5-15	○	5	M			M	Horticulture training 2 (FFS)	→2: Field training on transplanting and land preparation	6 Apr 2021: transplanting and land preparation 3 Nov 2021: Transplanting and top dressing			1 Apr 2021: transplanting/sowing and land preparation 23-24 Jun 2021: Planting for irish potato	
5-16	○	5	M			M	Horticulture training 3 (FFS)	→Field training on fertilization, rice husk charcoal and compost making	6 May 2021: weeding and fertilization 13 May 2021: compost making.			14-23 Apr 2021: compost making for all zones, 22 Apr 2021: fertilization	
5-17	○	5	M			M	Horticulture training 4 (FFS)	→4: Training on pest control and IPM	30 Nov 2021: Diseases and pest control			21 Jun 2021: Making organic pesticide for chili	
5-18	○	5	M			M	Horticulture training 5 (FFS)	→5: Field training on harvesting and post-harvesting	29 Jun 2021: Harvesting for green pepper 17 Jan 2022 : Harvesting and post-harvest			1-Oct 2021: harvesting irish potato	
5-19		5		L	L	L	Horticulture training 6 (FFS)	Field training on farm machine and tools (winnowing, planting machine, etc.)		23 Apr 2021: Repair work of damaged winnower machine of cooperatives with technicians. (20 machines are repaired)	30 Nov 2022: Training on winnower machine operation and maintenance	Cooperative plans to procure electric chemical sprayer machine next season, so after procurement, training on how to use it will be conducted.	
5-20	○	5		L	M		Field training on field-level water-saving paddy irrigation	Training on water management at on-farm level		Feb- 2021: preparation and implemented training	Feb- 2021: preparation and implemented training		
5-21	○	5	M			M	Field training on field-level water-saving upland irrigation	Training on water management at on-farm level	Feb- 2021: preparation and implemented training			Feb- 2021: preparation and implemented training	
5-22		5	M				Knowledge Co-Creation Program in the third country	Knowledge Co-Creation Program regarding farming (SHEP, CARD) in the third country	9-27 May 2022 : TF member participated "Market-Oriented Agriculture Promotion (Planning and Management)(A)" as an observer and prepared action plan (online).				
5-23		5	L			L	Improvement of nutrition	Improvement of nutrition through farming package	Jul 2021: Field survey Jan 2022 : Dietary Diversity Survey			Jul 2021: Field survey Jan 2022 : Dietary Diversity Survey	
5-24		5	M			M	Post-harvest training	→Training on post-harvesting, collecting and shipment	29 Jun 2021: Harvesting for green pepper 17 Jan 2022 : Harvesting and post-harvest			1-Oct 2021: harvesting irish potato	
5-25		5					Post-harvest training	→Training on operation and maintenance of agricultural facility (Drying yard, storage, etc.)					
5-26		5					Post-harvest training	→Training on operation and maintenance of cold storage					
5-27		5	M			L	Marketing training (option)	Introduction of contract farming and certificates	July-Aug 2020: consultation contract farming with cooperatives and private companies Sep 2020-Feb 2021: Consultation farming of chia seed and chili 26 May 2022 : Interviewing quinoa company			July 2021: consultation contract farming with cooperative and private company. 30-31 Aug 2021: Study Tour to Ngoma 22 Sep 2021: consultation of making contract	Cooperative
5-28		5					Coop management training (option)	Introduction of credit services for commercial farming					
5-29		5					Marketing training (option)	Trial introduction of parboiling technique					

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
2-1	2	Understanding the scheme	[Step 1] • Undertake preliminary survey and define the scheme service area	Existikng and reconfirmed in June 2023			Existikng and reconfirmed in June 2023	Existikng and reconfirmed in June 2023	
2-2	2	Database organization	[Step 2] • Database preparation and organizing the management structure	Conducted in June and July 2023			Conducted in June and July 2023	Conducted in June and July 2023	
2-3	2	Reorganization of IWUO and election of leaders	[Step 2] • Database preparation and organizing the management structure	Conducted in July 2023			Conducted in July 2023	Conducted in July 2023	
2-4	2	Explanation of scheme layout to IWUO	[Step 3] • Conduct initial training and explain the scheme layout and how IWUO is organized	August 3 2023 initial training was conducted to Gitinga IWUO and Cooperative leaders on the scheme layout and present condition of the irrigation system			July 2023 initial training was conducted to Rugende IWUO and Cooperative leaders on the scheme layout and present condition of the irrigation system	August 1 2023 initial training was conducted to Gatare IWUO and Cooperative leaders on the scheme layout and present condition of the irrigation system	July 2023 initial training was conducted to Cyili IWUO and Cooperative leaders on the scheme layout and present condition of the irrigation system
2-5	2	Establishment of Internal Regulation • Prepare the Rules and Internal Regulations (by-law) • Prepare role and responsibility of stakeholders [Step 5] • Hold general meeting for approval of the Rules and Internal Regulations and Action Plan • Prepare future Action Plan	Its being updated The updated version of internal regulation is shared among stakeholders for comment and suggestion				Its being updated The updated version of internal regulation is shared among stakeholders for comment and suggestion	Its being updated The updated version of internal regulation is shared among stakeholders for comment and suggestion	
2-6	2	Strengthening of IWUO [Step 6] • Capacity development on Leadership • Promotion of participation • Transparency and accountability • Conflict management • Preparation of Action Plan	August 9 2023 TF members trained the IWUO and Cooperatives on Strengthening of IWUO Training on office managemnt conducted Workshop was conducted for FC of all site to share good experience and learn each other problem as capacity building of the managmengt of scheme	August 9 2023 TF members trained the IWUO and Cooperatives on Strengthening of IWUO together with Gitinga Training on office management was conducted			August 7 2023 TF members trained the IWUO and Cooperatives on Strengthening of IWUO General Assembly meeting conducted Training on office managemnt conducted Workshop was conducted for FC of all site to share good experience and learn each other problem as capacity building of the managmengt of scheme	August 16 2023 TF members trained the IWUO and Cooperatives on Strengthening of IWUO General Assembly meeting conducted Workshop was conducted for FC of all site to share good experience and learn each other problem as capacity building of the managmengt of scheme	August 16 2023 TF members trained the IWUO and Cooperatives on Strengthening of IWUO together with Gatare

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
2-7	2	Financial Management	[Step 6] • Outline of financial management • Establishment of the O&M fund • Establishment of the O&M fee management mechanism Genaral Assembly meeting was cunducted, Water fee rate is increased from 100 to 200RwF per are The president agree to resign due to the pressure from the two Cooperatives leaders. A new president shall be elected during an extra-ordinary GA meeting to be held soon	August 10 2023 TF members trained the IWUO and Cooperatives on Financial Management Genaral Assembly meeting was conducted, Water fee rate is increased from 100 to 200RwF per are The president agree to resign due to the pressure from the two Cooperatives leaders. A new president shall be elected during an extra-ordinary GA meeting to be held soon	August 10 2023 TF members trained the IWUO and Cooperatives on Financial Management together with Gitinga		August 8 2023 TF members trained the IWUO and Cooperatives on Financial Management General assembly meeting was conducted Investigation of financial management was conducted with the help of WAMCAB NS IWUO understand the mismanagment of fund and agree to adjust the financial managment	August 17 2023 TF members trained the IWUO and Cooperatives on Financial Management Genaral assembly meeting was conducted Training on office management was conducted Preparation for community mobilized to rehabilitate the extremly damaged stream bank (Main Drainage system). Each farmers agree to vacate 2m wide land for the embankment on main drain	August 17 2023 TF members trained the IWUO and Cooperatives on Financial Management together with Gatare
2-8	2	Monitoring and Evaluation Method by DISC & RAB	[Step 6] • Role and function of M&E • Establishment of M&E system • Implementation of M&E	August 11 2023 TF members trained the IWUO and Cooperatives on PM&E New manager is hired and start working as the manager of Gitinga IWUO A computer is provided for smooth implementation of activities of IWUO Cooperatives and IWUO agree to mobilize fund to construct new weirs	August 11 2023 TF members trained the IWUO and Cooperatives on PM&E together with Gitinga		August 9 2023 TF members trained the IWUO and Cooperatives on PM&E	August 18 2023 TF members trained the IWUO and Cooperatives on PM&E	August 18 2023 TF members trained the IWUO and Cooperatives on PM&E together with Gatare
2-9	2	Commencement of the scheme activity	[Step 7] Commencement of scheme • Prepare and provide O&M manual • Start the scheme operation and management activities • Establish the system of collection water fee and member fee • Prepare financial management system • Establish performance agreement between IWUO and cooperative or other water users	A new manager or Field Collaborator is in the process of selection from within the community			On the job training is being done to IWUO manager and leadership with the help from NS of WAMCAB The impact of the training given by WAMCAB result in a lot of changes in the activities of IWUO and its manager For the first time IWUO achieve: Good office data management, Develop confidence in water managment, Prepare presentation for DISC meeting	On the job training is being done to IWUO manager and leadership with the help from FC of Nyigiri IWUO	

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
2-10	2	Support in the registration of the organization and IMTA agreement	[Step 8] • Apply for registration of IWUO and water permit • Registration and performance contract agreement [Step 9] • IMTA and M&E system • Prepare a follow up mechanism • IMTA with MINAGRI • Routine Training						
2-11	2	Construction of secondary canal in Rwamagana	Support for the construction of secondary canal in Rwamagana						
2-12	2	Make TF understand How the lower level IWUO is formed							
2-13	2	To improve the draft manuals	Discussion and updating the manuals						
3&4-1	3,4	Establishment of implementation structure for O&M and water management at the scheme level	•To organize the O&M Team and Farmers' Repair Team •To organize the Water Users Team	28 August 2023: Lecture for O&M structure in IWUO 1 September 2023: Discussion for the O&M structure in IWUO			21 August 2023: Lecture for O&M structure in IWUO 25 September 2023: Discussion for the O&M structure in IWUO		
3&4-2	3,4	O&M and Water Management Basic Training	•Sharing the basics and current issues of irrigation facility utilization •PIM (Participatory Irrigation Management) training •To promote activities of water management and O&M at block level •Study tour to good practice schemes	5-7 June 2023: Pre-Training			12-14 June 2023: Pre-training	19-21 June 2023: Pre-training	
3-3	3,4	O&M Training 1 (lecture)	Basic training on O&M to foster the ownership	28 August 2023: Lecture for PIM			22 August 2023: Lecture for PIM		
3-4	3,4	Survey / inspection and analysis of current facility condition	•To prepare irrigation and drainage system map in the scheme •To prepare Irrigation scheme map •Facility inspection to grasp the current condition	5-7 June 2023: Pre-Training 9-10 October 2023: Facility inspection training			12-14 June 2023: Pre-training 9-10 October 2023: Facility inspection training	19-21 June 2023: Pre-training 16-18 October 2023: Facility inspection training	
3-5	3,4	O&M Training 2 (lecture)	•To prepare the annual O&M plan of IWUO •To evaluate and consider the appropriate water fee setting	19-21 March: BoQ Preparation, O&M planning and Civil work Practise			19-23 February: BoQ Preparation, O&M planning and Civil work Practise	26 February-1 March: BoQ Preparation, O&M planning and Civil work Practise	
3-6	3,4	O&M Training 3 (field practice) Basic / Advanced level	•Basic civil work (masonry, plain concrete) •Advanced civil work (Reinforced concrete) •Participatory simple maintenance and cleaning activity •Countermeasures against soil erosion •Maintenance of hydrants/pipe/valve •Demonstration on typical facility maintenance and repair •Farm road repair	29-31 August and 1 September 2023: Lecture and practise for Basic Civil work in the model site 23 November 2023: BoQ Preparation training 19-21 March: BoQ Preparation, O&M planning and Civil work Practise			22-25 August 2023: Lecture and practise for Basic Civil work in the model site 16 November 2023: BoQ Preparation training 19-23 February: BoQ Preparation, O&M planning and Civil work Practise	4-8 September 2023: Lecture and practise for Basic Civil work in the model site 2 November 2023: BoQ Preparation training 26 February-1 March: BoQ Preparation, O&M planning and Civil work Practise	

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
4-7	3,4	Water management training 1 :Basic knowledge on irrigation (lecture)	•Lectures on efficient water use and irrigation methods mainly for hillside irrigation	20 - 23 November 2023: Basic Water Managemnet Training			13 - 16 November 2023: Basic Water Managemnet Training	30 October - 1 November 2023: Basic Water Managemnet Training	
4-8	3,4	Water management training 2 :water resources monitoring in irrigation scheme (lecture / field practice)	•Lectures on efficient water use and irrigation methods •Monitoring of the amount of available water resources and water use •Water management at the time of drought •Measurement of discharge and water level at dam reservoir •Rainfall observation by using simple rain gauge •Measurement of water consumption rate in paddy field						
4-9	3,4	Water management training 3: Practice for Hillside irrigation (lecture / field practice)	On-farm water management and water use mainly for hillside irrigation •Appropriate irrigation using soil moisture monitoring data •Trial of treadle pump Water distribution using Night Reservoir (•Trial installation of shallow well for dry season) (•Trial of foot pump) (•To install water storage)						
4-10	3,4	Field practice of on-farm level water-saving irrigation for marshland scheme	On-farm water management and water use mainly for marshland irrigation •Land levelling of the plot •Maintenance of levee at the leakage point and improvement of ridge preparation method •Installation of on-farm drainage (improvement of drainage condition) •Trial of water saving method for paddy rice (AWD: Alternate Wetting and Drying) •Adjustment of irrigation according to the growing stage •To promote the installation of secondary/tertiary canal				22 January: On-farm water management training	17 January: On-farm water management training	
4-11	3,4	Water management training 4 (lecture / field practice)	•To prepare annual water distribution plan •To evaluate and consider the appropriate water fee setting	29-30 April 2024: Training for formulation of Water distribution plan			9-10 May 2024: Training for formulation of Water distribution plan	6-7 May 2024: Training for formulation of Water distribution plan	

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
5-1	5	Establishment and reinforcement of Cooperative organizational structure	To establish the implementation structure for farm management at scheme level						
5-3	5	Profitability analysis	To analyze the profitability of each crop based on production record and BLS	BLS was conducted in July and August 2023					
5-5	5	Coop management training	Training on strengthening Coop management, gender main streaming, and accounting	12-14, 19-21 September 2023: Training on Coop management, gender main streaming	26-28 September 2023: Training on Coop management, gender main streaming	5- 6 October 2023 : Training on Coop management, gender main streaming	18- 20, 23- 25, October : Training on Coop management, gender main streaming	20-22, 27-29 September 2023: Training on Coop management, gender main streaming 26 Jan 2024: Training on Family Budget	
5-6	5	Coop management training	Study tour to good practice cooperatives			6 February 2024 : Study tour to Nyakaliba SSIT site			
5-7	5	Marketing training	→Training on marketing and market-oriented agriculture →Training on market research and analysis						
5-8	5	Marketing training	→Selection of crop/variety based on the analysis of profitability, making crop calendar	6, December 2023 : Training on Crop calendar making	12, December 2023 : Training on Crop calendar making	27-28, November 2023 : Marketing training	21, November 2023 : Training on Crop calendar making	20, December 2023: Training on Crop calendar making	
5-9	5	Rice cultivation and Horticulture training	Management of demonstration plots in the schemes						
5-10	5	Rice Cultivation training 1 (FFS)	→1: Field training on nursery sowing practice and soil improvement	18, January 2024: FFS training on nursery preparation (COPERIG and COCURIJE)			21, December 2023: FFS training on nursery preparation (COMSS) 27, December 2023: FFS training on nursery preparation (Ejoheza)		
5-11	5	Rice Cultivation training 2 (FFS)	→2: Field training on transplanting				22 January 2024: FFS training on paddling & levelling, transplanting and basal application (COMSS) 26 January 2024: FFS training on paddling & levelling, transplanting and basal application (Ejoheza Rugende)	17 January 2024: FFS training on paddling & levelling, transplanting, basal application, water management and band repair	
5-12	5	Rice Cultivation training 3 (FFS)	→3: Field training on fertilization and pest control	21 March 2024 : FFS training on 1st top dressing application, disease and pest control			20 February 2024: FFS training on fertilization and pest and disease control (COMSS) 21 February 2024: FFS training on fertilization and pest and disease control (Ejoheza)	24-25 April 2024: FFS training on pest and disease control (lecture and field session)	
5-13	5	Rice Cultivation training 4 (FFS)	→4: Field training on harvesting and post-harvesting	14 June 2024 : FFS training on harvesting and post-harvesting			17 May 2024: FFS training on harvesting and post-harvesting (COMSS) 12 June 2024 : FFS training on harvesting and post-harvesting (Ejoheza)		

S/N	Output	Contents of activity / training	Details						
				Gitinga	Gisaya	Mutenderi	Rugende	Gatare	Cyili
5-14	5	Horticulture training 1 (FFS)	→1: Field training on seed sowing and seedling preparation			14 March 2024 : FFS training on nursery preparation and sowing			
5-15	5	Horticulture training 2 (FFS)	→2: Field training on transplanting and land preparation			15 April 2024: FFS training on land preparation and transplanting			
5-16	5	Horticulture training 3 (FFS)	→Field training on fertilization, rice husk charcoal and compost making						
5-17	5	Horticulture training 4 (FFS)	→4: Training on pest control and IPM			15 May 2024: FFS training on disease and pest control			
5-18	5	Horticulture training 5 (FFS)	→5: Field training on harvesting and post-harvesting			9 July 2024: FFS training on harvesting and post-harvesting			
5-19	5	Horticulture training 6 (FFS)	Field training on farm machine and tools (winnowing, planting machine, etc.)						
5-20	5	Field training on field-level water-saving paddy irrigation	Training on water management at on-farm level						
5-21	5	Field training on field-level water-saving upland irrigation	Training on water management at on-farm level						
5-22	5	Knowledge Co-Creation Program in the third country	Knowledge Co-Creation Program regarding farming (SHEP, CARD) in the third country						
5-23	5	Improvement of nutrition	Improvement of nutrition through farming package						
5-24	5	Post-harvest training	→Training on post-harvesting, collecting and shipment						
5-25	5	Post-harvest training	→Training on operation and maintenance of agricultural facility (Drying yard, storage, etc.)						
5-26	5	Post-harvest training	→Training on operation and maintenance of cold storage						
5-27	5	Marketing training (option)	Introduction of contract farming and certificates						
5-28	5	Coop management training (option)	Introduction of credit services for commercial farming						
5-29	5	Marketing training (option)	Trial introduction of parboiling technique						



Memorandum of Cooperation

For

Sustainable Collaboration

Among

University of Rwanda (UR)

And

**Project for
Water Management and Capacity Building
(WAMCAB)**

And

**Rwanda Agriculture and Animal Resources
Development Board (RAB)**

August 2023

Dr.

Prof. [Signature]

**THIS MEMORANDUM OF COOPERATION (THIS “MOC”) IS ENTERED INTO
AMONG:**

The **University of Rwanda**, a public higher learning institution established by the law no 71/2013 of 10/09/2013 determining its mission, powers, organization, and functioning and having its head office at KK 737^{str} Gikondo, PO BOX 4285 Kigali, represented by **Dr. KAYIHURA Muganga Didas, Acting Vice Chancellor** hereinafter referred to as “UR”

And

The **Project for Water Management and Capacity Building in the Republic of Rwanda**, jointly implemented by Rwanda Agriculture and Animal Resources Development Board (RAB) and Japan International Cooperation Agency (JICA), represented by **Mr. KUNIYASU Norio, Chief Advisor** hereinafter referred to as “WAMCAB”

And

The **Rwanda Agriculture and Animal Resources Development Board**, an autonomous body established by law no 38/2010 of 25/11/2010, and currently governed by Presidential Order no 074/01 of 09/12/2022 determining its mission, organization, and functioning and having its head office at Huye District, PO BOX 5016 Huye, represented by **Dr. NDABAMENYE Telesphore, Director General** hereinafter referred to as “RAB”

Whereas, parties in order to contribute for sustainable utilization of WAMCAB achievement for collaboration training and research in water and soil management domain. Facilitation is made to implement item E, article 2 of the Memorandum of Understanding (MoU) dated August 2018 between Implementing Agencies of the Ministry of Agriculture and Animal Resources (MINAGRI) and Higher Learning Institutions. WAMCAB and College of Agriculture, Animal Science and Veterinary Medicine (CAVM), UR are referred to collectively as “Parties” or individually as “Party”.

ARTICLE 1: ABOUT THE PROJECT

WAMCAB has been implemented from April 2019 to March 2025 based on the Records of Discussions (R/D) signed on 27th September, 2018 between the Government of Rwanda represented by **RAB** and **JICA** and amended on 24th February, 2021 as well as 4th March, 2022.

ARTICLE 2: GENERAL RESPONSIBILITIES OF THE PARTIES

The Parties agree to carry out their respective responsibilities and activities in agreement with the requirements of the consensus.

ARTICLE 3: SPECIFIC ROLES AND RESPONSIBILITIES OF EACH PARTY

3.1. RESPONSIBILITIES OF CAVM

- i. To implement research, technology transfer and community outreach activities in collaboration with WAMCAB;
- ii. To provide technical support in research and technology transfer areas in which WAMCAB is involved;
- iii. To work together with WAMCAB for developing and providing trainings to all members concerned in WAMCAB with own expense by WAMCAB;
- iv. To avail a list of interns to be hosted by WAMCAB, send them to WAMCAB and ensure their supervision, if necessary;
- v. To avail experts who will work closely with WAMCAB, for community development;
- vi. To utilize findings and technical materials provided through the activities with WAMCAB for the lectures and/or course of CAVM;
- vii. To provide seasonal reports and recommendations from research findings according to research agreement to be annually developed between WAMCAB and CAVM; and
- viii. To ensure sustainability of activities generated under this partnership as far as CAVM mandate is concerned.



3.2. RESPONSIBILITIES OF WAMCAB

- i. To facilitate CAVM experts during the design and implementation of joint research exercises where necessary and available;
- ii. To involve CAVM students to enhance their capacity by the own expense of CAVM;
- iii. To participate and contribute in CAVM lectures, research and community outreach programs and others undertaken jointly by Parties;
- iv. To disseminate research findings through technical support in the target WAMCAB project sites;
- v. To avail data and information to CAVM for the purpose of research planning and scientific publication; and
- vi. To provide internship opportunities for CAVM students by the own expense of CAVM where necessary and available.

3.3. RESPONSIBILITIES OF RAB

- i. To host study tours of the students from UR/CAVM to developed irrigation schemes for learning purposes;
- ii. To share with students from UR/CAVM practical experiences on the ground and introduce them to different stakeholders in the scheme such as IWUOs, Cooperatives, local leaders, etc.;
- iii. To exchange practical and technical skills with the students from UR/CAVM;
- iv. To provide needed internship to students in the field of irrigation and drainage in the developed irrigation schemes;
- v. To share with students training manuals developed by the different stakeholders such as experts from WAMCAB, SMAP, PiCroP TWIGIRE MUHINZI.

ARTICLE 4: VALIDITY AND DURATION

This MoC will enter into force from the date of its signature and will remain valid till the end of WAMCAB project.



ARTICLE 5: FINANCIAL ARRANGEMENTS

The financial arrangements to cover expenses for the activities undertaken within the framework of this MoC will be mutually agreed upon by the respective Parties on a case-by-case basis subject to the availability of funds and resources.

ARTICLE 6: EARLY TERMINATION

For justifiable reasons, this MoC can be early-terminated by any of the Parties, provided a one-month early termination notice is given to the other Party.

ARTICLE 7: MODIFICATION OF CONTENT AND AMICABLE SETTLEMENT

The Parties agree to modify the content of this MOC when required and necessary.

Any dispute, controversy, claim arising out of or relating to this MOC or breach termination or invalidity thereof, shall be settled between the Parties.

The Parties agree to use good faith efforts to attempt to amicably settle any dispute between the Parties arising out of the interpretation or implementation of this MOC through consultations and negotiations between them. Failure to reach a common solution, the MOC shall be terminated in accordance with termination clause.

Lastly, this MOC is not a legally binding document.

ARTICLE 8: POINTS OF CONTACT

The point of contact shall act as the principal contact for program activities, distribute information, review and evaluate activities under the program, and propose new initiatives.

For UR: Resource Mobilization Division Manager, Mr. Djamali Nambajimana.

E-mail: principal.cavm@ur.ac.rw, Tel: +250 789 529 484.

For WAMCAB: JICA Rwanda Office. Email: rw_oso_rep@jica.go.io, Tel: +250 788301731/32/23



For RAB: Irrigation Water Users Association Specialist, Mr. Jules MPORANA.
E-mail: jules.mporana@rab.gov.rw, Tel: +250 788 479 342.

SIGNED for and on behalf of UR

Signature

for **Dr. Raymond NDIKUMANA**
DVC Strategic Planning and
Administration

By delegation of power

Date: 25th August 2023



SIGNED for and on behalf of WAMCAB

Signature

for **Mr. KUNIYASU Norio,**
Chief Advisor/ Irrigation Policy
Date: _____



SIGNED for and on behalf of RAB

Signature

Dr. NDABAMENYE Telesphore
Director General

Date: 27/09/2023



SIGNED as witness on behalf of JICA

Signature

Ms. SHIOTSUKA Minako,
Chief Representative of JICA Rwanda

Office

Date: 3rd Oct 2023

Memorandum of Understanding

Between

**Project for
Water Management and Capacity Building in
the Republic of Rwanda
(WAMCAB)**

And

**Horticulture in Reality Corporation Ltd
(HoReCo)**

July 2023



CLAUSE 1: PURPOSE AND AGREEMENT

This Memorandum of Understanding (MoU) sets out the agreement, under which the collaboration activity for capacity development of IWUO and agricultural cooperative will be conducted between the JICA-supported **Project for Water Management and Capacity Building in the Republic of Rwanda (WAMCAB)** on one hand and the **Horticulture in Reality Corporation Ltd (HoReCo)** on the other hand. WAMCAB and HoReCo are referred to collectively as “Parties” or individually as “Party”.

CLAUSE 2: GENERAL RESPONSIBILITIES OF THE PARTIES

The Parties agree to carry out their respective responsibilities and activities in agreement with the requirements of the consensus.

CLAUSE 3: SPECIFIC ROLES AND RESPONSIBILITIES OF EACH PARTY

3.1. RESPONSIBILITIES OF WAMCAB

- i. To explain objective and content of planned joint activities with HoReCo side, basically each time joint activity are planned.
- ii. To facilitate HoReCo staffs during planning and implementation of joint activities where necessary and available;
- iii. To mobilize funds for funding the joint activities where necessary and mutually agreed;
- iv. To avail data and information to HoReCo side for the purpose of extension of WAMCAB established models for capacity development of IWUO and agricultural cooperative.
- v. To report RAB side about conducted activity

3.2. RESPONSIBILITIES OF HoReCo

- i. To dispatch participants for the joint activity invited by WAMCAB side



- ii. To feedback the findings through the activity and contribute improvement of the manuals prepared by WAMCAB.
- iii. To work together with WAMCAB team for developing and providing trainings to the target IWUO and cooperative members;
- iv. To exchange technical information and recommendations for better capacity development of Rwandan IWUOs and cooperatives.
- v. To report RAB side about conducted activity

CLAUSE 4: VALIDITY AND DURATION

This MoU shall enter into force from the date of its signature. It will remain valid until the end of WAMCAB in February 2025, including the training period.

CLAUSE 5: FINANCIAL ARRANGEMENTS

The financial arrangements to cover expenses for the activities undertaken within the framework of this MoU shall be mutually agreed upon by the respective Parties on a case-by-case basis subject to the availability of funds and resources.

CLAUSE 6: EARLY TERMINATION

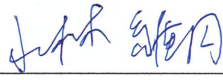
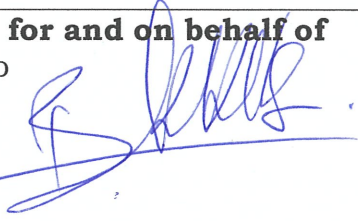


For justifiable reasons, this MoU can be early-terminated by any of the Parties, provided a three-month early termination notice is given to the other party.



CLAUSE 7: DISPUTE RESOLUTION

Any dispute arising during the implementation of the MoU shall be amicably settled; in case the dispute cannot be amicably settled, only the Rwandan Law shall apply.

Signed on 8th August 2023

Signed for and on behalf of WAMCAB	Signed for and on behalf of HoReCo
 Signature	 Signature
Mr. KUNIYASU Norio, Chief Advisor/ Irrigation Policy	Mr. BUCYANA Richard, Chief Executive Officer & Project Coordinator
	

ルワンダ国「灌漑水管理能力向上プロジェクト（第 2 期）」
事業継続計画書（3 月版）

注：下表の【】内の番号は、特記仕様書「第 7 条 業務の内容」の（）の番号に対応している。

年月	旬	当初業務計画 （＊当初計画の業務を記載する。業務計画書、JCC で合意された年間計画等）		見直し事業継続計画 （＊事業継続のための計画を記載する）		備考・補足
		国内業務	現地業務	国内業務	現地業務	
2020 年 3 月		第 2 期契約手続き 本邦研修実施に向けた調整	モデル地区の灌漑水利組合及び農協との 密な連絡・協議 モデル地区における継続的な気象観測業 務の支援 カウンターパート、タスクフォースメン バー、現地傭人等現地関係者による改 善計画／研修実施計画のレビュー 本邦研修実施に係る現地での調整業務	第 2 期契約手続き 本邦研修延期に向けた調整（＊）	モデル地区の灌漑水利組合及び農協との SNS・電話を通じた連絡・協議 モデル地区における継続的な気象観測業 務の支援 カウンターパート、タスクフォースメン バー、現地傭人等現地関係者による改 善計画／研修実施計画のレビュー（活 動制限あり） 本邦研修延期に係る現地での調整業務*	* 本邦研修の延期後の日程 が確定次第、再調整を開 始する。仮日程：2020 年 8 月が第一候補
4 月	上旬	【12】①第 1 期業務計画書のレビュー・ 第 2 期業務計画書の作成 【13】本邦研修の実施に係る事前準備	【12】①現地関係者による改善計画／研 修実施計画のレビュー	【12】①第 1 期業務計画書のレビュー・ 第 2 期業務計画書の作成 【13】本邦研修の実施に係る事前準備	【12】③現地関係者による改善計画／研 修実施計画のレビュー（活動制限あ り）	
	中旬	【12】①第 1 期業務計画書のレビュー・ 第 2 期業務計画書の作成 【13】本邦研修の実施に係る事前準備	【12】①現地関係者による改善計画／研 修実施計画のレビュー	【12】①第 1 期業務計画書のレビュー・ 第 2 期業務計画書の作成 【13】本邦研修の実施に係る事前準備	【12】③上記同様	
	下旬	【12】①第 2 期業務計画書に係る JICA との協議・承認、及び②③業務計画書 に基づく及びワーク・プラン（Ver.0） の作成 【13】本邦研修の実施	【12】①現地関係者による改善計画／研 修実施計画のレビュー	【12】④第 2 期業務計画書に係る JICA との協議・承認、及び②③業務計画書 に基づく及びワーク・プラン（Ver.0） の作成	【12】③上記同様	
5 月	上旬	【12】②③ワーク・プラン（Ver.0）の作 成 【13】本邦研修の実施及び事後対応	【14】①第 2 期ワーク・プラン（Ver.0） に係るカウンターパートとの協議と、協 議結果を踏まえたワーク・プラン （Ver.1）の作成 【15】[成果 1] 改善計画のレビュー、① 改善計画に基づく実施方針・実施時期に 関するカウンターパートとの協議 【15】[成果 2-5] 改善計画／研修実施計 画のレビュー、①改善計画／研修実施計 画に基づく具体的な研修対象・実施方 針・実施時期に関するカウンターパート との協議、②マニュアル骨子を基にした マニュアル／テキスト（案）の作成支援 【16】PDM 改定（案）と PO（案）に係 る JICA 及びカウンターパートとの協議	【12】②③ワーク・プラン（Ver.0）の作 成 【14】①第 2 期ワーク・プラン（Ver.0） に係るカウンターパートとの SNS・電 話を通じた協議と、協議結果を踏まえ たワーク・プラン（Ver.1）の作成 【15】[成果 1] 改善計画のレビュー、① 改善計画に基づく実施方針・実施時期 に関するカウンターパートとの SNS・ 電話を通じた協議 【15】[成果 2-5] 改善計画／研修実施計 画のレビュー、①改善計画／研修実施 計画に基づく具体的な研修対象、実施 方針、実施時期に関するカウンターパ ートとの SNS・電話を通じた協議、② マニュアル骨子を基にしたマニュアル ／テキスト（案）の作成支援 【16】PDM 改定（案）と PO（案）に係 る JICA との協議及びカウンターパ ートとの SNS・電話を通じた協議		
	中旬	【6】第三国研修の策定計画 【12】④ワーク・プラン（Ver.1）にかか る JICA の協議・承認	【14】①上記同様 【15】[成果 1] ①上記同様、②モニタリ ング・評価システム構築に向けた協議・ 検討 [成果 2-5] ①②上記同様、③モニタリン グ・評価システム構築に向けた協議・検 討 【16】上記同様	【6】第三国研修の策定計画 【12】④ワーク・プラン（Ver.1）にかか る JICA の協議・承認 【14】①上記同様 【15】[成果 1] ①上記同様 [成果 2-5] ①②上記同様 【16】上記同様		

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		国内業務	現地業務	国内業務	現地業務	
	下旬	【6】 上記同様	【14】 ①ワーク・プラン (Ver.1) の最終化 【15】 [成果 1] ①②上記同様 [成果 2-5] ①②③上記同様 【16】 第 3 回 JCC 会議の開催準備	【6】 上記同様 【14】 ①ワーク・プラン (Ver.1) の最終化 【15】 [成果 1] ①上記同様 [成果 2-5] ①②上記同様 【16】 上記同様		
6 月	上旬		【6】 第三国研修計画に係るカウンターパートとの調整・協議 【14】 ②第 3 回 JCC 会議におけるワーク・プランの合意と最終化 (Ver.2) 【15】 [成果 1] ①②上記同様 [成果 2-5] ①②③上記同様 【16】 第 3 回 JCC 会議の開催 (*)	【6】 第三国研修計画に係るカウンターパートとの SNS・電話を通じた調整・協議 【15】 [成果 1] ①上記同様 [成果 2-5] ①②上記同様		* 第 3 回 JCC 会議は、現地業務開始後の 7 月中旬に延期する。 ただし、それ以上遅れるようであれば、現地研修開始のためワーク・プランを合意する必要があるため、JICA チームは Skype 参加として早期に開催することを検討する。
	中旬		【6】 上記同様 【14】 ③関係者 (郡、ステーション等) への説明・周知 【15】 [成果 1] ①改善活動の支援、②モニタリングの実施、③IMT 実施マニュアル (案) の作成支援、④IWUO 政策・戦略と省令の改正に向けた準備 [成果 2-5] ①改善計画及び研修計画に基づいた指導活動の実施、②研修のフィードバックを踏まえたマニュアルの改善、③モニタリング・評価システムの構築、④モニタリング及び評価の実施 【16】 第 3 回 JCC 会議のフォローアップ	【6】 上記同様 【15】 [成果 1] ①上記同様 [成果 2-5] ①②上記同様		
	下旬		【6】 上記同様 【14】 ③上記同様、第 5 回 TF 会議の開催 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様	【6】 上記同様 【15】 [成果 1] ①上記同様 [成果 2-5] ①②上記同様		
7 月	上旬		【6】 第三国研修 (*) の実施に係る事前準備 【14】 ③第 5 回 TF 会議のフォローアップ 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様		【6】 第三国研修 (*) の実施に係る事前準備 【15】 [成果 1] ①改善計画に基づく実施方針・実施時期に関するカウンターパートとの確認、②モニタリング・評価システム構築に向けた協議・検討 [成果 2-5] ①改善計画／研修実施計画に基づく具体的な研修対象・実施方針・実施時期に関するカウンターパートとの確認、③モニタリング・評価システム構築に向けた協議・検討 【16】 第 3 回 JCC 会議の開催準備	* カウンターパートとの協議後、第三国研修の日程が確定次第、事前準備を開始する。仮日程：2020 年 8 月
	中旬		【6】 上記同様 【14】 ③上記同様 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様		【6】 上記同様 【14】 ②第 3 回 JCC 会議におけるワーク・プランの合意と最終化 (Ver.2) 【15】 [成果 1] ②上記同様 [成果 2-5] ③上記同様 【16】 第 3 回 JCC 会議の開催	

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		国内業務	現地業務	国内業務	現地業務	
	下旬		【6】 上記同様 【14】 ③上記同様 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様		【6】 上記同様 【14】 ③関係者（郡、ステーション等）への説明・周知 【15】 [成果 1] ①改善活動の支援、②モニタリングの実施、③IMT 実施マニュアル（案）の作成支援、④IWUO 政策・戦略と省令の改正に向けた準備 【成果 2-5】 ①改善計画及び研修計画に基づいた指導活動の実施、②研修のフィードバックを踏まえたマニュアルの改善、③モニタリング・評価システムの構築、④モニタリング及び評価の実施 【16】 第 3 回 JCC 会議のフォローアップ	
8 月	上旬		【6】 第三国研修の実施（契約には未反映） 【15】 [成果 1-5] ①②③④上記同様		【14】 ③上記同様、第 5 回 TF 会議の開催 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様	
	中旬		【6】 第三国研修の実施（契約には未反映） 【15】 [成果 1-5] ①②③④上記同様		【14】 ③第 5 回 TF 会議のフォローアップ 【15】 [成果 1-5] ①②③④上記同様 【16】 上記同様	
	下旬		【6】 第三国研修の実施（契約には未反映） 【15】 [成果 1-5] ①②③④上記同様	【13】 本邦研修の実施	【14】 ③上記同様 【15】 [成果 1-5] ①②③④上記同様	
9 月	上旬		【15】 [成果 1-5] ①②③④上記同様に加え、第 6 回 TF 会議（*）	【13】 本邦研修の実施及び事後対応（延期）	【14】 ③上記同様 【15】 [成果 1-5] ①②③④上記同様	第 6 回 TF 会議は 11 月頃開催見込み、現地業務再開後検討
	中旬		【15】 [成果 1-5] ①②③④上記同様、第 6 回 TF 会議のフォローアップ		【15】 [成果 1-5] ①②③④上記同様	
	下旬		【15】 [成果 1-5] ①②③④上記同様、第 6 回 TF 会議のフォローアップ		【15】 [成果 1-5] ①②③④上記同様	

Annex 2: List of Products produced by the Project

ANNEX 2: List of Products Produced by the Project

No	Item (language)	Type	Description	Issued Year (last version)
ANNEX 2-1-1 (Output 1)	Action Plan and Capacity Development Guidance for Irrigation Scheme Management	Handbooks		17th January 2025
ANNEX 2-1-2 (Output 1)	Manual for Implementation Procedure of IMT Agreement	Manual		17th January 2025
ANNEX 2-2 (Output 2)	Training Manual for Capacitating Irrigation Water Users Organization	Manual		17th January 2025
ANNEX 2-3 (Output 3)	Training Manual for Operation and Maintenance of Irrigation Infrastructures	Manual		17th January 2025
ANNEX 2-4 (Output 4)	Training Manual for Water Management	Manual		17th January 2025
ANNEX 2-5 (Output 5)	Text for Farm Management to Irrigation Scheme	Text		17th January 2025



*Water Management and Capacity Building Project
(WAMCAB)*



Action Plan and Capacity Development Guidance For Irrigation Scheme Management

February 2025

Prepared under WAMCAB in collaboration with RAB

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Annex 3: Short-term Action Plan in Three Districts

Chapter 1 Introduction

1.1 Background of the Document

In order to improve the agricultural production and income from farming, the Government of Rwanda (GoR) considers the promotion of irrigated agriculture as an important policy task and is promoting irrigation development intensively. In parallel, the GoR is promoting the policy of decentralization and self-governance of the irrigation schemes. Consequently, the responsibility of the Operation and Maintenance (O&M) of the developed irrigation scheme is being transferred from the Government to Irrigation Water Users Organization (IWUO) under the Ministerial Order. With this background and based on the request of the Government of Rwanda to the Government of Japan (GoJ), in 2019, the Japan International Cooperation Agency (JICA) has launched the Project for Water Management and Capacity Building (WAMCAB) targeting the sustainable management of irrigation schemes by IWUOs in collaboration with Rwanda Agriculture and Animal Resources Development Board (RAB) as the implementation agency.

This Project is a six year project and has targeted only three District and three Model Site. Considering the extension of the capacity building to other sites and Districts throughout the country, the Project is expected to prepare an action plan and an implementation guidance for capacity building and sustainable management of irrigation schemes that can be conducted by the implementing agency as RAB and/or the Districts.

Therefore, this document is prepared to summarize the activities performed under WAMCAB Project that could be used as a guide to implement capacity building and sustainable management of irrigation scheme in Rwanda.

1.2 Objectives of the Document

As indicated in the project framework the Project Overall Goal is stated as “The models of scheme management by IWUO are accepted in the target districts”.

The Capacity Development Guidance for Irrigation Scheme Management summarizes all interventions in WAMCAB model sites. In addition, the Capacity Development Guidance is positioned as a tool to disseminate the Project Outputs to the other irrigation schemes and contributes to achieve the Overall Goal after the Project in the three target Districts after completion of the Project. The contents of the Capacity Development Guidance for Irrigation Scheme Management are summarized mainly on manuals and texts prepared for each Output. It can be considered as the comprehensive document that covers information, contents, and know-how necessary for planning, operating and evaluating activities, in order to organize and implement necessary training to be carried out for capacity development.

The Action Plan describes the necessary and major activities for the dissemination of the WAMCAB Approach which based on modified IWUO Management Model and contribute the irrigation scheme management in the target Districts and Nationwide by Rwanda side toward after completion of the WAMCAB Project.

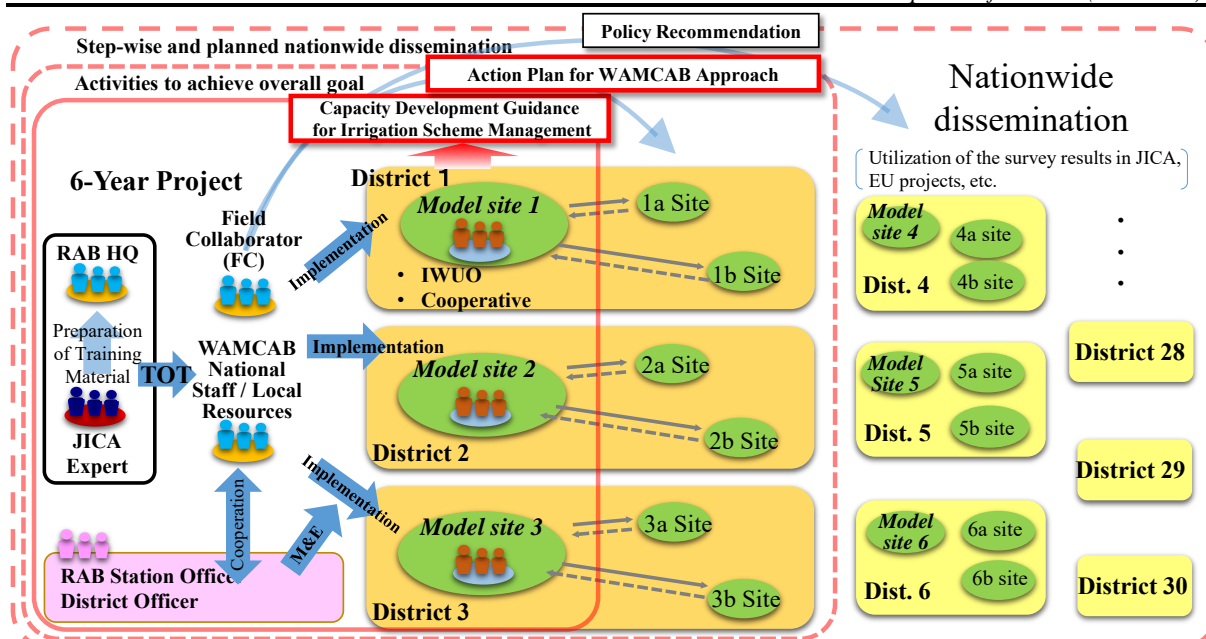


Figure 1.1 Process of Dissemination of Project Outputs

Therefore, the main objective of this document is to share the knowledge and procedure in the implementation of capacity building of stakeholders related to irrigation scheme for the sustainable management of the schemes in the country. One can pick the important aspect and approach adapted by this project and modify and improve to fits its purpose in capacitating IWUO and other stakeholders' that result in the sustainable management of irrigation scheme in the country.

As shown above the activities conducted on model site shall be extended to other sites in the District as extension schemes and nationwide. Success story and lesson learnt from Model sites shall be shared, modified and implemented in the other sites in collaboration of District and RAB station staffs.

1.3 Summary of the Project

The framework of the WAMCAB Project is described below.

Table 1.1 Project Framework

Item	Contents
Project Title	Project for Water Management and Capacity Building in Rwanda
Overall Goal	The models of scheme management by IWUOs are accepted in the target districts.
Project Purpose	The capacity of irrigation scheme management improves in the model sites.
Outputs	Output 1: IMT procedures, support system (including the roles of stakeholders), and contents of support to IWUO and procedures of monitoring are identified. Output 2: IWUO management is enhanced in the model sites. Output 3: O&M are properly implemented in the model sites. Output 4: Water management is properly implemented in the model sites. Output 5: Farm management is properly implemented in the model sites.
Target Area	Rwamagana District and Ngoma District in Eastern Province and Gisagara District in Southern Province
Implementation Agency	Rwanda Agriculture and Animal Resources Development Board (RAB)
Cooperation Agency	Ministry of Local Government (MINALOC), Districts, Rwanda Cooperative Agency (RCA), and Rwanda Governance Board (RGB)
Project Duration	Six years from March 2019 to February 2025 (72 months)

Based on the framework, the major activities were carried out in each phase as shown below. Generally the Project has three phases. The first phase is Survey/Planning phase (covers one year)

followed by the Technical Guidance Phase (two year) that was extended by one more year due to the outbreak of COVID-19. The third phase constitute the Institutionalization and Extension Preparation Phase (two year). The details of each phase is summarized in the following Figure.

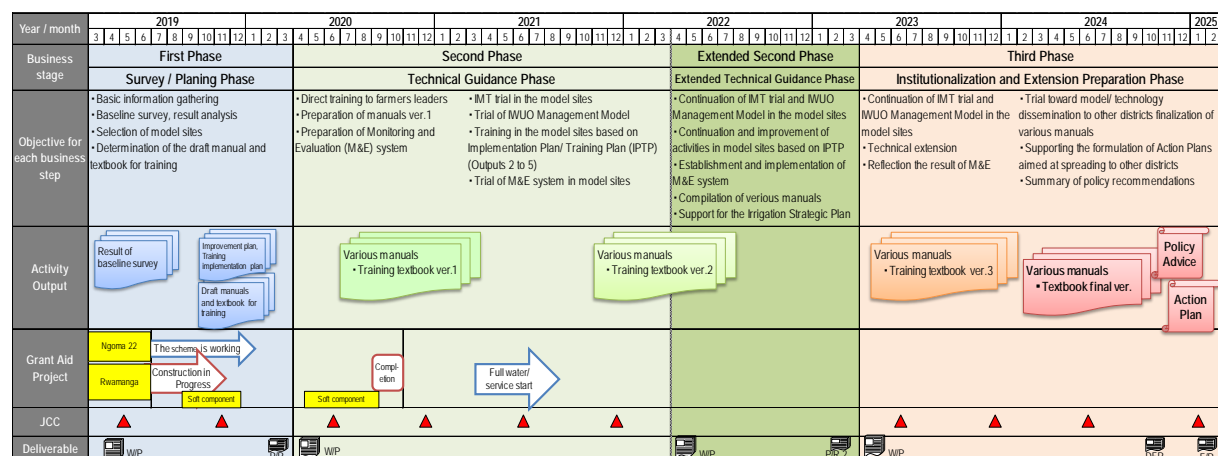


Figure 1.2 Duration and Major Activities of the Project at Each Phase

The Project team together with RAB has identified four model sites from the target Districts. The table below summarizes basic information and major crops in each model site.

Table 1.2 Basic Information of Model Sites

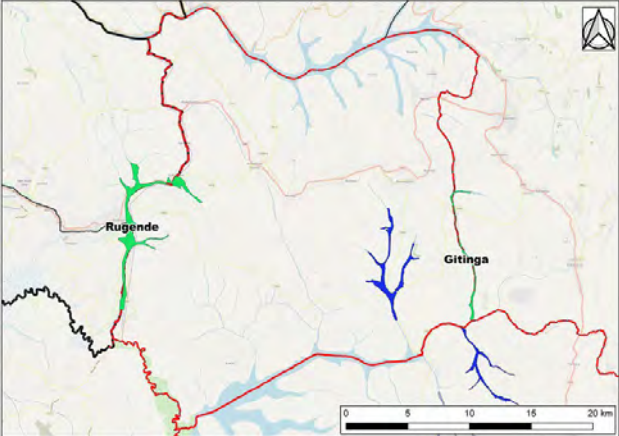

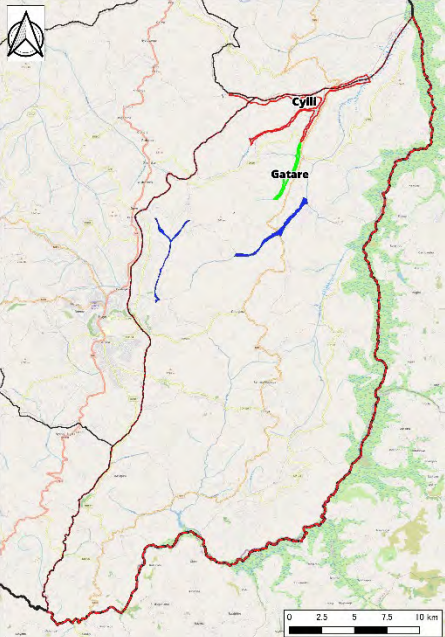
Model Site	Cyaruwego (Rwamagana District)	Ngoma (Ngoma District)	Nyabuyogera (Gisagara District)	Ngirya (Gisagara District)
Type	Marshland, rice: 285ha	Hillside/Marshland, horticulture: 265ha Rice: 165ha	Marshland, horticulture: 109ha	Marshland, rice: 168ha
Major crop	rice	maize, beans, vegetables, rice	maize, beans, vegetables	rice
Main water source	3 reservoir dams	Two reservoir dams	Springs	River
Organization	4 Cooperatives One IWUO*	2 Cooperatives One IWUO**	One Cooperative with SMC***	One Cooperative One IWUO**
Map				

Note: * : Newly established IWUO by WAMCAB
 ** : IWUO reorganized by WAMCAB
 *** : SMC (Scheme Management Committee) established under Cooperative by WAMCAB

In addition, the target Districts have selected target extension schemes which have a potential to disseminate the WAMCAB Approach. The table below shows the location of target extension schemes in three districts. Based on the need by the District, the target extension schemes were identified as three priority and three sub-target schemes.

Table 1.3 List of Target Extension Scheme

Distict	Target Extension Scheme and Location Map
Rwamagana	Priority scheme: Rugende marshland type with 500ha

District	Target Extension Scheme and Location Map
	<p>Sub-target scheme: No site</p> 
Ngoma	<p>Priority scheme: Gitinga marshland type with 280ha Sub-target scheme: Gisaya marshland type with 105ha, Mutenderi hillside type with 10ha</p> 
Gisagara	<p>Priority scheme: Gatere marshland type with 265ha Sub-target scheme: Cyili hillside type with 265ha</p> 

In each target extension scheme, the Improvement Plan and Training Plans (IP/TP)s were developed in

the beginning of the third phase constitute the Institutionalization and Extension Phase around April 2023. The IP/TPs for the target extension schemes are a more selective set of activities than the model sites, in line with local circumstances and conditions. Based on the consideration, Action Plans for the development and dissemination of activities were prepared for the extension schemes in January 2024, involving SPs, and activities have been newly launched, which are more in line with the actual situation when considering the dissemination of the WAMCAB Approach under the Rwandan initiative in other schemes.

Chapter 2 Analysis of Current Situation

2.1 Necessary Survey and Assessment

2.1.1 Outline of Baseline Survey

Before preparation of any intervention the first step is to conduct situation analysis on the present status of the area for which the collection of baseline data and capacity assessment of the existing scheme and organization must be conducted.

The Project was conducted in 3 phases, i.e. Survey/Planning (1 year), Technical Guidance (3 years) and Institutionalization/Extension Preparation (2 years). At the beginning of the Survey/Planning phase, WAMCAB has carried out basic information collection. Based on the information collected, the team analyzed and discussed with the officials concerned about problems and constraints on the irrigation scheme management in Rwanda by using Problem Tree method.

In order to clarify the actual situation both advantages and disadvantages, the Project conducted a baseline survey in cooperation with Counterparts (C/Ps) from May to September 2019, which consists of quick survey in Gisagara District, field survey on the current condition of the irrigation schemes and interview survey with IWUOs/cooperatives. After completion of these surveys, the WAMCAB has organized 3 workshops in Rwamagana, Ngoma and Gisagara Districts and a wrap-up meeting by the Task Force (TF) members consisting of related officials from RAB stations and Districts in August 2019. Results of the Problem Tree analysis, baseline survey, workshops, etc. are summarized in the Report of Baseline Survey authorized in November 2019 as Annex 1.

The baseline survey has several components which was summarized in the table below.

Table 2.1 Summary of Components of Baseline Survey

No.	Survey	Purpose	Target	Methodology / Contents	Period
1	Survey on existing information	To clarify the characteristics of irrigation in the country and situation of O&	Nationwide	Existing information, interview with related persons	April to June 2019
2	Extracting problems for each Output -Problem Tree	To clarify and the current condition, general issues and relation between problem and possible solutions.	Nationwide	Existing information, discussion with C/Ps	June to August 2019
3	Irrigation Scheme Survey in targeted Districts	To grasp the current situation, challenges and needs of highly-applicable training/activities of irrigation schemes.	26 schemes in the targeted Districts	Interview and field survey	June to July 2019
4	Survey on typical irrigation scheme on medium/large-scale and good practice	To grasp the current situation and challenges of medium/large-scale of irrigation schemes, and extract good practices.	7 schemes in 5 Districts	Interview and field survey	July 2019
5	Capacity Assessment	To evaluate the current situation and capacity of targeted IWUO and counterpart organizations.	IWUO-SU, targeted RAB stations, targeted Districts, model IWUOs	Interview with the representative using an evaluation sheet, result of Irrigation Scheme Survey	June to September 2019
6	Survey on service providers	To grasp the activity status and consider the cooperative relationship with service providers.	Service providers in the targeted Districts	Existing information, interview with related persons	June to September 2019

No.	Survey	Purpose	Target	Methodology / Contents	Period
7	Survey on farming	i) To grasp the current situation, challenges and needs of highly-applicable training/activities for farming. ii) To grasp the activity status and consider the cooperative relationship with SMAP and RAB-SMAP.	Targeted Districts, related persons of SMAP and RAB-SMAP, and private companies	Existing information, interview with related persons	June 2019

2.1.2 Outline of Capacity Assessment

Capacity Assessment (CA) is defined as the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (as Capacity) at multiple levels - including the individual, organizational and societal level - and the extent to which development process has brought about positive changes (as Capacity Development: CD, not Capacity Building), and then sharing the results from this with concerned parties in order to formulate CD strategies.

The objectives of CA in WAMCAB project are summarized as below:

1. To diagnosis on the capacity and needs of C/Ps in the related organizations, and to formulate the Improvement Plan / Training Plan;
2. To measure the transition of the capacity by implementing CA in these period such as during the baseline survey, at the end of the 2nd Phase and at the end of the 3rd Phase of the Project;
3. Based on the results of CA implemented in the period of baseline survey, to share the scenario of the capacity development and goals with C/Ps, and to clarify the role of the Project and its positioning;
4. Based on the results of CA implemented at the end of the 2nd Phase, to confirm the achievement of the Improvement Plan / Training Plan, and to review necessary inputs and supports with C/Ps; and
5. By sharing the result of CA implemented at the end of the 3rd Phase with C/Ps, to utilize them for the part of evaluation of the Project and preparation of actions toward after completion of the Project.

The focus of CA are i) IWUO-SU, ii) the target RAB stations namely Ngoma, Rubirizi and Rubona, iii) the target districts namely Ngoma, Rwamagana and Gisagara and iv) the selected model IWUOs. Although the respondents are individual C/Ps, the Project focuses on the overall capacity of target organization.

The main implementer of CA is IWUO-SU for ii) targeted RAB stations, iii) targeted districts and iv) selected model IWUOs. Only for i) IWUO-SU, the JICA experts conducts CA by interviewing with IWUO-SU.

The Project conducted the first CA from August to September 2019, and conducted CA in the end of each phase.

- Baseline survey in the 1st Phase (August to September 2019)
- The end of the 2nd Phase (February 2023)
- The end of the 3rd Phase (October 2024)

Capacity only comes about once the following three elements have been integrated that are Technical Capacity, Core Capacity and Enabling Environment that briefly are explained here. Technology, particular knowledge and tacit knowledge on the part of the organization is referred to as "Technical

Capacity (TC)". The will, attitude, leadership and management capabilities to activate technical capacity are referred to as "Core Capacity (CC)", serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the "Enabling Environment (EE)" that encompasses the organization.

2.2 Analysis of Baseline Survey Results

In order to achieve the project purpose and establish the system to achieve the overall goal after the project, the appropriate model sites in each target District should be selected. One of the purposes of the irrigation scheme survey is to support the selection of model sites and preparation of improvement plan and training plan in the target model sites.

The Project pointed out the general obstacles in the republic of Rwanda in the aspect of irrigation management and capacity development. Based on the core obstacles for the output of the Project, the results of the Irrigation Scheme Survey were analyzed. Before analyzing, the corresponded possible issues from prepared Problem Tree that are likely to be bottlenecks in each output on the Project and the corresponded questions in the Irrigation Scheme Survey were selected and mention in the following table.

Table 2.2 Summary of Corresponded Possible Issues and Questions

Item	Corresponded Possible Issues in Target Scheme	Corresponded Questions
Output 1 (IMT)	Understanding of IMT procedures by all concerned, Obligation and Contribution for Irrigation Scheme Management by all concerned, Respect for Law and Order	Establishment, IMTA including Registration, Annual Performance Contract with Authorities and Performance Contract between IWUO and Cooperative
Output 2 (IWUO)	Framework of Support for IWUO & Cooperative, Organizational Management for IWUO & Cooperative	Consensus as IWUO, Internal Rule, Action Plan, Relationship between IWUO and Cooperative, Community Work, Support by Authorities
Output 3 (O&M)	Framework of O&M for Irrigation Network, Capacity in aspect of O&M for IWUO	Major Irrigation Structure, Condition of Facility, Maintenance Work, Technical Support by Authorities
Output 4 (Water Management)	Framework of Water Management for Irrigation Network, Capacity in aspect of Water Management for IWUO	Water Resource, Equitable Water Distribution, Availability of Water, Technical Support by Authorities
Output 5 (Farming)	Framework of Support for Farming, Capacity in aspect of Farming for Cooperative, Variety of Crop	Profitability, Expand of Cultivation Area, Technical Support by Authorities

The detail results of analysis is described in Annex 1. The Project expects the methodology of baseline survey can be useful for future and similar survey in Rwanda.

2.3 Analysis of Capacity Assessment

The detail results of analysis is described in Annex 2. The CA was specifically conducted to measure indicators of Project Purpose of WAMCAB. The relevant indicator is "The level of organizational capacity¹ of IWUOs in the model sites increases to 70% or more through the improvement of IMT

¹ The Project applies Capacity Assessment Method that classifies capacity into three categories (External Condition, Technical Capacity and Core Capacity) and evaluates multiple question items in each category. Organizational Capacity is defined as the average achievement rate of Technical Capacity and Core Capacity in

procedures and the IWUO-Support system”.

Even in the results of the 2nd CA conducted in February 2023, the target value of 70% has already been achieved in all model sites. In the results of the 3rd and as final CA, it was 94.8%. The results and percentage increase from the 1st to the 3rd CA are presented below.

The summary shows the realization of achievement of Project Purpose on WAMCAB.

Table 2.3 Summary of Capacity Assessment as Evaluation of Project Purpose

Model Site	Timing ^{*1}	Total Score	Environment	Technical Capacity	Core Capacity	Organizational Capacity ^{*2}
Ngoma	1 st CA	37.1%	79.2%	32.3 %	23.3%	27.8%
	2 nd CA	74.1% (+37.0%)	41.7% (-37.5%)	86.0% (+53.7%)	79.0% (+55.7%)	82.7% (+54.9%)
	3 rd CA	80.3% (+43.2%)	45.8% (-33.4%)	89.2% (+56.9%)	89.7% (+66.4%)	89.4% (+61.6%)
Cyaruhogo	1 st CA	38.0%	66.7%	23.5%	38.3%	30.9%
	2 nd CA	85.3% (+47.3%)	50.0% (-16.7%)	96.2% (+72.7%)	92.9% (+54.6%)	94.7% (+63.8%)
	3 rd CA	93.7% (+55.7%)	75.0% (8.3%)	98.6% (+75.1%)	98.8% (+60.5%)	98.7% (+67.8%)
Ngiriyi	1 st CA	58.3%	79.2%	48.9%	49.8%	49.4%
	2 nd CA	80.2% (+21.9%)	12.5% (-66.7%)	97.8% (+48.9%)	98.8% (+49.0%)	98.3% (+48.9%)
	3 rd CA	91.6% (+33.3%)	66.7% (-12.5%)	98.8% (+49.9%)	97.6% (+47.8%)	98.3% (+48.9%)
Nyabuyogera	1 st CA	43.6%	79.2%	24.2%	48.6%	36.4%
	2 nd CA	71.8% (+28.2%)	8.3% (-70.9%)	80.3% (+56.1%)	98.4% (+49.8%)	90.4% (+52.3%)
	3 rd CA	76.7% (+33.1%)	16.7% (-62.5%)	87.8% (+63.6%)	98.4% (+49.8%)	92.8% (+56.4%)
Average					1 st CA	36.1%
					2 nd CA	91.3% (+55.0%)
					3 rd CA	94.8% (+58.7%)
Increase Rate					252% (2 nd Average / 1 st Average)	
					263% (3 rd Average / 1 st Average)	

*1: Scores for Ngoma, Ngiriyi and Nyabuyogera for the 1st CA were as at September 2020, and Cyaruhogo as at January 2021.

*2: Organizational capacity is the simple average of the individual achievement rates for Technical Capacity (TC) and Core Capacity (CC).

*3: In brackets, + or - values indicate differences from the results of the 1st CA.

*4: A lower score for Environment was observed in Ngoma, Ngiriyi and Nyabuyogera, but this may have been overestimated due to respondents' poor understanding of IWUO and incorrect responses in the 1st CA. At the start of the project, policies and policies on IWUO management were unclear and there was little administrative support, so the actual score can be said to be equivalent to zero. In light of this, from the 2nd capacity assessment, a four-point scale was established for each question to ensure that the level of capacity could be assessed correctly.

this method.

Chapter 3 Preparation of Improvement Plan and Training Plan (IP/TP)

3.1 Proposed Countermeasures

3.1.1 Establishing IP/TP per Each Output

After analyzing the baseline data and conducting capacity assessment a countermeasure should be designed as Improvement Plan and Training Plan (IP/TP) that will be implemented under the Project. The flow of preparation of IP/TP including all Output is summarized in the following figure.

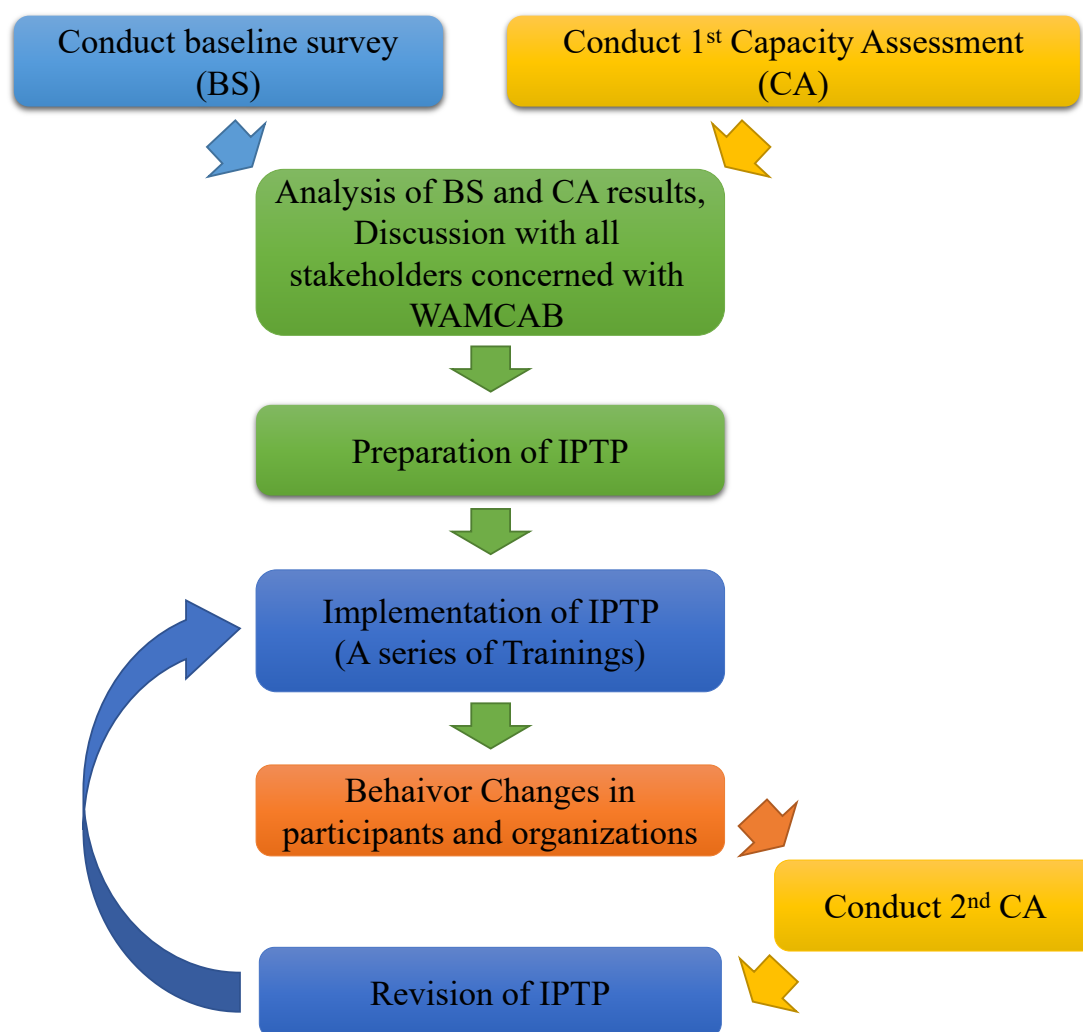


Figure 3.1 Flow of Preparation and Revision of IP/TP

For the possible issues mentioned in “Table 2.2”, the countermeasures were summarized in each output. In addition, the countermeasures especially Output 3 and 4 were divided into Eastern and Southern provinces. The countermeasures as the IP/TP for each issue is shown in the following tables.

Table 3.1 Prioritized Countermeasure in aspect of Output 1

Major Problem	Prioritized Countermeasure
IMT does not fit to the actual situation	Confirmation of what is required for IMTA and its gap
Low awareness of IMTA and IWUO	Conduct continuous explanation and training to senior officers

Major Problem	Prioritized Countermeasure
Uniform adaptation of IWUO policy over the country	Policy recommendations, update of ministerial order
Weak support system by MINAGRI, RAB and District	Policy advice to reorganize the IWUO support unit
Difficulties due to complicated IMT process for farmers	Simplifies the registration process based on the scheme size
IWUO registration process without support is difficult for farmers	Decentralization of registration process at District level

Table 3.2 Prioritized Countermeasure in aspect of Output 2

Major Problem	Countermeasures
No established approach to formulate and support IWUO	<ul style="list-style-type: none"> ➤ Establishing applicable procedure to the formation of IWUO ➤ Creating workable support system
Lack of management of basic scheme information	<ul style="list-style-type: none"> ➤ Establishment of basic scheme information system ➤ Dissemination of the information to all stakeholders
Same IWUO structure for different scheme scale and type	<ul style="list-style-type: none"> ➤ Preparation of different IWUO management related to scale and type of scheme
Lack of monitoring and evaluation system and staff	<ul style="list-style-type: none"> ➤ Insuring the required staffs of IWUO ➤ Establishment of M&E system

Table 3.3 Prioritized Countermeasure in aspect of Output 3 in Ngoma and Rwamagana District

Major Problem	Training for Prioritized Counter measurement
Damaged Irrigation facilities	Study of typical damage cases
	Repair and rehabilitation basic training
	Practical training for establishment of low cost repair methodologies like participatory works
Low scheme capacity for OM	Preparation of scheme facility map and implementation of the facility inspection
	Preparation of practical OM plan
	Basic preventive repair training
	Calculation of reasonable water fee
	Management of on-farm equipment (Hydrant and hoses)
	Periodical clearing of irrigation and drainage canal
	Exchange and training with IWUO members in advanced scheme

Table 3.4 Prioritized Countermeasure in aspect of Output 3 in Gisagara District

Major Problem	Prioritized Counter measurement training
Damaged Irrigation facilities	Study of typical damage cases
	Repair and rehabilitation basic training
	Training of road repair and drainage works
Scheme capacity for OM	Basic preventive repair training
	Preparation of practical OM plan
	Exchange and training with IWUO members in advanced scheme
Soil erosion	Testing of silting pool
	Drainage
	Coordination with District relevant project
	Training of watershed protection

Table 3.5 Prioritized Countermeasure in aspect of Output 4 in Ngoma and Rwamagana District

Major Problem	Prioritized Counter measurement training
Shortage of water resources	Monitoring of available water resources and estimation of current water demand

Major Problem	Prioritized Counter measurement training
	Water distribution planning based on the above study
	Basic capacity building training related to water management
	Gate keeper training for water distribution based on the plan
	Installation of instrument of water control in canal
Water shortage (on-farm level)	Sensitization and awareness raising to IWUO members, Cooperative and farmers
	[Marshland scheme] Levelling of paddy field
	Introduction of water saving rice cultivation techniques
	Reservoir, simple water storage
	[Hillside scheme] Basic training of hillside irrigation
	Soil water monitoring for upland crop
	Introduction of Water saving irrigation in Season-C
Water loss	Repair of leakage facilities
	Testing of lining method
	Promotion of branching canal system

Table 3.6 Prioritized Countermeasure in aspect of Output 4 in Gisagara District

Major Problem	Prioritized Counter measurement training
Water shortage	Estimation of current water supply and demand condition
	Water distribution planning based on study
	Basic capacity building training related to water management
	Gate keeper training
	Instrument of water control in canal
Water shortage (on-farm level)	Sensitization to IWUO members, Coop. and farmers
	Leveling of paddy field
	Water saving rice cultivation techniques
	Reservoir, simple water storage
	Water saving irrigation in Season-C
Leakage problem	Repair of leakage facilities
	Testing of lining method
	Promotion of branching canal system
Facility problem from beginning	Review and Recommendation to improve QWMDP implementation procedures

Table 3.7 Prioritized Countermeasure in aspect of Output 5 (rice production in marshland and horticulture production in hillside)

	Farming in Marshland	Farming in Hillside
Major Crops	Paddy Rice	Horticulture Crop
Direction of improvement	Profit = Productivity * Price – Cost Increasing productivity and reducing cost	Profit = Productivity * Price – Cost Increasing unit price (market-oriented)
Prioritized countermeasure for farming improvement	<u>Problem: Lack of supply QDS/certified seed</u> ➤ Introduction of recommended varieties by RAB ➤ Improve distribution channel of the rice seed ➤ To verify the yield through demonstration farm	<u>Problem: Cooperative is not active/organized</u> ➤ Training on accounting and financial management ➤ Training on cooperative management ➤ Training on gender mainstreaming
	<u>Problem: Farming technique on rice production</u> ➤ Lecture on rice production ➤ Introduction of agricultural materials ➤ Soil improvement ➤ Practical training on farming technique ➤ Considering online manuals	<u>Problem: Farming technique on horticulture</u> ➤ Lecture on horticulture ➤ Introduction of agricultural materials ➤ Practical training on farming technique ➤ Considering online manuals

	Farming in Marshland	Farming in Hillside
	<u>Problem: Lack of post-harvest facilities</u> <ul style="list-style-type: none"> ➤ Construction / rehabilitation of storage and drying yard ➤ Training on management of the facilities ➤ Introduction of tools for post-harvest ➤ Coordination with related project (USAID) 	<u>Problem: Lack of marketing information and skills</u> <ul style="list-style-type: none"> ➤ Lecture on marketing and market survey ➤ Record keeping (production cost, profitability, etc.) ➤ Contract farming ➤ Utilization of E-soko developed by MINAGRI
	<u>Problem: Insufficient water</u> <ul style="list-style-type: none"> ➤ Recommendation the implementation procedures (Output-3,4) 	<u>Problem: Water management</u> <ul style="list-style-type: none"> ➤ Recommendation the implementation procedures (Output-3,4)

While the countermeasures were identified for each Output and for each province, the issues were subdivided by the model site. The detailed countermeasures were considered for the subdivided issues, and IP/TPs were developed and piloted. However, the activities related to Output 2 in particular were recognized as the core and essential of capacity development in the period of the 1st and 2nd phase of the Project. This is related to the points for cross-cutting issues described below and discussed below.

3.1.2 Points of Cross-Cutting Output

(1) Utilization of Knowledge Co-Creation Program in Japan and Third Country

The Output 1 describes Knowledge Co-Creation Program (KCCP), which was set up by JICA, not training plan. In contrast to the training being specialized in technical content, KCCP emphasizes a process that encourages participants and stakeholders to change their awareness. From this point of view, the following are KCCPs in Japan and the third countries that contribute to fostering the policy and institutional aspects of Rwanda's IMT to satisfy the said improvement plan.

1) Meaning of Knowledge Co-Creation Program in Japan

It is necessary to consider a plan that not only achieves Output 1 but also contributes to the achievement of the project purpose. In Japan, the roles of the government and producers were discussed in the long history of rice cultivation, the agreement arrived with the background based on the discussion. Although the cultural and social backgrounds are different, the understanding of the process can be helpful in Rwanda. A possible KCCP in Japan is shown in the following table and will be confirmed by JICA headquarters (HQs).

Table 3.8 List of Possible Knowledge Co-Creation Program in Japan

Theme	Type	Trainer	Target	Manual	Remark
KCCP for Irrigation Policy	<ul style="list-style-type: none"> ➤ Exchange of views ➤ Lecture ➤ Site visits 	<ul style="list-style-type: none"> ➤ Japanese experts ➤ Concerned Organization for Irrigation Policy in Japan 	<ul style="list-style-type: none"> ➤ Decision maker for irrigation policy (as Project Director, Project Manager) ➤ IWUO-SU (as Core C/PS) ➤ Chairman of DISC 	According to concerned organization for Irrigation Policy in Japan	-
KCCP for Irrigation Management Transfer	<ul style="list-style-type: none"> ➤ Exchange of views ➤ Lecture ➤ Site visits 	<ul style="list-style-type: none"> ➤ Japanese experts ➤ Concerned Organization for Irrigation Policy in Japan 	<ul style="list-style-type: none"> ➤ Decision maker for irrigation policy (as Project Director, Project Manager) ➤ IWUO-SU (as Core C/PS) ➤ Chairman of DISC 	According to concerned organization for Irrigation Management	To be confirmed by JICA Headquarters (HQs)

Theme	Type	Trainer	Target	Manual	Remark
				nt Transfer in Japan	

2) Meaning of Knowledge Co-Creation Program in Third Country

Same as KCCP in Japan, it is necessary to consider a plan that not only achieves Output 1 but also contributes to the achievement of the project purpose. In the third country around Rwanda, in terms of irrigation water management, some countries are more advanced than Rwanda, some are the same, and some countries are behind. By sharing the advantages and challenges in the field of such countries, it can be utilized in activities in Rwanda. A possible KCCP in the third country is shown in the following table and will be confirmed by JICA HQs.

Table 3.9 List of Possible Knowledge Co-Creation Program in the Third Country

Theme	Type	Trainer	Target	Manual	Remark
KCCP for Irrigation Policy	<ul style="list-style-type: none"> ➤ Exchange of views ➤ Lecture ➤ Site visits 	<ul style="list-style-type: none"> ➤ Japanese experts ➤ Concerned Organization for Irrigation Policy in the Third Country 	<ul style="list-style-type: none"> ➤ IWUO-SU (as Core C/Ps) ➤ RAB station staffs (as TF members) ➤ District engineers (as TF members) ➤ IWUO members 	According to concerned organization for Irrigation Policy in the Third Country	To be confirmed by JICA HQs
KCCP for Irrigation Management Transfer	<ul style="list-style-type: none"> ➤ Exchange of views ➤ Lecture ➤ Site visits 	<ul style="list-style-type: none"> ➤ Japanese experts ➤ Concerned Organization for Irrigation Policy in the Third Country 	<ul style="list-style-type: none"> ➤ IWUO-SU (as Core C/Ps) ➤ RAB station staffs (as TF members) ➤ District engineers (as TF members) ➤ IWUO members 	According to concerned organization for Irrigation Management Transfer in the Third Country	To be confirmed by JICA HQs

(2) Utilization of JICA Knowledge Co-Creation Program for Group and Region Focus Courses such as Smallholder Horticulture Empowerment & Promotion (SHEP)

KCCP in aspect of Smallholder Horticulture Empowerment & Promotion (SHEP) in Japan was not realized from the concerned with the Project but the on line KCCP was realized in 2023.

3.2 Established Examples of IP/TP from WAMCAB Model Sites

3.2.1 Proposed IWUO Management Model as WAMCAB Approach

The development of irrigation system is a huge investment that consumes enormous budget of any country. These expensive projects should be treated as any other public property that serves the population like road, hospital, school etc. However, this survey reveals that most of the irrigation projects visited are left for the beneficiaries to handle its management and Operation and Maintenance Management (OMM) issue provided that the beneficiaries were having little or no knowledge of irrigation management at all. For this purpose, the Ministerial Order established in 2011/12 require the establishment of IWUO at each irrigation scheme and this organization is expected to perform its obligation acting like an NGO registered at RGB.

Although the concept of establishing a self-governing entity at each irrigation scheme seems good,

however, the idea of expecting the beneficiary farmers performing as NGO without support from outside and capacitating the organization is a futile attempt that need a thorough revision. On the other hand, in the Ministerial Order, there is no clear guidance on the responsibility of other stakeholders in the scheme like the District, Sector, Cooperatives, RAB, etc.

In all visited scheme, what is stated on Ministerial Order was not seen implemented because there is no clear responsibility on who should do what among the stakeholders. For example, trust fund, reserve fund, OMM fund, or the preparation of irrigation map, water users list, etc. are stated in the Ministerial Order in the establishment of IWUO, but one can't find them and no clear guidance on who must do what and who should be responsible for the monitoring and evaluation of the implementation of the activities as stated in the Order.

On top of this, the government staffs responsible for establishing IWUO, giving support, guidance, monitoring and evaluation of the activities of irrigation in the country is very few or sometimes nonexistence. For the entire country, only one staff is responsible at RAB for support of IWUO, and most of the districts does not have staffs in the field of irrigation.

Therefore, there is a need to prepare a clear guidance on the implementation of the Ministerial Order for IWUO and explicitly explained responsibility of stakeholders should also be put in place for better management of irrigation scheme in the country. Generally, it is not recommended to handover a huge public investment like irrigation scheme and leave it to the beneficiary alone for its management. A simple role and responsibility of stakeholders on an irrigation scheme is presented below for reference.

According to this survey the team found out that the basic irrigation management model being implemented in the country runs around IWUO/cooperative management model, except PPP (that is not yet tested). In all the other management model explained above (in IMP) IWUOs are considered the main actor in the management of the schemes. Either it is a Private Farmers' Model, Specialized Operator Model or Direct Support Model, all work under IWUO/cooperative Management Model in the ground. On the other hand, most of the irrigation scheme in the country are of marshland type that is relatively easy to be managed by IWUO provided dependable water source and intact irrigation facilities are available. Therefore, it is strongly recommended to first formulate a better way of managing the marshland irrigation scheme under IWUO Management Model that can be copied to the other type of scheme (e.g. hillside scheme).

In Rwanda, the existing practice in the formation and management of IWUO generally ends at the election of the management committee after calling for a general meeting of the members and the explanation of its objective. Although different modulus of training is given to the elected member after the formation of the management committee, mostly, the intended message is not translated well to most of the member existing at the lower level of the organization. There is a need to reach as many as possible IWUO's member in explaining all the issue related to the need for formation of IWUO starting from the basics of irrigation and layout of the irrigation system itself. For this purpose, the expert must first understand the scheme layout, how water is distributed starting from the source up to the field level (or distribution points). To address the above issue the following procedure (steps) of IWUO management proposed. Stakeholders can anytime, modify the proposed procedures as the need might arises. The detail explanation of steps to follow in IWUO management explained below. These nine steps are categorized into four stages of activities. Such as, Stage 1 covers the activities at step 1 and 2 focusing in database collection and irrigation blocking followed by Stage 2 that covers the activities at steps 3, 4 and 5, which mainly focus on formation of the organization with its internal regulation ratified. Stage 3 covers the activities at Step 6 and 7 that focus on conducting full package training and commencement of the actual operation, at last stage (Stage 4) IMT agreement (step 8) and step 9 (setup of M&E system with routine training) will be covered. During the implementation of this modified IWUO model an introduction of a Field Collaborator is paramount in the sustainability and functionality of IWUO that always need a support staffs.

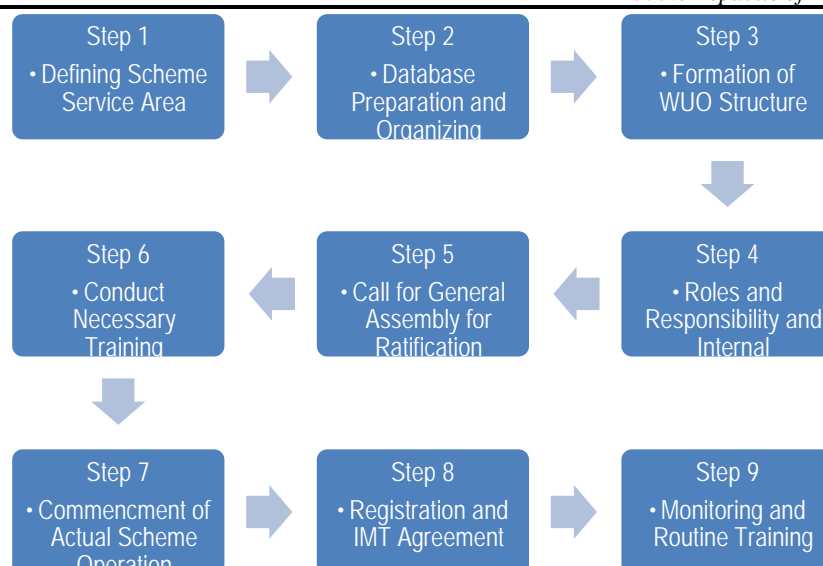


Figure 3.2 Schematic Flow Showing Proposed Nine Step for IWUO Management Model

3.2.2 Main Pillars of WAMCAB Approach

WAMCAB has been piloting an irrigation management model on targeted three Districts namely: Ngoma, Rwamagana and Gisagara District. The Project analyzed the status of the existing management model applied in Rwanda and proposed a modified approach to the IWUO Management Model established under the Ministerial Order. The main pillars of the modified IWUO Management Model, namely WAMCAB Approach which contributes the irrigation scheme management are summarized as follows;

(1) Implementation Manual to support Ministerial Order

The baseline survey conducted by WAMCAB has found out that the Ministerial Order established in the country is not being implemented properly during the establishment of IWUO in developed irrigation scheme in the country. The survey has also found that the Ministerial Order needs modification for practicality of the decree. WAMCAB has since prepared a draft implementation manual covering aspects on IMT, IWUO management (9-steps of IWUO Management), water management, Operation & Maintenance and Farm Management.

(2) Aggregating schemes for Sustainable Management

The baseline survey conducted by WAMCAB has found out that there are many IWUOs established at every marshland scheme resulting in weak IWUO which cannot sustain hired supporting staffs. Such small and weak IWUO end up with mismanagement of fund collected as water service fee. Typical examples of such scheme include Kibaya - located in Ngoma/Kirehe. Under modified (WAMCAB) IWUO model, such schemes will be aggregated and organized into one strong IWUO that can work side by side with the cooperative. WAMCAB has piloted this merging of small marshland schemes at the four schemes at Cyaruhogo Model Site into one strong IWUO, having four different cooperatives. Similarly, at Ngoma Model Site, three schemes are merged to create one strong IWUO that can hire support staffs and be able to pay for operators and electricity bill.

(3) Categorizing Schemes for Management System

Under the Ministerial Order, every scheme is expected to form one IWUO for the management of the irrigation scheme, regardless of its size, farmer's capability, and availability of functional irrigation infrastructures. The modified (WAMCAB) Model will categorize schemes for best fit management

models. For example, medium size marshland would best suit the modified (WAMCAB) model; large, mechanized schemes would best suit PPP model or commercial farmer model and small marshlands would best suit cooperative model (supported by a special committee on OMM).

(4) Introduction of Field Collaborator

Experience shows that IWUO needs to have support staffs, especially the manager, accountant, irrigators among others for the proper implementation of OMM of the scheme. Most projects (LWH, RSSP, etc.) create a system of hiring staffs to be the manager of IWUO paid by the project and expected to eventually become the employee of the IWUO (fully paid by IWUO). However, most of the staffs hired by the project do not remain with IWUO after the termination of the project. This may be due to the fact that the recruited person is not coming from the immediate community and is often a university/college graduate and hence cannot live with little salary paid by IWUO.

Under the modified management model it is proposed that a Field Collaborator (FC) is recruited at the inception of the formation of IWUO from within the beneficiaries and capacitated together with IWUO leaders. The FC should be one who lives, works (farm) with the beneficiaries, one who has a moderate educational background and who accepts the salary scale of IWUO or Cooperative. Once selected, FC will be capacitated and trained together with IWUO on different subject related to irrigation OMM. At the initial stage of the intervention, the salary of FC will be covered by the project and eventually become the employee of the IWUO or Cooperative as the manager of the scheme.

(5) Activating Stakeholders to perform Their Responsibility

According to the Ministerial Order, DISC was to be established at each District for monitoring and evaluation of the activities of IWUO. However, in almost all Districts visited, DISC was not functional or sometimes not existed. At the time of the inception of WAMCAB project, except Gisagara District, where the District creates a system of approving expense order presented, there was no District that involve in the activity of IWUO. Even the so-called DISC meeting that has been held in most of the Districts were the usual Season Preparation Meeting that has focused on production aspect of each Cooperatives (such as input distribution, product collected and plan for next season). Even in this season preparation meeting the District Agricultural Officer is the main presenter of the meeting. No discussion or presentation related to IWUO activities or irrigation management was discussed. WAMCAB believes that as directed by the Ministerial Order DISC has to be reactivated and make to becomes functional at all districts that has irrigation scheme so that at least the monitoring part of irrigation management is fulfilled by involving the District.

(6) Creation of participatory rehabilitation/construction system

IWUOs that have the financial capacity of rehabilitating small structures or construction of new one has been outsourcing the work to private company or individual regardless of the size of the rehabilitation work. WAMCAB believe that some small repair work can be done by the beneficiaries themselves as it creates ownership of the facilities.

Therefore, it is important to create a team from within the scheme beneficiaries who will be capacitated to carry out their own maintenance work by themselves. Under the modified (WAMCAB) model a Repair Team is formed from within the beneficiaries and will be trained to conduct proper masonry, concrete repair works and road maintenance work. These trained farmers will be engaged in rehabilitating and constructing some small structures by themselves. The pilot project has found that the application of this system has saved more money to IWUO had it been outsourced. Such an initiative is valuable to improve farmers' capability to maintain and manage irrigation system as their own properties.

(7) Long-term Capacity Development of IWUO/Cooperative before IMTA

Management of irrigation scheme by the participation of the beneficiaries is a long-term process that requires capacitating IWUO/Cooperative before the scheme is transferred to farmers. MINAGRI/RAB need to have within its organization a system of implementing and updating the available training materials and upskill farmers on various aspects of scheme management before a final IMTA is achieved. The proper implementation of the specialized operator model by applying the proposed implementation and training manual discussed above could be one of the system that can be proposed by RAB, if RAB remains the same as it is found now (lack of enough staffs and experience).

The pilot project of WAMCAB has showed that this Modified Management Model, namely WAMCAB Approach is best suited to be implemented on marshland irrigation schemes and to some extent to LWH established hillside scheme, provided that the issue of land tenure, secured market outlet and active participation of local leaders in IWUO activities is fulfilled

3.2.3 Sample Table of IP/TP

(1) IP/TP for Output 1

Table 3.10 IP/TP for Output 1

S/N	Contents of activity / training	Details
1-1	Identifying challenges on the current IWUO policy and strategy	➤ Discussion and workshop with stakeholders
1-2	Identifying challenges on the current Ministerial Order	➤ Discussion and workshop with stakeholders
1-3	Re-activation of DISC	➤ Discussion and workshop with stakeholders (District, IWUO, Coop, RAB, RCA, etc.) and clarification of role sharing ➤ Support for holding DISC meeting
1-4	Identifying challenges on the current IMT procedures	➤ Discussion and workshop with stakeholders
1-5	Knowledge Co-Creation Program in Japan	➤ Policy discussion including the topic of nutrition improvement
1-6	Policy discussion / recommendation	➤ Discussion on future direction with stakeholders (MINAGRI, RAB, District, RGB, RCA, etc.)
1-7	Knowledge Co-Creation Program in the third country	➤ Sharing experience and case studies on IWUO and IMT system from neighboring countries
1-8	Considering the awards system of IWUOs	➤ To promote competition and awards system of IWUOs
1-9	Lecture and advice from Prof. Satoh	➤ Lecture ➤ Webinar series
1-10	Development of IMT manuals	➤ To prepare the materials of the draft IMT manual
1-11	Considering the re-activation of irrigation forum and/or IWUO forum	➤ Discussion with related institutions ➤ Considering the points to be discussed
1-12	Public relations on IWUO and IMT	➤ Discussion and theme setting with policymakers ➤ Utilization of radio and/or TV, making leaflet

Table 3.11 IP/TP for Output 2

S/N	Contents of activity / training	Details
2-1	Understanding the scheme	[Step 1] ➤ Undertake preliminary survey and define the scheme service area
2-2	Database organization	[Step 2] ➤ Database preparation and organizing the management structure
2-3	Reorganization of IWUO and election of leaders	[Step 2] ➤ Database preparation and organizing the management

S/N	Contents of activity / training	Details
		structure
2-4	Explanation of scheme layout to IWUO	[Step 3] ➤ Conduct initial training and explain the scheme layout and how IWUO is organized
2-5	Establishment of Internal Regulation	[Step 4] ➤ Prepare the Rules and Internal Regulations (by-law) ➤ Prepare role and responsibility of stakeholders [Step 5] ➤ Hold general meeting for approval of the Rules and Internal Regulations and Action Plan ➤ Prepare future Action Plan
2-6	Strengthening of IWUO	[Step 6] ➤ Capacity development on Leadership ➤ Promotion of participation ➤ Transparency and accountability ➤ Conflict management ➤ Preparation of Action Plan
2-7	Financial Management	[Step 6] ➤ Outline of financial management ➤ Establishment of the O&M fund ➤ Establishment of the O&M fee management mechanism
2-8	Monitoring and Evaluation Method by DISC & RAB	[Step 6] ➤ Role and function of M&E ➤ Establishment of M&E system ➤ Implementation of M&E
2-9	Commencement of the scheme activity	[Step 7] ➤ Commencement of scheme ➤ Prepare and provide O&M manual ➤ Start the scheme operation and management activities ➤ Establish the system of collection water fee and member fee ➤ Prepare financial management system ➤ Establish performance agreement between IWUO and cooperative or other water users
2-10	Support in the registration of the organization and IMTA agreement	[Step 8] ➤ Apply for registration of IWUO and water permit ➤ Registration and performance contract agreement [Step 9] ➤ IMTA and M&E system ➤ Prepare a follow up mechanism ➤ IMTA with MINAGRI ➤ Routine Training
2-11	Construction of secondary canal in Rwamagana	➤ Support for the construction of secondary canal in Rwamagana Scheme
2-12	Explanation for TF member	➤ Make TF understand How the lower level IWUO is formed
2-13	To improve the draft manuals	➤ Discussion and updating the manuals

Table 3.12 IP/TP for Output 3&4

S/N	Contents of activity / training	Details
3&4-1	Establishment of implementation structure for O&M and water management at the scheme level	➤ To organize the O&M Team and Farmers' Repair Team ➤ To organize the Water Users Team
3&4-2	O&M and Water Management Basic Training	➤ Sharing the basics and current issues of irrigation facility utilization ➤ PIM (Participatory Irrigation Management) training ➤ To promote activities of water management and O&M at block level

S/N	Contents of activity / training	Details
		➤ Study tour to good practice schemes
3-3	O&M Training 1 (lecture)	➤ Basic training on O&M to foster the ownership
3-4	Survey / inspection and analysis of current facility condition	➤ To prepare irrigation and drainage system map in the scheme ➤ To prepare Irrigation scheme map ➤ Facility inspection to grasp the current condition
3-5	O&M Training 2 (lecture)	➤ To prepare the annual O&M plan of IWUO ➤ To evaluate and consider the appropriate water fee setting
3-6	O&M Training 3 (field practice) Basic / Advanced level	➤ Basic civil work (masonry, plain concrete) ➤ Advanced civil work (Reinforced concrete) ➤ Participatory simple maintenance and cleaning activity ➤ Countermeasures against soil erosion ➤ Maintenance of hydrants/pipe/valve ➤ Demonstration on typical facility maintenance and repair ➤ Farm road repair
4-7	Water management training 1 :Basic knowledge on irrigation (lecture)	➤ Lectures on efficient water use and irrigation methods mainly for hillside irrigation
4-8	Water management training 2 :water resources monitoring in irrigation scheme (lecture / field practice)	➤ Lectures on efficient water use and irrigation methods ➤ Monitoring of the amount of available water resources and water use ➤ Water management at the time of drought ➤ Measurement of discharge and water level at dam reservoir ➤ Rainfall observation by using simple rain gauge ➤ Measurement of water consumption rate in paddy field
4-9	Water management training 3: Practice for Hillside irrigation (lecture / field practice)	➤ On-farm water management and water use mainly for hillside irrigation ➤ Appropriate irrigation using soil moisture monitoring data ➤ Trial of treadle pump ➤ Water distribution using Night Reservoir ➤ (Trial installation of shallow well for dry season) ➤ (Trial of foot pump) ➤ (To install water storage)
4-10	Field practice of on-farm level water-saving irrigation for marshland scheme	➤ On-farm water management and water use mainly for marshland irrigation ➤ Land levelling of the plot ➤ Maintenance of levee at the leakage point and improvement of ridge preparation method ➤ Installation of on-farm drainage (improvement of drainage condition) ➤ Trial of water saving method for paddy rice (AWD: Alternate Wetting and Drying) ➤ Adjustment of irrigation according to the growing stage ➤ To promote the installation of secondary/tertiary canal
4-11	Water management training 4 (lecture / field practice)	➤ To prepare annual water distribution plan ➤ To evaluate and consider the appropriate water fee setting
3&4-12	Monitoring & Feedback	➤ Monitoring and feedback on the implementation of the O&M plan (3-5) and water distribution plan (4-11)
3-a	Others	➤ Support for the development/ rehabilitation plan of irrigation scheme, incorporating an O&M perspective from the planning stage
3-b	Daily technical guidance on O&M 1	➤ Facility O&M
3-c	Daily technical guidance on O&M 2	➤ Practice of O&M along the plan (3-5)
3-d	Repair/rehabilitation work	➤ Dredging of Chinese old dam at Mwanbu and utilization of borrow materials
3-e	Construction	➤ Intake structure at Cyaruhogo scheme ➤ Night Reservoir at Nyabuyogera scheme

Table 3.13 IP/TP for Output 5

S/N	Contents of activity / training	Details
5-1	Establishment and reinforcement of Cooperative organizational structure	➤ To establish the implementation structure for farm management at scheme level
5-2	Soil improvement	➤ Conducting soil analysis in the schemes Compost training
5-3	Profitability analysis	➤ To analyze the profitability of each crop based on production record and BLS
5-4	Relationship with IWUO	➤ Consideration of performance contract with IWUO
5-5	Coop management training	➤ Training on strengthening Coop management, gender main streaming, and accounting
5-6	Coop management training	➤ Study tour to good practice cooperatives
5-7	Marketing training	➤ Training on marketing and market-oriented agriculture Training on market research and analysis
5-8	Marketing training	➤ Selection of crop/variety based on the analysis of profitability, making crop calendar
5-9	Rice cultivation and Horticulture training	➤ Management of demonstration plots in the schemes
5-10	Rice Cultivation training 1 (FFS)	➤ 1: Field training on nursery sowing practice and soil improvement ➤ 2: Field training on transplanting ➤ 3: Field training on fertilization and pest control 4: Field training on harvesting and post-harvesting
5-11	Horticulture training 1 (FFS)	➤ 1: Field training on seed sowing and seedling preparation ➤ 2: Field training on transplanting and land preparation ➤ 3: Field training on fertilization, rice husk charcoal and compost making ➤ 4: Training on pest control and IPM ➤ 5: Field training on harvesting and post-harvesting ➤ 6: Field training on farm machine and tools (winnowing, planting machine, etc.)
5-12	Field training on field-level water-saving paddy irrigation	➤ Training on water management at on-farm level
5-13	Knowledge Co-Creation Program in the third country	➤ KCCP regarding farming (SHEP, CARD) in the third country
5-14	Improvement of nutrition	➤ Improvement of nutrition through farming package
5-15	Post-harvest training	➤ 1: Training on post-harvesting, collecting and shipment ➤ 2: Training on operation and maintenance of agricultural facility (Drying yard, storage, etc.) ➤ 3: Training on operation and maintenance of cold storage

3.2.4 Sample IWUO Structure for Model Sites

(1) Charuhogo Model Site

The model site in Rwamagana District consists of interconnected four irrigation schemes such as Cyimpima, Bugugu, Gashara and Cyaruhogo. In addition to the existing springs and the marshland itself, three dams are set to provide irrigation water to the scheme. Downstream of dams, two main canals running left and right side of the marshlands are set. Each main canals are provided with turnouts that provides irrigation water to secondary canals that serves irrigate a certain number of plots which constitutes an Irrigation Unit (IU).

Therefore, an IU is a member of water users that are served by one common turnout on the main canal. This IU will constitute the lower level of IWUO in the organization structure. Each IU will be responsible for operation of their turnout, maintenance of the portion of main canal and their own secondary/tertiary canal and management of water distribution within the member. The members shall elect a leader that will be responsible for the mobilization of members, monitoring and management of

the activity of IU. This leadership shall be rotated among the member so that responsibility shall be shared among all IU members.

Depending on the set-up of the scheme, organization of RGB and size of membership, a certain number of IU shall form Water Users Team/Group (WUG) that will be responsible to organizing/mobilizing its members to conduct agricultural activities according to the agreed plan in collaboration with RGP. The agricultural activities include land preparation, planting, irrigating etc.

Zonal Committee (ZC) shall be set on each main canal (left and right side canal) that will be responsible to monitoring the overall activity of members within the main canal.

Scheme Management Committee (SMC) shall be organized for each scheme whose responsibility shall be the management of each irrigation scheme (Cyimpima, Gashara, Bugugu and Cyaruhogo marshland).

These scheme management committees of each marshland shall come together and elect the higher level IWUO organ which will be called the IWUO of Rwamagana Scheme. The higher level organ shall include the executive committee, conflict resolution committee, audit committee and supporting staffs (manager, accountant, operators etc.)

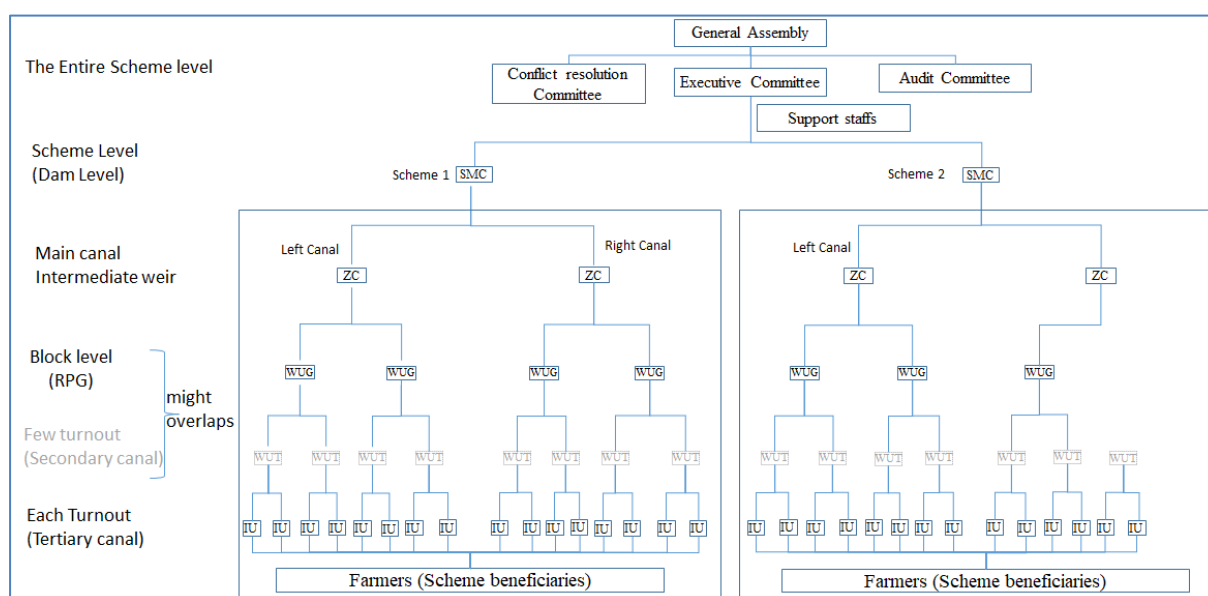


Figure 3.3 Proposed Management Structure in Rwamagana Model Site

(2) Ngoma Model Site

The model site in Ngoma District has one cooperative that consists of two irrigation schemes (Ngoma 22 and Mwambu) and an additional hillside irrigation scheme on Ngoma 22 scheme. The source of water to these schemes are the two reservoir dam at Ngoma 22 and Mwambu irrigation scheme.

The marshland scheme will have two SMC (Scheme Management Committee) for Ngoma 22 and Mwambu scheme. The lower level structures are set in similar way as discussed above.

Similarly, the hillside scheme will have one SMC. The hillside scheme consists four main canal and about 226 water taking valves (secondary canals) and 868 hydrants (which is the watering point to the field). Contrary to the marshland setting of lower level structure of the management, in the hillside scheme the lower level structure is set in such a way that more than 5 secondary canals (water taking valve on the main canal) is set to form one Water Users Team who is responsible for operation of the valves and management of water during irrigation period. The IU is formed of each secondary canals but are not considered as the lower level structure under IWUO. The four main canals on the hillside scheme constitute zonal committee of the IWUO. The roles and responsibility of each entity shall be

prepared once the structure is formed. The distribution of these facilities according to the main canal and the number of WUT to be set for hillside scheme is summarized below.

Table 3.14 Expected Number of Water Users Team in Ngoma Model Site

Facility	Upper Left MC	Upper Right MC	Lower Left MC	Lower Right MC
Valves	49	62	52	63
Hydrant	218	252	184	214
WUT	9	12	10	12

The scheme management committee set at hillside and marshland will form one IWUO to be supported by local technician after the training. The proposed structure is presented below.

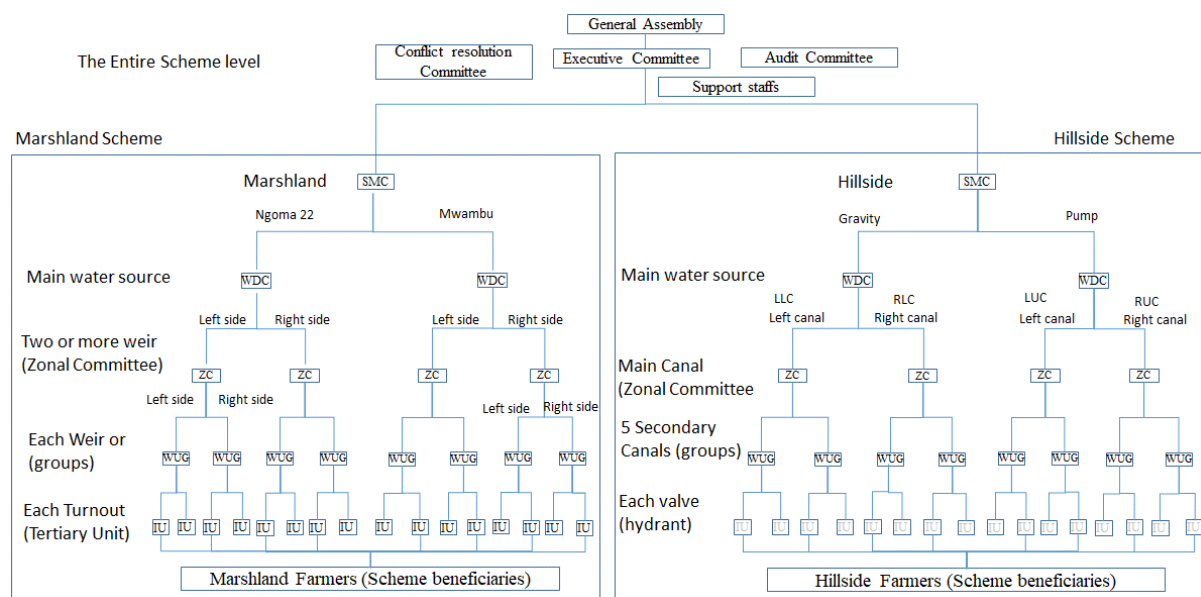


Figure 3.4 Proposed Management Structure in Ngoma Model Site

(3) Nyabuyogera Model Site

This scheme is one of the typical schemes found in Gisagara. It is comparatively small scale irrigation scheme with lack of enough water resource and proper irrigation facilities. Initially there must be proper irrigation facilities set in place corresponding to the available water resource. Considering its capacity, it is not practical to establish a separate entity (like IWUO) for the management of the scheme. An autonomous Scheme Management Committee under the existing cooperative is believed to be sufficient for the management of the scheme. A clear role and responsibility of the scheme management committee and the president of the cooperative shall be set before this approach is implemented. The support staff of the cooperative and DISC shall play a vital role in the monitoring of the activities of this kind of schemes. The proposed structure of irrigation management for scheme like Nyabuyogera can be presented as shown below.

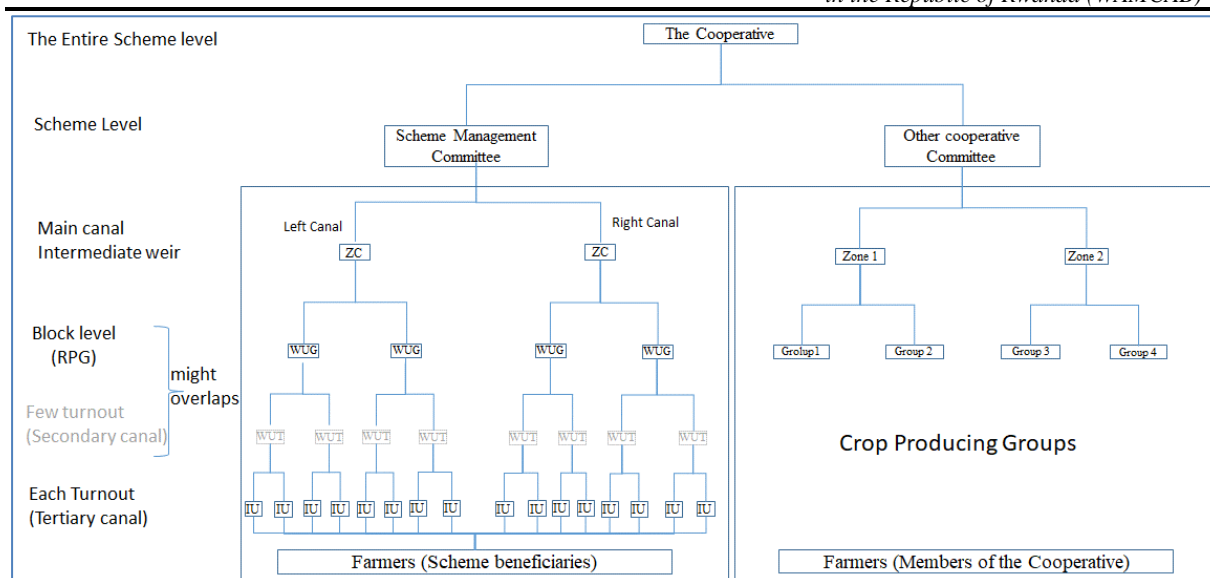


Figure 3.5 Proposed Management Structure in Nyabuyogera Model Site

(4) Ngiriyi Model Sites

These two schemes are found in a continuous land marshland with water source from the existing perennial stream. These two scheme has two cooperatives and two separate IWUO. Considering the capability of O&M of the scheme by dividing the limited resource they have it will be practical to combine the two IWUO into one while creating SMC at each scheme level similar to the case in Rwamagana and Ngoma. The combined IWUO will be able to hire support staff (local technician) that helps run the scheme smoothly and professionally after capacitated by the project. The proposed structure can be depicted as shown below.

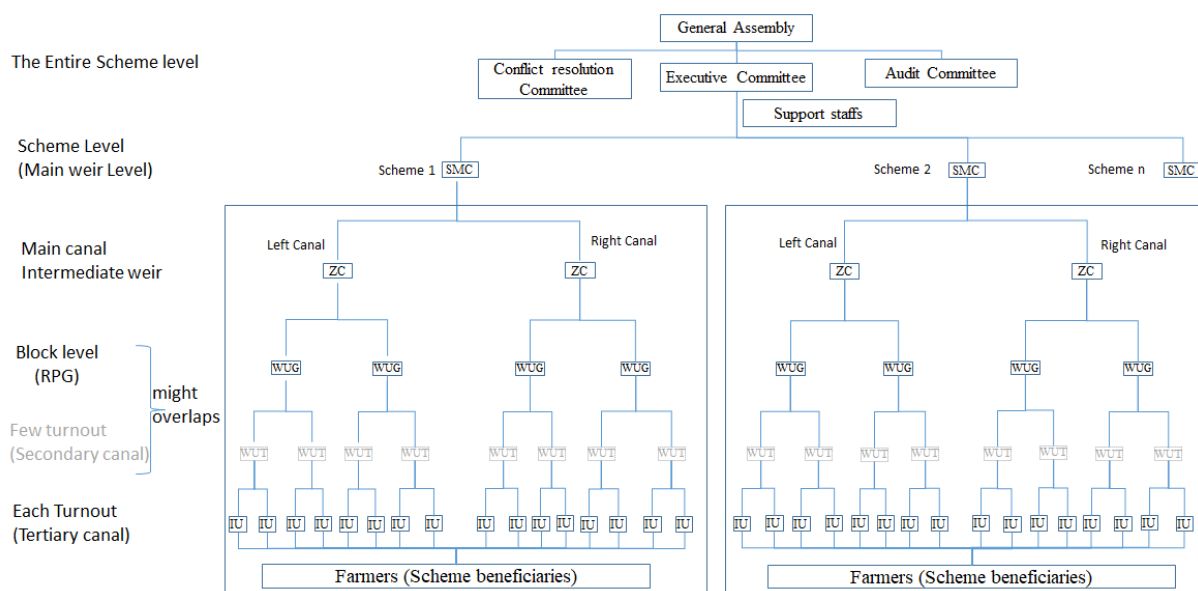


Figure 3.6 Proposed Management Structure in Ngiriyi Model Site

3.2.5 Procedure of Training

In order to achieve the training, the procedure of training is considered in the following tables.

Table 3.15 Procedure of Training for Output 2

Theme	Type	Trainer	Target	Manual	Remark
Approach in the	➤ Lecture	➤ Japanese	➤ IWUO-SU (as Core C/P)	Drafted	-

Theme	Type	Trainer	Target	Manual	Remark
Formation of IWUO	➤Field study	experts ➤(IWUO-SU)	➤DISC members ➤RAB station staffs (as TF members) ➤District engineer (as TF members) ➤Field collaborators (from target IWUO) <i>Monitoring by IWUO-SU (as Core C/Ps)</i>	based on the existed manuals	
Preparation of Scheme data base	➤Lecture ➤Field study	➤Japanese experts ➤(IWUO-SU)	➤IWUO-SU (as Core C/P) ➤DISC members ➤RAB station staffs (as TF members) ➤District engineer (as TF members) ➤Field collaborators (from target IWUO) <i>Monitoring by IWUO-SU (as Core C/Ps)</i>	Drafted based on the existed manuals	-
IWUO Management	➤Lecture	➤Japanese experts ➤(IWUO-SU) ➤(Field collaborators)	➤Field collaborators (from target IWUO) ➤IWUO members ➤Cooperative members ➤Service Provider (SPs) staffs <i>Monitoring by RAB station staffs and District engineers (as TF members)</i>	Modified based on RAB module	KCCP in the third country will be planed according to the progress and if necessary.

Table 3.16 Procedure of Training for Output 3&4

Theme	Type	Trainer	Target	Manual	Remark
Training of trainer (TOT)	➤Lecture ➤Field study	➤Japanese experts ➤(IWUO-SU)	➤IWUO-SU (as Core C/P) ➤RAB station staffs (as TF members) ➤District engineer (as TF members) ➤Field collaborators (from target IWUO) <i>Monitoring by IWUO-SU (as Core C/Ps)</i>	Drafted based on the existed manuals	KCCP in the third country will be planed according to the progress and if necessary.
Field Training for IWUO and farmer	➤Lecture ➤Field study	➤Japanese experts ➤(IWUO-SU) ➤(Field collaborators)	➤Field collaborators ➤IWUO members ➤Cooperative members ➤Service Providers (SPs) <i>Monitoring by RAB station staffs and District engineers (as TF members)</i>	Drafted based on the existed manuals	KCCP in the third country will be planed according to the progress and if necessary.

Table 3.17 Procedure of Training for Output 5

Theme	Type	Trainer	Target	Manual	Remark
Training of trainer (TOT) on rice	➤Lecture ➤Practical training	➤Japanese experts ➤(RAB station)	➤Field collaborators (from target IWUO and cooperative)	Modified based on SMAP	KCCP in the third country and

Theme	Type	Trainer	Target	Manual	Remark
production and horticulture	➤ Study tour	staffs) ➤ (District agronomist)	➤ SP staffs <i>Monitoring by IWUO-SU (as Core C/Ps) and RAB station staffs and District agronomists (as TF members)</i>	manuals and SHEP handbook	Coalition for African Rice Development (CARD) program will be planed according to the progress and if necessary.
Field Training for IWUO and cooperative on rice production and horticulture	➤ Lecture ➤ Practical training ➤ Study tour	➤ Japanese experts ➤ Field collaborators ➤ (SP staffs)	➤ Cooperative members (IWUO members) <i>Monitoring by IWUO-SU (as Core C/Ps) and RAB station staffs and District agronomists (as TF members)</i>	Modified based on SMAP manuals and SHEP handbook	KCCP in the third country and CARD program will be planed according to the progress and if necessary.

3.3 Extension of IP/TP

3.3.1 Selection of the Plans

Through Output 1 to 5, the information was collected, issues analyzed and objectives organized from baseline surveys, etc., as a result of which IP/TPs were developed and a series of trainings were conducted in the Model Sites in line with the IP/TPs. In the Extension Schemes, core training and activities were identified based on hypotheses in line with the characteristics of each Extension Scheme from the IP/TP developed in the Model Sites, and IP/TPs for each Extension Scheme were also developed.

It is necessary to select and prioritize the activity for important improvement and training plan conducted in this project when one considers the extension of the approach to another scheme or District. The results of the CA can be useful to determine the priorities for activities in the IP/TP. It is important to prepare IP/TP for differences among the irrigation schemes, rather than provinces, in accordance with local conditions.

For example, the WAMCAB selected schemes with similar condition such as natural environment, etc. as target extension schemes through the implementation of IP/TPs in Model Sites. In addition, IP/TPs were developed for each extension scheme by selecting core activities based on the past experience of external support for the extension scheme and the situation of IWUOs and cooperatives, etc.

3.3.2 Revision of the Plans

The revised activities of the IP/TP have been applied with local condition during the series of trainings. As a major direction, the IP/TP was also updated at the beginning of the 3rd phase of the Project, as mentioned above, in a manner that corresponds to the level of adoptability of the 9 steps and the need for such proficiency.

(1) Lesson learnt from Each Output after the Implementation of the Project

Regarding the Output 2, the IWUO strengthening, which was initially implemented for the IWUO, it was decided to provide the same training for the cooperatives in order to help both sides understand the division of roles between IWUO and cooperative in the irrigation schemes. As a result, not only IWUO but also the cooperative acquired capacity in irrigation scheme management, and both sides had the same information, which ensured transparency and promoted understanding of both positions. The organizational strengthening seems to be necessary for the cooperatives, not only for the farming technique on the Output 5.

For the maintenance and water management under the Output 3 & 4, some of the training courses conducted by the WAMCAB were not well understood by farmers initially, but some efforts were made to address this by practicing the techniques learned in the training courses in daily activities together with Rwandan Expert of WAMCAB and others, and conducting training again on the details that did not go well. In addition, in the training for the schemes targeted for dissemination, FC and others in the Model Sites assisted the lecturers and provided guidance in local languages and based on their experience, which greatly contributed to technology transfer and capacity building of IWUOs and others in the targeted schemes. Furthermore, in cases where there were many participants, the training was divided into several sessions so that each participant could be fully involved in the training.

For the farming under the Output 5, the technical training was conducted in a series of farming activities such as seedling production, transplanting, fertilizer application and harvesting in demonstration plots, but as the experience, skills and motivation of the farmers differed, some farmers were able to understand and practice the content, while others showed no action after the training, and there was several farmers at different levels. As a response, after the training, the agronomists and Rwanda expert of WAMCAB monitored the plots, identified farmers and technologies that needed improvement and conducted supplementary training for them. The complementary training focused only on the technologies that needed improvement, and farmers were motivated by using the actual farmers' plots that needed improvement, rather than demonstration plots.

Even in the same hillside irrigation schemes, the small-scale type of Mutenderi scheme has created a virtuous circle of increased area under cultivation and higher farmer income through repair of the pipeline network, bottom-up organizational development, capacity development for the maintenance and management, and introduction of market-oriented agriculture. The organic combination of minimum infrastructure requirements and soft-component measures adapted to each scheme has paved the way for sustainable scheme management even in hillside irrigation schemes.

(2) Summary of the Training through the application of the 9 Steps

There is no objection that the 9 steps is a core of extension of the WAMCAB Approach.

As mentioned above, trust and transparency between IWUO and cooperatives are key, and on this basis can contribute to the realization of sustainable irrigation scheme management.

It is fundamental to ensure transparency regarding the activities of each organization through the publication of appropriate activity reports, financial reports, activity plans and budget proposals at the general assemble meetings of both parties, and mutual participation of IWUO and cooperatives in their respective general meetings to understand the actual situation of the organizational management. It is effective to promote exchanges of views and discussions through joint activities (e.g. visits to developed areas, joint participation in training courses, etc.) in line with the common goal of both parties, which is the expansion and modernization of agricultural production.

In sites where there are particular problems, it has been shown that it is effective to have a third party, such as a district government, intervene to clarify the problems faced by both parties and provide a forum for calm discussion, as well as to provide continuous monitoring and support through DISC and

other means.

As for organizational issues, in Nyabuyogera Model Site, there are no major irrigation facilities such as reservoirs that should be managed jointly, and the amount of irrigation water is insufficient and irrigation dependency is low. Instead of the establishment of IWUO, Scheme Management Committee (SMC) , which is responsible for the work of water management and maintenance under the cooperative was proposed and trialed. From the perspective of the actual situation of water use in each zone and the establishment of a sustainable scheme management system, it is desirable to consider a management system that corresponds to each zone and to hold discussions with the relevant authorities towards its realization.

Chapter 4 Process of Implementation of the Plan

4.1 Substantial Aspects

4.1.1 Preparation of Curriculum

A new curriculum combining training on Output 2-5 was developed according to the current status and issues of the irrigation scheme, the level of the target participants, and the location and time availability for the training. Based on the process up to the 3rd phase of the Project, the curriculum was revised and piloted based on the 9 Steps.

4.1.2 Preparation of Text

In accordance with the above curriculum, available methods such as PowerPoint presentation, distribution of printed materials, oral explanation, demonstration, etc. were considered by using the technical manuals in order to extract the necessary contents based on the current status and issues of the scheme, the level of the target participants, and the available place and time, etc.

4.1.3 Selection of Trainer

(1) Trainer from the District

Since the irrigation scheme is under the supervision of the district, it is important to explain the outline of the activity, objectives, effectiveness, implementation structure, and relevant parties to the vice mayor, who is the chairperson of DISC, before the training is fully implemented, and to obtain his/her approval to implement the activity.

The content of the training should be explained to the vice mayor, and potential trainers will be selected who are available within the district. Referring to the “3.2.5 Procedure of Training”, it is recommended to select mainly district government officials who have experience in participating in WAMCAB activities and in serving as trainers, which can contribute to effective implementation of the training. In addition, it is better to consider the existing work volume of the trainers and avoid the overload of the work.

(2) Trainer from outside of the District

Referring to the “3.2.5 Procedure of Training”, the appropriate persons will be selected from RAB staff, sector agronomists, IWUO managers, cooperative agronomists, and private companies such as construction companies, agricultural product marketing companies, and companies handling agricultural inputs, based on the experience in participating in WAMCAB activities and in serving as trainers.

In addition, the former FCs of the model scheme (present IWUO managers and cooperative agronomists) who have been trained by the WAMCAB or IWUO managers and agricultural cooperative agronomists who have been trained at the extension sites in the 3rd phase will be potential trainers. IWUO managers and cooperative agronomists who have a short distance between schemes will be selected because they will visit and monitor the extension sites regularly after the training.

It is necessary to select trainers according to the areas of training, since the training covers a wide range of topics such as IWUO organization, water management, repair and maintenance of irrigation facilities, and agronomic activities. For example, the main trainers for Output 2-4 will be RAB station staff, district government officials, and IWUO managers, while the main trainers for Output 5 will be, in addition to the above, cooperative agronomists and sector agronomists.

In order to expand the training and activities, one supervisor will be selected from the RAB station to

establish an implementation system to ensure that the activities proceed smoothly. As in the process of selecting a trainer from the district government, it is essential that the IWUO-SU and the RAB station manager have a good understanding of this activity before selecting the trainer.

4.2 Logistical Aspects

4.2.1 Selection of Participant

(1) Target

The participants vary depending on the output and the content of the training. The WAMCAB Approach does not train all beneficiaries, but rather establishes an extension model as farmer-to-farmer extension. For Output 2-4, IWUO officers, and for Output 5, cooperative officers, cooperative agronomists, and leaders of each of the compartmentalized groups will be targeted.

(2) Scale

In the case of large irrigation schemes, some schemes have nearly 100 zones, which would be difficult to handle if all the target members were invited. Therefore, the number of target participants should be determined depending on the size of the scheme, number of members, budget, and technical level. If the number of target participants is large, it is also important to minimize the scope of selection by region, skill level, and other factors. When selecting the target group, people who are active in IWUO activities and agricultural activities should be chosen, aiming for a dissemination effect to surrounding farmers.

(3) Expected Collaboration with Service Providers

The main actors at the field level will be IWUO managers and cooperative agronomists. From the perspective of training IWUO managers and cooperative agronomists, it is important to work with HoReCo and the other service providers to ensure the sustainability of activities. Therefore, in schemes where service provider staff are assigned, they will be involved and invited to participate in the training.

4.2.2 Arrangement of Venue

(1) Preparation Meeting

When local government officials meet with each other at the startup of an activity, it is good to use the District office or Sector office.

(2) Theoretical Training

The basic idea is to use a venue that is easily accessible to IWUO and cooperative members, preferably at a cooperative office, IWUO office, or if neither is available, at a cell office.

(3) Practical Training

The technical training at the field level can be conducted at the WAMCAB model scheme or at extension sites in the 3rd phase, which can contribute to effective training implementation.

4.2.3 Provision of Supporting Arrangement (such as Transportation Fee)

Actual costs are summarized in the following table.

Table 4.1 Summary of Actual Cost Item

No.	Item	Basic Concept of Estimation
1	Travel expenses	➤ Provide the costs from the transfer from location of each participant to the training location in accordance with the regulations.
2	Daily allowance (participants)	<ul style="list-style-type: none"> ➤ In case of WAMCAB, provided lunch + drinking water in addition to the daily allowance. ➤ But it is preferable that the organizer or the participant pay for this as part of the daily allowance because of the time and effort required to make arrangements.
3	Reward for training lecturers	<ul style="list-style-type: none"> ➤ In the case of local administration, such as district government employees, apply to the institution to be paid in accordance with the regulations. ➤ IWUO managers and cooperative agronomists are basically paid by the organizer or the participant.

Training costs will be secured by development partners, projects, RAB, district offices, IWUO, and cooperatives that will host the training. In order to hold the training, it is necessary to request application from the district government and, if possible, to apply for a budget for IWUO management, and to conduct the training within the budget that will be executed.

4.3 Other

4.3.1 Mind Set Building

The mindset that those conducting the training should have is to image the activities in the sites where the knowledge will be applied, as incorporated during the preparation and revision of the IP/TP.

One way to maintain the motivation of the participants is to strengthen the communication and implementation system with stakeholders in advance and to involve the local administration, since activities will not be facilitated without the involvement of the administration.

For Output 3 and 4, theoretical lectures were kept to a minimum, and activities with easy-to-see results, such as civil work, were conducted in the early stages to motivate participants to participate and to get them interested in the activities.

Chapter 5 Monitoring and Evaluation

5.1 Kirkpatrick Method

In the proposed implementation structure, TF members are mainly responsible for Monitoring and Evaluation (M/E). For M/E of the training activities, WAMCAB applies Kirkpatrick method as described below.

5.1.1 Purpose

In general, the main purposes of M/E by Kirkpatrick method are as follows;

- Strategic planning and implementation
 - To grasp the progress of training implementation, impacts and results of the training at scheme, district and national level.
 - To take necessary actions by objective evaluation on the understanding and behavior change of the participants.
 - By identifying the internal/external factors that impacts on the results, i) to improve planning and implementation and ii) to promote cooperation with other stakeholders.
- Results-based training
 - To improve the effectiveness of the training program by evaluating not only the number of training but also the actual results.
- Accountability
 - By demonstrating the effectiveness of the training, to gain the understanding from the top-line and stakeholders about the necessity.

As a different point of view, M/E is a key role on administrative side for sustainable IWUO scheme management. In other words, it is necessary for the central and local government to continue to be interested and involved in the schemes in some forms, not only technical and/or financial support.

5.1.2 Method

Kirkpatrick Method is four-level evaluation system as shown in the table below. This method evaluates the training effects from the aspects of i) satisfaction, ii) understanding of the training contents, iii) behavioral change of trainees, and iv) the result of improved organizational capacity. Level 1 to 3 will be evaluated for each training theme or module of each Output, and Level 4 will be evaluated by Capacity Assessment method, which was introduced in the baseline survey.

Table 5.1 M/E Plan by Kirkpatrick Method

Level	Contents	Timing	Implementer
4. Results	➤ Capacity Assessment	➤ Baseline Survey in the 1st Phase ➤ The end of 2nd Phase ➤ The end of 3rd Phase	IWUO-SU RAB Stations District officer
3. Behavior	➤ Follow-up questionnaire survey	➤ 3 to 6 months after the training	RAB Stations District officer
2. Learning	➤ Mini-exam	➤ Before and after the training	RAB Stations District officer
1. Reaction	➤ Questionnaire survey	➤ after the training	RAB Stations District officer

(1) Reaction

Immediately after training, measure the level of satisfaction with the training of the participants, the appropriateness of the contents, time and timing of the training, contributing to improving motivation, lecturer's skills, future action plans, etc. and measure the effectiveness of the training.

(2) Learning

Before and after the training, we will conduct a written examination and measure the level of comprehension of the participants to the content of the training. If understanding is judged to be inadequate, it is also important to promote understanding through counseling and providing additional information.

(3) Behavior

Several months after training, hearing changes in productivity and efficiency by utilizing the contents of learning, changes in the quality of work, changes in motivation for work, etc. In addition, evaluate same items with their boss and colleague, and evaluate behavior changes with the participants.

(4) Results

Measure changes in the organization's performance with regard to the quality of work, productivity, efficiency, etc. by participants. The Project do not evaluate each training; however, we propose to evaluate each organization in Capacity Assessment.

5.1.3 Implementation Plan

In the end of the 1st Phase, pre-training on Output 5 was conducted in order to examine the new implementation structure. Through the pre-training, the draft indicators at level 1 to 3 was prepared. At the beginning of the 2nd Phase, the indicators will be validated with TF members, and those indicators will be used for M/E activities.

5.2 Meaning of Capacity Assessment

Outline of Capacity Assessment (CA) is mentioned above. In the WAMCAB, the CA is used for the evaluation the Project Purpose.

5.2.1 Components of Capacity in WAMCAB

Capacity only comes about once the following three elements have been integrated. Technology, particular knowledge and tacit knowledge on the part of the organization is referred to as "Technical Capacity (TC)". The will, attitude, leadership and management capabilities to activate technical capacity are referred to as "Core Capacity (CC)", serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the "Enabling Condition (EC)" that encompasses the organization.

5.2.2 Assessment Item

Each component has several assessment items as follows. For instance, TC1 is "Knowledge Management" which means that IWUO-SU shall manage the necessary knowledge such as water management, O&M and farm management by preparing the guidelines and/or manuals. These assessment items differs by organisations and basically are based on its role and responsibility. The same assessment items were used in the first and second CAs, but clear criteria were set for the second CA, taking advantage of the lessons learnt from the first CA, where no clear criteria were set. Each assessment item has more detailed indicators aiming at the proper evaluation.

- Technical Capacity : TC (explanation in each level is described in the following table)
- Core Capacity : CC (explanation in each level is described in the following table)
- Enabling Condition : EC (explanation in each level is described in the following table)

Table 5.2 Assessment Item for IWUO-SU

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」 EC2 「Legal Framework」	Pre-condition (external condition).
TC	TC1 「Knowledge Management」 ➤ Water Management ➤ O&M ➤ Farm Management TC2 「Training System」 TC3 「Monitoring / Evaluation」 TC4 「Financial Management (budgeting)」 TC5 「Organizational Management (Headquarter and Stations)」 TC6 「Project Management」 TC7 「Policy Advice」	Necessary techniques, certain knowledge, and those management skills for the proper instruction and support to RAB Stations, District, etc. Monitoring and Evaluation (M/E) System for irrigation schemes (facility and IWUO). Administrative capacity for IMT procedure, budgeting and policy advice, etc.
CC	CC1 「Leadership」 CC2 「Membership」 CC3 「Awareness of Problems」 CC4 「Awareness of Challenges」 CC5 「Gender Mainstreaming」 CC6 「Communication System」 CC7 「Cooperation & Collaboration System」	Willingness and attitude to solve the problem and achieve the goal initiatively. Leadership to determine the policy solve the problem based on the opinions from RAB Stations and District/Sector, etc. Communication and collaboration system with RAB Stations and Districts.

Table 5.3 Assessment Item for RAB Stations (Ngoma, Rubirizi and Rubona)

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」 EC2 「Legal Framework」 EC3 「Supporting System by Central Government」	Pre-condition (external condition). Necessary resources provided by central government.
TC	TC1 「Survey」 TC2 「Plan / Design」 TC3 「Procurement」 TC4 「Supervision」 TC5 「Water Management」 TC6 「O&M」 TC7 「Farm Management」 TC8 「Training System」 TC9 「Monitoring / Evaluation」	Necessary techniques, certain knowledge, and training system for the proper instruction and support to District/Sector. (Required particularly high expertise)
CC	CC1 「Leadership」 CC2 「Accountability (Ownership)」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Cooperation & Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems. Coordination skills for both central government (RAB HQ) and District/Sector.

Table 5.4 Assessment Item for Districts including Sectors (Ngoma, Rwamagana, Gisagara)

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」 EC2 「Legal Framework」	Pre-condition (external condition).
TC	TC1 「Survey」 TC2 「Plan / Design」	Necessary techniques, certain knowledge, and training system for the proper instruction and

Capacity	Assessment Item	Explanation
	TC3 「Procurement」 TC4 「Supervision」 TC5 「Water Management」 TC6 「O&M」 TC7 「Farm Management」 TC8 「IWUO Organizational Management」 TC9 「Training System」 TC10 「Monitoring / Evaluation」 TC11 「Financial Management (budgeting)」	support to District/Sector. (including the support from RAB Stations)
CC	CC1 「Leadership」 CC2 「Ownership」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Cooperation & Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems. Administrative capacity for the smooth operation for IMT procedure, budgeting and cooperation with IWUO, etc.

Table 5.5 Assessment Item for Model IWUO

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」 EC2 「Legal Framework」 EC3 「Administrative Supporting System」 EC4 「Environmental condition」	Pre-condition (external condition). Necessary resources provided by government.
TC	TC1 「Water Management」 TC2 「O&M」 TC3 「Farm Management」 TC4 「Financial Management」 TC5 「Rule Making」 TC6 「Internal Evaluation」 TC7 「Organizational Management」 TC8 「Audit System」	Necessary techniques, certain knowledge, and systems for the proper scheme management.
CC	CC1 「Leadership」 CC2 「Accountability (Ownership)」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, and systems. Administrative systems for the smooth operation of IWUO.

5.2.3 Evaluation Method

For each assessment item as mentioned above, one or several indicators (*questions*) are prepared. Evaluators score with three (or four) grade such as (3 (Excellent),) 2 (Good), 1 (Fair), 0 (Poor) for each indicator. Average score for each assessment item will be calculated and indicated in a spider chart.

Table 5.6 Sample of Scoring for Evaluation

Assessment Item	Indicator	Result	Score	Average Score
TC1 「Plan」	TC1-1 <i>Yes/No Question</i>	Fair (Yes but not enough)	1	1
	TC1-2 <i>Existence of necessary documents</i>	Poor (No documents)	0	
	TC1-3 <i>Qualitative Evaluation</i>	Good	2	
TC2 「Water Management」	...		...	1.5
TCC 「O&M」	...		...	2
...

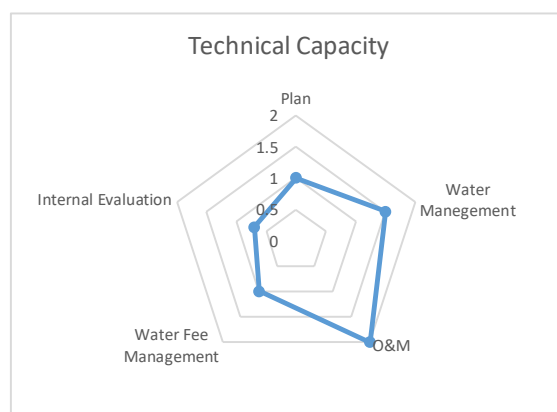


Figure 5.1 Sample of Spider Chart for Evaluation

5.2.4 Other Necessary Documents

- ✓ Organizational chart
- ✓ Chart or table of personnel assignment (staffing)
- ✓ Budget (operating and development budget)
- ✓ Manuals, etc.

5.2.5 Implementation Method

For IWUO-SU, WAMCAB team conducted the CA. For RAB Stations, District/Sector and model IWUO, basically IWUO-SU together with WAMCAB team conducts CA by hearing from C/Ps in the station and District. The first CA for model IWUOs, they evaluate based on the result of baseline survey.

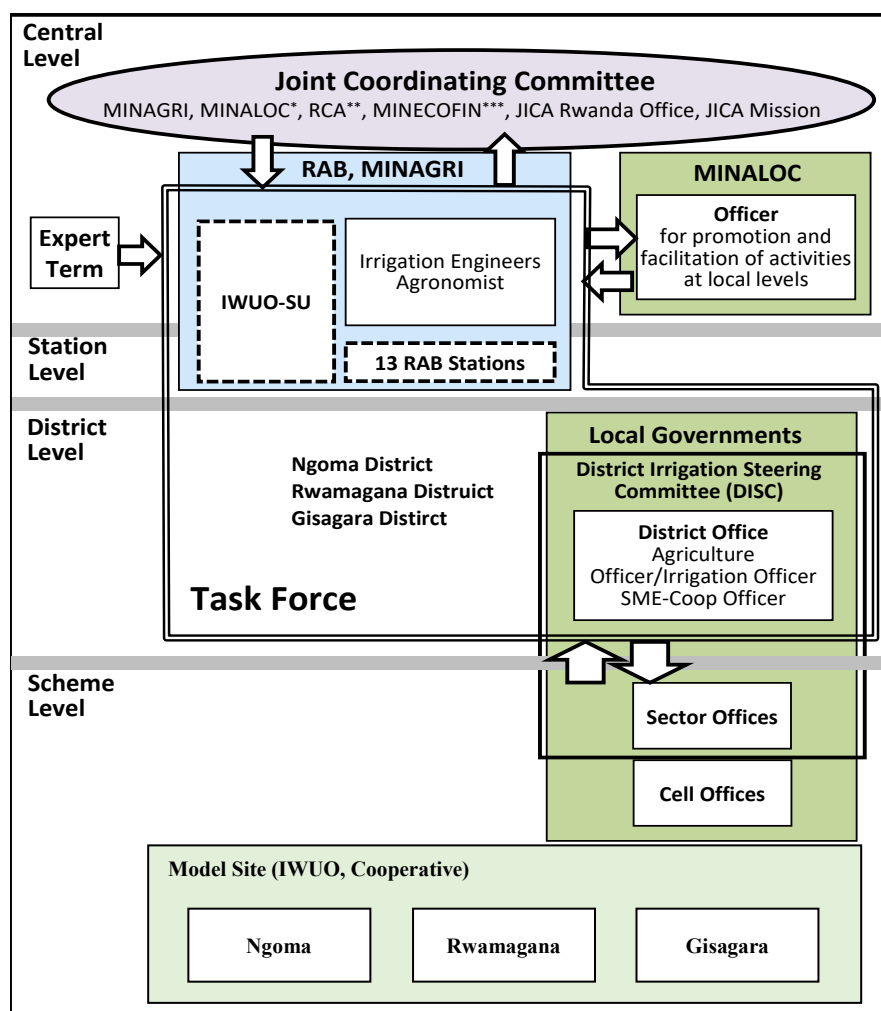
5.3 Implementation Structure

In Rwanda, an IMP was developed in 2010, and a new IMP was compiled in 2020 in response to the need for integration with the Water Resources Master Plan. The new IMP proposes new irrigation development and rehabilitation of existing irrigation areas, as well as various methods for irrigation scheme management, including IWUO-type methods. However, in view of the delay in the implementation of the new IMP, MINAGRI has planned to develop an Irrigation Strategic Plan with specific measures and requested JICA to prepare the draft in August 2021. The Strategic Plan also proposes to disseminate the WAMCAB Approach demonstrated in WAMCAB on a national scale as a representative model for sustainable irrigation scheme management, which is expected to serve as a guide for achieving the top objectives and realizing future irrigation policies.

RAB has implemented different approaches to IWUO capacity strengthening, focusing on Proximity Coaching, a training method that is field-based and provides direct support to farmers. Initially, proximity coaching for organizing and strengthening the capacity of IWUOs was conducted by RAB headquarters staff, but when IWUO officers were reassigned from headquarters to the various stations, station staff replaced headquarters staff in conducting proximity coaching. However, due to the busy workload caused by staff shortages, sufficient activities could not be carried out, and the private sector started to be involved in proximity coaching for irrigation schemes, but due to the lack of expertise and experience of the service providers, who were the main implementers, the expected effects could not be achieved.

In the WAMCAB, the implementation structure initially expected was that the TOT would be implemented to RAB and District government officials, who would then strengthen the capacity of IWUO and agriculture to achieve sustainable irrigation scheme management. However, through the experience in the first phase on WAMCAB, it was found that the TF members, consisting of RAB and

District government officials, were too busy to take on capacity strengthening of individual schemes. In order to substantively advance the activities from phase 2 of WAMCAB, a training implementation structure has been established and put into practice, with the FC assigned to the IWUO or cooperative in each scheme as the implementing body, and the TF members responsible for evaluation and monitoring. The implementation structure itself is expected to be as shown in below, but some points need to be noted, including the implementation of evaluation and monitoring.



*MINALOC : Ministry of Local Government

**RCA : Rwanda Cooperative Agency

***MINECOFIN : Ministry of Finance and Economic Planning

Figure 5.2 Expected Implementation Structure

Implementation considerations are listed below.

1. Regarding the implementation of training, instead of the cascade-style approach done by the government officials as originally expected, TOT is implemented for FCs who are expected to be employed as IWUOs or cooperative staffs in the future, and the implementation structure is centered on them.
2. As TF members are busy with their daily work and have limited operating budget, making continuous field work difficult, they are responsible for evaluating and monitoring the training conducted by FCs etc. and provide necessary follow-up to FCs, IWUOs, cooperatives etc., taking into consideration the level of understanding of the beneficiaries, that is, IWUOs and cooperative members.
3. By improving the current stagnant activities of DISCs, which are originally responsible for providing guidance and capacity building to IWUOs, and revitalizing both the quality and quantity, the TF encourage the sharing of good practices among IWUOs, smooth relationships with cooperatives, and

provide necessary support and guidance from Districts etc., thereby strengthening their capabilities.

The Project expects the methodology of Capacity Assessment can be useful for evaluation of the others IWUO in whole country and Imihigo evaluation and human resources assessment in Rwanda.

Chapter 6 Necessary and Major Activities for Dissemination of WAMCAB Approach

6.1 Elementary Conditions and Promotion Effects for Irrigation Scheme Management

There are some conditions that may inclusive and further enhance the elementary conditions of the WAMCAB approach established through the work of the WAMCAB towards sustainable irrigation scheme management.

6.1.1 Developing a Sense of Common Understanding, Transparency and Trust among Stakeholders

The first priority is to ensure that the current situation of the main stakeholders is taken into account, their respective roles and responsibilities are clarified and understood and agreed in each direction. Next, it is important to put the highest priority on strengthening the relationship between the government, IWUOs and cooperatives; to set water fee at a reasonable price by agreement of the stakeholders based on a long-term action plan; to disclose the activities and budget execution of IWUOs and cooperatives in a transparent manner; and to realize the benefits of irrigation network, including increased cultivated area and stable yields. Based on these, it will be possible to disseminate the effectiveness and advantages of the WAMCAB approach, which will further strengthen its impact.

6.1.2 Bi-Directional Perspective in Scheme Management towards Development of Activities that are not limited to Assigned Areas

In particular, in the irrigation scheme, the irrigation unit established at each intake, which is the terminal facility, was used as the basic unit, and the organization was developed from the bottom up to the trunk canal, diversion weir and the entire irrigation scheme, while the specific maintenance and management responsibilities of each level of the organization were recognized and the capacity of the organization was strengthened. The roles related to maintenance, water management and agriculture were recognized and capacity development was achieved.

Based on these, multifaceted improvements in organizational management, maintenance, water management, market-oriented farming and cooperation between IWUOs and cooperatives were observed, and IWUO performance improved.

6.1.3 Consider, Plan, Trial and Reflect on Details Activities, while aligning with Policy

The WAMCAB approach was established to better embody the policies aimed at in the IMP and irrigation strategy. The cornerstone is a detailed plan, including the IP/TP, which has been further improved by involving stakeholders, examining and piloting plans to put the policies into practice at the field level.

6.2 Action Plan in Nationwide

The Action Plan describes the necessary and major activities for the dissemination of WAMCAB Approach which based on modified IWUO Management Model and contribute the irrigation scheme management in the target Districts and Nationwide by Rwanda side toward after the completion of WAMCAB Project.

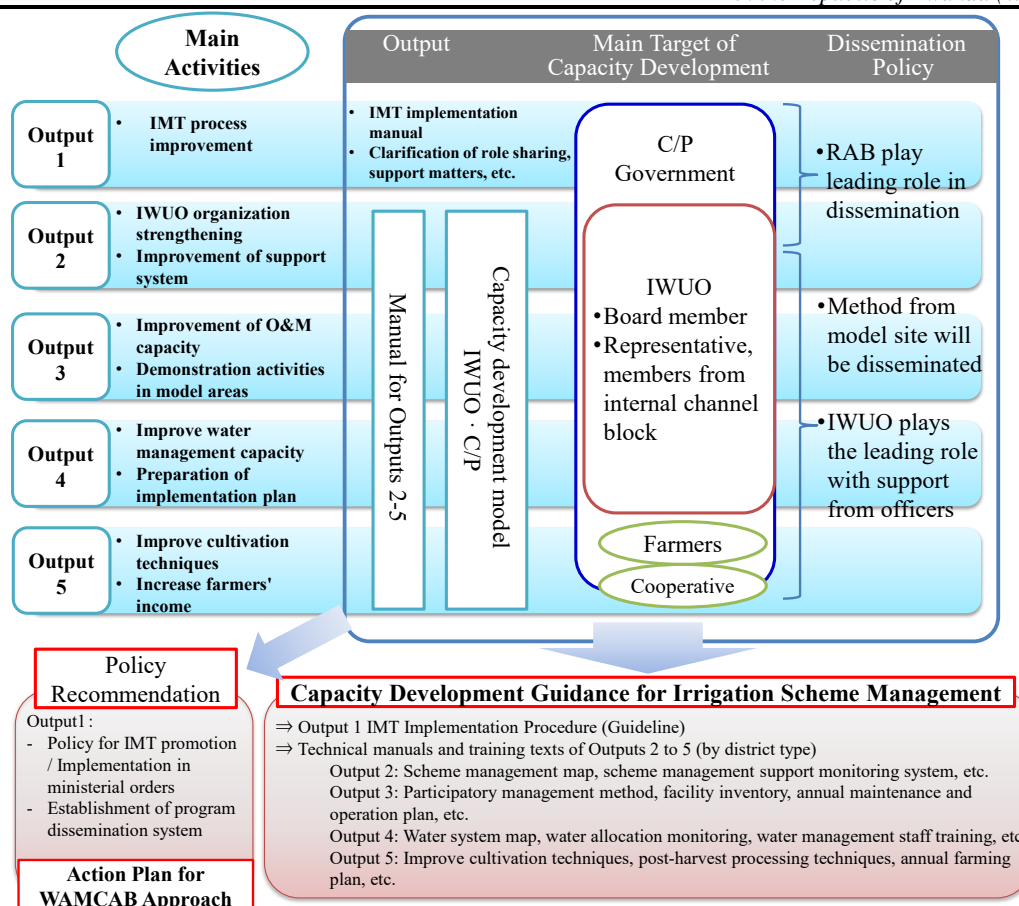


Figure 6.1 Action Plan in/out WAMCAB

It will be made mainly with practical materialized contents, so that the Rwandan side can independently disseminate the irrigation scheme management model demonstrated by WAMCAB nationwide toward after completion of the Project. Therefore, Core CP and TF member shall prepared the AP involving Service Providers.

The major activities were identified to disseminate the WAMCAB Approach as mentioned in the following table.

Table 6.1 Medium-term Action Plan in Nationwide

No.	Overall Action	Major Activity	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030	Source
1	Activation of DISC	1) Consider Support System for IWUOs by District/RAB Station						RAB, District
		2) Prepare internal rules and regulation of DISC						District
		3) Organize biannual/quarterly DISC Meetings						District, DPs
2	Coordination of Donor-funded Projects	1) Organize monthly coordination meeting among the projects*						RAB, District
		2) Organize study tour among the projects						DPs, IWUOs
3	Strengthening Capacity of IWUOs	1) Prepare data base of IWUOs						IWUO, RAB, DPs
		2) Organize trainings for IWUOs and Cooperatives						District, RAB, DPs
4	Collaboration with the potential stakeholders	1) Formulate/conduct functional ToR of contract with Service Providers for capacity building						RAB
		2) Strengthen/conduct collaboration with UR-CAVM for human resources development						RAB, UR

*Expected potential project: WB (SAIP, CDAT, DIME), IFAD (KIWP), JICA (WAMCAB), KOICA (SAPMP)

The detailed information of all major activities are mentioned in all manual and guidance.

6.3 Sample of Detailed Action Plan in Target Districts

In each target extension scheme, the IP/TPs were developed in the beginning of the third phase constitute the Institutionalization and Extension Phase around April 2023. Based on the consideration, Action Plans for the development and dissemination of activities were prepared for the extension schemes in January 2024, involving SPs, and activities have been newly launched.

Table 6.2 Short-term Action Plan prepared by Rwamagana District

Name of scheme	Major Activity	Details of the Activities (Intervention)	2025-2026	2026-2027	2027-2028
1. Rugende 2. Mutukura 3. Rwamagana 34 4. Musha 5. Gahengeri	Defining scheme service area	➤ Confirm irrigation facilities			
		➤ Confirm the available Water for irrigating the command area			
		➤ Checking finance capacity of the IWUO to hire the additional staff			
	Database Preparation and Organizing Irrigation Block	➤ Complete the draft Irrigation Map			
		➤ Complete the drafted of Irrigation Map			
		➤ Reorganization of Irrigation block			
	Formation of IWUO Structure	➤ Complete the lower level organ of IWUO(WUT& SWD)			
	Clarify Roles, Responsibility and Internal Regulation	➤ Discuss on the roles and responsibility of each stakeholders			
		➤ Modify the internal rules and regulation			
		➤ Collect the inputs on prepared internal rules and regulation			
		➤ Validate the prepared internal rules and regulation			
	Call for General Meeting and ratification of by-law	➤ Held of the general assembly meeting to ratify the by-law			
		➤ Election of executive committee			
	Conduct Necessary Training Output 2	➤ Preparation of sensitization document for low level leaders			
		➤ Conduct sensitization workshop to Lower level leaders			
	Conduct Necessary Training Output 3&4	➤ Facility Inspection			
		➤ Basic Civil Work Training			
		➤ O&M planning			
		➤ Basic Water management Training			
		➤ Erosion control training			
		➤ Conduct M&E for OM and Water Management			
		➤ Cooperative Management and Gender mainstreaming			
		➤ Cropping Calander			
		➤ FFS (Farmers Field School)			

Table 6.3 Short-term Action Plan prepared by Ngoma District

Name of scheme	Major Activity	Details of the activities (Intervention)	2025-2026	2026-2027	2027-2028
1. RUKIZI_KI BAYA 2. RWAKAG ANZA	Define scheme service Area	➤ To assess the current condition of IWUO (IWUO structure,Financial management, Irrigation facilities conditions)			
		➤ Checking the availability of water for irrigation			
		➤ Hiring supporting staffs			
	Prepare Database and Organize Irrigation Block	➤ Preparation of Irrigation Map			
		➤ Preparation of Irrigation block			
		➤ Preparation of Water Users List			
	Reorganize of IWUO structure	➤ Reorganization of IWUO structure(Bottom -up)			
	Clarify Roles, Responsibility and Internal Regulation	➤ Set a clear roles and responsibilities of stakeholders			
		➤ Amendment of internal rules and Regulations			
	Call for General Meeting and ratification of by-law	➤ Validate the amended internal rules and regulations			
		➤ Follow-up on implementation of those laws			
	Conduct Necessary Training (Output 2)	➤ Training on Financial mgt of IWUO			
		➤ IWUO strengthening			
		➤ Sensitization on responsibilities of IWUO to lower levels			
	Conduct Necessary Training (Output 3 & 4)	➤ PM&E (Participatory Monitoring and Evaluation)			
		➤ Training on facility Inspection			
		➤ Basic civil work training			
		➤ Proper water management			
		➤ Water distribution plan			

*Action Plan and Capacity Development Guidance for Irrigation Scheme Management
Project for Water Management and Capacity Building
in the Republic of Rwanda (WAMCAB)*

Name of scheme	Major Activity	Details of the activities (Intervention)	2025-2026	2026-2027	2027-2028
	Conduct Necessary Training (Output 5)	<ul style="list-style-type: none"> ➤ Cooperative Management and Gender mainstreaming ➤ Crop calendar ➤ FFS (Farmers Field Scholl) 			

Table 6.4 Short-term Action Plan prepared by Gisagara District

Scheme Name	Major Activity	Details of the activities (Intervention)	2025-2026	2026-2027	2027-2028
1. MIRAYI 2. NYIRAMA 3. MIGINA	Define Scheme Service Area	➤ Introduction session			
		➤ Command area determination (availability of water, facility status , management status , irrigable area)			
		➤ proposal of management model			
	Prepare Database and Organize Irrigation Block	➤ Preparation of irrigation map			
		➤ Preparation of water user list			
		➤ Preparation of Irrigation block for lower level organization			
	Reorganize IWUO Structure	➤ Reorganization of existing structure			
		➤ Election of leaderships			
	Clarify Roles, Responsibility and Internal Regulation	➤ Drafting role and responsibility of stakeholders			
		➤ Clarification of role and responsibility of each stakeholder			
		➤ Amendment of internal rule and regulation			
	Call for General Meeting and ratification of by-law	➤ call for general assembly			
		➤ Election of overall committees			
		➤ Ratification of internal rule and regulation			
	Conduct Necessary Training (Output 2)	➤ Sensitization on responsibility of lower level leaders			
		➤ IWUO strengthening			
		➤ Financial management			
	Conduct Necessary Training (Output 3 & 4)	➤ Participatory monitoring and evaluation			
		➤ Proper water management			
		➤ Water distribution plan trainings			
		➤ PIM (Participatory Irrigation Management)			
		➤ Training on basic repair work (basic civil work training)			
	Conduct Necessary Training (Output 5)	➤ Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)			
		➤ Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)			
		➤ Cooperative management , gender mainstrimming and finicial literacy and family badgeting training			

The detailed Short-term Action Plan toward 2028 for the three target districts is attached as Annex 3.

Chapter 7 Reference

7.1 List of Texts

The manuals for each Output are listed in the table below.

Table 7.1 List of Manual and Text in Each Output of WAMCAB

	Title of Manual and Text	Contents
Output 1	Irrigation Management Transfer (IMT)	Implementation Procedure of IMT Agreement Irrigation Management Model (WAMCAB Approach)
Output 2	IWUO Management	IWUO Strengthening Financial Management Participatory Monitoring & Evaluation Office Management
Output 3	O&M	Operation & Maintenance Management Basic and Advanced Civil Works Inspection of Irrigation Facilities
Output 4	Water Management	Proper Water Management
Output 5	Farming Text	Farm Management to Irrigation Scheme

7.2 List of External Trainers

As we mentioned above, the trainer will be selected who are available within the district like district government officials for the certain training. However, the trainers were procured from private sector, NGO, etc. in the WAMCAB for more effectiveness. The following table shows the trainers who gave appropriate training in the WAMCAB and can be referred if the similar training will be organized.

Table 7.2 List of External Trainers

Output	Type of Service	Organization	Address
Output 3	Civil Work Training	Rural and Civil Engineers Consultants Ltd.	Musanze District
Ditto	Training on Pipeline and Hydrant Repair	Rwanda Institute for Conservation Agriculture (RICA)	Bugesera District
Ditto	Farm Road Repair by using Do-nou Technology	Core RWANDA	Kicukiro District

**Rwanda Agriculture and Animal Resources
Development Board (RAB)
The Republic of Rwanda**

**Project for Water Management and
Capacity Building
in the Republic of Rwanda
(WAMCAB)**

Report of Baseline Survey

November 2019

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Photo 1 Irrigation Scheme in Gisagara District



Photo 2 Interview Survey with IWUO staff in Ngoma District



Photo 3 Field Survey in Gisagara District



Photo 4 Workshop in Ngoma District



Photo 5 Capacity Assessment of Station Office in Gisagara District



Photo 6 Presentation by Ngoma District at the 2nd TF meeting

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Abbreviation

Abbreviation	Standard Nomenclature
C/P	Counterpart Personnel
CA	Capacity Assessment
CAPI	Computer-Assisted Personal Interviewing
CC	Core Capacity
CD	Capacity Development
CFSVA	Comprehensive Food Security and Vulnerability Analysis
DISC	District Irrigation Steering Committee
EE	Enabling Environment
EU	European Union
GDP	Gross Domestic Product
GoR	the Government of Rwanda
HoReCo	Horticulture in Reality Cooperative
IMT	Irrigation Management Transfer
IMTA	Irrigation Management Transfer Agreement
IWUO	Irrigation Water Users Organization
IWUO-SU	Irrigation Water Users Organization Support Unit
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
M/E	Monitoring and Evaluation
M/M	Minutes of Meeting
MINAGRI	Ministry of Agriculture and Animal Resources
NISR	National Institute of Statistics of Rwanda
O&M	Operation and Maintenance
OMMIS Project	Operation, Maintenance and Management of Irrigation Scheme Project
QWMDP	Quick Win Marshland Development Program
R/D	Record of Discussions
RAB	Rwanda Agriculture and Animal Resources Development Board
RCA	Rwanda Cooperative Agency
RGB	Rwanda Governance Board
RMA	Rwanda Meteorology Agency
RSSP	Rural Sector Support Project
SAIP	Sustainable Agricultural Intensification and Food Security Project
SMAP	Smallholder Market-oriented Agriculture Project in Rwanda
SP	Service Providers
SSIT	Small Scale Irrigation Technology
TC	Technical Capacity
TF	Task Force
USAID	United States Agency for International Development
W/P	Work Plan
WAMCAB	Project for Water Management and Capacity Building
WB	World Bank

Chapter 1 Introduction

1.1 Background

The agricultural sector of Rwanda accounted for approximately 33% of its GDP, and employed around 70% of its working population. In order to improve agricultural production and farm income, the Government of Rwanda (GoR) considers the promotion of irrigated agriculture as an important policy task and is promoting irrigation development intensively. In parallel, the Government is promoting the policy of decentralization and self-governance of the irrigation schemes. Consequently, the responsibility of the Operation and Maintenance (O&M) of the developed irrigation scheme is being transferred from the Government to Irrigation Water Users Organization (IWUO), which is called Irrigation Management Transfer (IMT).

The Rwanda Agriculture and Animal Resources Development Board (RAB) under the Ministry of Agriculture and Animal Resources (MINAGRI) which is responsible for establishing the formation of IWUO has created a Support Unit (IWUO-SU) to promote this activity. However, the development of the system of IMT is still insufficient, and in fact the capacity of both the implementing agency and IWUO is at its infant stage. With this background and based on the request of GoR, Japan International Cooperation Agency (JICA) has launched the Project for Water Management and Capacity Building (WAMCAB) targeting the sustainable management of irrigation schemes by IWUOs in collaboration with RAB as the implementation agency of the Project and counterpart agency of JICA.

According to the Record of Discussions (R/D) of the Project signed on 27 September 2018 between RAB and JICA, it will attain outputs stated below through the implementation of the Project activities. It is expected to make a positive impact in developing sustainable irrigation scheme management run by IWUO and contribute to achieving the Project purpose and overall goal after the completion of the Project.

Table 1.1 Project Summary

Item	Contents
Project Title	Project for Water Management and Capacity Building in Rwanda
Overall Goal	The models of scheme management by IWUOs are accepted in the target districts.
Project Purpose	The capacity of irrigation scheme management improves in the model sites.
Outputs	Output 1. IMT procedures, support system (including the roles of stakeholders), and contents of support to IWUO and procedures of monitoring are identified.
	Output 2. IWUO management is enhanced in the model sites.
	Output 3. O&M are properly implemented in the model sites.
	Output 4. Water management is properly implemented in the model sites.
	Output 5. Farm management is properly implemented in the model sites.
Target Area	Rwamagana and Ngoma District in Eastern province and Gisagara District in Southern province
Implementation Organization	RAB
Project Duration	Five years from April 2019 to March 2024

The Project will be conducted in 3 phases, i.e. Survey/Planning (1 year), Technical Guidance (2 years) and Institutionalisation/Extension Preparation (2 years). At the beginning of the Survey/Planning phase, WAMCAB has carried out basic information collection. Based on the information collected, the team analysed and discussed with the officials concerned about problems and constraints on the irrigation scheme management in Rwanda by using *Problem Tree* method.

In order to clarify the actual situation both advantages and disadvantages, the Project team has carried out baseline survey from June to August 2019, which consists of quick survey in Gisagara District, field survey on the current condition of the irrigation schemes and interview survey with IWUOs/cooperatives. After completion of these surveys, the WAMCAB has organized 3 workshops in Rwamagana, Ngoma

and Gisagara Districts and a wrap-up meeting by the Task Force (TF) members consisting of related officials from RAB stations and Districts in August 2019. Results of the *Problem Tree* analysis, baseline survey, workshops and the 2nd TF meeting are summarised in this document. Capacity Assessment (CA) of institutions/organizations concerned and survey on Service Providers (SPs) will be followed in the later stage of the Survey/Planning phase.

1.2 Outline

In accordance with the Work Plan (W/P) of the Survey/Planning phase, WAMCAB conducted a baseline survey in cooperation with counterparts (C/Ps) from May to September 2019. The baseline survey has several components as shown in the table below.

The 2nd Joint Coordinating Committee (JCC) meeting will be held in November 2019, and the final result of baseline survey and the draft Improvement Plan/Training Plan will be presented.

Table 1.2 Plan of Baseline Survey

#	Survey	Purpose	Target	Methodology / Contents	Period
1	Survey on existing information	To clarify the characteristics of the target area	Nationwide	Existing information, interview with related persons	April to June 2019
2	Extracting problems for each Output - <i>Problem Tree</i>	To clarify the current condition, general issues and relation between problem and possible solutions.	Nationwide	Existing information, discussion with C/Ps	June to August 2019
3	Irrigation Scheme Survey in targeted Districts	To grasp the current situation, challenges and needs of highly-applicable training/activities of irrigation schemes.	26 schemes in the targeted Districts	Interview and field survey	June to July 2019
4	Irrigation Scheme Survey in typical irrigation scheme at medium/large-scale and good practice	To grasp the current situation and challenges of medium/large-scale of irrigation schemes, and extract good practices.	7 schemes in 5 Districts	Interview and field survey	July 2019
5	Capacity Assessment	To evaluate the current situation and capacity of targeted IWUO and counterpart organizations.	IWUO-SU, targeted RAB stations, targeted Districts, model IWUOs	Interview with the representative using an evaluation sheet, result of Irrigation Scheme Survey	June to September 2019
6	Survey on service providers	To grasp the activity status and consider the cooperative relationship with service providers.	Service providers in the targeted Districts	Existing information, interview with related persons	June to September 2019
7	Survey on farming	i) To grasp the current situation, challenges and needs of highly-applicable training/activities for farming. ii) To grasp the activity status and consider the cooperative relationship with SMAP and RAB-SMAP.	Targeted Districts, related persons of SMAP and RAB-SMAP, and private companies	Existing information, interview with related persons	June 2019

Chapter 2 Problem Tree and Countermeasures

2.1 Objective

The followings are objectives of formulating *Problem Tree* which is composed of five sections in accordance with five outputs of the Project.

- ♦ To grasp and analyse the current project conditions about the project scheme organizations, Irrigation and agriculture.
- ♦ To extract and list-up all relevant problems which can be found from baseline survey results.
- ♦ To clarify the relation of each problem and classify the problems according to problem categorization.
- ♦ To think of all possible solution idea for each problem, as the project activities which will be conducted in the next phase, like training and field demonstrations, will be selected from the listed idea
- ♦ To make the consensus about current conditions and problems among stakeholders, which will be the foundation for next project activities

2.2 Reference

Reference for preparation of *Problem Tree* in aspect of 1) Irrigation Policy, 2) IWUO organizational capacity, 3) irrigation, and 4) farming in Rwanda are listed as follows.

(Overall aspects)

- Basic Information Collection by WAMCAB from April to June 2019
- Final Report on Technical Assistance in the establishment of a baseline of agricultural households using irrigation systems by EU in 2016
- Activity Reports by Horticulture in Reality Cooperative (HoReCo)

(Irrigation policy and IWUO organizational capacity)

- Report on the Detailed Planning Survey for the Project for Water Management and Capacity Building in the Republic of Rwanda in 2017
- Irrigation Water Users Organizations Policy and Strategy (2014-2020), 2014

(Irrigation)

- Final Report on Data Collection Survey on Irrigation Development at Lowland Swamp in Eastern Province, 2015
- Final Report on data collection survey on irrigation development in Ngoma District of Eastern province in Rwanda, 2012
- Final Report on the study on sustainable rural and agricultural development in Bugesera District, Eastern province in the Republic of Rwanda, 2009
- Study report on the preparatory study for formulation of the program for rural development in eastern province in the Republic of Rwanda, 2009

(Farming)

- Seasonal Agricultural Survey Report by National Institute of Statistics of Rwanda (NISR)
- Several Reports and the other documents on “Smallholder Market oriented Agriculture Project in the Republic of Rwanda” from 2014 to 2019
- Comprehensive Food Security and Vulnerability Analysis (CFSVA) in the Republic of Rwanda,

2018

2.3 Problem Tree for Each Output and Countermeasures

The draft *Problem Tree* for 5 output was prepared by WAMCAB and was finalized through discussion with C/Ps. The final version of *Problem Tree* for each output is shown as follows.

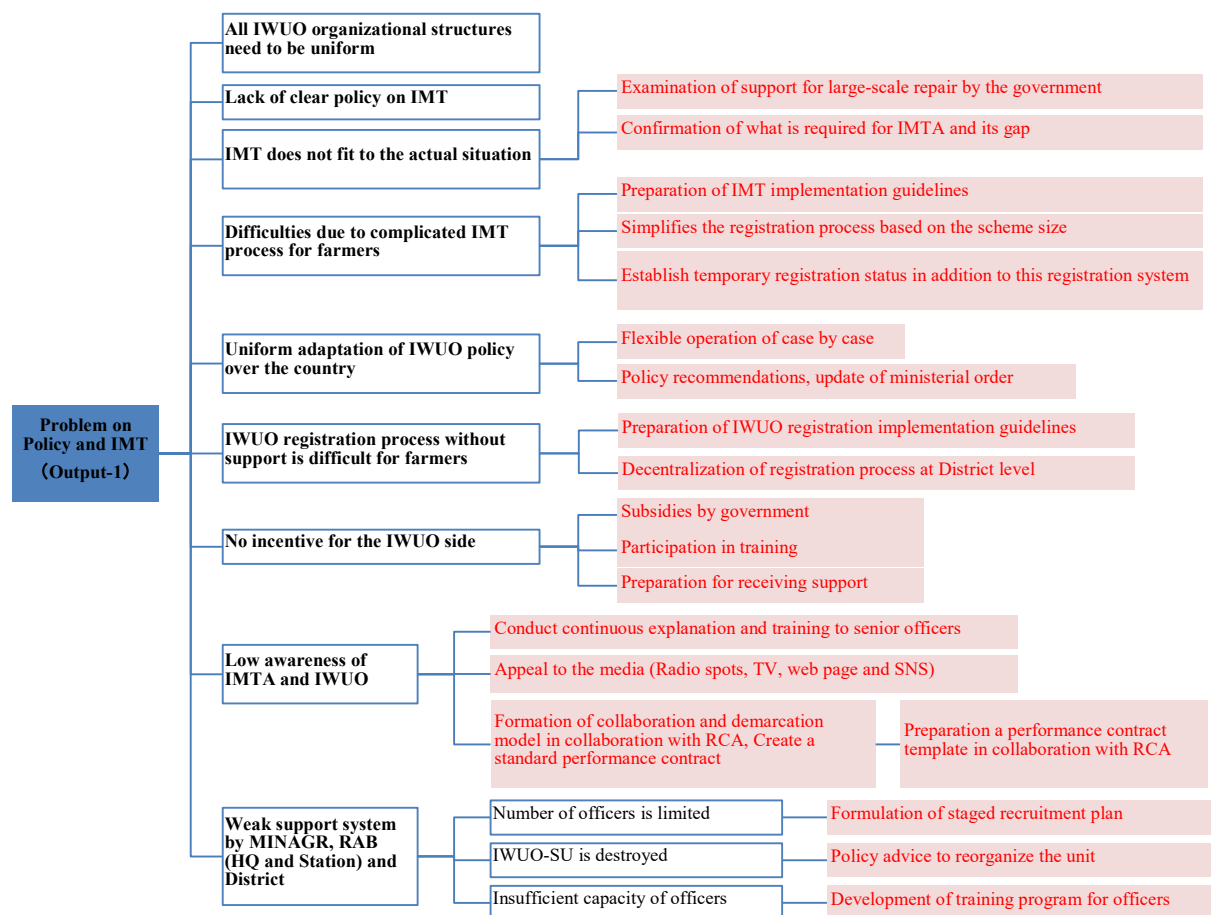


Figure 2.1 Problem Tree in aspect of Output 1 of the Project

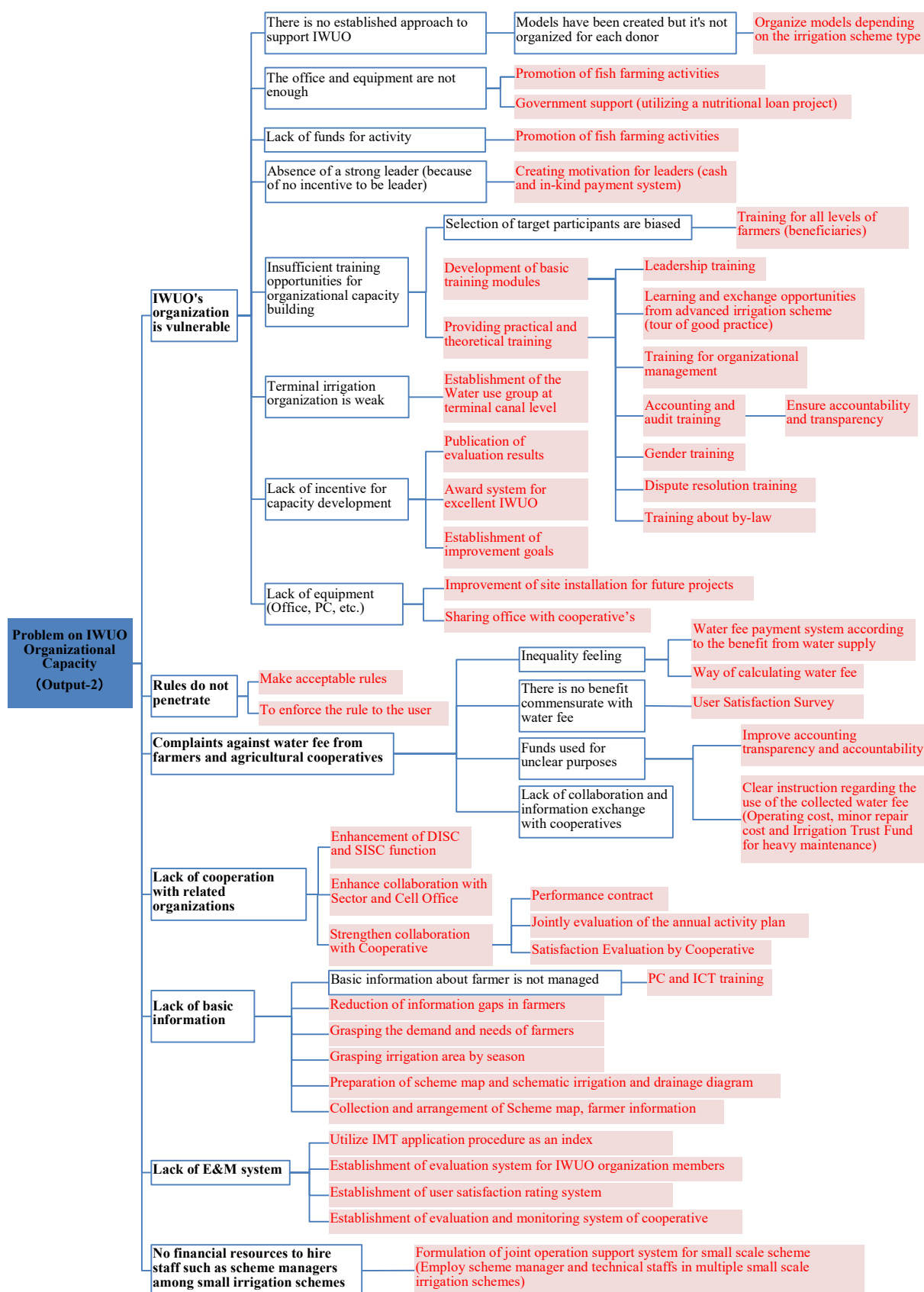


Figure 2.2 Problem Tree in aspect of Output 2 of the Project

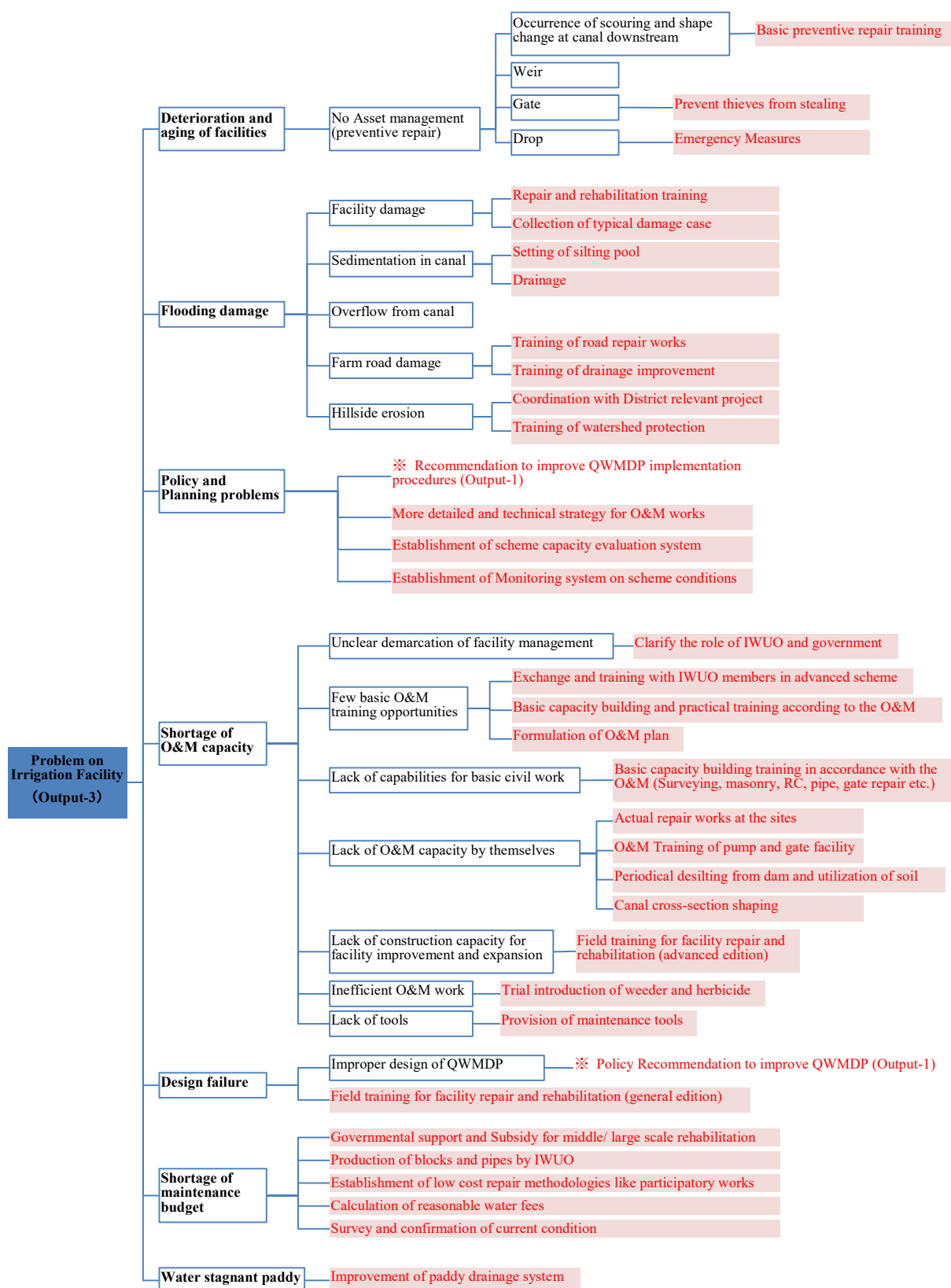


Figure 2.3 Problem Tree in aspect of Output 3 of the Project

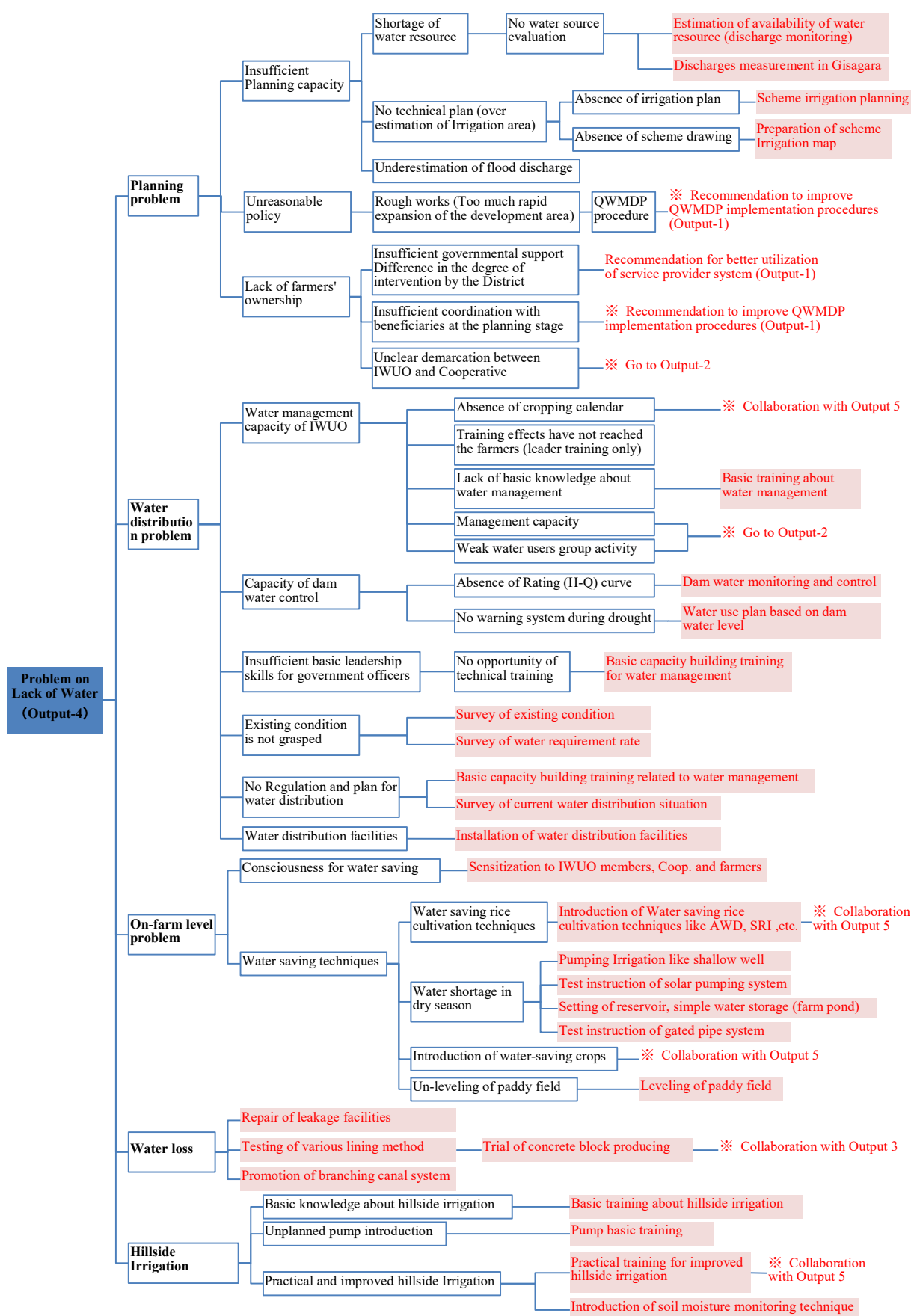


Figure 2.4 Problem Tree in aspect of Output 4 of the Project

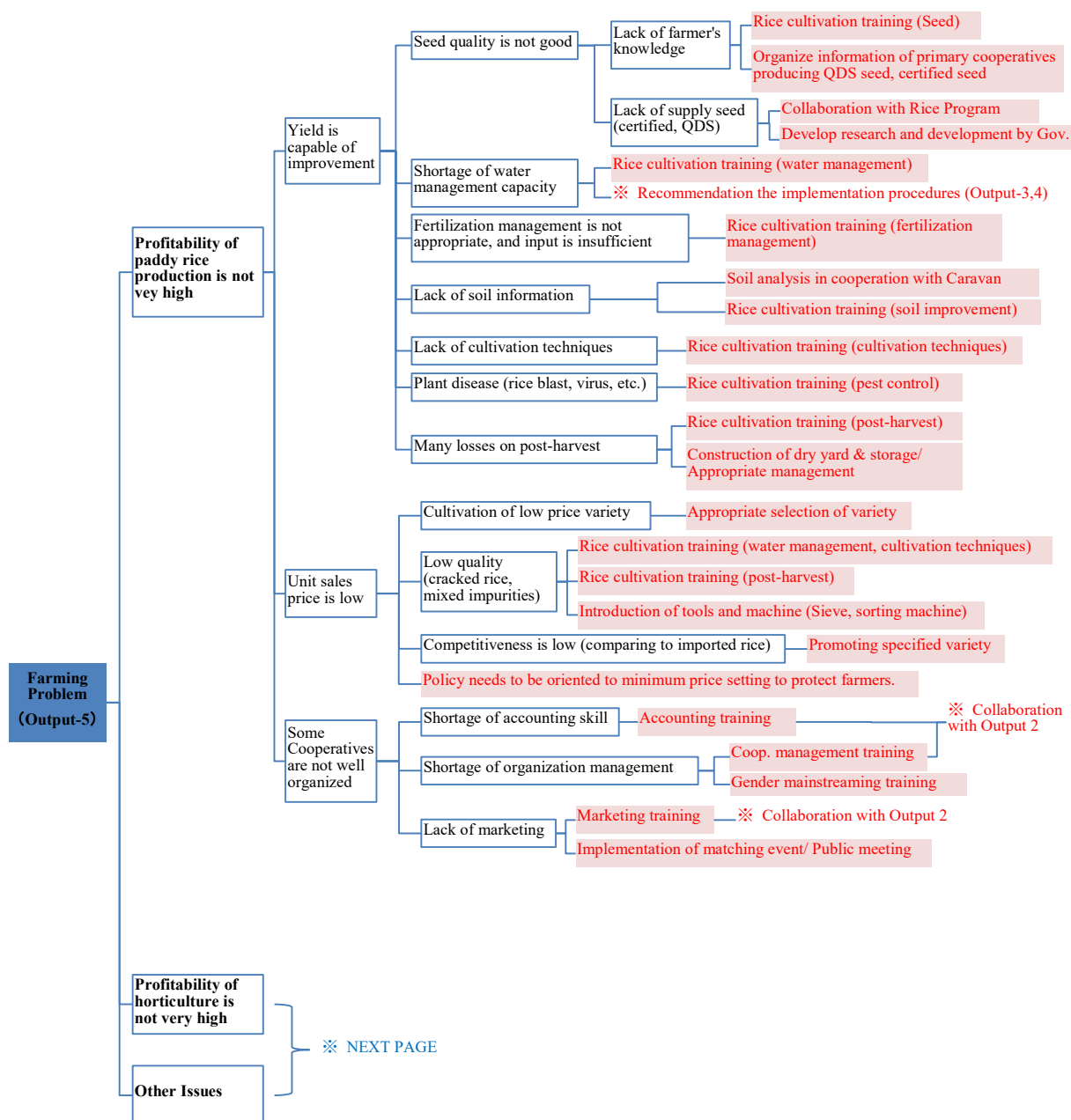


Figure 2.5 Problem Tree in aspect of Output 5 of the Project (1/2)

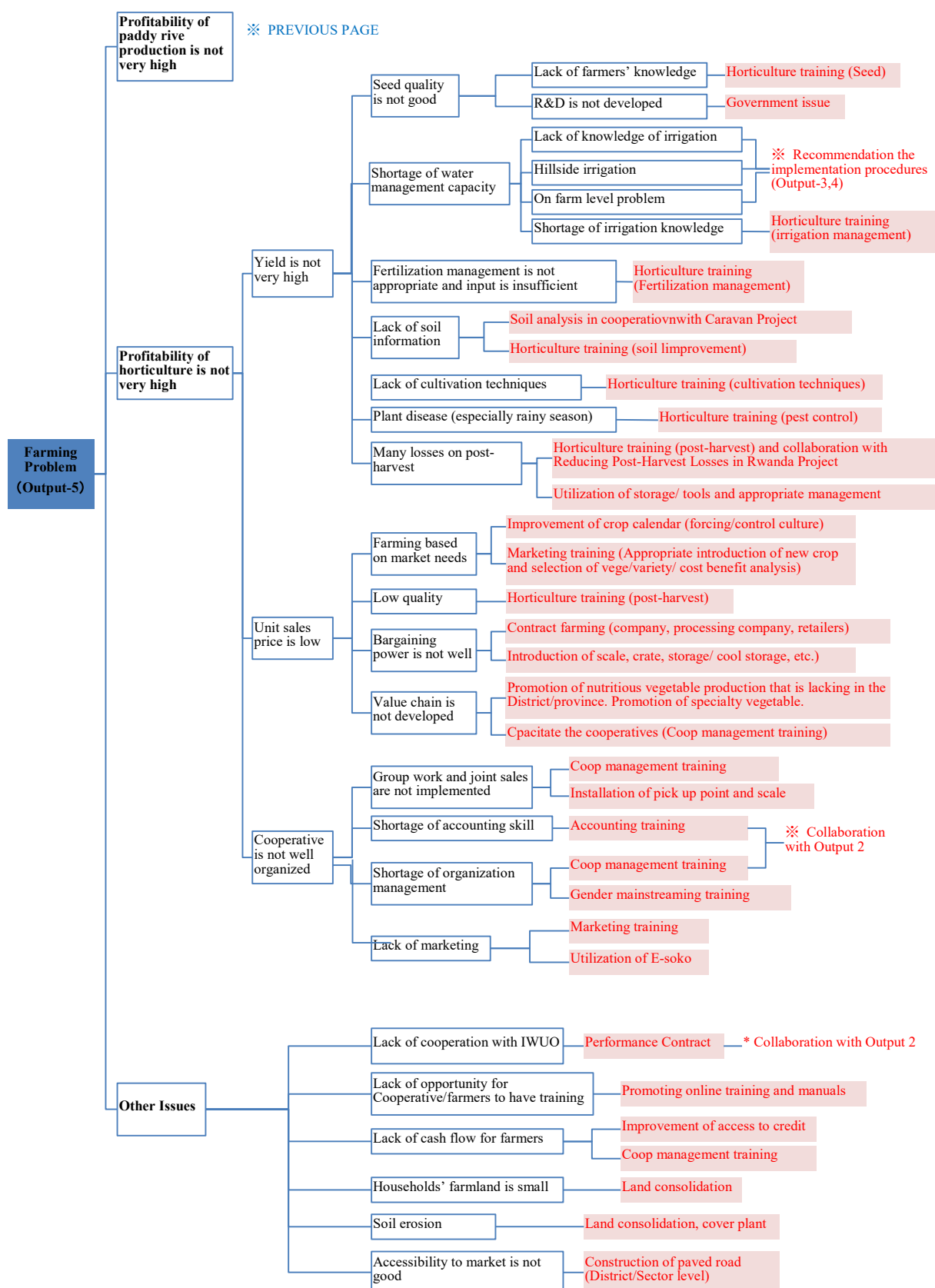


Figure 2.6 Problem Tree in aspect of Output 5 of the Project (2/2)

Chapter 3 Irrigation Scheme Survey

3.1 Outline

3.1.1 Introduction

As mentioned in **Chapter 1**, Irrigation Scheme Survey is one of the main parts of the baseline survey, which consists of (1) interview survey and (2) field survey. It aims to grasp the accurate condition of the targeted schemes to select the model IWUOs, and to utilize the results for drafting Improvement Plan / Training Plan.

Irrigation Scheme Survey was conducted in the targeted three Districts and other Districts with typical irrigation schemes at medium/large scale and good practices. Based on the baseline survey funded by EU¹ and Marshland Survey by RAB and JICA², the target irrigation schemes were determined by discussion with C/P and approved by the 1st TF meeting held on 28th June.

Particularly, for Gisagara District, the Project implemented Quick Survey in advance in order to collect basic information and refine the target schemes for the main Irrigation Scheme Survey (hereinafter refer to “the main survey”).

Table 3.1 Outline of Irrigation Scheme Survey

Survey	District	Period
Gisagara Quick Survey	Gisagara	June 2019
Irrigation Scheme Survey in Ngoma District	Ngoma	July 2019
Irrigation Scheme Survey in Rwamagana District	Rwamagana	
Irrigation Scheme Survey in Gisagara District	Gisagara	
Irrigation Scheme Survey in typical irrigation scheme at medium/large scale	Kayonza, Kirehe, Nyanza	
Irrigation Scheme Survey in good practice	Gisagara, Bugesera	

3.1.2 Method

(1) Interview Survey

WAMCAB team conducted an interview survey to the representatives of IWUOs and cooperatives with the same question items on quantitative data. The topics of question items are shown in the following table.

In the main survey, WAMCAB firstly obtained consent from the respondents to conduct the survey and use the results for WAMCAB activities. Topic A and B have the same questions both for IWUOs and cooperatives, which ask the basic information about the survey and irrigation scheme. The detailed question items for Gisagara Quick Survey, IWUO and cooperative are attached as **Annex 1-1, 1-2 and 1-3** for each.

Table 3.2 Topics of Question Items for Interview Survey

Gisagara Quick Survey	IWUO	Cooperative
<ul style="list-style-type: none"> Basic Information Section 1 (General Information of Irrigation Scheme) Section 2 (Irrigation Facility) 	<ul style="list-style-type: none"> Introduction to the respondents to be interviewed (consent) A. Information of Survey B. General Information of Irrigation Scheme C. Organization and Administrative Management D. Governing Rules and Regulation 	<ul style="list-style-type: none"> Introduction to the respondents to be interviewed (consent) A. Information of Survey B. General Information of Irrigation Scheme C. Cooperative D. Farming

¹ Transtec, SHER Consult Ltd. and Agrotec, Technical Assistance in the establishment of a baseline of agricultural households using irrigation systems, 2016, financed by EU

² RAB/JICA, The Marshland Survey in Rwanda, August 2018

Gisagara Quick Survey	IWUO	Cooperative
	E. Financial Management F. Water Management, Operation and Maintenance	

For the interview survey, the Project adopted a technique called *CAPI* (Computer-Assisted Personal Interviewing) and used Survey Solutions³ which is free software developed in the Data group of The World Bank. Using the *CAPI* method, interviewers can carry out the face-to-face interview survey by following with software-installed tablet PC, and enter the results directly into the tablet. Survey Solutions, one of the application software for *CAPI*, helps to design a question format (questionnaire) and specifies the data type for each question item, such as numeric, single-choice, multiple-choice, GPS, photo, voice, etc. As a result, it can reduce the response variance and save a lot of time to transcribe the results into a computer form.

The necessary steps for setting up a survey in Survey Solutions are as follows:

1. Create a questionnaire on Designer
2. Test the questionnaire with Tester
3. Import the questionnaire onto HQ
4. Create terms of supervisors and enumerators
5. Make assignments
6. Install the interviewer application

Following the above steps, the Project created three question formats as shown in **Annex 1-1, 1-2 and 1-3** with Survey Solutions Designer. After setting the formats, web server and terms of supervisors and enumerators, the Project conducts the survey with Survey Solutions Interviewer application.

(2) Field Survey

WAMCAB visited each irrigation scheme and checked the necessary points. The survey items are as follows:

- Existence of irrigation facilities such as dam, weir, intake, canal, etc.
- GPS information on irrigation facilities
- Simple discharge measurement of developed spring
- Photo taking

³ Reference URL: <https://mysurvey.solutions/>

3.2 Gisagara Quick Survey

3.2.1 Background

In accordance with the R/D between GoR and JICA, Ngoma District and Rwamagana District were selected to be model sites as medium-scale marshland and hillside model areas. On the other hand, Gisagara District was proposed by RAB as the other model area during R/D. Through the circumstance, at the 1st JCC meeting on 8th May 2019, Gisagara District was officially selected as the third model site of the WAMCAB Project. Irrigation schemes in Gisagara District could be a model as small scale irrigation because of its scale. However, there was a lack of basic information such as location, catchment area, source of water, developed or rehabilitated irrigation schemes, irrigation infrastructure, organization (IWUO/Cooperative), major crops, etc. in the District. Therefore, WAMCAB implemented the Quick Survey in June 2019.

3.2.2 Objective

- To collect basic information on irrigation schemes in Gisagara District.
- To select 10 irrigation schemes from 16 irrigation schemes in Gisagara District for baseline survey (irrigation scheme survey).

3.2.3 Method

WAMCAB carried out the interview and the filed survey to collect basic information in the irrigation schemes in Gisagara District. WAMCAB prepared the questionnaires (**Annex 1-1**) to be used during the core C/P meeting. Basically, interviews were carried out with IWUO board members and cooperative board members in cooperation with HoReCo, service provider. Also, WAMCAB carried out the filed survey taking photos and GPS data of irrigation infrastructure, road and farmland to confirm the current status.

Besides, WAMCAB prepared the criteria, which is a three-grade evaluation and scoring each irrigation scheme 0 to 10, in order to evaluate the irrigation schemes in Gisagara District. Therefore, WAMCAB selected 10 schemes as the high scored scheme. The criteria are shown in the table below.

Table 3.3 Selection Criteria for Baseline Survey

Item	Indicator
1. Accessibility	Accessibility by car (Very good, Good, Moderate, Poor; evaluation by GPS data) How far from the paved road (must be within 20km)
2. Willingness of IWUO for improvement and self-management	Evaluate with Q11 to Q13 (Questionnaire) Subjective evaluation by the Project
3. Typically as small scale Quick Win Marshland Development Program (QWMDP) scheme model	Scale; < 100 ha = 2pt, 100-150 ha = 1pt, >150 ha = 0pt The scheme must be without dam (with dam is excluded).
4. Condition of irrigation facilities	Photos of facilities, subjective evaluation by the Project Intact facility = good (2pt) Fairly functional = moderate (1pt) Dysfunctional = poor (0pt)
5. Water potential	Ratio between catchment and command area >3:1 good (2pt), 1:1~1:3 moderate (1pt), <1:1 poor (0pt)

3.2.4 Result

As a result of the implementation of the quick survey, findings are summarized as follows;

- There are 16 irrigation schemes under development by QWMDP, Rural Sector Support Project (RSSP), etc. covering a total area of 1,297 ha and over 12,000 IWUO members.
- Almost all of the irrigation schemes have IWUO and cooperative, and only one scheme namely

Ruvugangoma does not have both IWUO and cooperative.

- The main source of water is spring and natural stream. Several irrigation schemes have dam, underground water as the source of water.
- Major crops are rice and maize in season A, rice, soybean, bean, vegetables in season B, vegetables or no cultivation in season C.

The quick survey was conducted from 3rd to 13th June 2019, followed by the summarization of the results.

Major issues of IWUO and irrigation to hinder sustainable management are identified; i) shortage of water from the source of water, ii) damaged irrigation infrastructure and facilities due to soil erosion, silting, flooding, etc. without properly O&M, iii) many of water gates were stolen, iv) irrigation water was not flowing properly in the main and secondary canal, because canals have not been kept clean, v) canals and drainage system were also damaged due to flood and soil erosion, vi) several roads and bridges were damaged due to flooding, vii) poor management of IWUO and lack of training opportunities in matter of O&M, and viii) lack of acquisition of IWUO certificate issued by Rwanda Governance Board (RGB).

Major issues of farming to hinder sustainable management are identified; i) lack of certified and improved rice seeds, ii) lack of post-harvest facilities, iii) farm management is not very good due to inadequate used of manure and fertilizer, iv) lack of market information, and v) poor management of the cooperative, etc.

Good points and advantages of IWUO are specified; i) regular community works on maintenance of the facilities, funding, recording, etc., and ii) collection of water fee.

Therefore, based on the criteria, WAMCAB gave scores each irrigation scheme in total 16 schemes and selected 10 schemes in order high scored scheme by the 1st TF meeting on 28th June 2019. Selected 10 irrigation schemes are Akaboti, Mwura-Gatare, Kigaga-Kabogobogo, Nyakagezi, Ruvungirana, Ngiriyi, Rwasave, Agatare, Rumira-Urukungu and Nyabuyogera. The results of the scoring and selection of the schemers are shown in the table below.

Table 3.4 Scoring 16 Schemes Based on the Result of Quick Survey

Irrigation Scheme	Item 1		Item 2		Item 3		Item 4		Item 5		Total Score	Rank
	Access ability	Score	Status of WUA	Score	Beneficiary Area (ha)	Score	Facility Condition	Score	Ratio	Score		
Akaboti	good	2	Moderate	1	65	2	good	2	0.93	0	7	1
Mwura-Gatare	good	2	Moderate	1	130	1	good	2	1.69	1	7	1
Kigaga-Kabogobogo (1)	moderate	1	Moderate	1	28	2	moderate	1	7.3	2	7	1
Nyakagezi	moderate	1	Active	2	80	2	poor	0	2.76	2	7	1
Ruvungirana	good	2	Moderate	1	75	2	moderate	1	0.77	0	6	5
Kigaga-Kabogobogo (2)	moderate	1	Moderate	1	36	2	poor	0	23.49	2	6	5
Ngiriyi	good	2	Moderate	1	182	0	moderate	1	3.58	2	6	5
Rwasave	good	2	Infant	0	110	1	moderate	1	4.14	2	6	5
Agatare	moderate	1	Moderate	1	59	2	moderate	1	0.77	0	5	9
Rumira-Urukungu	good	2	Moderate	1	83	2	poor	0	0.53	0	5	9

Irrigation Scheme	Item 1		Item 2		Item 3		Item 4		Item 5		Total Score	Rank
	Access ibility	Scor e	Status of WUA	Scor e	Beneficia ry Area (ha)	Scor e	Facilit y Condit ion	Scor e	Ratio	Scor e		
Nyabuyogera	very good	3	Infant	0	109	1	modera te	1	0.95	0	5	9
Rwamporera-Nyiramageni	good	2	Moder ate	1	180	0	modera te	1	0.89	0	4	12
Kibugazi (1)	poor	0	Moder ate	1	64	2	poor	0	1.43	1	4	12
Ruvugangoma	poor	0	-	-	15	2	poor	0	3.58	2	4	12
Nyakanyeri	modera te	1	Infant	0	75	2	poor	0	0.47	0	3	15
Kibugazi (2)	poor	0	Infant	0	6	2	poor	0	1	1	3	15

3.3 Interview Survey for IWUO and Cooperative

3.3.1 Objective

- To grasp the current situation, challenges and needs of highly-applicable training/activates of irrigation schemes in target three Districts
- To prepare the establishment of IWUO in Rwamagana District
- To grasp the current situation and challenges of medium/large-scale of irrigation schemes
- To clarify the extract of good practice

3.3.2 Result

WAMCAB implemented the interview survey with IWUOs and cooperatives for 33 irrigation schemes in 7 Districts including the targeted 3 Districts from 10th to 29th July 2019.

By the title of the survey, the numbers of targeted irrigation schemes are 26 in the targeted Districts, 5 in typical irrigation schemes at medium/large-scale, and 2 as good practice schemes.

By District, 9 schemes are in Ngoma, 6 schemes are in Rwamagana, 11+1 schemes are in Gisagara, 1 scheme is in Nyanza, 1 scheme is in Kayanza, 3 schemes are in Kirehe and 1 scheme is in Bugesera.

By type of irrigation scheme, 28 schemes are marshland type and 5 schemes are hillside type. The 5 schemes of hillside type are **Ngoma 22, Rwamagana 34, Nyanza 23, Kinoni 1 and Kinoni 2.**

The schedule of the survey is shown the table below.

Table 3.5 Schedule of Implemented Interview Survey

Title of Survey	District	Irrigation Scheme	Date of Visit
Baseline survey on target Districts (26)	Ngoma (9)	Gisaya	22 nd July, 2019
		Rwakaganza	24 th July, 2019
		Kinyamarebe (Binoni)	24 th July, 2019
		Ngoma 22*	22 nd July, 2019
		Mwanbu	22 nd July, 2019
		Nyaruvumu/Kibaya	23 rd July, 2019
		Rukizi/Kibaya	23 rd July, 2019
		Cyunuzi	23 rd July, 2019
		Gitinga	23 rd July, 2019
	Rwamagana (6)	Rugende	10 th July, 2019
		Rwamagana 34*	26 th July, 2019
		Bugugu	29 th July, 2019
		Cyimpima	29 th July, 2019
		Gashara	29 th July, 2019
		Cyuruhogo	29 th July, 2019
	Gisagara (11)	Agatare	18 th July, 2019
		Akaboti	17 th July, 2019
		Kigaga-Kabogobogo	18 th July, 2019
		Mwura	16 th July, 2019
		Gatare	16 th July, 2019
		Ngirya	16 th July, 2019
		Nyabuyogera	15 th July, 2019
		Nyakagezi	16 th July, 2019
		Rumira-Urukungu	17 th July, 2019
		Ruvungirana	15 th July, 2019
		Rwasave	15 th July, 2019
Comparative survey on typical irrigation scheme at medium/large-scale and good practice (7)	Nyanza (1)	Nyanza 23*	19 th July, 2019
	Kayonza (1)	Rugendabari	26 th July, 2019
	Kirehe (3)	Kinoni 1*	25 th July, 2019
		Kinoni 2*	25 th July, 2019
		Sagatare	25 th July, 2019
	Gisagara (1)	Cyili	16 th July, 2019
	Bugesera (1)	Rurambi	26 th July, 2019
Total		33	

*Hillside irrigation scheme



Figure 3.1 Location Map of Irrigation Scheme in Eastern Province

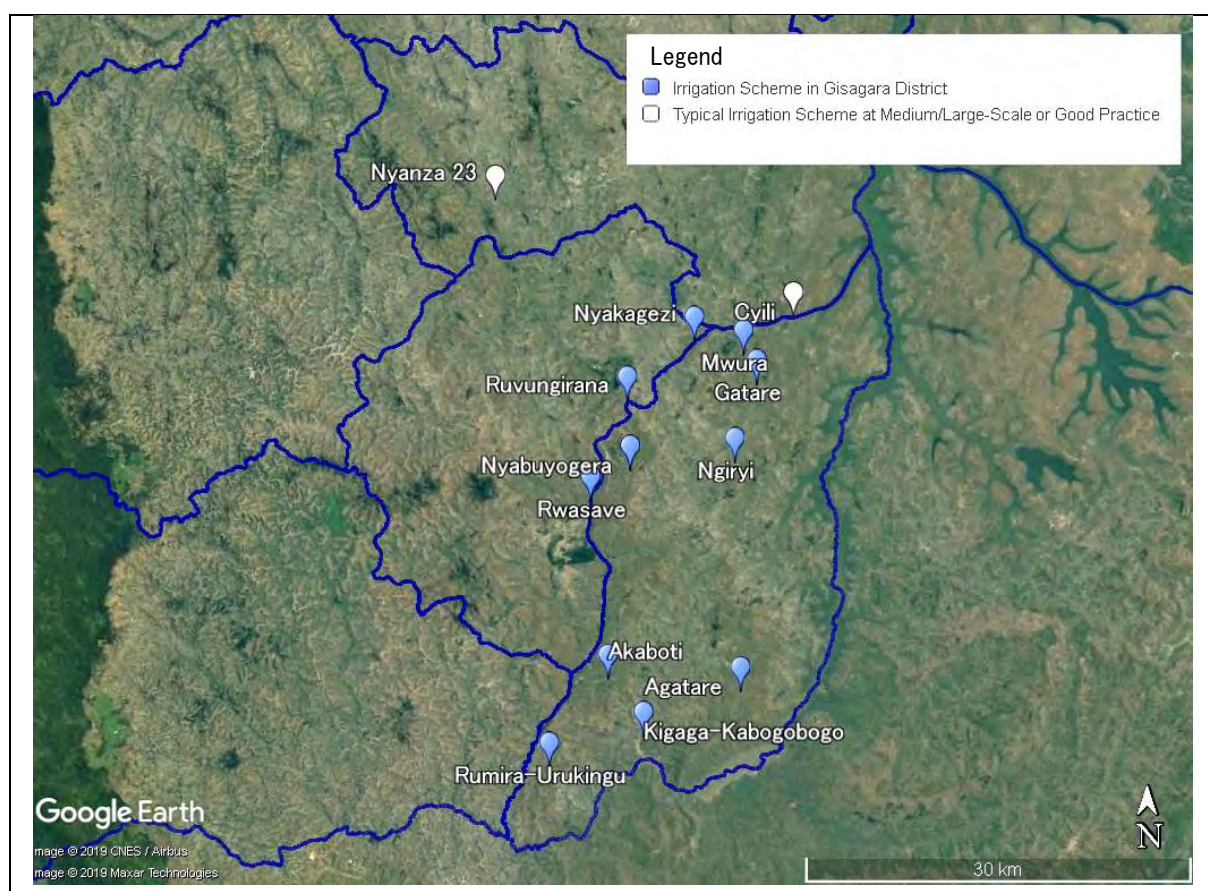


Figure 3.2 Location Map of Irrigation Scheme in Southern Province

The findings of the interview survey are summarised in the following parts. First, the general information on irrigation schemes and the formation of IWUO and cooperatives are described in part (1) and part (2). As explained below, the formation of IWUO and cooperative differs by each scheme, so secondly from part (3) to (6), the information of IWUO is summarised in terms of organisation, rules, finance, water management and O&M. Thirdly, in part (7), the information of cooperative is summarised especially from the perspective of farming.

(1) General Information of Irrigation Scheme

The total size of the area implemented the survey for the irrigation schemes is 5,645 ha, of which 4,630 ha is marshland irrigation schemes and 1,015 ha is hillside irrigation schemes. The average size of the area for marshland and hillside is 167 ha and 234 ha respectively. In the District level, the average size for irrigation schemes in Ngoma District is about 181 ha, in Rwamagana District is 173 ha, in Gisagara District is 88 ha, in typical irrigation schemes in Nyanza, Kayonza and Kirehe District are 150.2 ha, and good practice in Gisagara and Bugesera District is 674 ha respectively.

Among 33 irrigation schemes the Project implemented the survey, there are no IWUOs and cooperatives have common areas for farming.

18 irrigation schemes have a dam as the water source for the management of irrigation schemes. From the viewpoint of District, regarding the water resource, 4 out of 9 irrigation schemes in Ngoma District, 6 out of 6 irrigation schemes in Rwamagana District, 2 out of 11 irrigation schemes in Gisagara District, 5 out of 5 typical irrigation schemes, and 1 out of 2 good practice schemes have dam. The other irrigation schemes have river, spring, and pond as the water source.

Table 3.6 Basic Information on Irrigation Scheme

District	Irrigation Scheme	Total Area (ha)	Marshland (ha)	Hillside (ha)	Command Area (ha)	Common Area (ha)	Water Resource
Ngoma (9)	Gisaya	105	105	0	65	0	River, Spring
	Rwakaganza	42	42	0	42	0	River, Spring
	Kinyamarebe (Binoni)	138	138	0	42	0	River, Spring
	Ngoma 22*	300	35	265	300	0	Dam
	Mwanbu	135	135	0	135	0	Dam, Spring
	Nyaruvumu/Kibaya	560	560	0	480	0	River, Spring
	Rukizi/Kibaya	126	126	0	-	-	Spring
	Cyunuzi	94	94	0	-	-	Dam, River
Rwamagana (6)	Gitinga	130	130	0	130	0	Dam
	Rugende	506	506	0	506	0	Dam, River, Spring
	Rwamagana 34*	267	59	208	0	0	Dam
	Bugugu	32	32	0	32	0	Dam, Spring
	Cyimpima	75	75	0	75	0	Dam, Spring
	Gashara	47	47	0	47	0	Dam, Spring
	Cyaruho	111	111	0	111	0	Dam, Spring
	Agatare	59	59	0	59	0	Spring
-Gisagara (11)	Akaboti	65	65	0	65	0	Pond, Spring
	Kigaga-Kabogobogo	64	64	0	64	0	River
	Mwura	130	130	0	130	0	Dam, River, Spring
	Gatare						
	Ngirya	168	168	0	168	0	River, Spring
	Nyabuyogera	109	109	0	109	0	River
	Nyakagezi	-	-	-	-	-	-
	Rumira-Urukingu	83	83	0	83	0	River, Spring
	Ruvungirana	100	100	0	75	0	Spring
	Rwasave	101	101	0	-	-	Dam, River
Nyanza (1)	Nyanza 23*	301	0	301	471	0	Dam
Kayonza (1)	Rugendabari	150	150	0	150	0	Dam, Spring
Kirehe (3)	Kinoni 1*	120	14	106	-	-	Dam
	Kinoni 2*	135	0	135	135	0	Dam

District	Irrigation Scheme	Total Area (ha)	Marshland (ha)	Hillside (ha)	Command Area (ha)	Common Area (ha)	Water Resource
	Sagatare	45	45	0	-	-	Dam
Gisagara (1)	Cyili	347	347	0	347	0	Dam, River, Spring
Bugesera (1)	Rurambi	1000	1000	0	1000	0	River
	Total	5,645	4,630	1,015	4,919	0	

(2) IWUO and Cooperatives

Basically, IWUO is established based on an irrigation scheme, and cooperatives are formed by cultivating crops and/or irrigation schemes. However, as a result of the survey, the form of IWUO and cooperative differs by each irrigation scheme. For example, **Ngoma 22** has one IWUO and one cooperative for hillside, also a rice cooperative covers both **Ngoma 22** and **Mwanbu**; **Nyaruvubu/Kibaya**, **Rukizi/Kibaya** and **Cyunuzi** have one IWUO for each, and they have one cooperative; **Rugende** has one IWUO and three cooperatives; **Rwamagana 34** has one IWUO but no cooperative. Therefore, the Project conducted the interview survey with 24 IWUOs and 28 cooperatives in 33 irrigation schemes in total.

Among 24 IWUOs the Project surveyed, 11 IWUOs, less than 50% of the total, have been officially registered, and 8 IWUOs have signed Irrigation Management Transfer Agreement (IMTA). Although only registered IWUO can sign IMTA in principal, **Ngoma 22** and **Rugende** have already signed IMTA but not been registered yet. By District, 4 out of 7 IWUOs have been registered in Ngoma, 0 out of 2 IWUOs have been registered in Rwamagana, and 3 out of 10 have been registered in Gisagara including **Cyili** as good practice. In the typical irrigation schemes at medium/large-scale, in Nyanza, Kayonza and Kirehe District, 3 out of 4 IWUOs have been registered. On the other hand, among 28 cooperatives, 23 cooperatives, more than 80% of the total, have been registered.

Most members of IWUO and cooperative are overlapping, but the numbers of IWUO and cooperative differs by each scheme. The average numbers of IWUO and cooperative are 913 and 745 respectively.

Table 3.7 Formation of IWUOs and Cooperatives

District	Irrigation Scheme	Total Area (ha)	IWUO				Cooperative		
			No.	Registration	IMTA	No. of members	No.	Registration	No. of members
Ngoma (9)	Gisaya	105	1			325	1	✓	325
	Rwakaganza	42	1			588	1	✓	558
	Kinyamarebe (Binoni)	138	1	✓	✓	489	1	✓	809
	Ngoma 22*	300	1		✓	1082	2		936
	Mwanbu	135	-	-	-	-		✓	824
	Nyaruvubu/Kibaya	560	1	✓		420	1	✓	3,222
	Rukizi/Kibaya	126	1	✓	✓	738			
	Cyunuzi	94	1	✓	✓	653			
	Gitinga	130	-	-	-	-	1	✓	463
Rwamagana (6)	Rugende	506	1		✓	831	3	✓ (3)	395
	Rwamagana 34*	267	1			1,315	-		1,197
	Bugugu	32	-	-	-	-	1	✓	141
	Cyimpima	75	-	-	-	-	1	✓	250
	Gashara	47	-	-	-	-	1	✓	206
	Cyuruhogo	111	-	-	-	-	1	✓	567
Gisagara (11)	Agatare	59	1			535	1	✓	535
	Akaboti	65	1			380	1	✓	380
	Kigaga-Kabogobogo	64	1			2,756	1	✓	2,756
	Mwura	130	1			823	1	✓	803
	Gatare			✓	✓				
	Ngirya	168	1			816	1	✓	816
	Nyabuyogera	109	1			1,540	1		700
	Nyakagezi	-	(part of Cyili)				(part of Cyili)		
	Rumira-Urukungu	83	1			908	1	✓	908
	Ruvungirana	100	1			858	1		628

District	Irrigation Scheme	Total Area (ha)	IWUO				Cooperative		
			No.	Registration	IMTA	No. of members	No.	Registration	No. of members
	Rwasave	101	1	✓		1,500	1	✓	-
Nyanza (1)	Nyanza 23*	301	1	✓		923	1		35
Kayanza (1)	Rugendabari	150	-	-	-	-	1	✓	234
Kirehe (3)	Kinoni 1*	120	1	✓		264	-		-
	Kinoni 2*	135	1			357	1		487
	Sagatare	45	1	✓	✓	317	(part of other 2 scheme)		
Gisagara (1)	Cyili	347	1	✓	✓	1,408	1	✓	1,408
Bugesera (1)	Rurambi	1000	1	✓		2,096	1	✓	1,667
Total		5,645	24	11	8	21,922	28	23	20,855

(3) Organization and Administrative Management of IWUO

WAMCAB implemented the interview on the following items. The representative answers are extracted in the table below.

- ✓ Establishment of IWUO
- ✓ Satisfaction rate of IWUO (by the representatives)
- ✓ Members, chairperson, staffs of IWUO
- ✓ Structure of IWUO (lower groups, committee and its members)

Most of the IWUOs were formed in projects such as RSSP, QWMDP, etc. As supplementary information, the Ministerial Order regarding IWUO was issued in 2011.

22 IWUOs have a relatively good satisfaction rate; 14 IWUOs achieved more than 80% and 8 IWUOs achieved 60 to 80% satisfaction. **Ngoma 22** has low satisfaction compared to other schemes. Note that the satisfaction rate of IWUO is subjective evaluation from the representatives of IWUO, therefore the result does not necessarily show the satisfaction of all the IWUO members.

All 24 IWUOs have a chairperson who was elected by IWUO members or representatives, Management Committee, Audit Committee and Dispute Resolution Committee. Particularly, **Nyanza 23** and **Cyili** have a committee concerning procurement. Each IWUO is divided into several smaller (lower) groups called Zone or Block.

Table 3.8 Organisational Information of IWUO

Irrigation Scheme	Year of Establishment	No. of members	Satisfaction Rate of IWUO	Chairperson	Committees			Lower Group (No.)
					Management (No.)	Audit	Dispute Resolution	
Gisaya	2012	325	60 to 80%	✓	✓ (11)	✓	✓	✓ (3)
Rwakaganza	2014	588	60 to 80%	✓	✓ (5)	✓	✓	✓ (2)
Kinyamarebe (Binoni)	2015	489	more than 80%	✓	✓ (11)	✓	✓	✓ (5)
Ngoma 22*	2015	1082	less than 20%	✓	✓ (5)	✓	✓	✓ (NA)
Nyaruvumu/Kibaya	1998	420	more than 80%	✓	✓ (11)	✓	✓	✓ (2)
Rukizi/Kibaya	2012	738	more than 80%	✓	✓ (5)	✓	✓	✓ (3)
Cyunuzi	2006	653	more than 80%	✓	✓ (12)	✓	✓	✓ (4)
Rugende	2018	831	more than 80%	✓	✓ (11)	✓	✓	✓ (8)
Rwamagana 34*	2016	1,315	more than 80%	✓	✓ (5)	✓	✓	✓ (4)
Agatare	2016	535	60 to 80%	✓	✓ (11)	✓	✓	✓ (5)
Akaboti	2015	380	60 to 80%	✓	✓ (11)	✓	✓	✓ (5)
Kigaga-	2000	2,756	more than	✓	✓ (5)	✓	✓	✓ (10)

Irrigation Scheme	Year of Establishment	No. of members	Satisfaction Rate of IWUO	Chairperson	Committees			Lower Group (No.)
					Management (No.)	Audit	Dispute Resolution	
Kabogobogo			80%					
Mwura	2007	823	more than 80%	✓	✓ (14)	✓	✓	✓ (6)
Gatare								
Ngiriyi	1993	816	60 to 80%	✓	✓ (5)	✓	✓	✓ (3)
Nyabuyogera	2013	1,540	60 to 80%	✓	✓ (5)	✓	✓	✓ (10)
Rumira-Urukungu	2015	908	40 to 60%	✓	✓ (5)	✓	✓	✓ (10)
Ruvungirana	2015	858	more than 80%	✓	✓ (5)	✓	✓	✓ (6)
Rwasave	1981	1,500	more than 80%	✓	✓ (11)	✓	✓	✓ (12)
Nyanza 23*	2012	923	more than 80%	✓	✓ (5)	✓	✓	✓ (10)
Kinoni 1*	2015	264	more than 80%	✓	✓ (11)	✓	✓	✓ (11)
Kinoni 2*	2012	357	60 to 80%	✓	✓ (5)	✓	✓	✓ (14)
Sagatare	2009	317	more than 80%	✓	✓ (11)	✓	✓	✓ (4)
Cyili	2011	1,408	60 to 80%	✓	✓ (5)	✓	✓	✓ (5)
Rurambi	2012	2,096	more than 80%	✓	✓ (13)	✓	✓	✓ (6)
Total		21,922	-	24	24	24	24	24

(4) Governing Rules and Regulation of IWUO

WAMCAB implemented the interview on the following items. The representative answers are extracted in the table below.

- ✓ Internal Rules (By-laws): existence, procedure, contents, compliance rate, prohibited matters and sanctions
- ✓ Meeting of General Assembly and Management Committee: frequency, attendance rate, minutes taking, information sharing
- ✓ Employed staffs, properties, equipment
- ✓ Management system of staffs, properties, equipment
- ✓ Attendance of external meeting (DISC, Agricultural Forum)
- ✓ Dispute
- ✓ Training program, exchange visit and needs
- ✓ Visit from the governmental side

20 IWUOs have the internal rules (by-laws) created by themselves referring to other IWUO's rules or using a template. According to the interview, the contents of the rules differ by each IWUO, but all IWUOs who possess their internal rules completely get approvals from General Assembly and/or Management Committee (representative assembly). Except **Rwasave** scheme, the internal rules prescribe prohibited matters and its penalties. For instance, water stealing, damage to the structure, late or non-payment of water fee, etc., are prohibited, and fine, confiscation, reporting to the District are prescribed as sanction. Most of the rules can be changed based on the request from the members.

Regarding the meetings both inside and outside of IWUO, 20 IWUOs hold the General Assembly twice to four times in a year. 22 IWUOs hold the meeting of Management Committee twice up to thirteen times in a year. 9 IWUOs participate in DISC meeting about twice a year. The result of those meetings is shared with water users in different ways such as notice board, written memorandum, spoken, mobile phones, etc.

Almost all of the IWUOs have experienced training and/or exchange visit to other schemes in the past.

Only **Rwamagana 34** has no experience of training and exchange visits. The contents and target of the training vary with each IWUO. Furthermore, all IWUO have some requests on training related to organisational management, water management, O&M or farming.

Table 3.9 Information on Governance of IWUO

Irrigation Scheme	Internal Rules (By-laws)	Change of Internal Rules	Meeting during the last 12 months			Training and/or Visit	Visit from Govt. Side
			General Assembly	Management Committee	DISC		
Gisaya			2	4	-	✓	✓
Rwakaganza	✓	✓		2	-	✓	
Kinyamarebe (Binoni)	✓	✓	2	4	2	✓	✓
Ngoma 22*	✓	✓	4	6	-	✓	✓
Nyaruvumu/Kibaya	✓	✓	2	6	2	✓	
Rukizi/Kibaya	✓	✓	2	8	-	✓	
Cyunuzi	✓	✓	2	4	-	✓	✓
Rugende	✓	NA	2	8	-	✓	✓
Rwamagana 34*	✓			4	-		
Agatare	✓	✓	2	6	-	✓	✓
Akaboti	✓	✓	2	4	2	✓	✓
Kigaga-Kabogobogo	✓	✓	4		2	✓	✓
Mwura			2	4	2	✓	✓
Gatare						✓	✓
Ngiryi	✓	✓	2	4	2	✓	✓
Nyabuyogera	✓	NA	2	5	-	✓	✓
Rumira-Urukungu	✓	✓	2	3	-	✓	✓
Ruvungirana			2	12	-	✓	✓
Rwasave	✓	NA			-	✓	✓
Nyanza 23*	✓	✓	2	3	-	✓	✓
Kinoni 1*	✓	✓	3	3	-	✓	✓
Kinoni 2*	✓	✓	2	4	-	✓	✓
Sagatare	✓	✓	2	4	2	✓	
Cyili	✓	✓	3	4	2	✓	✓
Rurambi	✓	✓		13	3	✓	✓
Total	20		20	22	9	23	

(5) Financial Management of IWUO

WAMCAB implemented the interview on the following items. The representative answers are extracted in the table below.

- ✓ Bank account
- ✓ Water Fee: amount, collection rate, balance, collecting time and method
- ✓ Financial planning (budget), management and reporting
- ✓ Audit system
- ✓ Income source besides water fee

Except **Ngoma 22**, 23 IWUOs are collecting water fees. The rate of the payment differs by the scheme. There are 12 IWUOs who answered the payment rate as more than 80%. All 24 IWUOs have their own bank account, and some of them have more than two accounts. 23 IWUOs have cash book(s), 20 IWUO prepare annual budget, and 16 IWUOs make the annual financial report. Out of them, 15 financial reports were approved by General Assembly or Management Committee.

Table 3.10 Financial Information of IWUO

Irrigation Scheme	Water Fee	Rate of Payment	Bank Account	Cash Book	Annual Budget	Annual Report	approved
Gisaya	✓	60-80 %	✓	✓	✓	✓	✓
Rwakaganza	✓	40-60 %	✓	✓	✓	✓	
Kinyamarebe (Binoni)	✓	more than 80%	✓	✓	✓	✓	✓

Irrigation Scheme	Water Fee	Rate of Payment	Bank Account	Cash Book	Annual Budget	Annual Report	approved
Ngoma 22*	-	-	✓				
Nyaruvumu/Kibaya	✓	100%	✓	✓	✓	✓	
Rukizi/Kibaya	✓	more than 80%	✓	✓	✓	✓	✓
Cyunuzi	✓	more than 80%	✓	✓	✓	✓	✓
Rugende	✓	less than 20%	✓	✓	✓	✓	✓
Rwamagana 34*	✓	less than 20%	✓	✓			
Agatare	✓	60-80 %	✓	✓	✓	✓	✓
Akaboti	✓	60-80 %	✓	✓	✓	✓	✓
Kigaga-Kabogobogo	✓	100%	✓	✓	✓	✓	✓
Mwura	✓	100%	✓	✓	✓	✓	✓
Gatare							
Ngiriyi	✓	more than 80%	✓	✓	✓	✓	✓
Nyabuyogera	✓	more than 80%	✓	✓	✓		
Rumira-Urukungu	✓	40-60 %	✓	✓			
Ruvungirana	✓	less than 20%	✓	✓	✓	✓	✓
Rwasave	✓	more than 80%	✓	✓			✓
Nyanza 23*	✓	20-40 %	✓	✓	✓	✓	✓
Kinoni 1*	✓	less than 20%	✓	✓	✓		
Kinoni 2*	✓	20-40 %	✓	✓	✓		
Sagatare	✓	more than 80%	✓	✓	✓	✓	✓
Cyili	✓	100%	✓	✓	✓	✓	✓
Rurambi	✓	more than 80%	✓	✓			
Total	23	12 (more than 80%)	24	23	20	16	15

(6) Water Management and Operation and Maintenance

WAMCAB implemented the interview on the following items. The representative answers are extracted in the table below.

- ✓ Responsible for water management and O&M
- ✓ Irrigation map, water users list, water distribution plan
- ✓ Condition of actual water distribution, method of water distribution
- ✓ Water-related dispute, reason, resolution
- ✓ Problem and its cause for water distribution
- ✓ Maintenance inspection, maintenance plan, community work, and its record
- ✓ Measurement system of water discharge

23 IWUOs answered that the responsible organization for water management and O&M is IWUO. Only in **Ngoma 22**, the responsible organizations are Government/RAB and contracted SPs, not IWUO.

The numbers of IWUOs who have irrigation map, water users list and water distribution plan are 4, 6 and 12 respectively. Among 12 IWUOs who prepare the water distribution plan, 9 IWUOs are in Gisagara District including good practice scheme. Especially, **Ngiriyi** and **Cyili** have all the irrigation map, water users list and water distribution plan.

23 IWUOs have conducted maintenance inspections of the entire irrigation scheme, and 19 IWUOs have prepared maintenance plan during the last 12 months. Most of the IWUOs carry out the community work such as cleaning the canal and road more than once a month.

According to the survey, there are no IWUOs who conduct any measurement on water discharge.

Table 3.11 Information on Water Management and O&M of IWUO

Irrigation Scheme	Responsible	Irrigation Map	Water Users List	Water Distribution Plan	Maintenance Inspection	Maintenance Plan	Community Work
Gisaya	IWUO				✓	✓	✓
Rwakaganza	IWUO				✓	✓	✓
Kinyamarebe (Binoni)	IWUO				✓	✓	✓
Ngoma 22*	Govt., SPs				✓		✓
Nyaruvumu/Kibaya	IWUO			✓	✓	✓	✓
Rukizi/Kibaya	IWUO			✓	✓	✓	✓
Cyunuzi	IWUO				✓	✓	NA
Rugende	IWUO				✓	✓	NA
Rwamagana 34*	IWUO, SAIP				✓		NA
Agatare	IWUO			✓	✓	✓	✓
Akaboti	IWUO			✓	✓	✓	✓
Kigaga-Kabogobogo	IWUO		✓	✓	✓	✓	✓
Mwura	IWUO			✓	✓	✓	✓
Gatare							
Ngirya	IWUO	✓	✓	✓	✓	✓	✓
Nyabuyogera	IWUO, SPs			✓	✓	✓	✓
RumiraUrakingu	IWUO			✓		✓	✓
Ruvungirana	IWUO			✓	✓	✓	✓
Rwasave	IWUO				✓		NA
Nyanza 23*	IWUO				✓	✓	✓
Kinoni 1*	IWUO	✓	✓		✓		NA
Kinoni 2*	IWUO	✓	✓		✓		NA
Sagatare	IWUO				✓	✓	✓
Cyili	IWUO	✓	✓	✓	✓	✓	✓
Rurambi	IWUO, Govt.		✓	✓	✓	✓	✓
Total	-	4	6	12	23	19	NA

(7) Farming

WAMCAB implemented the interview on the following items. The representative answers are extracted in the table below.

- ✓ Crop calendar, land preparation, rice and vegetable seed, chemical fertilizer, organic manure, casual labour for farming, small and big agricultural tools, pests and disease, pesticides, crop rotation, mixed/multiple cropping, row spacing, crop residue, crop theft, post-harvest infrastructure, facility to store harvested, farming individually and collectively, extension service, marketing, key buyers, contract farming, access credit service, private company/investor business, production book.
- ✓ Cultivated area, yield and farm-gate price of the agricultural products in season A, B, and C.

According to the interview with cooperatives, the main crop in marshland is rice, however, several cooperatives in Gisagara District cultivate maize, beans, soybean, and vegetables even in marshland. The main crops in hillside are maize, beans, soybean, and vegetables including tomato, onion, etc.

In marshland schemes, mainly rice is produced in season A and season B with double-cropping. On the other hand, in hillside schemes, horticultural crops are mainly produced in season A, season B and season C with triple-cropping.

During season A, the average yield for rice is about 4.87 tons per ha in marshland irrigation schemes compared with 4.04 tons per ha in 2019 reported by NISR. The average yield for maize is about 3.27 tons per ha in marshland and hillside compared with 1.53 tons per ha in 2019 reported by NISR.

During season B, the average yield for rice is about 5.14 tons per ha in marshland irrigation schemes

compared with 3.96 tons per ha in 2019 reported by NISR. The average yield for maize is about 2.0 tons per ha in marshland and hillside compared with 1.23 tons per ha in 2019 reported by NISR.

Table 3.12 Crop Yield by Seasons

Irrigation Scheme	Season A		Season B		Season C	
	Crop	Yield (kg/ha)	Crop	Yield (kg/ha)	Crop	Yield (kg/ha)
Gisaya	Rice	4,500	Rice	4,500		
Rwakaganza	Rice	4,000	Rice	4,000		
Kinyamarebe (Binoni)	Rice	6,000	Rice	6,000		
Ngoma 22*	Beans	600	Maize, Beans, etc	1,000 700	Vegetable, etc.	10,000
Mwanbu	Rice	6,000	Rice	6,000		
Nyaruvumu/Kibaya	Rice	5,200	Rice	5,200		
Rukizi/Kibaya	N/A	N/A	N/A	N/A	N/A	N/A
Cyunuzi	N/A	N/A	N/A	N/A	N/A	N/A
Gitinga	N/A	N/A	N/A	N/A	N/A	N/A
Rugende	Rice, Maize, Vegetable	3,979 2,152 450	Rice, Soybean, Vegetable	3,862 400 450	Vegetable	450
Rwamagana 34*	N/A	N/A	N/A	N/A	N/A	N/A
Bugugu	Rice	5,000	Rice	5,000		
Cyimpima	Rice	4,700	Rice	4,700		
Gashara	Rice	5,000	Rice	5,000		
Cyuruhogo	Rice	4,840	Rice	4,840		
Agatare	Rice	2,200	Rice	2,300		
Akaboti	Rice, Maize	5,000 3,000	Rice, Maize	5,000 3,000	Vegetable	20,000
Kigaga-Kabogobogo	Rice	5,000	Rice	5,000		
Mwura	Rice	6,000	Rice	6,000		
Gatare						
Ngiriyi	Rice	5,500	Rice	5,800		
Nyabuyogera	Maize	2,500	Beans, Tomato, etc.	1,500 15,000		
Nyakagezi	N/A	N/A	N/A	N/A	N/A	N/A
Rumira-Urukungu	Rice, Maize	3,700 4,500	Beans, Vegetable	2,000 4,000	Irish potato, Vegetable	7,000 8,000
Ruvungirana	Maize	3,800	Soybean	500	Vegetable	30,000
Rwasave	Rice	6,000	Rice	7,000		
Nyanza 23*	Vegetable, Chili	10,000 8,000	Chili, etc.	8,000	Chili	8,000
Rugendabari	Rice, Maize	4,500 3,000	Rice, Beans	3,900 1,500		
Kinoni 1*	N/A	N/A	N/A	N/A	N/A	N/A
Kinoni 2*	Maize	4,000	Beans	1,200	Onion, Tomato	8,800 31,280
Sagatare	Rice	5,700	Rice	7,100		
Cyili	Rice	4,500	Rice	6,700		
Rurambi	Rice	5,000	Rice	5,000		

Crop calendar before irrigation is prepared by 26 out of 29 cooperatives, besides most cooperatives share the calendar with IWUO members. Chemical fertilizers are used by almost all the farmers in all marshland and hillside irrigation schemes during the cultivation of rice, maize, beans, vegetables, etc. In contrast to the utilization of chemical fertilizer, organic manure is hardly used by cooperatives (14 out of 29 cooperatives use organic manure below 25%). Almost all the cooperatives and farmers implemented the survey use chemical pesticides to prevent pests and diseases such as insects, mildew, bacteria, virus, etc. Regarding the post-harvest infrastructure, most cooperatives have some infrastructure such as drying yard, crop storage, and machine to prevent food losses.

Table 3.13 Information on Farming of Cooperative

Irrigation Scheme	Crop Calendar	Fertilizer	Organic Manure	Pesticide	Crop residue for farming	Post-harvest infra. **
Gisaya	✓	Over 75%	Below 25%	Over 75%	Below 25%	D, C
Rwakaganza	✓	Over 75%	Below 25%	Over 75%	Below 25%	C
Kinyamarebe (Binoni)	✓	Over 75%	50-75%	Over 75%	Over 75%	D, C
Ngoma 22		50-75%	50-75%	Over 75%	50-75%	D, C, O
Mwanbu	✓	Over 75%	Below 25%	Over 75%	Below 25%	DY
Nyaruvumu/Kibaya	✓	Over 75%	Below 25%	Over 75%	25-50%	DY, CS
Rukizi/Kibaya	N/A	N/A	N/A	N/A	N/A	N/A
Cyunuzi	N/A	N/A	N/A	N/A	N/A	N/A
Gitinga	✓	Over 75%	Below 25%	N/A	N/A	N/A
Rugende	✓	Over 75%	Over 75%	Over 75%	Below 25%	DY, CS, M
Rwamagana 34	N/A	N/A	N/A	N/A	N/A	N/A
Bugugu		Over 75%	Below 25%	Over 75%	Below 25%	DY, CS
Cyimpima	✓	Over 75%	Below 25%	Over 75%	25-50%	DY
Gashara	✓	Over 75%	Below 25%	Over 75%	Below 25%	DY, M
Cyaruhogo	✓	Over 75%	Below 25%	Over 75%	Below 25%	DY, CS, M
Agatare	✓	Over 75%	Below 25%	Over 75%	25-50%	
Akaboti	✓	Over 75%	25-50%	Over 75%	Below 25%	
Kigaga-Kabogobogo	✓	Over 75%	25-50%	Over 75%	Over 75%	DY, CS, M
Mwura	✓	Over 75%	25-50%	Over 75%	50-75%	DY, CS
Gatare						
Ngiryi	✓	Over 75%	Below 25%	Over 75%	50-75%	DY, CS
Nyabuyogera	✓	Over 75%	Over 75%	Over 75%	Over 75%	DY
Nyakagezi	N/A	N/A	N/A	N/A	N/A	N/A
Rumira-Urukingu	✓	Over 75%	Over 75%	Over 75%	Below 25%	
Ruvungirana	✓	Over 75%	Over 75%	Over 75%	Below 25%	
Rwasave	✓	Over 75%	25-50%	Over 75%	25-50%	CS
Nyanza 23	✓	Over 75%	Over 75%	Over 75%	Over 75%	O
Rugendabari	✓	Over 75%	Below 25%	Over 75%	50-75%	DY
Kinoni 1	✓	N/A	N/A	N/A	N/A	N/A
Kinoni 2	✓	Over 75%	50-75%	Over 75%	50-75%	CS
Sagatare	✓	N/A	N/A	N/A	N/A	N/A
Cyili	✓	Over 75%	Below 25%	Over 75%	Below 25%	DY, CS
Rurambi	✓	Over 75%	Below 25%	Over 75%	25-50%	DY, CS

**Post-harvest infrastructure: DY=Drying yard, CS=Crop storage, M=Machine, O=Other

3.4 Field Survey

At the same time as the Interview Survey conducted during July 2019, WAMCAB team also made an additional survey on the source of water to the scheme, the status of the existing irrigation facilities and the extent of the scheme by preparing rough irrigation map of the scheme. The location of developed springs within the scheme and the amount of water from these springs is also estimated by measuring the discharge from the spring. The result of the summary of the existing condition of irrigation scheme in Gisagara, Rwamagana and Ngoma Districts is presented below.

3.4.1 Gisagara District

In Gisagara District a total of 10 schemes were visited during the baseline survey. In addition to the basic data collection on the schemes; source of water for the scheme and the status of irrigation infrastructures were also visited. The result of the field survey is summarized below:

(1) Agatare Scheme

1) Rough Scheme Map

The rough irrigation map of the scheme is prepared and presented below including the positions of diversion points and developed springs.

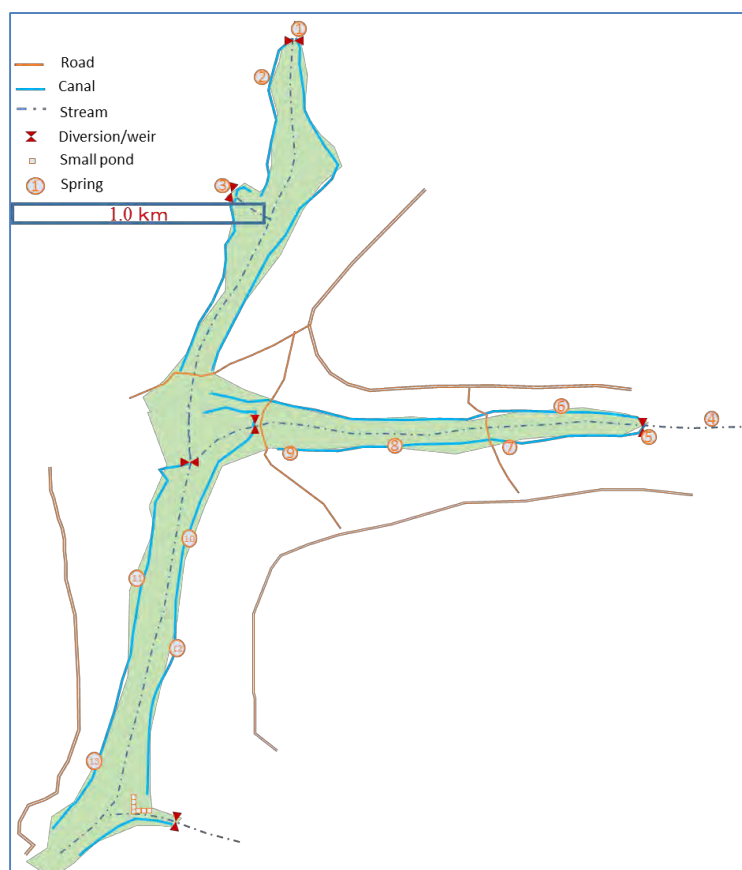


Figure 3.3 Rough Irrigation Map of Agatare

2) Source of water

The main source of water in the scheme is the marshland itself (groundwater). In addition, there are about 13 developed springs scattered along the scheme that serves as household consumption and source of supplementary water for irrigation. Most of the water from these spring flows into the nearby plots or the natural stream (drainage system of the scheme) on which the diversion structures are set. The quantity of water got from these springs cannot be considered as a reliable source of irrigation to divert and convey into the canal system, especially around upstream part of the scheme.

The discharge from each of these developed springs was estimated during Field Survey (in the month of July 2019, considered as base flow). The discharge estimation per each developed spring is summarized in the following table.

Table 3.14 Discharge Estimation of Developed Spring in Agatare

Position (refer map below)	Discharge (lt/sec)
1	0.34
2	0.21
3	0.74
4	1.37
5	0.48
6	0.14
7	0.20
8	0.19
9	0.23
10	0.08
11	0.41
12	0.08
13	0.11

3) Existing Irrigation facilities

The scheme is located inside two valleys covering over 5 km length of marshland with a width ranging from 50 to 200 m. In the scheme there are around 7 water diversion points. Some of these diversions are made of concrete or masonry structure (by QWMDP project) and some are locally made by farmers themselves. Canals are also set on both sides of the marshland serving mainly as flood controlling facilities than irrigation canals. Some of the photos of developed springs are also presented below.



(2) Akaboti Scheme

1) Rough Scheme Map

The rough irrigation map of the scheme is prepared and presented below including the positions of diversion points, developed springs and farm pond. Some of the photos of developed springs and farm pond are also presented below

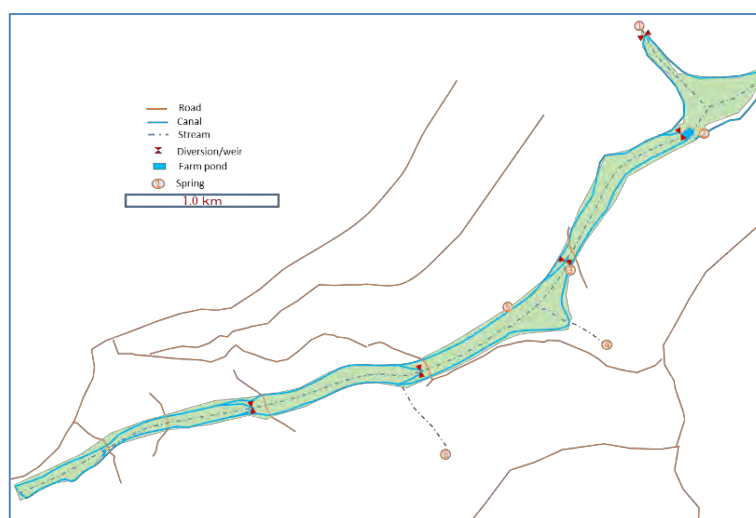


Figure 3.4 Rough Irrigation Map of Akaboti

2) Source of water

Similar to Agatare scheme, the main source of water in Akaboti scheme is the marshland itself (groundwater). In addition, there are about 7 developed springs and one farm pond constructed next to the existing spring.

The discharge from each of these developed springs was estimated during the baseline survey (in the month of July 2019, considered as base flow). The discharge estimation per each developed spring is summarized in the following table.

Table 3.15 Discharge Estimation of Developed Spring in Akaboti

Position (refer map below)	Discharge (lt/sec)
1	0.66
2	0.12
3	0.25
4	0.53
5	0.21
6	0.27
7	0.22

3) Existing Irrigation facilities

The scheme covers over 7 km length of marshland with a width ranging from 50 to 200 m. In the scheme, there are around 5 water diversion points. Some of these diversions are made of concrete or masonry structure (by QWMDP project) and some are locally made by farmers themselves. Canals are also set on both sides of the marshland serving mainly as flood controlling facilities than irrigation canals.



(3)Kigaga-Kabogobogo Scheme

1)Rough Scheme Map

The rough irrigation map of the scheme is prepared and presented below including the positions of weirs, water diversion points and the existing lake.

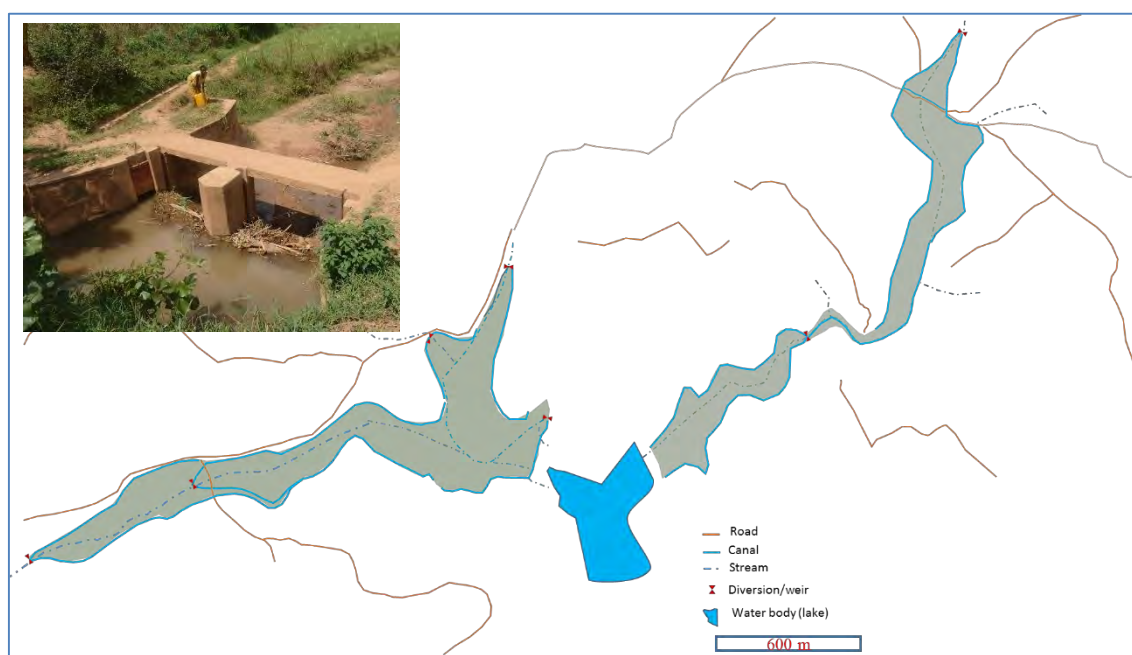


Figure 3.5 Rough Irrigation Map of Kigaga-Kabogobogo

2) Source of water

The Kigaga-Kabogobogo Scheme consists of two marshlands flowing toward a lake, southward and eastward respectively. The main source of water to this scheme is the existing three perennial rivers flowing into marshland. The rivers bring a huge amount of sediment into the scheme.

3) Existing Irrigation facilities

There are mainly three diversion weirs constructed on the three rivers flowing into the scheme. One of the weirs is totally broken by the flood of 2019 and is not functional. In addition, huge part of the marshland is filled with sediment transported by the flood in 2016.



(4)Gatare Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the irrigation scheme is presented below. The map shows the position of water diversion points, developed springs and the position of reservoir.

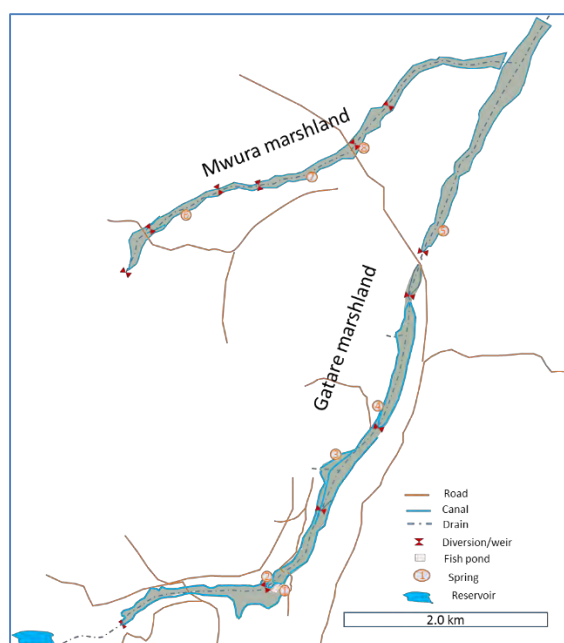


Figure 3.6 Rough Irrigation Map of Mwura and Gatare

2) Source of water

This scheme covers two marshlands namely: Gatare and Mwura. The two marshlands have different sources of water such as Mushaduka reservoir, 8 developed springs and the wetland (groundwater). A part of Mwura marshland is lacking enough water mainly during dry season.

3) Existing Irrigation facilities

The scheme covers over 14 km length of the valley with an average width of less than 50 m. A reservoir dam (Mushaduka dam) located about 500 m above the first diversion weir is one of the main irrigation facilities in the scheme. A total of 12 water diversion weirs are set in the scheme. The canals set on both sides of the marshland serve to convey water to the field and protect flood from the hillsides.



(5) Ngiriyi Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below showing the position of water diversion points and existing canals. The positions of developed springs are also indicated in the map.

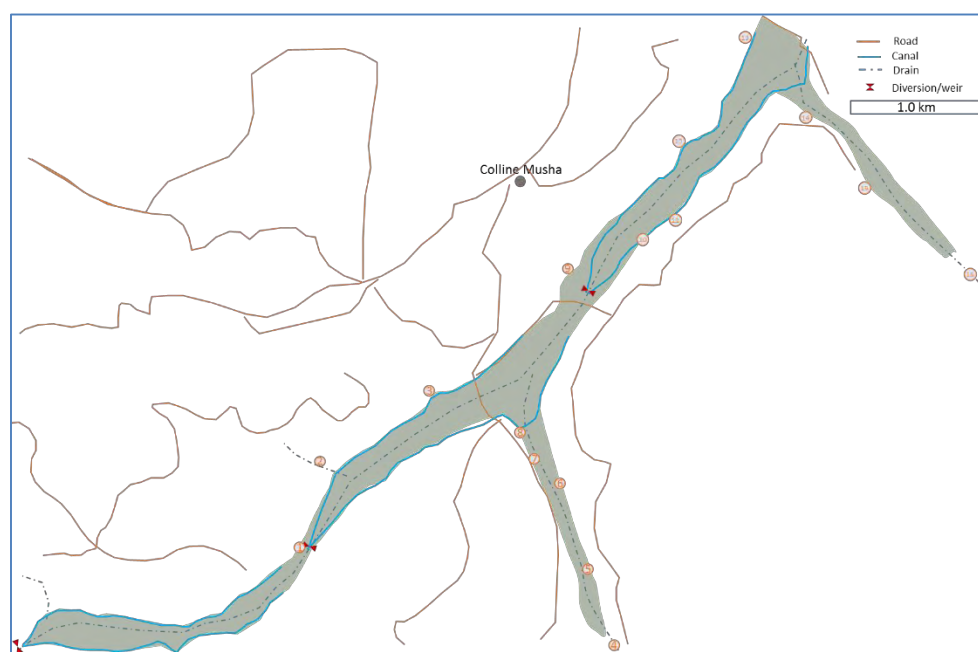


Figure 3.7 Rough Irrigation Map of Ngiriyi

2) Source of water

This scheme covers one main marshland of around 6 km long and two small valley lands with about 2 km long each. The source of water to the main marshland of this scheme is a perennial river and springs. The river carries too much sediment to the extent that it covers the first weir constructed in 1991 by the French Government.

3) Existing Irrigation Facilities

A total of three diversion points are set by the farmers along the perennial river. The old diversion weirs constructed in 1991 are covered by sediment and are not functional. Canal networks are also seen in the scheme. A locally made diversion point on the left main canal constructed by

Smallholder Market Oriented Agriculture Project (SMAP) as a demonstration facility.



(6) Nyabuyogera Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below showing the position of water diversion points and that of developed springs in the scheme.

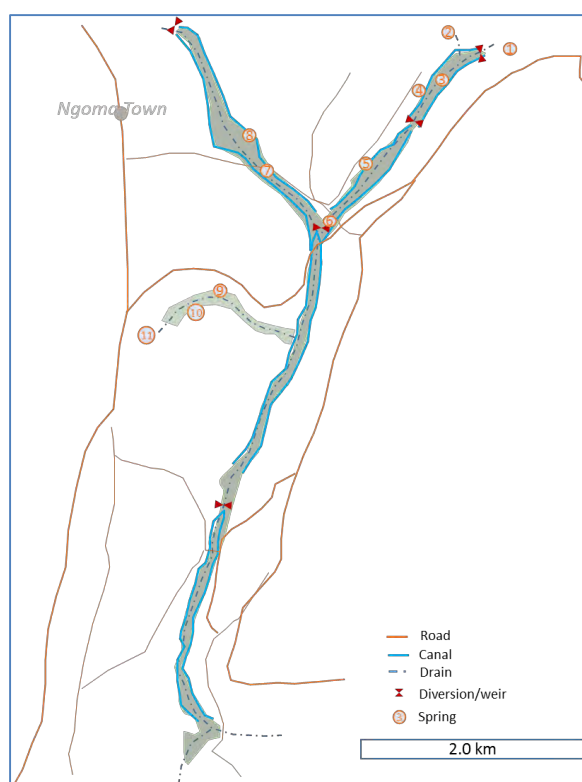


Figure 3.8 Rough Irrigation Map of Nyabuyogera

2) Source of water

The scheme has a relatively small catchment area (about 10 km² at the first diversion weir), that cannot produce sufficient water to irrigate 109 ha of command area. However, there are a total of 12 developed springs exists in the two valleys of Nyabuyogera marshland that flows into the stream.

At the time of the survey, there was no water flowing inside the stream especially at upstream of the scheme where the first diversion weir structure is set by QWMDP project. Generally, the source of water to the scheme is springs and groundwater. The farmers in the scheme prepare the land in such a way that they dig a trench around each plot of land (heap-levelled soil) and collect water from underground and spring and hand-irrigate the crop planted on the heap-levelled soil as indicated in the picture below.



The estimated discharge of developed springs is presented in the table below (the position of each spring is shown in the map). It is noted that the discharge at position number 3 (3-1 and 3-2) is from broken pipes that comes from springs and was connected to a water chamber that conveys water to a water storage tank (downstream) to supply water to the public (see photo below).

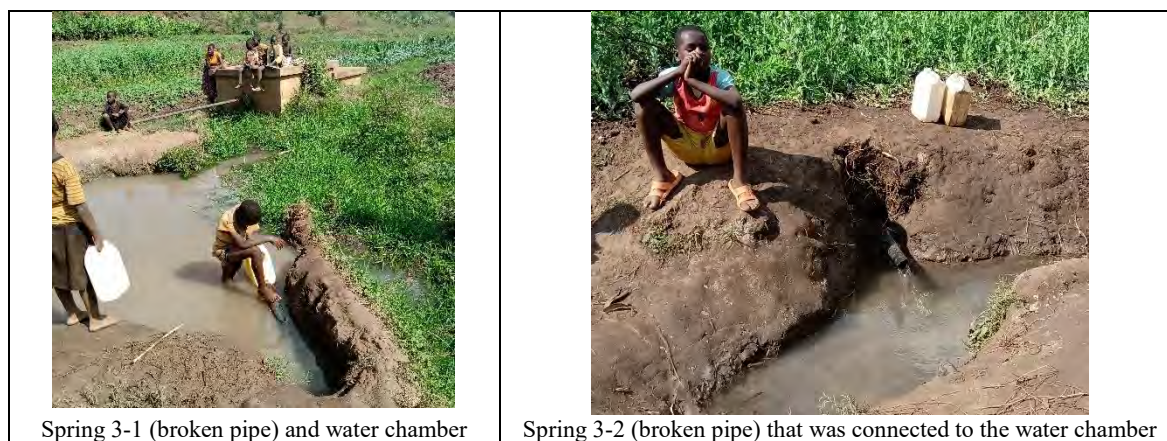


Table 3.16 Discharge Estimation of Developed Spring in Nyabuyogera

Position (refer map below)	Discharge (lt/sec)
1	0.21
2	0.10
3-1	0.53
3-2	1.55
4	0.23
5	0.21
6	0.10
7	0.15
8	1.20
9	0.64
10	1.16
11	0.79

3) Existing Irrigation Facilities

There are a total of 5 water diversion points in the scheme. Some are installed by QWMDP project and some by the farmers themselves. Technically speaking, the diversion weir that has been set at the upstream of the scheme has no purpose as such for an irrigation system since there is no water in the stream to divert to the field. However, the diversion weirs that have been set downstream of the scheme help divert the water collected from the springs and groundwater and flowing in the stream.

Two sets of canals also run on the left and right sides of each diversion weir. The canal serves to convey irrigation water to the field and protect the field from flood that comes the hill on both sides of the marshland.

(7) Cyili Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below. The position of water diversion points and canal networks in the scheme is also indicated in the map.

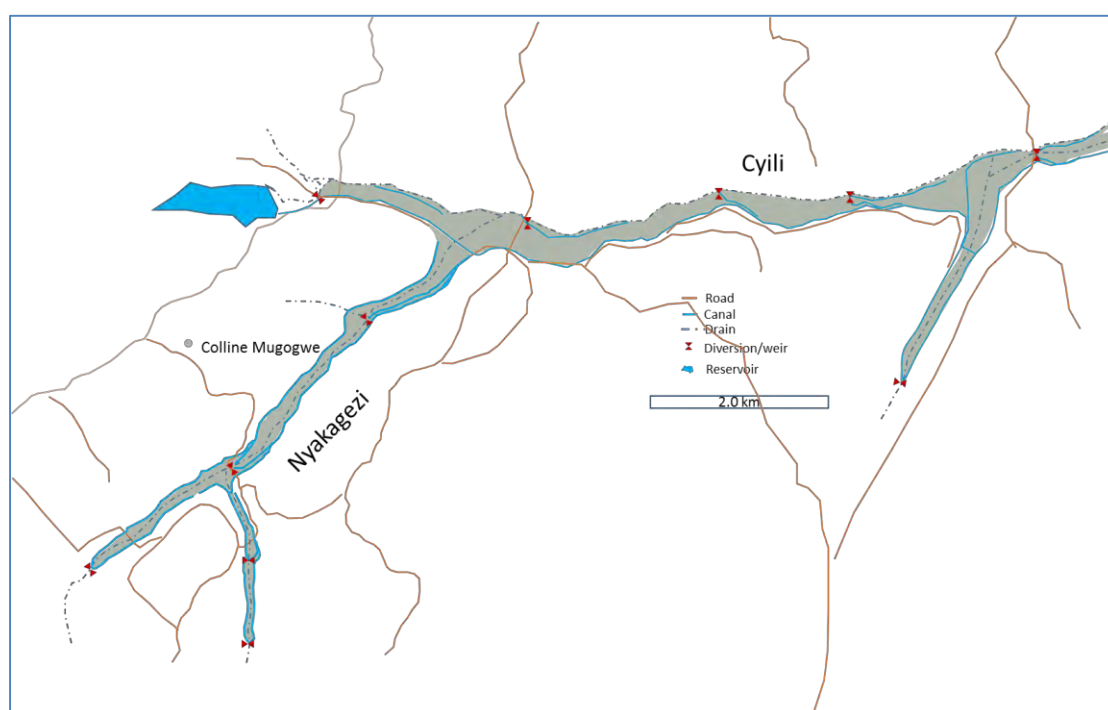


Figure 3.9 Rough Irrigation Map of Cyili and Nyakagezi

2) Source of water

Cyili Irrigation Scheme covers two marshlands namely: Cyili and Nyakagezi. The two marshlands have different sources of water such as Cyili reservoir, streams, springs and the wetland (groundwater). The stream on Nyakagezi marshland has good water potential as its catchment is bigger (22 km²) compared to the command area.

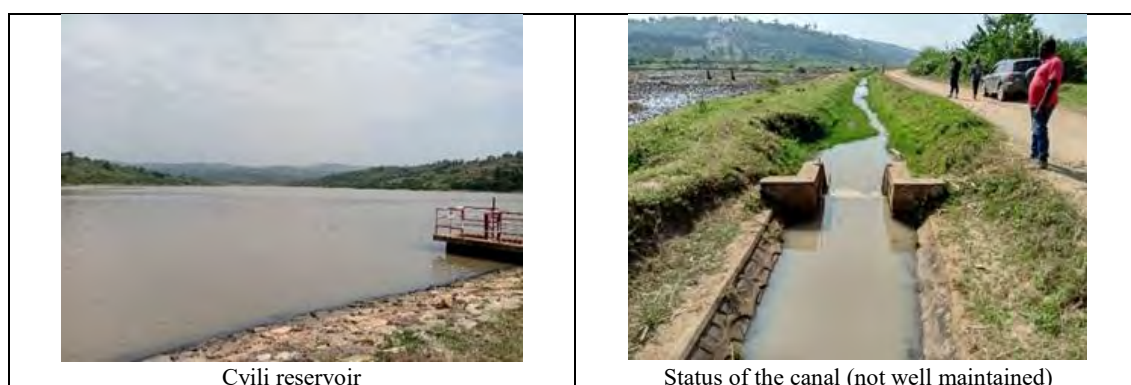
3) Existing Irrigation Facilities

In addition to the reservoir dam (Cyili reservoir), there are around 11 water diversion points in the scheme. Since Cyili irrigation scheme is selected as a successful IWUO site, no detailed survey was done on the existing springs in the scheme.

There are many turnouts along the main canal. The status of the canal shows that maintenance is not well conducted by the IWUO.

Financially strong IWUO exists in the scheme helped by a manager hired by IWUO. Discussions made with the manager found out that the manager is focused only on the financial management of

water fee contribution. They lack the basic concept of irrigation facility management and require training on the O&M of irrigation scheme.



(8) Rumira-Urukingu Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented in the map below. The location of each developed springs and water diversion points are indicated in the map below.

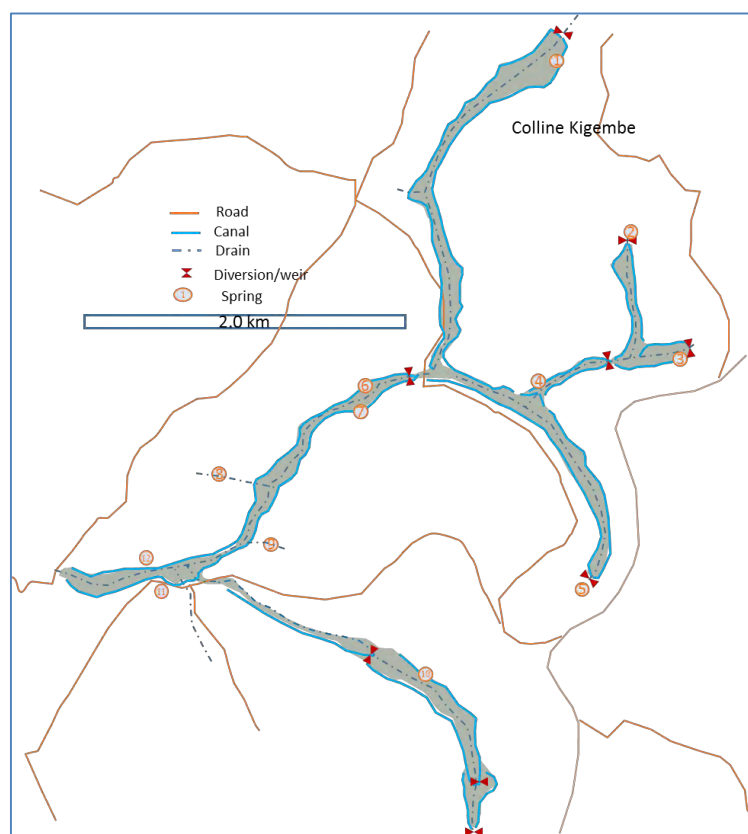


Figure 3.10 Rough Irrigation Map of Rumira-Urukingu

2) Source of Water

This scheme has a very small catchment area (about 4 km²) that is unable to produce enough water to irrigate the command area of 83 ha as indicated in the report of QWMDP report. The major source of water is the existing springs and the groundwater (marshland). The discharge estimated on the existing developed springs is presented in the table below.



Table 3.17 Discharge Estimation of Developed Spring in Rumira-Urukungu

Position (refer map below)	Discharge (lt/sec)
1	0.10
2	0.17
3	0.09
4	0.10
5	0.68
6	0.03
7	0.10
8	0.85
9	0.01
10	0.01
11	0.01

3) Existing Irrigation Facilities

The scheme mainly covers four valleys (marshland) interconnected to each other. In this scheme, there are around 9 water diversion points distributed inside the marshland. In addition, 11 developed springs exist in the scheme. The canals set on both sides of the marshland mainly serve as flood protection facilities.

(9)Ruvungirana Irrigation Scheme

1) Rough Scheme Map

The scheme consists of four valleys (marshland) interconnected to each other. The rough sketch of the scheme is presented below. The map also includes the position of developed springs, water diversion points and the existing canal networks.

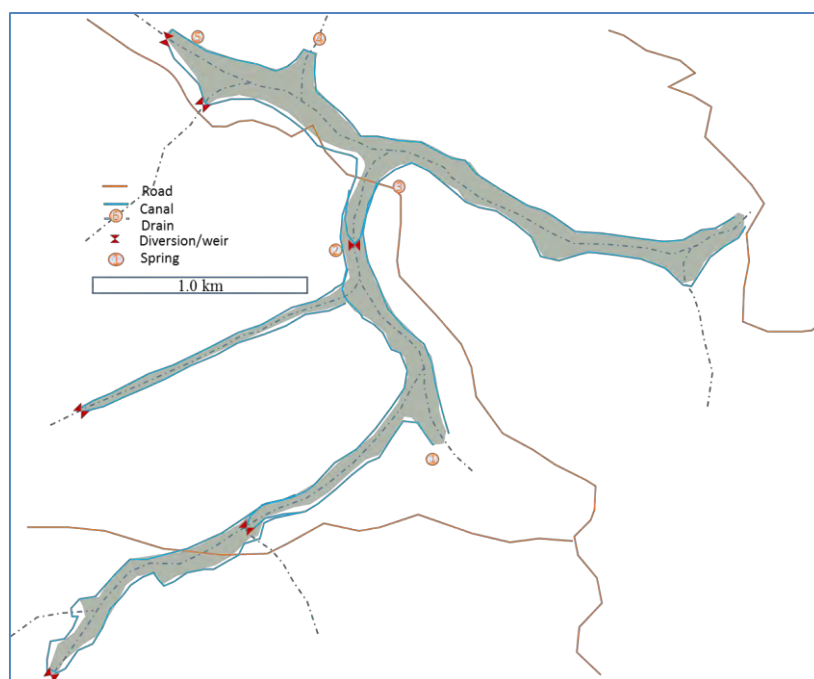


Figure 3.11 Rough Irrigation Map of Ruvunginana

2) Source of Water

The catchment area of the scheme is about 6 km² which is relatively small to produce a sufficient amount of water to irrigate the command area (77 ha) of the scheme. The main source of water to the scheme is the existing five developed springs and the groundwater (marshland). The discharge estimated from each spring is presented in the table below.

Table 3.18 Discharge Estimation of Developed Spring in Ruvungirana

Position (refer map below)	Discharge (lt/sec)
1	0.11
2	0.52
3	0.55
4	0.09
5	0.12

3) Existing Irrigation Facilities

There are around 6 water diversion points in the scheme constructed by QWMDP project or the farmer themselves. Most of the diversions are not functional as there is no water in the stream to divert, especially at the upstream of each valley. Most of the canal networks built in the scheme are not functioning as planned. Some of the pictures of the facilities are presented in the table below.





(10)Rwasave Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is showing the position of reservoirs, diversion points, developed springs and main canal network.

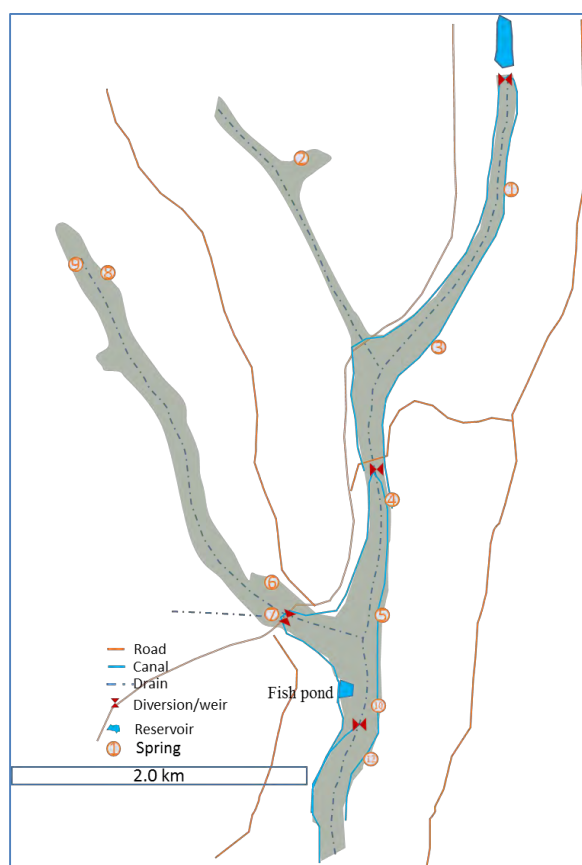


Figure 3.12 Rough Irrigation Map of Rwasave

2) Source of Water

Rwasave irrigation scheme consists of three sets of marshlands which has a different source of water. The major part of the marshland has a reservoir as a source of water developed by RSSP. The sources of water to the other marshlands are the existing perennial stream, developed springs and groundwater. The estimated discharge of developed spring is summarized in the table below.

Table 3.19 Discharge Estimation of Developed Spring in Rwasave

Position (refer map below)	Discharge (l/sec)
1	0.48
2	0.26
3	0.42
4	0.28
5	0.15
6	0.30
7	0.40
8	0.31
9	0.27
10	0.30
11	0.47
12	0.31

3) Existing Irrigation Facilities

In addition to the reservoir dam, the scheme has a total of four water diversion facilities and around 12 km long canal on both sides of the marshland. In addition, around 12 developed springs are installed inside the scheme to supply portable water to the community which are also used to irrigate the field around the springs. Some of the views of the irrigation facilities are presented below.



Developed spring

Main canal

3.4.2 Rwamagana District

Around three schemes were visited during this Field Survey in Rwamagana District. During this Field Survey on the status of irrigation facilities, other infrastructures were also surveyed. The brief explanation of these schemes is presented below.

(1) Rugende Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below which includes the position of the irrigation infrastructures

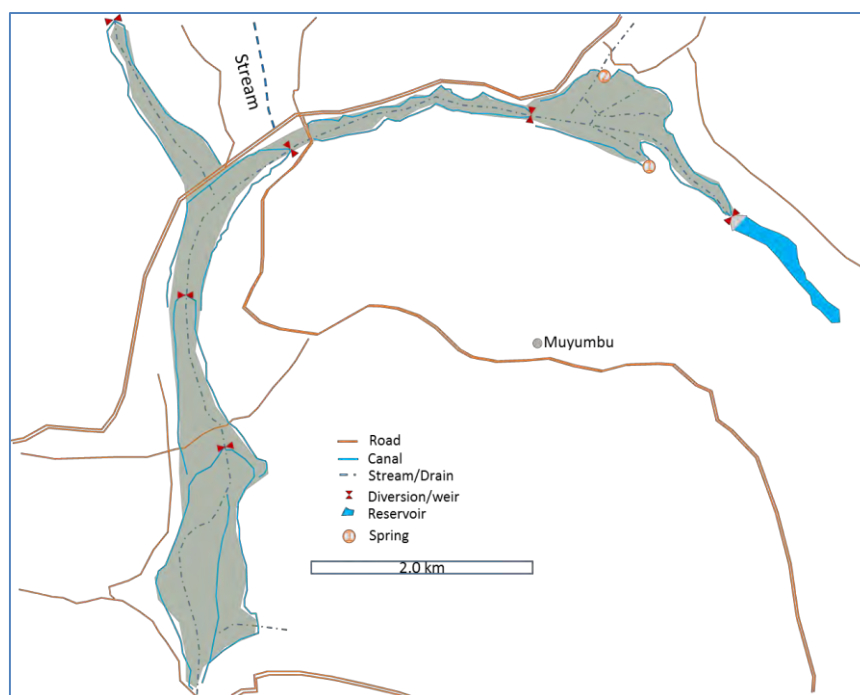


Figure 3.13 Rough Irrigation Map of Rugende

2) Source of Water

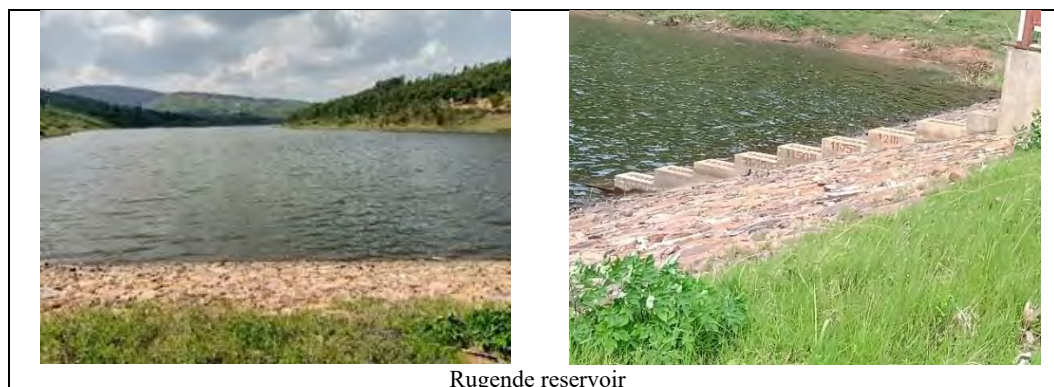
The main source of Rugende irrigation scheme is a reservoir constructed by RSSP in 2018. There is also a perennial stream that flows into the scheme at about 4 km downstream of the dam and developed springs that supply water to the field around. The estimated discharge from the springs and stream is tabulated below.

Table 3.20 Discharge Estimation of Developed Spring in Rugende

Position (refer map below)	Discharge (l/sec)
1	1.14
2	0.59
Stream (estimated by floating)	47.00

The farmers at the upstream of the scheme produce vegetables, those in the middle area produce rice and downstream farmers produce maize and beans. The rice producers are organized into one cooperative and a women association (who are owned by politicians and are not part of IWUO and not contributing to water fee).

There is a strong request from IWUO management committee for training on water management, O&M and the purpose of IMTA.



Rugende reservoir



3) Existing Irrigation Facilities

A total of 6 water diversion points exist inside the scheme divert water from the stream/drain to the field. At each diversion point, two canals are set on the left and right sides of the marshland to convey water to the field. In addition, two developed springs also exist inside the scheme for the purpose of supplying water to household consumption.

(2) Rwamagana-34 Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the irrigation scheme is presented below.

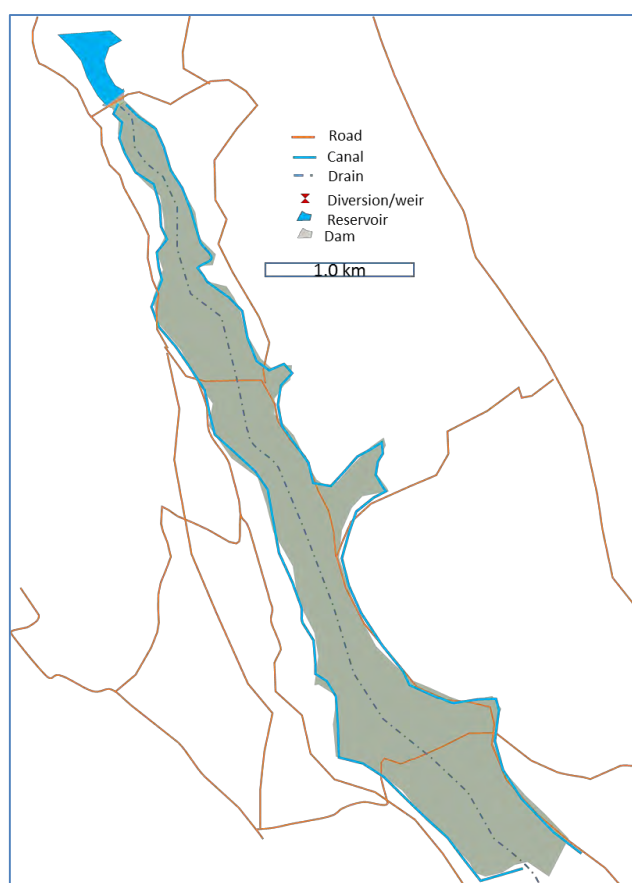


Figure 3.14 Rough Irrigation Map of Rwamagana 34

2) Source of Water

Rwamagana-34 irrigation scheme is a hillside irrigation scheme developed by LHW. The main source of irrigation water is a reservoir dam constructed in 2018. Presently Sustainable Agricultural

Intensification and Food Security Project (SAIP) is engaged in the capacity building of IWUO and cooperative.



Reservoir

3) Existing Irrigation Facilities

In addition to the reservoir dam, there are two lined canals set on the left and right side of the hill running for over 12 km long. Along these two canals, a turnout is set at every 100 m interval which is connected to a number of hydrant from where the farmers connect flexible pipes to irrigate their land.

(3)Rwamagana Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below indicating the four marshlands and the location of reservoir dams under construction.

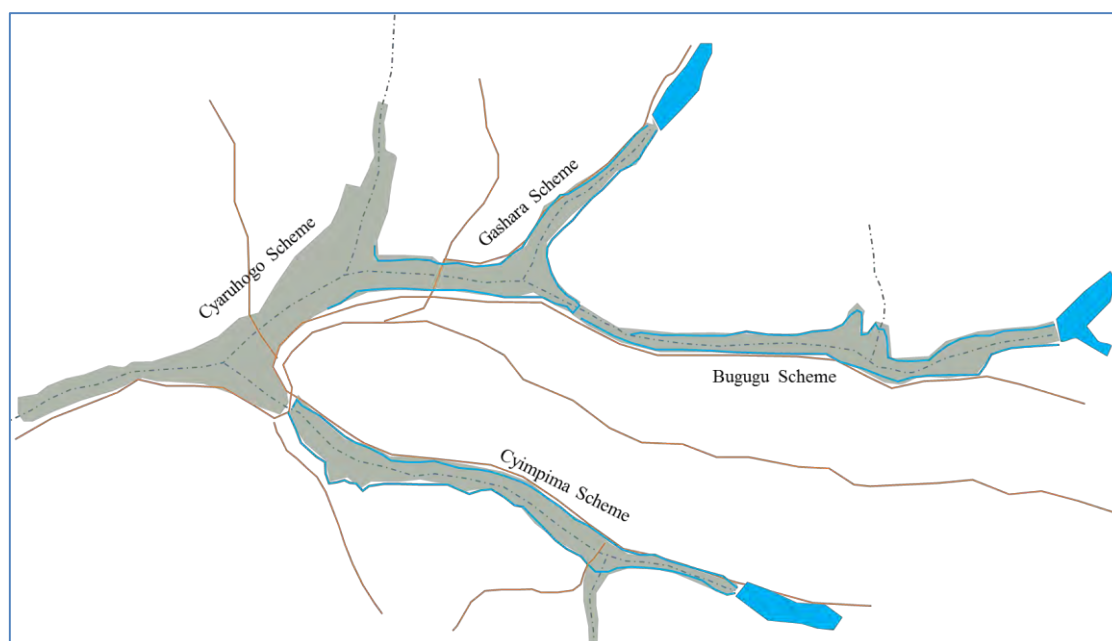


Figure 3.15 Rough Irrigation Map of Rwamagana (Bugugu, Cyimpima, Gashara and Cyaruhogo)

2) Source of Water

Rwamagana Irrigation Scheme consists of four marshlands namely: Bugugu, Cyimpima, Gashara and Cyaruhogo. The farmers producing rice in these four marshlands are organized into four different cooperatives. The main sources of water to these schemes are the existing three old reservoirs located at Bugugu, Cyimpima and Gashara. Other sources of water include springs and seasonal streams. Presently, JICA is rehabilitating the existing reservoir dams at Bugugu, Cyimpima and

Gashara. The construction is expected to complete March 2020.

3) Existing Irrigation Facilities

By utilizing the grant aid program of JICA, the existing reservoir dams at Bugugu, Cyimpima and Gashara is under construction. In addition, the existing main canals of these marshlands are being substituted by reinforced concrete canal under this project. On these canals, a number of turnouts will be set to provide water to irrigation units (an irrigation unit consists a certain number of plots that get water from one turnout).

In this project, Cyaruhogo marshland is considered as an indirect beneficiary of the scheme as it is located downstream of these schemes. It gets water from the drainage canals and/or by extending the main canal of Gashara and Cyimpima.



3.4.3 Ngoma District

(1) Ngoma-22 and Mwanbu Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below showing the main infrastructure of the scheme.

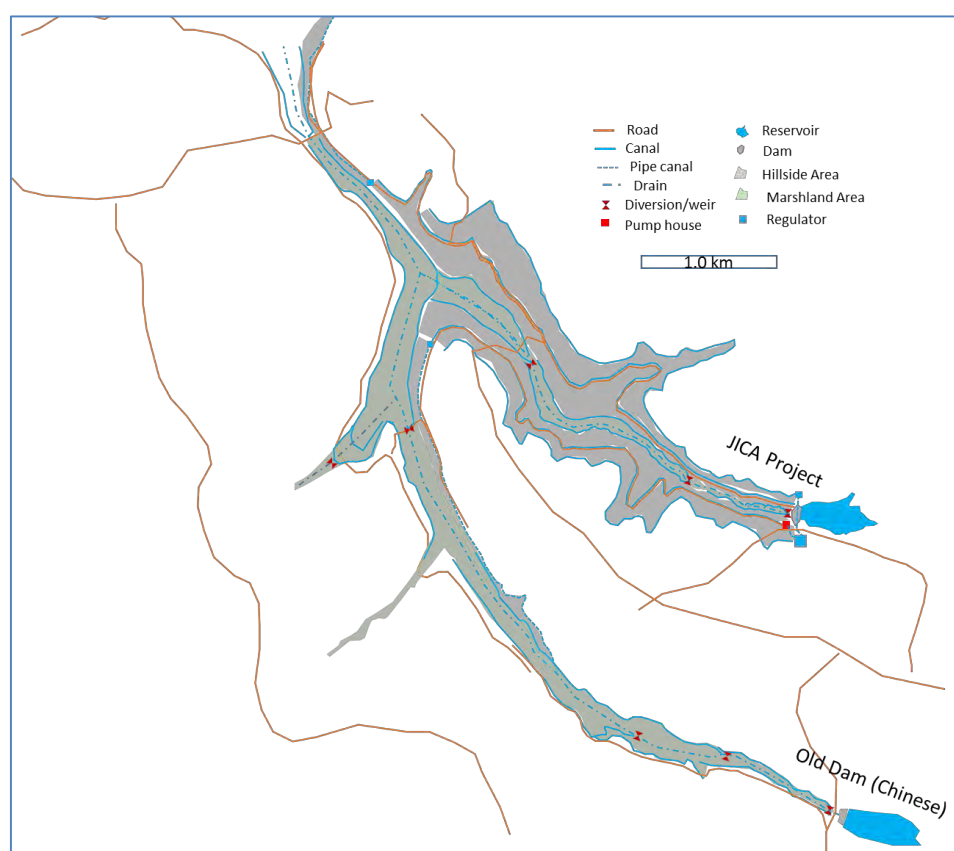


Figure 3.16 Rough Irrigation Map of Ngoma 22

2) Source of Water

Both Ngoma-22 (hillside and marshland) and Mwambu (marshland) schemes are developed separately by JICA (2016) and Chine (1980's) respectively. However, both schemes are operating under one IWUO for hillside and marshland and two cooperatives for marshland and hillside. Therefore, the two schemes are treated as one so that the existing management set up (especially the cooperative) is not affected by WAMCAB project.

The major source of water to the scheme is the existing two reservoirs set by JICA (Ngoma 22) and China (Mwambu). In addition, there are many developed springs within the scheme that supply water to the scheme.

3) Existing Irrigation Facilities

In addition to the two reservoir dams, there are a total of 8 water diversion points (3 on Ngoma 22 and 5 on Mwambu) that serve to divert water into the irrigation canals inside the marshland. On the other hand, the hillside scheme is equipped with 4 concrete-lined canals (2 on the right and 2 on the left) and pipe canals. A pump house and a reservoir tank are also set to supply water to the upper canal on the hillside irrigation field. At every 100 m interval on the main canals, intake valves are set to supply water into pipes (secondary canals) and to hydrants from where the farmers get water for irrigation. Presently some of the hydrants are broken and a contract farming is being practiced on the hillside where the company starts to set sprinkler.



In addition to broken hydrants (due to siltation), a lot of leaks from the hydrant (due to lack of valves). No records of the distribution of valves, hose, water-can, etc. Means of flushing sediment from pipes (secondary canal) is not provided, Ngoma Station has to dig and extract some of the pipes for flushing sediments.

An operator opens the dam/pump twice a day. Valve for marshland left open all day. A lot of water loss from leaks from hydrant. There is no clear distinction on the responsibility of HoReCo (service provider), operator, District (sector) on operation of the scheme.

There is a strong cooperative for rice production covering the two schemes. The cooperatives on hillside are not active and presently a private company is involving in the production of fresh beans on 4 ha of land leased from the farmers. The area might be increased in the future.

There is a need to reorganize the water users' association (WUA) for marshland and hillside separately and create a joint IWUO

(2)Gisaya Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented indicating the position of water diversion points, developed springs and canal networks.

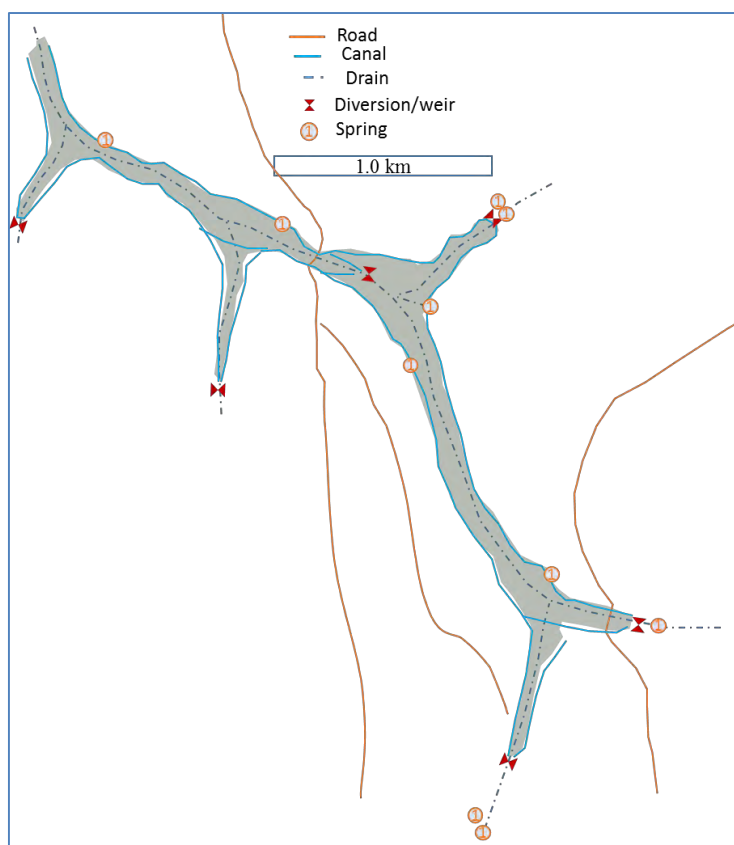


Figure 3.17 Rough Irrigation Map of Gisaya

2) Source of Water

The scheme consists of about 5 valleys with interconnected marshlands. The major source of water in the scheme is the existing stream and in addition, there are around 10 developed springs which flow into the field and stream. The estimated discharge of each developed spring is tabulated below.

Table 3.21 Discharge Estimation of Developed Spring in Gisaya

Position (refer map below)	Discharge (l/sec)
1	0.92
2	0.96
3	0.19
4	0.87
5	0.62
6	0.75
7	0.65
8	1.98
9	0.29
10	0.21

3) Existing Irrigation Facilities

There are around 6 water diversion points built by RSSP and the community. Most of the weirs are not functioning well. The canals are not cleaned and well maintained. Most part of the canal networks built in the scheme help to protect flood from the hillside.



(3)Nyaruvumu Kibaya Scheme

1) Rough Scheme Map

The rough sketch of the scheme is presented below showing the location of infrastructures within the scheme.

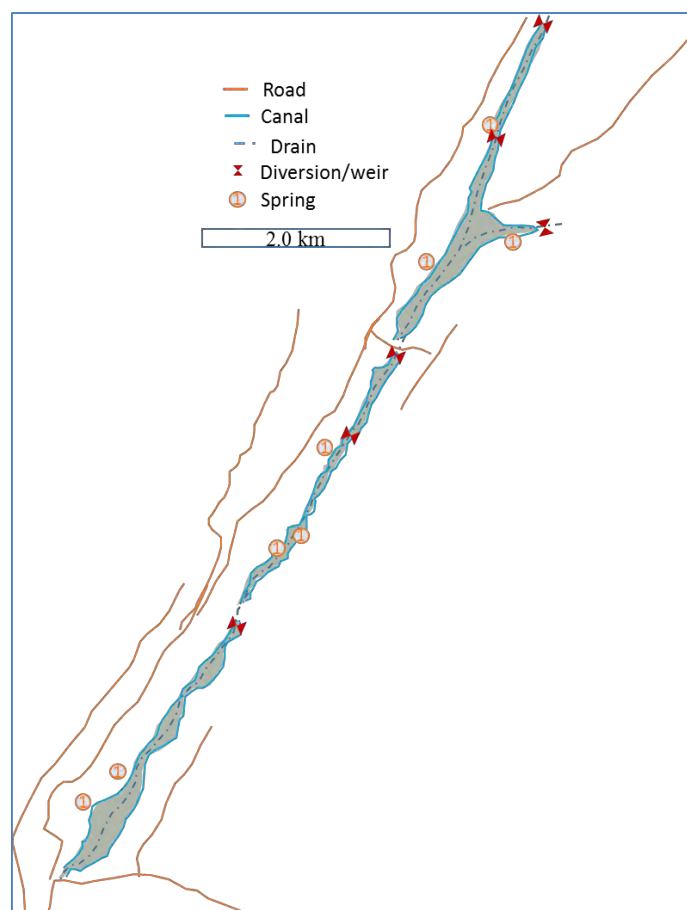


Figure 3.18 Rough Irrigation Map of Nyaruvumu Kibaya

2) Source of Water

The source of water to the scheme is the groundwater which is also supplied by the existing stream and around 8 developed springs. The estimated discharge of the developed springs is tabulated below.

Table 3.22 Discharge Estimation of Developed Spring in Nyaruvumu Kibaya

Position (refer map below)	Discharge (lt/sec)
1	0.28
2	0.44
3	0.30
4	0.70
5	0.64
6	1.19
7	0.97
8	1.03

3) Existing Irrigation Facilities

The scheme is part of Kibaya marshland. Kibaya is a narrow and long marshland of length more than 20 km crossing two sectors namely Nyaruvumu and Rukizi. The marshland is divided according to the two sectors having two IWUOs but a member of one cooperative (Copriki-Cyunuzi found in Kirehe District).

The scheme has about six water diversion points where stream water is diverted to left and right side of the marshland and conveyed to the field through the main canal. There are also 8 developed springs built to supply water to household consumption. The flow of water from these developed

springs also supplies the stream or the field around. Some of the views of these springs are presented below.



(4)Rukizi Kibaya

1) Rough Scheme Map

The rough sketch of the scheme including the location of infrastructure is presented below.

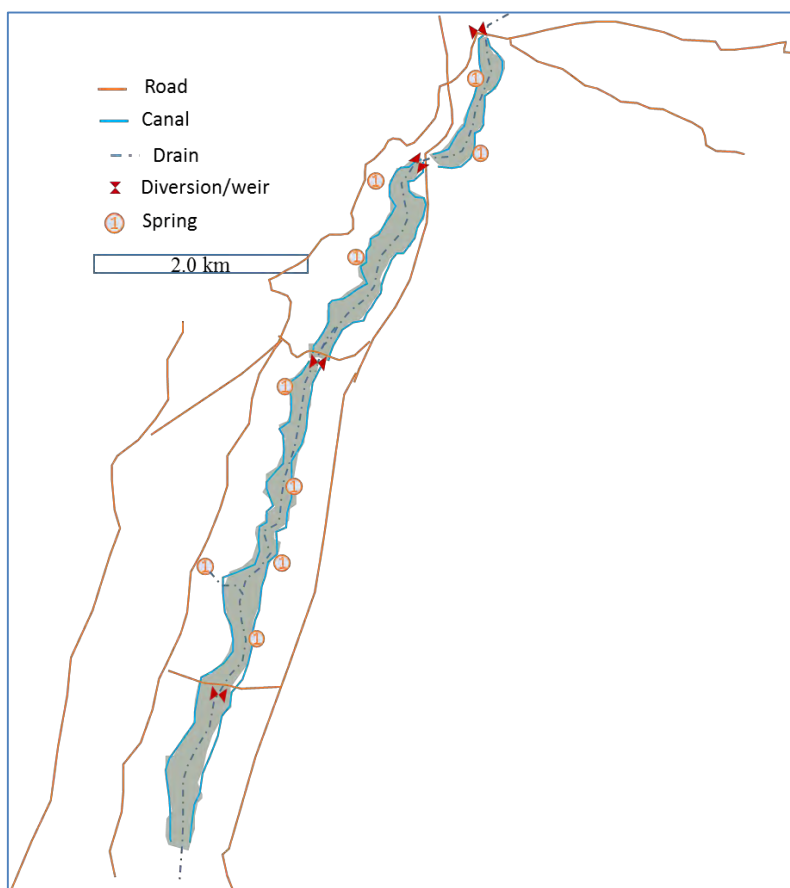


Figure 3.19 Rough Irrigation Map of Rukizi Kibaya

2) Source of Water

As it is the continuation of Kibaya marshland, the source of water to the scheme is also the stream flowing through the marshland. In addition, there are around 9 developed springs that supply water to the scheme. The estimated discharges of these developed springs are presented in the following table.

Table 3.23 Discharge Estimation of Developed Spring in Rukizi Kibaya

Position (refer map below)	Discharge (lt/sec)
1	0.519
2	0.173
3	0.429
4	0.966
5	0.331
6	0.308
7	0.074
8	0.234
9	0.314

3) Existing Irrigation Facilities

There are around four water diversion points in the scheme. At each diversion point, two main canals are set to convey water to the left and right side of the scheme from where irrigation water is supplied to the field. The total length of the marshland is around 8 km.

In this scheme around the second diversion point (or spring No 3), there is a company that produces bricks intensively using the water from the scheme (groundwater or spring). During the formation of IWUO, this company might also require to contribute to the scheme for the use of water (according to the guidelines of IWUO).



Developed spring

Brick production by the side of the scheme

(5) Kinyamarebe Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme including the location of infrastructure is presented below.

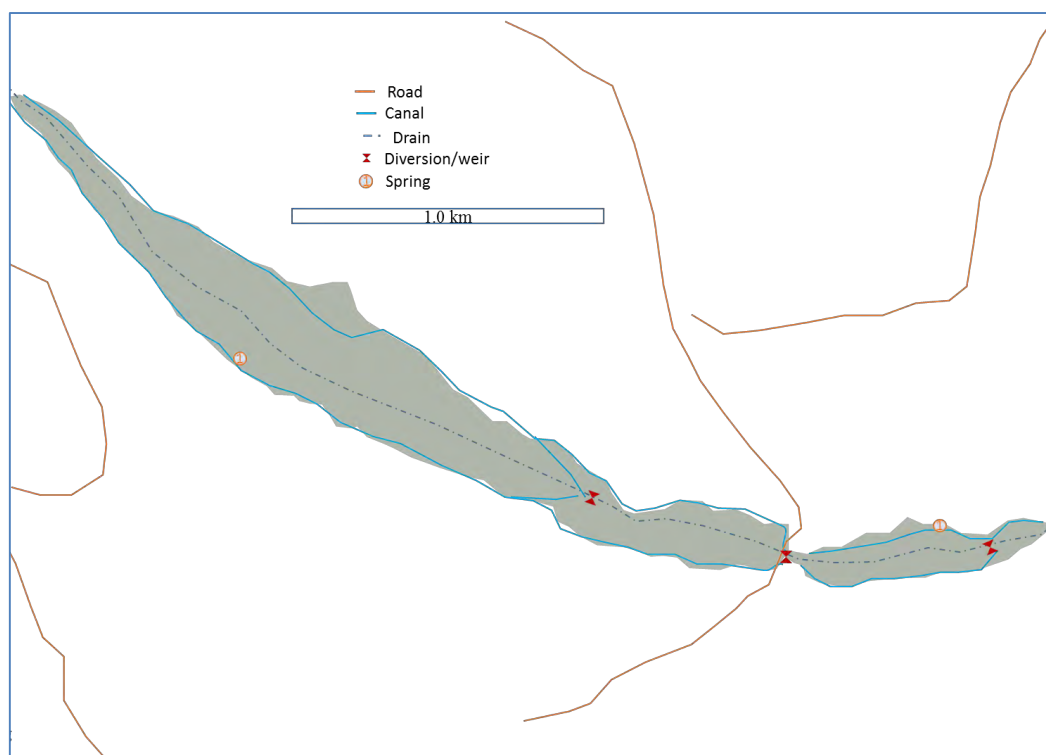


Figure 3.20 Rough Irrigation Map of Kinyamarebe

2) Source of Water

The source of water is a stream, groundwater and the existing two developed springs (with estimated discharge of 0.46l t/sec). This scheme is part of Binoni scheme inside Kirehe District which is the member of Mushakiri cooperative (Kirehe District)

3) Existing Irrigation Facilities

There are three water diversion points in the scheme and main canal on both sides of the marshland starting from the diversion points. Two developed springs are also installed inside the scheme to supply water for the community (household consumption). Some of the pictures of the structures are presented below.



(6)Rwakaganza Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme including the location of infrastructure is presented below.

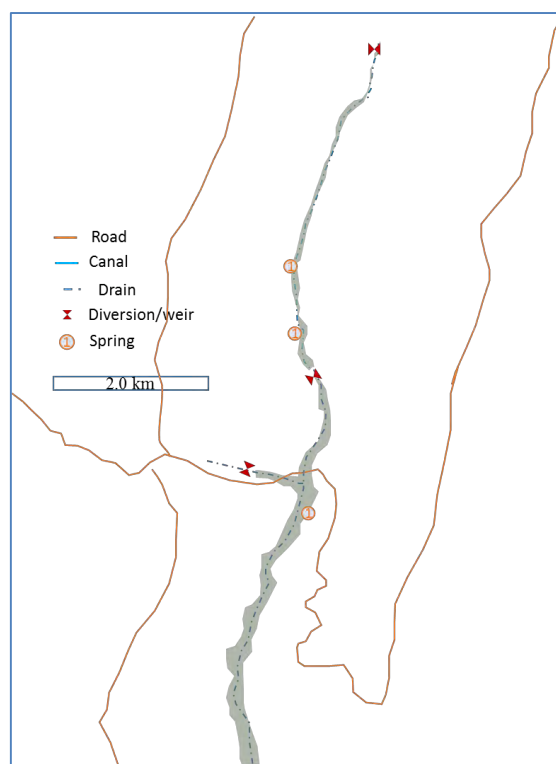


Figure 3.21 Rough Irrigation Map of Rwakaganza

2) Source of Water

This is one of the longest and narrowest marshland visited during this baseline survey. The major source of water in the scheme is a perennial river that crosses the marshland. There are also three developed springs inside the scheme that also contribute to the scheme as an additional source of water with estimated discharge presented below.

Table 3.24 Discharge Estimation of Developed Spring in Rwakaganza

Position (refer map below)	Discharge (lt/sec)
1	0.38
2	0.35
3	0.71

3) Existing Irrigation Facilities

The main infrastructures in the scheme are the three water diversion points, the developed springs and the canal network set at each diversion point. Some of the views of the developed springs are presented below.



Views from the existing developed springs

(7)Gitinga Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme including the location of infrastructure is presented below.

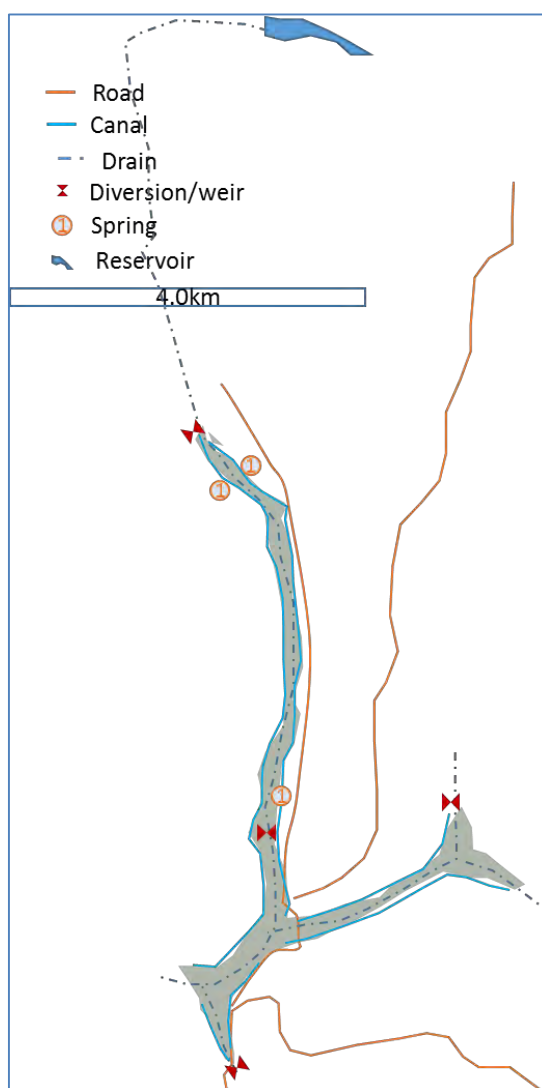


Figure 3.22 Rough Irrigation Map of Gitinga

2) Source of Water

The source of water to Gitinga scheme is an old reservoir at the border of Rwamagana and Kayonza Districts built by China in the 1980's. In addition, the scheme is an indirect beneficiary of Ngoma 22 and Mwanbu scheme where a weir is built at the end point of Mwambu scheme to supply water to part of Gitinga scheme. There are also three developed springs that supply water to the stream (drainage canal). The estimated discharge from these developed springs is tabulated below.

Table 3.25 Discharge Estimation of Developed Spring in Gitinga

Position (refer map below)	Discharge (lt/sec)
1	0.10
2	1.77
3	0.14

3) Existing Irrigation Facilities

There is an old reservoir built in the 1980s by Chinese Government which is in bad condition. The facilities around the dam (such as pump houses) are destroyed. There are around four water diversion points in the scheme. The first diversion is being set at around 8 km downstream of the dam site. The area between the dam site and the first diversion point produces vegetables and other crops and they are not part of the Gitinga cooperatives. The view of some of the infrastructure is presented below.



(8) Cyunuzi Irrigation Scheme

1) Rough Scheme Map

The rough sketch of the scheme including the location of infrastructure is presented below.

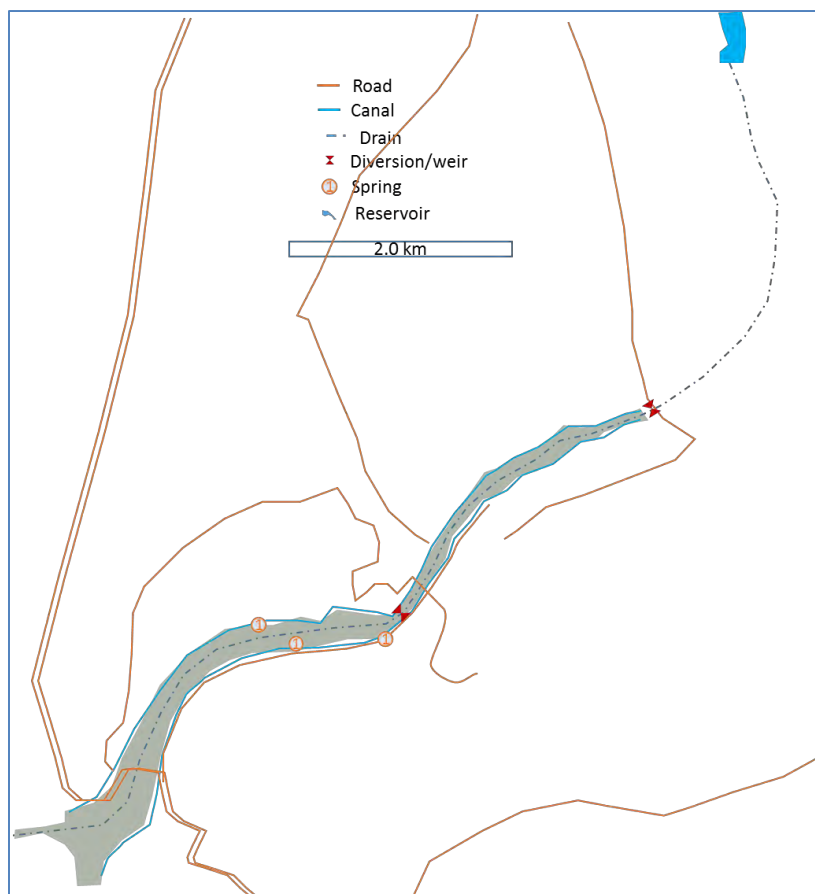


Figure 3.23 Rough Irrigation Map of Cyunuzi

2) Source of Water

This scheme is located at the border between Ngoma and Kirehe Districts. It is also a member of Copriki-Cunizi cooperative (Similar to Kibaya Scheme). The major source of water is Cunizi dam constructed by RSSP at around 4 km above the scheme. Macro-level water management can be seen in the scheme whereby during harvest time the intake gate is totally closed and one can see full reservoir water and excess water flowing through the spillway, which is very rare in other reservoir visited.

3) Existing Irrigation Facilities

In addition to the reservoir dam, there are two water diversion structures inside the scheme. Some of the facilities are damaged due to lack of proper maintenance in the scheme. Some of the facilities visited are presented below.



Water flowing through spillway

Broken weir

3.5 Analysis for Surveys based on Consideration of Outputs on WAMCAB and Proposition of Model Site

3.5.1 Points of Analysis

One of the purposes of the irrigation scheme survey is to support the selection of model sites and preparation of improvement plan and training plan in the target model sites. In order to achieve the project purpose and establish the system to achieve the overall goal after the project, the appropriate model sites in each target District should be selected.

In **Chapter 2** for the *Problem Tree* based on the existed information and additional survey, the Project pointed out the general obstacles in the republic of Rwanda in the aspect of irrigation management and capacity development. Based on the core obstacles for the output of the Project, the results of the Irrigation Scheme Survey were analysed. Before analysing, the corresponded possible issues from prepared *Problem Tree* that are likely to be bottlenecks in each output on the Project and the corresponded questions in the Irrigation Scheme Survey were selected and mention in the following table.

Table 3.26 Summary of Corresponded Possible Issues and Questions

Item	Corresponded Possible Issues in Target Scheme	Corresponded Questions
Output 1 (IMT)	Understanding of IMT procedures by all concerned, Obligation and Contribution for Irrigation Scheme Management by all concerned, Respect for Law and Order	Establishment, IMTA including Registration, Annual Performance Contract with Authorities and Performance Contract between IWUO and Cooperative
Output 2 (IWUO)	Framework of Support for IWUO & Cooperative, Organizational Management for IWUO & Cooperative	Consensus as IWUO, Internal Rule, Action Plan, Relationship between IWUO and Cooperative, Community Work, Support by Authorities
Output 3 (O&M)	Framework of O&M for Irrigation Network, Capacity in aspect of O&M for IWUO	Major Irrigation Structure, Condition of Facility, Maintenance Work, Technical Support by Authorities
Output 4 (Water Management)	Framework of Water Management for Irrigation Network, Capacity in aspect of Water Management for IWUO	Water Resource, Equitable Water Distribution, Availability of Water, Technical Support by Authorities
Output 5 (Farming)	Framework of Support for Farming, Capacity in aspect of Farming for Cooperative, Variety of Crop	Profitability, Expand of Cultivation Area, Technical Support by Authorities

3.5.2 Summary of Analysis

The result of the irrigation scheme survey was analysed with the corresponded questions as below. In addition, the rate of the satisfaction by the board members of IWUO and irrigation fee collection in IWUO is keenly linked to the indicator of project purpose. So these corresponded question is also added in the following table.

Table 3.27 Summary of Results of Irrigation Scheme Survey in Consideration with Corresponded Questions

Irrigation Scheme Survey on	District	Irrigation Scheme	Name of IWUO	Name of Cooperative	Satisfaction by Board Member	Irrigation Fee	Output				
							1	2	3	4	5
Target Districts	Ngoma	Gisaya	ISAGI /Gisaya	COCURIGI	60% to 80%	Yes	Bad	Bad	Bad	Fair	Bad
		Rwakaganza	Tuyasaranganye Rwakaganza	KOPAMONYA	60% to 80%	Yes	Bad	Bad	Bad	Fair	Bad
		Kinyamarebe (Binoni)	Duce umuzi winzara Binoni	MUSHIKIRE RICE GROWERS COOPERATIVE (M.R.G.C.)	More than 80%	Yes	Good	Fair	Fair	Fair	Fair
		Ngoma 22	TUVUGURURE UBUHINZI NGOMA 22	TUVUGURURE UBUHINZI NGOMA 22	Less than 20%	No	Bad	Bad	Bad	Fair	Fair
		Mwanbu	No IWUO	COPRIMWA	More than 80%	No	-	Bad	Bad	Fair	Fair
		Nyaruvumu/Kibaya	COPRIKI	-	More than 80%	Yes	Bad	Good	Bad	Fair	Fair
			-	COOPRIKI CYUNUZI	-	-	(Bad)	-	(Bad)	(Bad)	(Fair)
		Rukizi/Kibaya	TUYAKORESHENEZA – RUKIZI		More than 80%	Yes	Good	Good	Fair	Fair	Bad
		Cyunizi	Tuyakoresheneza cyunuzi		More than 80%	Yes	Good	Good	Fair	Fair	Bad
		Gitinga	No IWUO	COPERIG	More than 80%	Yes	Bad	Bad	Bad	Fair	Fair
	Rwamagana	Rugende	EJOHEZA RUGENDE RICE	EJOHEZA RUGENDE RICE	40% to 60%	Yes	Bad	Bad	Bad	Fair	Fair
			-	COMSS Rugende	-	-	-	(Bad)	(Bad)	(Fair)	(Bad)
			-	COOPALEG	-	-	-	(Bad)	(Bad)	(Fair)	(Bad)
		Rwamagana 34	Abagendana nigihe	-	More than 80%	Yes	Bad	Bad	Bad	Fair	Fair
		Bugugu	No IWUO	COCURIBU	-	Yes	Bad	(Bad)	Bad	Fair	Fair
		Cyimpima	No IWUO	COCURICYA	-	Yes	Bad	(Bad)	Bad	Fair	Fair
		Gashara	No IWUO	COCURIGA	-	Yes	Bad	(Fair)	Bad	Fair	Fair
		Cyaruhogo	No IWUO	CORICYA	-	Yes	Bad	(Bad)	Bad	Fair	Fair
	Gisagara	Agatare	Amazi meza atugereho agatare	Dufatanye Agatare	60% to 80%	Yes	Bad	Bad	Fair	Bad	Bad
		Akaboti	IGISUBIZO CYABAHINZI	GARUKUORE	60% to 80%	Yes	Bad	Bad	Fair	Bad	Bad
		Kigaga-Kabogobogo	COPRORIZ Kabogobogo	COOPRORIZ KABOGOBOGO	More than 80%	Yes	Bad	Bad	Bad	Bad	Bad
		Mwura	No IWUO	COOPRORIZ GATARE	More than 80%	Yes	-	-	-	-	-
		Gatare	COOPRORIZ GATARE		More than 80%	Yes	Good	Bad	Fair	Fair	Bad
		Ngiriyi	Cooprорiz Ngiriyi	Cooprорiz Ngiriyi	60% to 80%	Yes	Bad	Bad	Bad	Fair	Fair
		Nyabuyogera	ABAKORANAMURAVA NYABUYOGERA	ABAKORANAMURAVA NYABUYOGERA	60% to 80%	Yes	Bad	Bad	Bad	Fair	Fair

Irrigation Scheme Survey on	District	Irrigation Scheme	Name of IWUO	Name of Cooperative	Satisfaction by Board Member	Irrigation Fee	Output				
							1	2	3	4	5
		Nyakagezi (Refer to Cyili)	-	-	-	-	-	-	-	-	-
		Rumira-Urukungu	NYAMARICOO	NYAMARICCO	40% to 60%	Yes	Bad	Good	Fair	Fair	Bad
		Ruvungirana	TUZAMURANE RUVUNGIRANA	TUZAMURANE RUVUNGIRANA	More than 80%	Yes	Bad	Bad	Fair	Fair	Bad
		Rwasave	COAIRWA	KOAIRWA	More than 80%	Yes	Bad	Good	Bad	Fair	Fair
Typical irrigation scheme at medium/large-scale	Nyanza	Nyanza 23	Tuyakoreshe Kagondo	JYAMBERE MUHINZI Nyanza	More than 80%	Yes	Bad	Fair	Fair	Fair	Bad
	Kayanza	Rugendabari	No IWUO	Cocurivamu	40% to 60%	No	-	Fair	Bad	Fair	Bad
	Kirehe	Kinoni 1	TWITEZIMBERE KINONI 1		More than 80%	Yes	Bad	Fair	Bad	Fair	Bad
		Kinoni 2	Tuyongezumusaruro - Kinoni 2	Imbaraga	60% to 80%	Yes	Bad	Bad	Bad	Fair	Fair
		Sagatare	Bungabunga ibikorwaremezo sagatare		More than 80%	Yes	Good	Fair	Fair	Fair	Bad
Good practice	Gisagara	Cyili	TUVOMERE CYILI	COOPRORI CYIRI	60% to 80%	Yes	Good	Fair	Bad	Fair	Bad
	Bugesera	Rurambi	UDUAGIRU -RURAMBI	CORIMARU	More than 80%	Yes	Bad	Good	Fair	Fair	Bad

The determination of rate of evaluation on each output is mentioned in the following table.

Table 3.28 Summary of Determination of Evaluation Rate for Each Output

Item	Determination of Evaluation
Output 1 (IMT)	Good: all corresponded questions were positive, Fair: most corresponded questions were positive but IMTA process was not completed, Bad: most corresponded questions were negative
Output 2 (IWUO)	Good: all corresponded questions were positive, Fair: most corresponded questions were positive but relationships between IWUO and Cooperative was not good, Bad: most corresponded questions were negative
Output 3 (O&M)	Good: all corresponded questions were positive, Fair: most corresponded questions were positive but concerned training was limitedly done, Bad: most corresponded questions were negative
Output 4 (Water Management)	Ditto
Output 5 (Farm Management)	Ditto

In most irrigation schemes, the irrigation water fee is collected through IWUO or cooperative. Even though the evaluation of Output 1 and 2 on WAMCAB is “Bad”, but the rate of satisfaction by the board member was high in many irrigation schemes. All irrigation schemes have a “Fair” or “Bad” evaluation on Outputs 3 to 5 on WAMCAB. It was realized the necessity of technical capacity development in our target Districts.

In Ngoma District, Ngoma 22, Mwanbu and Gitinga irrigation scheme are the challenging schemes to be capacitated. In Rwamagana District, IWUO has not been established in the four irrigation schemes such as Bugugu, Cyimpima, Gashara, and Cyaruhogo irrigation scheme. In Gisagara District, most irrigation schemes except Cyili irrigation scheme are challenging schemes to be capacitated.

In the irrigation schemes outside of the target Districts, the certain evaluation was good but not all even in the typical irrigation scheme at medium/large-scale and the irrigation scheme in good practice. However, the positive situation can be useful for the model sites in the target Districts.

3.5.3 Proposition of Model Site

The model site in Ngoma and Rwamagana District was mostly confirmed and Gisagara District was added as another target District in the 1st JCC meeting in May 2019. The model of irrigation scheme management will be finalized through activities in the site by the end of the Project in order to achieve the overall goal in the target areas. So much trials and errors should be needed on the site. The draft model sites were proposed based on the irrigation scheme survey as below.

Proposition of Model Site: 2 Schemes surrounded Japan Grand Aid Project

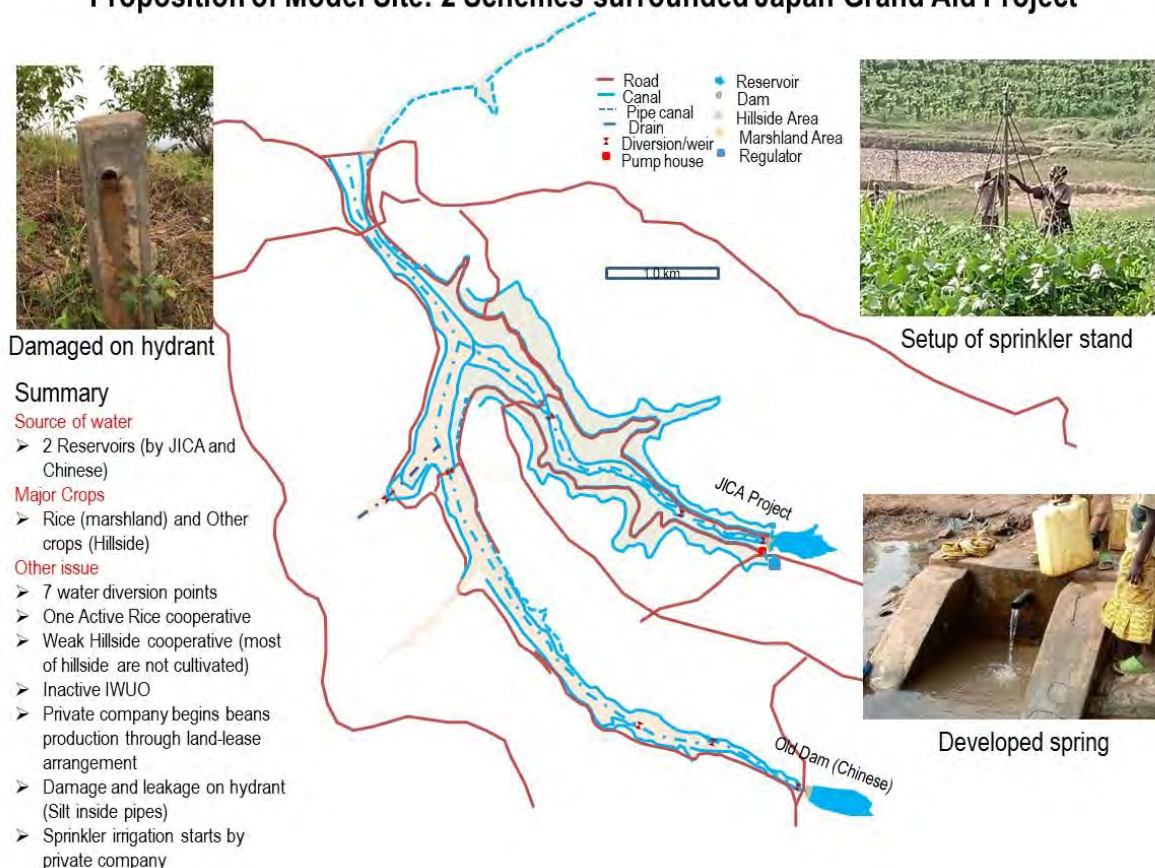


Figure 3.24 Proposed Model Site in Ngoma District

Proposition of Model Site: 4 Schemes surrounded Japan Grand Aid Project

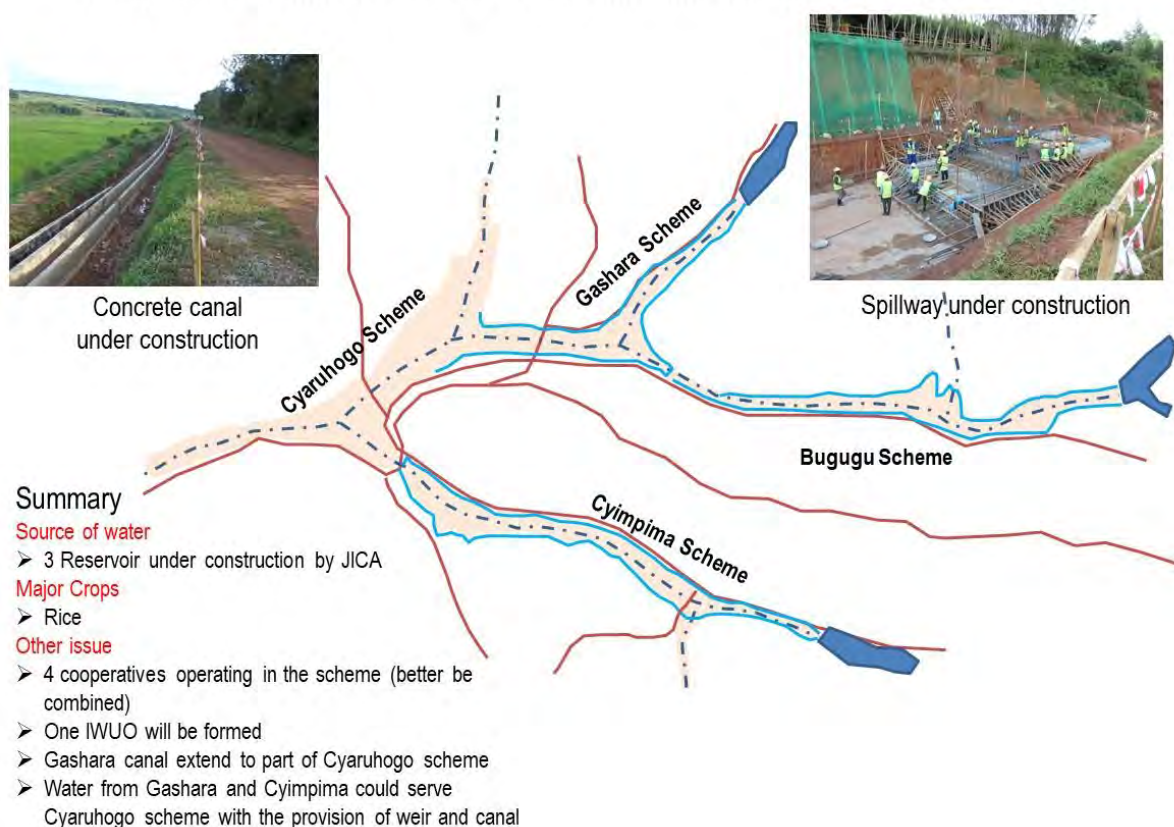


Figure 3.25 Proposed Model Site in Rwamagana District

The irrigation schemes in Gisagara District are relatively small. For efficient irrigation management, it is better to merge some schemes. In order to merge some irrigation schemes, WAMCAB considers making groups with the condition as below.

- (1) Location as closeness among schemes;
- (2) Diversity of cultivated crops;
- (3) Diversity of irrigation facilities;
- (4) Availability of local and capable/educated human resources in the model site. He/She will be the candidate of manager in the merged scheme and should be hired themselves in the future;
- (5) Willingness by target schemes.

Proposition of Model Site: 3 schemes

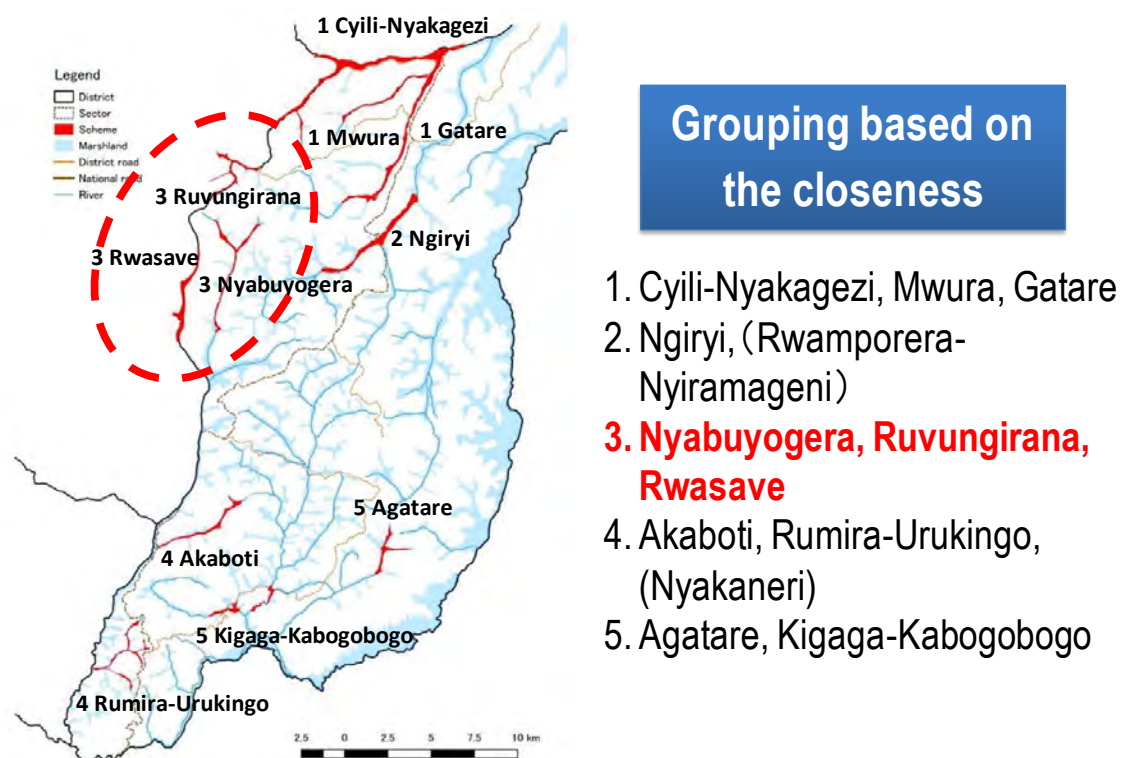


Figure 3.26 Proposed Model Site in Gisagara District

These propositions were discussed in the workshop in each District and the 2nd TF meeting.

Chapter 4 Workshops

4.1 Outline

In order to report the results of *Problem Tree* and Irrigation Scheme Survey, and to discuss the candidate of model IWUO based on the results and their analysis, workshops were held in the targeted Districts namely Ngoma, Rwamagana and Gisagara. For the purpose of information sharing among all the TF members within the District, the workshop was held once in each District without dividing it into each Output as shown below.

Table 4.1 Outline of Workshops

District	Date and Time	Chairperson	Participants
Gisagara	20 th August 2019 09h00-12h00	Executive Secretary	Chief Implementer Director of Agriculture Cooperative Officer TF member from Gisagara District TF member from Rubona station
Rwamagana	21 st August 2019 09h00-11h00	Vice-Mayor	Chief Implementer Cooperative Development Officer TF member from Rwamagana District TF member from Rubirizi station Executive Secretary of sectors
Ngoma	22 nd August 2019 09h00-11h30	Advisor of Mayor	Chief Implementer Director of Agriculture TF member from Ngoma station Executive Secretary of sectors JICA Volunteer

The common agenda of the workshop is as follows:

1. Presentation on Findings by baseline survey for irrigation schemes
2. Confirmation and proposition of the model site
3. Explanation of Capacity Assessment for target organizations
4. Explanation of the concept of Improvement Plan and Training Plan
5. Explanation of survey on service providers
6. Explanation of future steps
7. Others

4.2 Results of Each Workshop

During each workshop, WAMCAB proposed the candidate of model sites and explained the future plan based on the results of existing information, *Problem Tree* and Irrigation Scheme Survey. To respond the proposition of model sites, each District presented their answer, proposal and/or challenges at the site in the 2nd TF meeting held in the next week. In addition, the Project explained about CA and survey on SPs.

All workshops confirmed the schedule of future activities as below.

1. The 2nd TF meeting in Kigali on 30th August 2019
2. Terminal analysis on baseline survey including implementation of CA in September 2019
3. Preparation of the draft of Improvement Plan/Training Plan, and the 3rd TF meeting in October 2019 (rescheduled the meeting in November 2019)

4. The 2nd JCC meeting in November 2019
5. Preparation of pre-training based on the draft Improvement Plan/Training Plan from December 2019 to February 2020
6. Finalization of Improvement Plan/Training Plan, preparation of work plan for the second phase and the 4th TF meeting from February to April 2020
7. Launch of the second phase from May 2020
8. Training in Japan in order to know the IMT in Japan for ten days from April to June 2020

The conclusions and recommendations of the workshop in each District are summarized below. The M/M (Minutes of Meetings) for the workshops are attached in **Annex 3-1, 3-2 and 3-3**.

Gisagara, 20th August 2019

- Based on the suggestion by the District, the model site must be located within the boundaries of Gisagara District
- TF members in Gisagara District will explain their idea of the model site in the 2nd TF meeting
- TF members in Gisagara District will bring the MoU confirmed in the 1st TF meeting

Rwamagana, 21st August 2019

- Establishment of a single IWUO in the schemes under construction by JICA namely Bugugu, Gashara, Cyimpima and Cyaruhogo for efficient and sustainable management of the scheme.
- Water users that are out of the scheme will also be members of the IWUO and they will fulfill their responsibilities like payment of water fees, community works, etc. for proper operation & maintenance and sustainable management of irrigation infrastructures.
- TF members in Rwamagana District will bring the MoU confirmed in the 1st TF meeting.

Ngoma, 22nd August 2019

- Survey of SPs is pended because the expected personnel (e.g. Director of Agriculture and Natural Resource, District agronomist, JADF, etc.) are not present to the workshop, and the District does not have enough information on SPs;
- Ngoma District expected to carry out the meeting among Vice Mayor, JADF, Director of Agriculture and Natural Resources, District agronomist, RAB representative and both executive secretary of Remera and Rurenge sector (where Ngoma model site located) in order to discuss on the technical defects in Ngoma 22 scheme and the key issues for good cooperation on implementation of this project in Ngoma District. The meeting was scheduled for 27th August 2019 at Ngoma District office.
- The MoU will be discussed in the next meeting on 27th August before the 2nd TF meeting.

Chapter 5 Second Task Force Meeting

5.1 Outline

TF is the main structure of the Project implementation with core members of C/Ps at central, station and District levels as well as the Japanese expert team. The main function of TF is to implement the Project on daily basis.

R/D prescribes that the TF meeting will be held at least once in every quarter and whenever deems it necessary. The 1st TF meeting in the first phase of the Project was held on 28th June 2019, which focused on the plan of baseline survey. Thus, to report the progress of baseline survey, especially Irrigation Scheme Survey, the 2nd TF meeting was held on 30th August 2019. The outline of the meeting is shown in the table below.

Table 5.1 Outline of the 2nd TF Meeting

Date and Time	Place	Chairperson	Participants
30 th August 2019 09h00-12h30	Classis Hotel in Kigali	Chief Implementer, Head of IWUO- SU / RAB *Representative of Project Manager	Central Level - IWUO Management - Farm Management
			Station Level - Ngoma TF members - Rubirizi TF members - Rubona TF members
			District Level - Vice-Mayor in Ngoma District - JADF Officer in Ngoma District - Director of Agriculture in Ngoma District - Ngoma TF members - Executive secretaries of sectors in Ngoma Districts - Rwamagana TF members - Gisagara TF members
			Project Team - Deputy Chief Advisor / Irrigation Policy - Coordinator / Training - Coordinator / IWUO officer - Assistant IWUO officer / Secretary - Irrigation Engineer - Agronomist - JICA staff

One of the purposes of the 2nd TF meeting is to receive the answer from each District regarding the model sites which were proposed by WAMCAB in the workshops. Therefore, after reviewing the outline of WAMCAB, the representative of each District gave a presentation in the TF meeting.

The agenda of the TF meeting is as follows:

1. Outline of WAMCAB
2. Presentation of conclusion on workshop in target Districts
3. Explanation of CA for target organizations and survey on SPs
4. Explanation of the concept of Improvement Plan and Training Plan
5. Explanation of future Steps
6. Others

5.2 Result of Presentation by Districts

The following table summarizes the possible model sites from the presentations by each target District.

Table 5.2 Summary of Possible Model Sites

District	Model Site
Gisagara	Ngiryi and Nyabuyogera irrigation schemes
Rwamagana	Neighboring Gashara, Cyimpima, Bugugu and Cyaruhogo irrigation schemes
Ngoma	Neighboring Ngoma 22 and Mwambu irrigation schemes

Gisagara District proposed the model sites with two separated irrigation schemes, and Rwamagana and Ngoma Districts proposed the model sites with some neighbouring irrigation schemes in order to integrate them and create one IWUO among them.

The participants from the Districts strongly emphasized and understood the importance of the merging of the small and closer schemes to have strong IWUO in aspects of self-reliant financially, possibility to employ operators and even engineers for O&M of irrigation infrastructures. Then a workshop of a technical team composed of WAMCAB, RAB C/Ps, targeted Districts and other key persons was requested in order to discuss the modality of merging the IWUOs into a single one in proposed model sites.

WAMCAB confirmed that each District brings the draft MoU in the said workshops to the TF meeting. However, no District brought the MOU confirmed in the 1st TF meeting. Then WAMCAB explained the draft of the MoU to be signed by the three parties such as RAB, Districts and WAMCAB. All participants confirmed that the MoU must be finalized before as it will be confirmed by the 2nd JCC meeting in November 2019.

5.3 Conclusion of Task Force Meeting

The discussions and recommendations of the TF meeting are summarized below.

(a) Operational Method of IWUO as Local Non-Governmental Organization

Under ministerial order and law, IWUO is one of the Non-Governmental Organization (NGO). However, it is difficult to supervise IWUO in exactly the same way as other local NGOs because of the low capacity of IWUO members and/or committees in terms of education, financial management, etc. for the District.

Concerned order and Laws such as the Law N° 50/2007 of 18/09/2007 determining the Establishment, Organization and Functioning of Cooperative Organizations in Rwanda, Ministerial Order No. 001/11.30 of 23/11/2011 on Establishing Irrigation Water Users Association in Irrigation Scheme (Official Gazette n° 50 of 12/12/2011) and Law No.4/2012 of 17/02/2012 on governing the organizations and the functioning of the national non-governmental organizations, the transition from IWUA to IWUO were explained.

(b) Merging the IWUOs

The participants strongly emphasized the importance of merging with the small and closer schemes in order to create bigger schemes in aspects of self-reliant financially, possibility to employ operators and even engineers for O&M of irrigation infrastructures.

(c) Training in Japan and the third Countries

The content of the training in Japan and in the third countries like Tanzania and/or Egypt where have good or advanced irrigation experiments and participants can learn a lot was explained to the participants of the meeting. However, some participants requested much detailed consideration and the similarity of the climate condition, development level, model case to encourage the mind-set of TF members, etc. especially for selecting the third country,

The M/M including the above information and the conclusions for the TF meeting is attached in **Annex 4-1**.

Chapter 6 Capacity Assessment

6.1 Background

Capacity Assessment (CA) is defined as the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels - including the individual, organizational and societal level - and the extent to which development process has brought about positive changes (Capacity Development: CD), and then sharing the results from this with concerned parties in order to formulate CD strategies.

6.2 Objective

The objectives of CA in WAMCAB project are summarized as below:

1. To diagnosis on the capacity and needs of C/Ps in the related organizations, and to formulate the Improvement Plan / Training Plan;
2. To measure the transition of the capacity by implementing CA in the period of baseline survey, at the end of the 2nd Phase and at the end of the 3rd Phase of the Project;
3. Based on the results of CA implemented in the period of baseline survey, to share the scenario of the capacity development and goals with C/Ps, and to clarify the role of the Project and its positioning;
4. Based on the results of CA implemented at the end of the 2nd Phase, to confirm the achievement of the Improvement Plan / Training Plan, and to review necessary inputs and supports with C/Ps; and
5. By sharing the result of CA implemented at the end of the 3rd Phase with C/Ps, to utilize them for the part of evaluation of the Project and preparation of actions toward after completion of the Project.

6.3 Method

(1) Target and Implementer

Targets of CA are i) IWUO-SU, ii) targeted RAB stations namely Ngoma, Rubirizi and Rubona, iii) targeted districts namely Ngoma, Rwamagana and Gisagara and iv) selected model IWUOs. Although the respondents are individual C/Ps, the Project focuses on the overall capacity of target organization.

In order to measure the effect of training, CA will be implemented for IWUOs in the model sites. The first CA is implemented by using the result of baseline survey. For missing information, a supplemental survey is conducted. Regarding IWUOs in Rwamagana district, which have not been organized yet, the first CA will be conducted at the time of their establishment.

The main implementer of CA is IWUO-SU for ii) targeted RAB stations, iii) targeted districts and iv) selected model IWUOs. Only for i) IWUO-SU, the JICA experts conducts CA by interviewing with IWUO-SU.

(2) Timing

The Project conducted the first CA from August to September 2019, and will conduct CA in the end of each phase.

- Baseline survey in the 1st Phase (August to September 2019)
- The end of the 2nd Phase (February 2021)
- The end of the 3rd Phase (February 2024)

(3) Components of Capacity in WAMCAB

Capacity only comes about once the following three elements have been integrated. Technology,

particular knowledge and tacit knowledge on the part of the organization is referred to as “Technical Capacity (TC)”. The will, attitude, leadership and management capabilities to activate technical capacity are referred to as “Core Capacity (CC)”, serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the “Enabling Environment (EE)” that encompasses the organization.

(4) Assessment Item

Each component has several assessment items as follows. For instance, TC1 for IWUO-SU is “Knowledge Management” which means that IWUO-SU shall manage the necessary knowledge such as water management, O&M and farm management by preparing the guidelines and/or manuals. These assessment items differs by organisations and basically are based on its role and responsibility. As shown in **Annex 5-1**, each assessment item has more detailed indicators aiming at the proper evaluation.

1) IWUO-SU

Table 6.1 Assessment Items for IWUO-SU

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」	Pre-condition (external condition).
	EE2 「Legal Framework」	
TC	TC1 「Knowledge Management」 ➤ Water Management ➤ O&M ➤ Farm Management	Necessary techniques, certain knowledge, and those management skills for the proper instruction and support to RAB Stations, District, etc.
	TC2 「Training System」	Monitoring and Evaluation (M/E) System for irrigation schemes (facility and IWUO). Administrative capacity for IMT procedure, budgeting and policy advice, etc.
	TC3 「Monitoring and Evaluation」	
	TC4 「Financial Management (budgeting)」	
	TC5 「Organisational Management」	
	TC6 「Project Management」	
	TC7 「Policy Advice」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatively. Leadership to determine the policy solve the problem based on the opinions from RAB Stations and District/Sector, etc. Communication and collaboration system with RAB Stations and Districts.
	CC2 「Membership」	
	CC3 「Awareness of Problems」	
	CC4 「Awareness of Challenges」	
	CC5 「Gender Mainstreaming」	
	CC6 「Communication System」	
	CC7 「Collaboration System」	

2) RAB Stations (Ngoma, Rubirizi and Rubona)

Table 6.2 Assessment Items for RAB Stations

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」	Pre-condition (external condition). Necessary resources provided by central government.
	EE2 「Legal Framework」	
	EE3 「Supporting System by Central Government」	
TC	TC1 「Survey」	Necessary techniques, certain knowledge, and training system for the proper instruction and support to District/Sector. (Required particularly high expertise)
	TC2 「Plan and Design」	
	TC3 「Procurement」	
	TC4 「Supervision」	
	TC5 「Water Management」	
	TC6 「O&M」	
	TC7 「Farm Management」	
	TC8 「Training System」	
	TC9 「Monitoring and Evaluation」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems.
	CC2 「Accountability (Ownership)」	
	CC3 「Membership」	

Capacity	Assessment Item	Explanation
	CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Coordination skills for both central government (RAB HQ) and District/Sector.

3) Districts (Ngoma, Rwamagana, Gisagara)

Table 6.3 Assessment Items for District

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」 EE2 「Legal Framework」	Pre-condition (external condition).
TC	TC1 「Survey」 TC2 「Plan and Design」 TC3 「Procurement」 TC4 「Supervision」 TC5 「Water Management」 TC6 「O&M」 TC7 「Farm Management」 TC8 「IWUO Organizational Management」 TC9 「Training System」 TC10 「Monitoring and Evaluation」 TC11 「Financial Management (budgeting)」	Necessary techniques, certain knowledge, and training system for the proper instruction and support to District/Sector. (including the support from RAB Stations)
CC	CC1 「Leadership」 CC2 「Ownership」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems. Administrative capacity for the smooth operation for IMT procedure, budgeting and cooperation with IWUO, etc.

4) Model IWUOs

Table 6.4 Assessment Items for Model IWUO

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」 EE2 「Legal Framework」 EE3 「Administrative Supporting System」 EE4 「Environmental Condition」	Pre-condition (external condition). Necessary resources provided by government.
TC	TC1 「Water Management」 TC2 「O&M」 TC3 「Farm Management」 TC4 「Financial Management」 TC5 「Rule Making」 TC6 「Internal Evaluation」 TC7 「Organizational Management」 TC8 「Audit System」	Necessary techniques, certain knowledge, and systems for the proper scheme management.
CC	CC1 「Leadership」 CC2 「Accountability (Ownership)」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, and systems. Administrative systems for the smooth operation of IWUO.

(5) Evaluation

As mentioned above, each assessment item has one or several indicators (*questions*). Evaluators score with four grades such as Excellent (3pt.), Good (2pt.), Fair (1pt.) and Poor (0pt.) for each indicator. Average scores for each assessment item will be calculated and indicated in a spider chart as below.

Table 6.5 Example of Indicators for Assessment Item

Assessment Item	Indicator	Result	Score	Average Score
TC1 「Survey」	TC1-1 <i>Manuals or reference documents for survey are prepared.</i>	Good	2	1
	TC1-2 <i>Team or committee in charge of surveying in the district is clear.</i>	Poor	0	
	TC1-3 <i>Existence of competent human resource who can utilize the manuals. (who has academic background and/or practical experience)</i>	Fair	1	
TC2 「Plan and Design」	...	...	...	1.5
TC3 「Procurement」	...	...	...	2
...

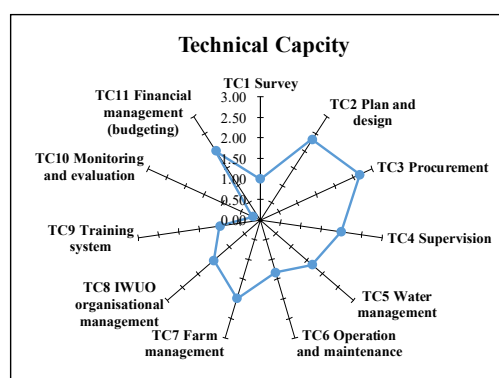


Figure 6.1 Example Result of Technical Capacity

According to the example result of technical capacity, this organisation has advantages on “TC2 Plan and Design”, “TC3 Procurement” and “TC7 Farm Management”. On the other hand, “TC1 Survey”, “TC9 Training System” and “TC10 M/E” are the weak points of the organisation. The Project can utilize the result to develop a strategy to enhance the capacity of the organisation by combining the results of other baseline survey, which can be Improvement Plan and Training Plan.

In addition, by chasing the transition of the capacity, the Project can measure the effectiveness of training activities and review necessary inputs and supports.

6.4 Result and Discussion

(1) IWUO-SU

The total score of CA for IWUO-SU is approximately 50%. As for EE, policy framework such as national policy and strategy for IWUO is relatively clear. However, the actual organisational structure is almost broken, and there are only two officers in the supporting unit as of 2019. With the limited number of personnel in the unit, it is unreasonable to fulfill all the responsibilities as regulated. The implementation of the Ministerial order No 001/11.30 of 23/12/2011 is relatively poor.

Although one of the missions of IWUO-SU is to oversee the installation of reliable IWUO’s performance monitoring system at IWUO, District and National levels, the result shows that the capacity on M/E system is remarkably poor.

Compared to the result of TC and CC, TC is smaller than CC. This trend is shown in the results of

other organisations, and the staffs can strongly feel the importance of technical training and the restructuring of the unit is required in order to equip it with staff and tools for enabling its functioning and performance. All the scores of TC have the low evaluation, less than 1.5pt. Especially, capacity on M/E is limited. On the other hand, CC is relatively well-balanced. IWUO-SU has advantages on “CC3 Awareness of Problems” and “CC7 Collaboration System”.

Table 6.6 Result of CA for IWUO-SU

Capacity	Assessment Item		Average Score
Enabling Condition	EE1	Policy framework	2.00
	EE2	Legal system	1.33
Technical Capacity	TC1	Knowledge management	1.50
	TC2	Training system	0.50
	TC3	Monitoring and evaluation	0.00
	TC4	Financial management (budgeting)	1.00
	TC5	Organizational management	1.00
	TC6	Project management	1.00
	TC7	Policy advise	1.00
Core Capacity	CC1	Leadership	2.00
	CC2	Membership	2.33
	CC3	Awareness of problems	2.50
	CC4	Awareness of challenges	1.50
	CC5	Gender mainstreaming	2.00
	CC6	Communication system	1.25
	CC7	Collaboration system	2.50
Total Score (%)			48.78

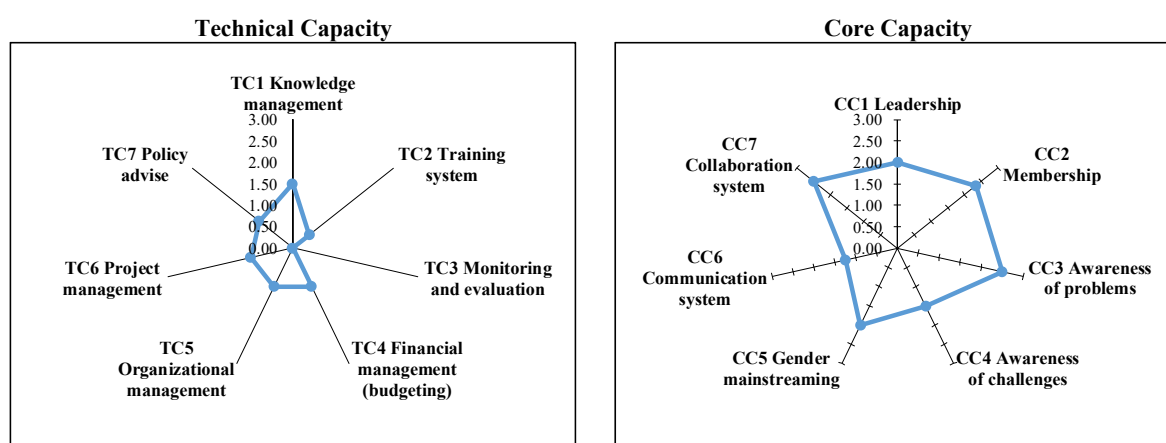


Figure 6.2 TC and CC of IWUO-SU

(2) RAB Stations

The total scores of CA for RAB stations are between 30% to 40%. As for EE, all the Districts evaluated that the supporting system from the central government is insufficient. As mentioned above, one of the reasons is considered to be the limited number of personnel in the central organisation.

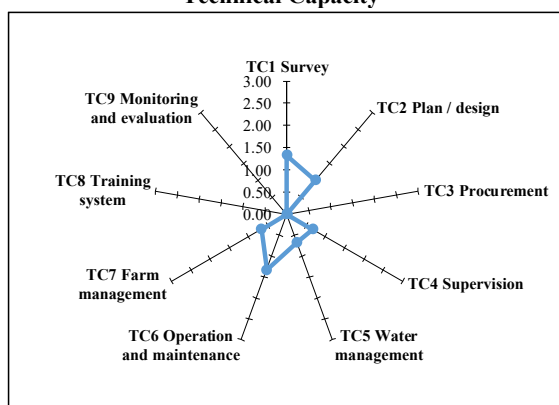
By stations, the result of Ngoma station shows that TC is very limited but CC is relatively good except CC1 and CC7. TC of Rubirizi station shows similar characteristics as Ngoma station. TC is very limited and CC is better than TC. The result of Rubona station differs from other two stations'. They have advantages on the procurement system and capacity of farm management, and capacity on conflict resolution is the weakest point.

In common, all stations do not have sufficient training system. As for CC, all stations have relatively good evaluations on accountability and membership.

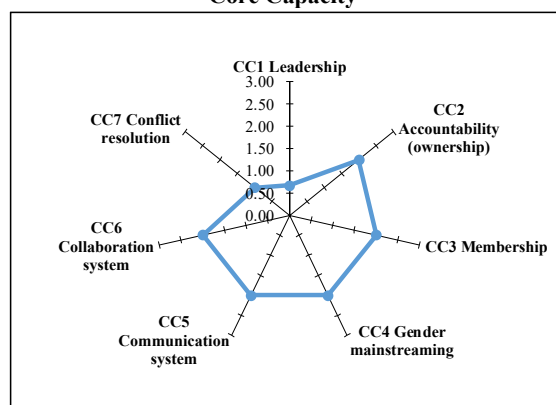
Table 6.7 Result of CA for RAB Stations

Capacity	Assessment Item		Average Score		
			Ngoma Station	Rubirizi Station	Rubona Station
Enabling Environment	EE1	Policy framework	2.00	1.00	0.00
	EE2	Legal system	2.00	2.00	1.00
	EE3	Supporting system by central government	0.50	0.50	0.00
Technical Capacity	TC1	Survey	1.33	1.33	1.00
	TC2	Plan and design	1.00	1.00	1.00
	TC3	Procurement	0.00	0.00	2.00
	TC4	Supervision	0.67	0.67	1.00
	TC5	Water management	0.67	0.67	0.33
	TC6	Operation and maintenance	1.33	1.33	0.33
	TC7	Farm management	0.67	0.00	2.00
	TC8	Training system	0.00	0.00	0.00
	TC9	Monitoring and evaluation	0.00	0.00	1.00
Core Capacity	CC1	Leadership	0.67	0.67	1.00
	CC2	Accountability (ownership)	2.00	2.00	2.00
	CC3	Membership	2.00	2.00	2.33
	CC4	Gender mainstreaming	2.00	2.00	1.00
	CC5	Communication system	2.00	0.50	1.00
	CC6	Collaboration system	2.00	1.50	1.50
	CC7	Conflict resolution	1.00	1.00	0.00
Total Score (%)			38.30	31.87	32.46

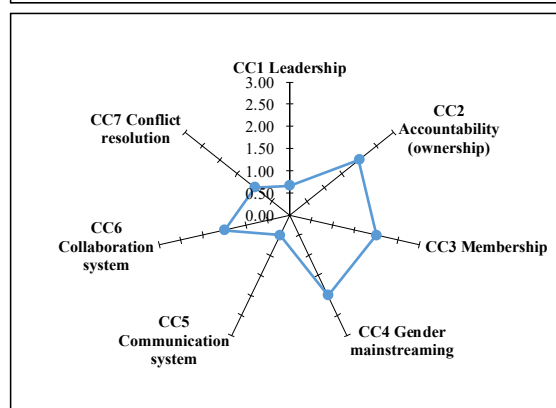
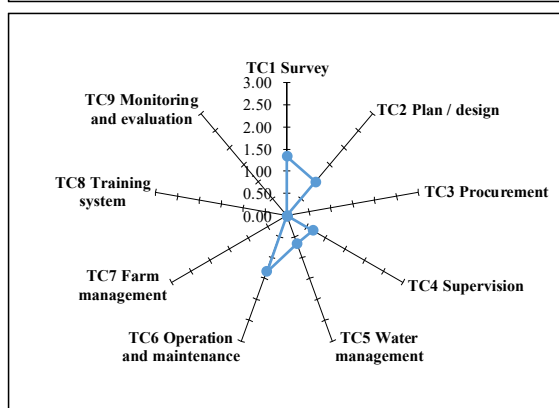
Technical Capacity



Core Capacity



Ngoma Station



Rubirizi Station

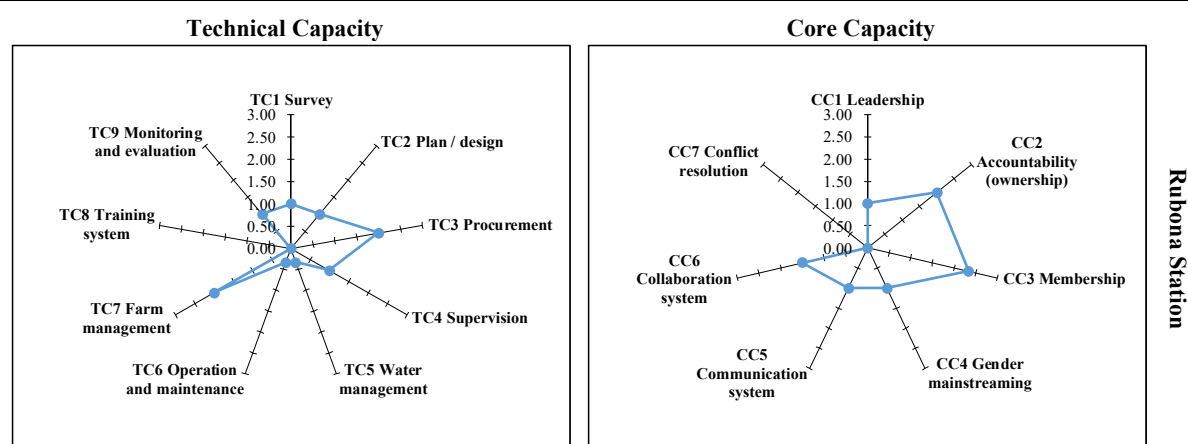


Figure 6.3 TC and CC of RAB Stations

(3) Districts

The total scores of CA for districts are between 40% to 50%. Although EE is relatively fair in all the districts, Ngoma district gives lower evaluations than other two districts.

The result of TC differs by districts. Ngoma district has low evaluation especially on TC9, TC10 and TC11, and apparently CC7 compared to other CCs. Rwamagana district has weak points on TC2, TC9 and TC10. CC of Rwamagana district is relatively sufficient, but CC4 is still challenging. Gisagara district has a good evaluation of TC3 because they have a certain committee for procurement, but it is not only for irrigation schemes. CC of Gisagara district is well-balanced, but collaboration system is lower than other CCs.

In common, the training system and M/E are weak points for all districts. Compared to TC, CC is close to the circle shape, which means the capacity is well-balanced.

Table 6.8 Result of CA for Districts

Capacity	Assessment Item		Average Score		
			Ngoma District	Rwamagana District	Gisagara District
Enabling Environment	EE1	Policy framework	1.00	2.00	2.00
	EE2	Legal system	1.00	2.00	2.00
Technical Capacity	TC1	Survey	1.67	2.00	0.67
	TC2	Plan and design	1.33	0.67	0.67
	TC3	Procurement	2.00	2.00	2.33
	TC4	Supervision	1.00	2.00	2.00
	TC5	Water management	1.00	1.33	1.33
	TC6	Operation and maintenance	1.33	1.33	1.33
	TC7	Farm management	2.00	2.00	1.00
	TC8	IWUO organisational management	1.50	1.50	1.67
	TC9	Training system	0.25	0.00	0.50
	TC10	Monitoring and evaluation	0.00	0.00	1.00
	TC11	Financial management (budgeting)	0.00	1.00	2.00
Core Capacity	CC1	Leadership	1.50	2.00	2.00
	CC2	Ownership	2.00	2.00	2.00
	CC3	Membership	1.33	2.00	2.00
	CC4	Gender mainstreaming	2.00	1.00	2.00
	CC5	Communication system	2.00	2.00	2.00
	CC6	Collaboration system	1.33	2.00	1.33
	CC7	Conflict resolution	0.00	2.00	2.00
Total Score (%)			40.42	51.39	53.06

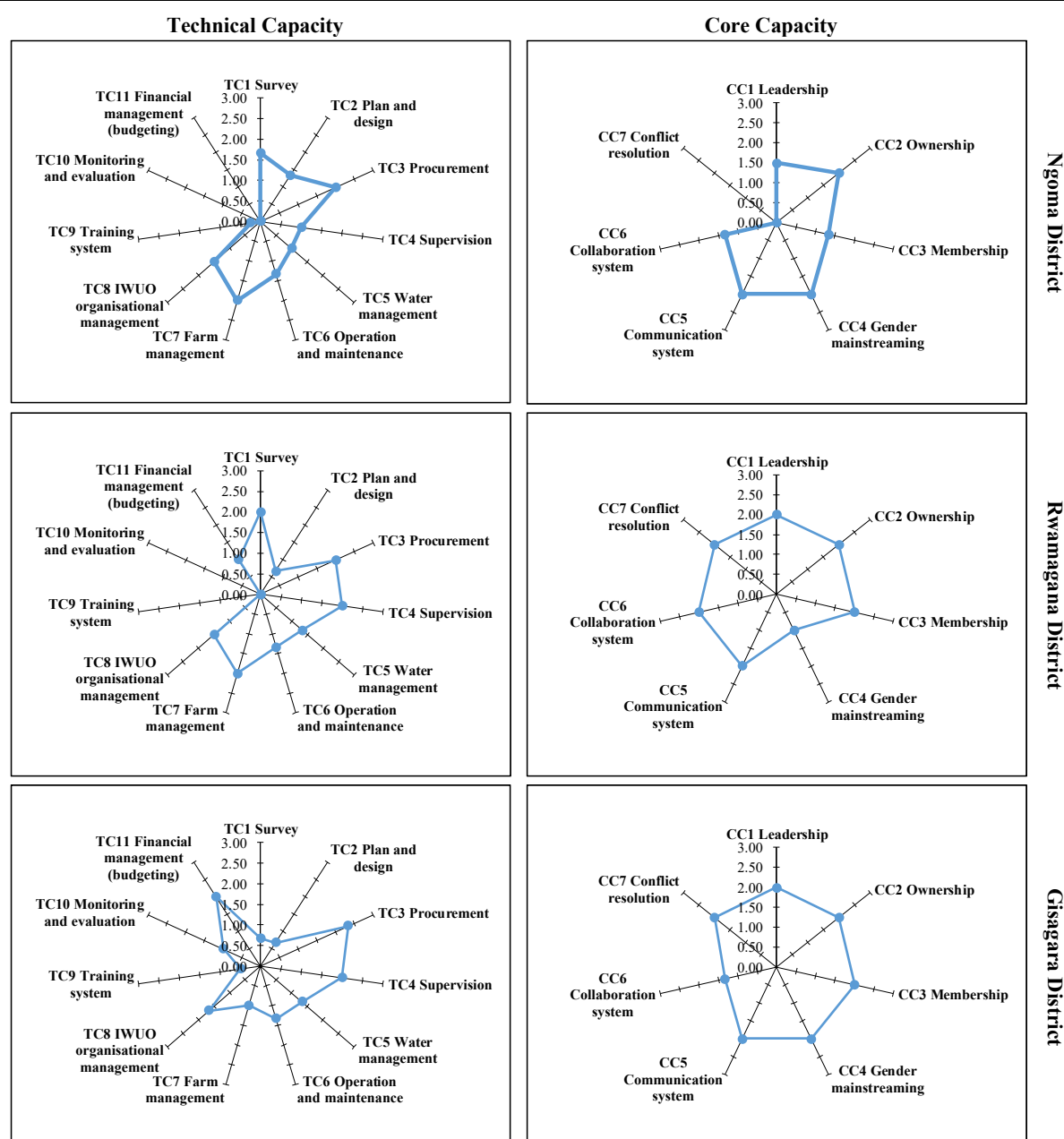


Figure 6.4 TC and CC of Districts

Current Condition of District Irrigation Steering Committee (DISC)

In general, DISC is a committee made up of different stakeholders at the district level whose responsibility is the overall management and supervision of irrigation infrastructures. According to the Ministerial Order No 001/11.30 of 23/12/2011, the DISC is composed of all stakeholders operating in irrigation within the district. Its mandate is to orient and supervise IWUOs activities in all irrigation schemes within the district. The responsibilities of DISC are as follows.

Table 6.9 Responsibilities of DISC

Responsibilities of DISC
<ul style="list-style-type: none"> • Provide a technical and managerial support to IWUOs; • Monitor and evaluate the operation and maintenance of all irrigation infrastructures; • Financial audit of IWUOs; • Share and coordinate responsibilities between stakeholders operating in irrigation schemes; • Coordinate implementation of the land lease and management agreements, the water permit, the irrigation

Responsibilities of DISC	
	management transfer agreement;
•	Draft an evaluate, every growing season, the performance contract between the District and the IWUOs and the Cooperatives;
•	Resolve any differences of opinion between IWUOs and the cooperatives;
•	Approval of the IWUOs annual plans and budgets; annual activities and financial reports;
•	Any other responsibility specified in internal regulation of the Committee.

Source: Final Report on Data Collection Survey on Irrigation Development at Lowland Swamp in Eastern Province, 2015

IWUO-SU has managed to establish DISCs in following districts namely Gatsibo, Nyagatare, Ngoma, Nyamagabe, Gakenke, Muhanga, Rulindo, Ruhango, Kamonyi, Nyamasheke, Karongi Nyanza, Bugesera, Kirehe, Ngororero, Huye, Gisagara, Rwamagana and Rusizi, where irrigation schemes are developed.

As mentioned above, DISC was established in all the targeted districts. However, all DISCs are not necessarily active.

In Ngoma and Rwamagasa districts, although seasonal preparation meetings are regularly held, DISC do not hold any meetings and not discuss on irrigation schemes or IWUOs. This is because Ngoma and Rwamagana do not have a big number of IWUOs in the district as Gisagara, and the irrigation schemes were recently developed.

On the other hand, Gisagara district holds the DISC meeting once a quarter. It is held at the same time with seasonal preparation meeting for the efficiency. Gisagara's DISC is supervising the management of water fees for IWUOs, communicating with IWUOs well, and contribute in establishment of SISC (Scheme Irrigation Steering Committee), which is also functioning. The reasons why DISC in Gisagara district is more active than other districts are as follows. Still, it is hard to say that DISC in Gisagara is fully functioning for the management of irrigation schemes and IWUOs.

- There are a large number of IWUOs, and this can also be a factor to seriously consider the DISC as crucial to deal with the issues related to IWUOs and its management;
- Gisagara district is endowed of a large number of developed irrigation schemes since many years ago (developed in eighties), and many projects have been implemented such as RSSP, LWH by World Bank and QWMDP by MINAGRI/RAB. Thus, the local authorities have much interest to make DISC active for management of developed schemes; and
- Gisagara district mainly relies on growing paddy, which requires much irrigation water.

As mentioned above, DISC is one of the key organisations for management of irrigation schemes or IWUOs. It is necessary to make DISC active and capacitate the members of DISC in the Project.

(4) Model IWUOs

1) Ngoma 22 in Ngoma District

The total score of CA for Ngoma 22 is below 40%. EEs of Ngoma 22 are good enough except EE3. This is because several donors have intervened in Ngoma 22. Both irrigation infrastructures and IWUO were established by those donors' support. However, IWUO is still in the infant stage. The general capacity combining three aspects is insufficient.

Although the results of TC5 and TC7 are seemed to be slightly good, TC of Ngoma 22 is very limited. As a result of CC shows, the basic capacity such as ownership and membership is very low, therefore, the acceptability of the IWUO is insufficient. For this IWUO, rebuilding of the organisation is necessary and basic organisational training is firstly needed.

Table 6.10 Result of CA for Ngoma 22

Capacity	Assessment Item		Average Score
Enabling Condition	EE1	Policy framework	3.00
	EE2	Legal system	3.00
	EE3	Administrative support system	0.50
	EE4	Environmental condition	3.00
Technical Capacity	TC1	Water management	0.75
	TC2	Operation and maintenance	0.00
	TC3	Farm management	1.00
	TC4	Financial management	0.00
	TC5	Rule making	2.00
	TC6	Internal evaluation	0.00
	TC7	Organisational management	2.00
	TC8	Audit system	1.00
Core Capacity	CC1	Leadership	0.50
	CC2	Ownership	0.33
	CC3	Membership	1.00
	CC4	Gender mainstreaming	1.00
	CC5	Communication system	0.40
	CC6	Collaboration system	0.67
	CC7	Conflict resolution	1.00
Total Score (%)			37.11

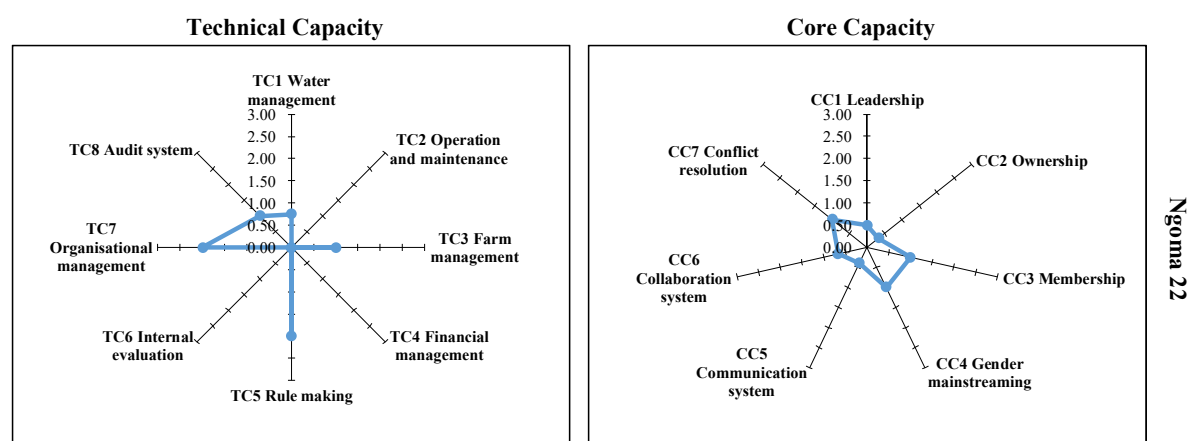


Figure 6.5 TC and CC of Ngoma 22

2) Ngiriyi and Nyabuyogera in Gisagara District

The results of CA are different between Ngiriyi and Nyabuyogera. Both Ngiriyi and Nyabuyogera scheme are located in the north part of Gisagara district, however, the total capacity of Ngiriyi is better than that of Nyabuyogera. It may be because Ngiriyi has established in 1993 and it has longer experience while Nyabuyogera was established in 2013. On the other hand, the result of Nyabuyogera shows that the IWUO and cooperative are still in the infant stage especially in terms of technical aspect. In the training activities, Nyabuyogera IWUO can learn from Ngiriyi IWUO. The other reasons of Nyabuyogera power performance are associated to insufficiency of water storage facilities, poor infrastructures.

Table 6.11 Result of CA for IWUO-SU

Capacity	Assessment Item		Average Score	
			Ngiriyi	Nyabuyogera
Enabling Condition	EE1	Policy framework	3.00	3.00
	EE2	Legal system	3.00	3.00
	EE3	Administrative support system	0.50	0.50
	EE4	Environmental condition	3.00	3.00
Technical Capacity	TC1	Water management	1.25	0.25
	TC2	Operation and maintenance	1.80	0.60
	TC3	Farm management	1.50	0.00

Capacity	Assessment Item		Average Score	
			Ngirya	Nyabuyogera
	TC4	Financial management	1.86	0.29
	TC5	Rule making	1.50	2.00
	TC6	Internal evaluation	2.00	1.00
	TC7	Organisational management	1.33	0.67
Core Capacity	TC8	Audit system	2.00	1.00
	CC1	Leadership	1.75	1.50
	CC2	Ownership	1.33	2.00
	CC3	Membership	2.00	1.50
	CC4	Gender mainstreaming	1.25	2.00
	CC5	Communication system	1.80	1.20
	CC6	Collaboration system	1.33	1.33
Total Score (%)			58.26	43.57

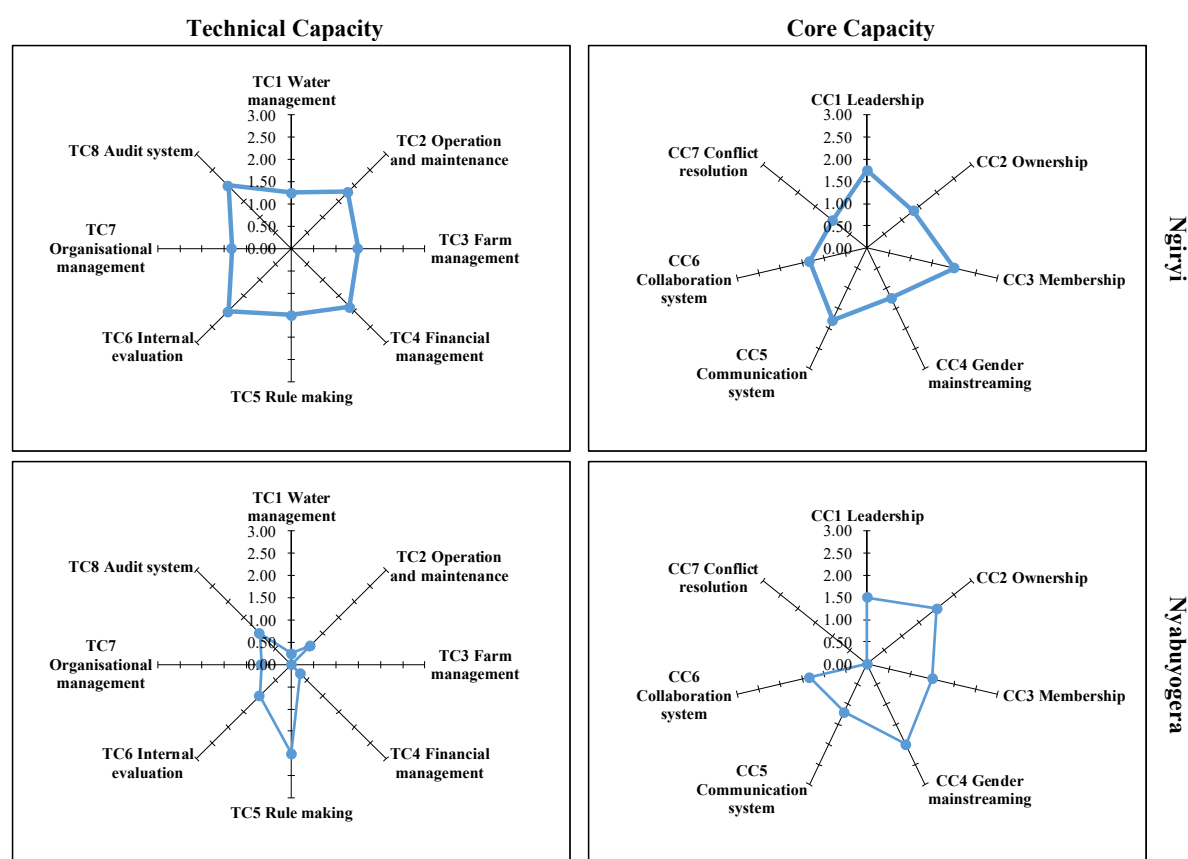


Figure 6.6 TC and CC of Ngirya and Nyabuyogera

Chapter 7 Survey on Service Providers

7.1 Objective

Considering i) the current situation that RAB is allocating a certain budget for SPs, ii) limited personnel condition of RAB staffs and iii) “specialized operator companies” are mentioned as potential business model in draft “Improving and Updating Rwanda Irrigation Master Plan (2019)”, the cooperative relationship with SPs should be considered in the Project.

With this background, during the first phase of Survey and Planning, the Project organized the survey for existing SPs in the field of water management, O&M and farm management by collecting basic information and evaluating the current activity status in order to study a possible collaboration for training activities in the future.

7.2 Result and Discussion

According to the information from RAB, there are about 20 SPs operating in the field of water management, O&M and farm management as shown in the table below. Most of them have worked in the targeted districts of the Project. For the Rwandan fiscal year of 2019/2020, 15 SPs have signed a contract with RAB. Regarding their specification, many SPs are related to Outputs 3 and 4 of the Project, followed by SPs related to Output 5. In particular, there are many SPs for Small Scale Irrigation Technology (SSIT), which is a project coordinated by RAB under MINAGRI.

Regarding the organisational form, there are different types of SPs such as company type and NGO type. HoReCo and Once Acre Fund are relatively large organisations who have more than hundred staff. However, most of the SPs are small organisations with 5 or less permanent staff.

Challenges which were pointed out in the hearing survey from RAB are as follows:

- Challenges of RAB side: delay of payment from RAB, high contract price, lack of fund;
- In some case service providers, implementation modalities are not tested before expansion, therefore possibility of errors;
- Challenges of SP side: shortage of SSIT equipment in store, lack of fund, unstable employment due to salary;
- Challenges of farmers side: lack of skills, farmers’ mindset;
- Other challenges: lack of spare parts, monopoly/less competitive method in procurement.

The Project also conducted questionnaire survey on SPs with RAB station staffs and district officers in workshops held in August 2019. However, basically a contract is signed between two parties, a SP company/NGO and RAB HQs. Therefore, district side does not intervene in the agreement and not exactly know the activities. While HoReCo is relatively well known compared to other SPs, information sharing with RAB and districts is the most challenging issue in the SP system. The district side also requested the detailed information on SPs and their activities.

Since there is no direct involvement with SPs at station and district level, the results of questionnaire survey will be used only as supplemental information. All the results of the questionnaire survey are shown in **Annex 6-1**.

Table 7.1 List of Service Providers in the Rwandan Fiscal Year of 2018/2019

No.	Service provider	Domain of intervention	Possible Cooperation in WAMCAB	Human resource	District			Challenges	2019/2020
					N	R	G		
1	HORECO	Operation, maintenance and management of irrigation schemes	Output 2 Output 3 and 4 Output 5	Approximately 110 staffs in total (Large SP) i) crop production and value chain manager, ii) community mobilization and capacity building field officer, and iii) irrigation engineer at irrigation scheme level in Opearation, Maintenance and Management of Irriarion Scheme (OMMIS) Project	✓		✓	Monopoly/less competitive method in recruitment, lack of skills and mindset of farmers, contract price is high.	✓
2	ETC AGRO TRACTORS AND IMPLEMENTS	• Supply and installation of SSIT equipment • Maintenance of irrigation infrastructure lot 1 (hillside)	Output 3 and 4	N/A	✓	✓	✓		✓
3	ECM	Supplying, installation, capacity building of SSIT facilities	Output 3 and 4	N/A	✓	✓	✓	Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	✓
4	SOCOSE LTD	Supplying, installation, capacity building of SSIT facilities	Output 3 and 4	Irrigation and drainage 3, and one in management (4 in total)	✓	✓	✓	Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	✓
5	INNOVATECHS LTD	Supply and installation of SSIT equipment	Output 3 and 4	N/A	✓	✓	✓	Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	✓
6	GENERAL CONSULTANCY AND TRADING COMPANY LTD	Supply and installation of SSIT equipment	Output 3 and 4	Irrigation and drainage 4, and one in management (5 in total)	✓	✓	✓	Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	✓
7	COCA LTD	Supplying, installation, capacity building of SSIT facilities	Output 3 and 4	N/A	✓	✓			
8	HOLLAND GREENTECH	Supply and installation of SSIT equipment	Output 3 and 4	N/A	✓	✓	✓		✓
9	WATER AND ENERGYCENTER LTD	Supply and installation of SSIT equipment	Output 3 and 4	N/A	✓	✓	✓		✓
10	INTERTECH	Supply and installation of SSIT equipment	Output 3 and 4	N/A		✓	✓		✓

No.	Service provider	Domain of intervention	Possible Cooperation in WAMCAB	Human resource	District			Challenges	2019/2020
					N	R	G		
11	IGNITE POWER RWANDA	Supply and installation of SSIT equipment	Output 3 and 4	N/A	✓	✓	✓		✓
12	URUGAGA IMBARAGA	<ul style="list-style-type: none"> • Economic services to members ; • Research, training and information ; • Good Governance and Civic Participation ; • Gender equity and women empowerment ; • Environmental protection, management and climate change ; • Lobby and Advocacy 	Output 1 and output 5	N/A					
13	RDO	Supplying, installation, capacity building of SSIT facilities	Output 3 and 4	Irrigation and drainage 4, and one in management (5 in total)	✓			Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	
14	RYAF	Operation, maintenance and management of irrigation schemes	Output 2 Output 3 and 4 Output 5	N/A		✓		Employment is not stable because of their salary.	✓
15	YEAN	Capacity building on cooperative, management, post-harvest activities and market linkage. Also in social protection	Output 5	N/A	✓			Lack of fund	
16	RWARRI	Capacity building on cooperative, management, post-harvest activities and market linkage. Also in social protection	Output 5	N/A	✓				
17	ONE ACRE FUND	<ul style="list-style-type: none"> • Supply mineral fertilizers • Supply and distribution of certified hybrid and open pollinated (OPVs) maize seeds 	Output 5	More than 800 staffs with different background (Large SP)	✓	✓	✓		✓
18	OPEN CONSTRUCTION & RELATED SERVICES (OCSRS) LTD	Supply and installation of SSIT equipment	Output 3 and 4	Irrigation and drainage 4, and one in management (5 in total)	✓	✓	✓	Delay of payment, lack of skills of farmers on O&M, shortage of SSIT equipment in store, lack of spare party	✓
19	NIKKI PRODUCTION LTD	Supply and installation of SSIT equipment	Output 3 and 4	N/A	✓	✓	✓		✓
20	Pro-water Rwanda Ltd	Supply and installation of SSIT equipment	Output 3 and 4	N/A					✓

Chapter 8 Survey on Farming

8.1 Background

In the field of farming improvement, there are already several GoR and donor projects, therefore several agricultural training materials have been prepared. For this reason, cooperatives are more developed comparing to IWUO, hence some of the cooperatives have strengthen. In farm improvement activities in WAMCAB, the existing lessons learned and achievements will be utilized as much as possible to implement the Project efficiently.

8.2 Objective

Objectives of the survey on farming are as follows:

- To collect the existing training materials and information related to agriculture;
- To grasp the current situation, challenges and need of highly-applicable farming; and
- To grasp the activity status, and to consider the cooperative relationship

8.3 Result

WAMCAB implemented the visiting to the Government organizations, private companies and donors in May and June 2019 to collect the training materials, data and services related to agriculture. The collected data is shown in the table below.

Table 8.1 The List of the Existing Training Materials and Stakeholders related to Rice Production and Vegetable Production

Existing Training Materials/ Stakeholders	Contents of the Training Materials/ Project/Program/Services of the Stakeholders
Training Materials for Agriculture	<ul style="list-style-type: none"> ✓ SMAP/JICA technical manual for market-oriented farming: Rice cultivation, horticulture, management and gender, marketing. Human resources from RAB and districts. ✓ PiCROPP/JICA technical manual: Rice cultivation, water management, post-harvest, horticulture, marketing, organization strengthening & gender mainstreaming. ✓ Horticulture Center of Excellence supported by Israel: Horticulture production, soil improvement, etc. ✓ E-hinga supported by World Vision Rwanda and Farm Concern International: Online manual for crop and vegetable cultivation
The Government of Rwanda Program/Service	<ul style="list-style-type: none"> ✓ Twigire Muhinzi implemented by RAB: Agriculture extension system ✓ Rice Program implemented by RAB: Recommended rice varieties ✓ E-soko managed by MINAGRI: Market price information and analysis ✓ Seasonal Agricultural Survey Annual Report 2018 and Season (A, B) Report issued by NISR: Agriculture statistic data ✓ Rwanda Meteorology Agency (RMA): ✓ Service Providers: Irrigation scheme management, agriculture extension, etc.
Donor's Project	<ul style="list-style-type: none"> ✓ Horticulture Center of Excellence supported by Israel ✓ Reducing Post-Harvest Losses in Rwanda supported by United States Agency for International Development (USAID): Post-harvest technique to reduce food losses ✓ Caravan Project supported by Morocco: Soil data analysis ✓ HortInvest supported by SNV
Private Sector/Cooperative	<ul style="list-style-type: none"> ✓ Seed Company, Agricultural Material Company: Recommended vegetable seed ✓ Rice Mill Company (ICM Rwanda Agribusiness Ltd.: Gikonko rice mill company, Rwamagana rice mill company): Market information, contract farming. ✓ Private agricultural company exporting agricultural products ✓ Local Market (Kigali, Rwamaganam district, Ngoma, and Gisagara districts): Market information, sales price. ✓ Cooperative's production record: production area, yield, sales price

In WAMCAB Project, there is a possibility to utilize particularly SMAP manuals, rice varieties recommended by Rice Program, vegetable varieties recommended by seed companies, marketing information such as E-soko and production record. Furthermore, WAMCAB identified issues that need to be addressed in marketing and use of irrigation water so as to improve the profitability of rice and vegetable production.

Report of First Capacity Assessment for IWUOs

1.1 Background

Capacity Assessment (CA) is defined as the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels - including the individual, organizational and societal level - and the extent to which development process has brought about positive changes (Capacity Development: CD), and then sharing the results from this with concerned parties in order to formulate CD strategies.

1.2 Objective

The objectives of CA in WAMCAB project are summarized as below:

1. To diagnosis on the capacity and needs of C/Ps in the related organizations, and to formulate the Improvement Plan / Training Plan;
2. To measure the transition of the capacity by implementing CA in the period of baseline survey, at the end of the 2nd Phase and at the end of the 3rd Phase of the Project;
3. Based on the results of CA implemented in the period of baseline survey, to share the scenario of the capacity development and goals with C/Ps, and to clarify the role of the Project and its positioning;
4. Based on the results of CA implemented at the end of the 2nd Phase, to confirm the achievement of the Improvement Plan / Training Plan, and to review necessary inputs and supports with C/Ps; and
5. By sharing the result of CA implemented at the end of the 3rd Phase with C/Ps, to utilize them for the part of evaluation of the Project and preparation of actions toward after completion of the Project.

1.3 Method

(1) Target and Implementer

Targets of CA are i) IWUO-SU, ii) targeted RAB stations namely Ngoma, Rubirizi and Rubona, iii) targeted districts namely Ngoma, Rwamagana and Gisagara and iv) selected model IWUOs. Although the respondents are individual C/Ps, the Project focuses on the overall capacity of target organization.

In order to measure the effect of training, CA will be implemented for IWUOs in the model sites. The first CA is implemented by using the result of baseline survey. For missing information, a supplemental survey is conducted. Regarding IWUOs in Rwamagana district, which have not been organized yet, the first CA will be conducted at the time of their establishment.

The main implementer of CA is IWUO-SU for ii) targeted RAB stations, iii) targeted districts and iv) selected model IWUOs. Only for i) IWUO-SU, the JICA experts conducts CA by interviewing with IWUO-SU.

(2) Timing

The Project conducted the first CA from August to September 2019, and will conduct CA in the end of each phase.

- Baseline survey in the 1st Phase (August to September 2019)
- The end of the 2nd Phase (February 2021)
- The end of the 3rd Phase (February 2024)

(3) Components of Capacity in WAMCAB

Capacity only comes about once the following three elements have been integrated. Technology,

particular knowledge and tacit knowledge on the part of the organization is referred to as “Technical Capacity (TC)”. The will, attitude, leadership and management capabilities to activate technical capacity are referred to as “Core Capacity (CC)”, serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the “Enabling Environment (EE)” that encompasses the organization.

(4) Assessment Item

Each component has several assessment items as follows. For instance, TC1 for IWUO-SU is “Knowledge Management” which means that IWUO-SU shall manage the necessary knowledge such as water management, O&M and farm management by preparing the guidelines and/or manuals. These assessment items differs by organisations and basically are based on its role and responsibility. As shown in **Annex 5-1**, each assessment item has more detailed indicators aiming at the proper evaluation.

1) IWUO-SU

Table 1.1 Assessment Items for IWUO-SU

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」	Pre-condition (external condition).
	EE2 「Legal Framework」	
TC	TC1 「Knowledge Management」 ➤ Water Management ➤ O&M ➤ Farm Management	Necessary techniques, certain knowledge, and those management skills for the proper instruction and support to RAB Stations, District, etc.
	TC2 「Training System」	Monitoring and Evaluation (M/E) System for irrigation schemes (facility and IWUO).
	TC3 「Monitoring and Evaluation」	Administrative capacity for IMT procedure, budgeting and policy advice, etc.
	TC4 「Financial Management (budgeting)」	
	TC5 「Organisational Management」	
	TC6 「Project Management」	
	TC7 「Policy Advice」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatively. Leadership to determine the policy solve the problem based on the opinions from RAB Stations and District/Sector, etc. Communication and collaboration system with RAB Stations and Districts.
	CC2 「Membership」	
	CC3 「Awareness of Problems」	
	CC4 「Awareness of Challenges」	
	CC5 「Gender Mainstreaming」	
	CC6 「Communication System」	
	CC7 「Collaboration System」	

2) RAB Stations (Ngoma, Rubirizi and Rubona)

Table 1.2 Assessment Items for RAB Stations

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」	Pre-condition (external condition). Necessary resources provided by central government.
	EE2 「Legal Framework」	
	EE3 「Supporting System by Central Government」	
TC	TC1 「Survey」	Necessary techniques, certain knowledge, and training system for the proper instruction and support to District/Sector. (Required particularly high expertise)
	TC2 「Plan and Design」	
	TC3 「Procurement」	
	TC4 「Supervision」	
	TC5 「Water Management」	
	TC6 「O&M」	
	TC7 「Farm Management」	
	TC8 「Training System」	
	TC9 「Monitoring and Evaluation」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems.
	CC2 「Accountability (Ownership)」	
	CC3 「Membership」	

Capacity	Assessment Item	Explanation
	CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Coordination skills for both central government (RAB HQ) and District/Sector.

3) Districts (Ngoma, Rwamagana, Gisagara)

Table 1.3 Assessment Items for District

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」 EE2 「Legal Framework」	Pre-condition (external condition).
TC	TC1 「Survey」 TC2 「Plan and Design」 TC3 「Procurement」 TC4 「Supervision」 TC5 「Water Management」 TC6 「O&M」 TC7 「Farm Management」 TC8 「IWUO Organizational Management」 TC9 「Training System」 TC10 「Monitoring and Evaluation」 TC11 「Financial Management (budgeting)」	Necessary techniques, certain knowledge, and training system for the proper instruction and support to District/Sector. (including the support from RAB Stations)
CC	CC1 「Leadership」 CC2 「Ownership」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, information and systems. Administrative capacity for the smooth operation for IMT procedure, budgeting and cooperation with IWUO, etc.

4) Model IWUOs

Table 1.4 Assessment Items for Model IWUO

Capacity	Assessment Item	Explanation
EE	EE1 「Policy Framework」 EE2 「Legal Framework」 EE3 「Administrative Supporting System」 EE4 「Environmental Condition」	Pre-condition (external condition). Necessary resources provided by government.
TC	TC1 「Water Management」 TC2 「O&M」 TC3 「Farm Management」 TC4 「Financial Management」 TC5 「Rule Making」 TC6 「Internal Evaluation」 TC7 「Organizational Management」 TC8 「Audit System」	Necessary techniques, certain knowledge, and systems for the proper scheme management.
CC	CC1 「Leadership」 CC2 「Accountability (Ownership)」 CC3 「Membership」 CC4 「Gender Mainstreaming」 CC5 「Communication System」 CC6 「Collaboration System」 CC7 「Conflict Resolution」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, and systems. Administrative systems for the smooth operation of IWUO.

(5) Evaluation

As mentioned above, each assessment item has one or several indicators (*questions*). Evaluators score with four grades such as Excellent (3pt.), Good (2pt.), Fair (1pt.) and Poor (0pt.) for each indicator. Average scores for each assessment item will be calculated and indicated in a spider chart as below.

Table 1.5 Example of Indicators for Assessment Item

Assessment Item	Indicator	Result	Score	Average Score
TC1 「Survey」	TC1-1 <i>Manuals or reference documents for survey are prepared.</i>	Good	2	1
	TC1-2 <i>Team or committee in charge of surveying in the district is clear.</i>	Poor	0	
	TC1-3 <i>Existence of competent human resource who can utilize the manuals. (who has academic background and/or practical experience)</i>	Fair	1	
TC2 「Plan and Design」	...	...	...	1.5
TC3 「Procurement」	...	...	...	2
...

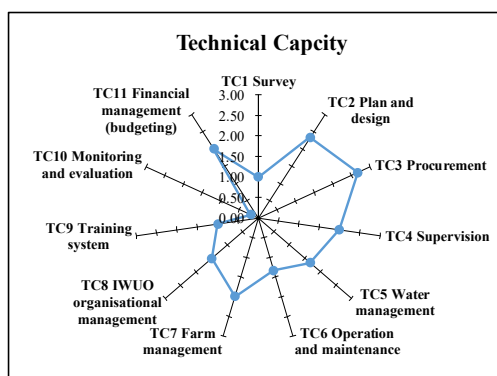


Figure 1.1 Example Result of Technical Capacity

According to the example result of technical capacity, this organisation has advantages on “TC2 Plan and Design”, “TC3 Procurement” and “TC7 Farm Management”. On the other hand, “TC1 Survey”, “TC9 Training System” and “TC10 M/E” are the weak points of the organisation. The Project can utilize the result to develop a strategy to enhance the capacity of the organisation by combining the results of other baseline survey, which can be Improvement Plan and Training Plan.

In addition, by chasing the transition of the capacity, the Project can measure the effectiveness of training activities and review necessary inputs and supports.

6.4 Result and Discussion

(1) IWUO-SU

The total score of CA for IWUO-SU is approximately 50%. As for EE, policy framework such as national policy and strategy for IWUO is relatively clear. However, the actual organisational structure is almost broken, and there are only two officers in the supporting unit as of 2019. With the limited number of personnel in the unit, it is unreasonable to fulfill all the responsibilities as regulated. The implementation of the Ministerial order No 001/11.30 of 23/12/2011 is relatively poor.

Although one of the missions of IWUO-SU is to oversee the installation of reliable IWUO’s performance monitoring system at IWUO, District and National levels, the result shows that the capacity on M/E system is remarkably poor.

Compared to the result of TC and CC, TC is smaller than CC. This trend is shown in the results of

other organisations, and the staffs can strongly feel the importance of technical training and the restructuring of the unit is required in order to equip it with staff and tools for enabling its functioning and performance. All the scores of TC have the low evaluation, less than 1.5pt. Especially, capacity on M/E is limited. On the other hand, CC is relatively well-balanced. IWUO-SU has advantages on “CC3 Awareness of Problems” and “CC7 Collaboration System”.

Table 1.6 Result of CA for IWUO-SU

Capacity	Assessment Item		Average Score
Enabling Condition	EE1	Policy framework	2.00
	EE2	Legal system	1.33
Technical Capacity	TC1	Knowledge management	1.50
	TC2	Training system	0.50
	TC3	Monitoring and evaluation	0.00
	TC4	Financial management (budgeting)	1.00
	TC5	Organizational management	1.00
	TC6	Project management	1.00
	TC7	Policy advise	1.00
Core Capacity	CC1	Leadership	2.00
	CC2	Membership	2.33
	CC3	Awareness of problems	2.50
	CC4	Awareness of challenges	1.50
	CC5	Gender mainstreaming	2.00
	CC6	Communication system	1.25
	CC7	Collaboration system	2.50
Total Score (%)			48.78

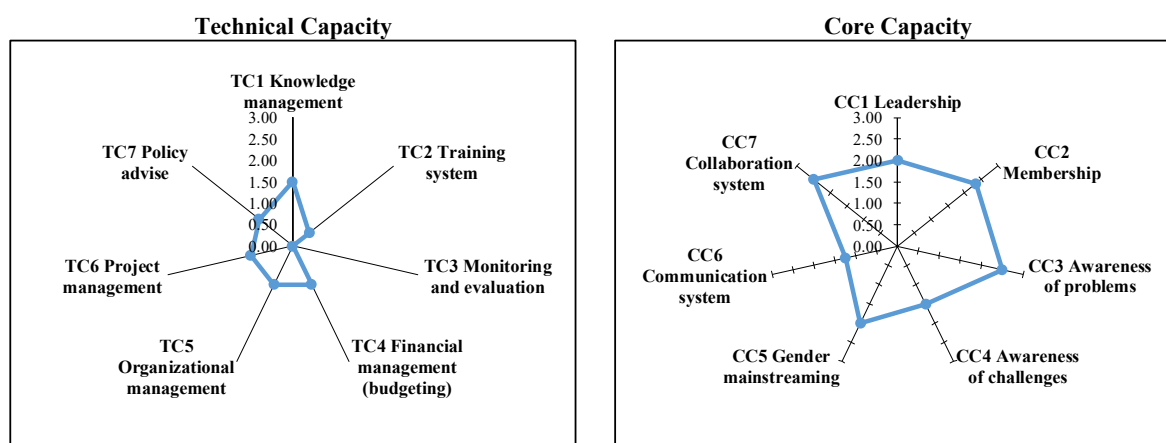


Figure 1.2 TC and CC of IWUO-SU

(2) RAB Stations

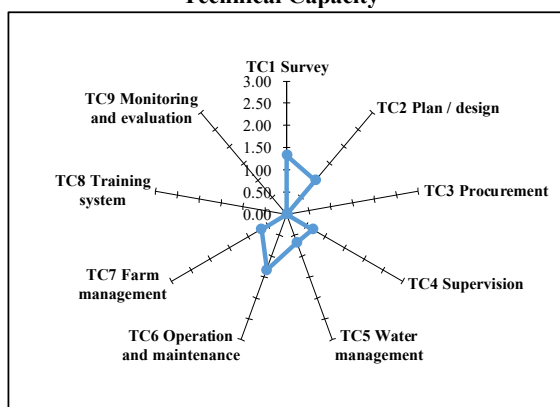
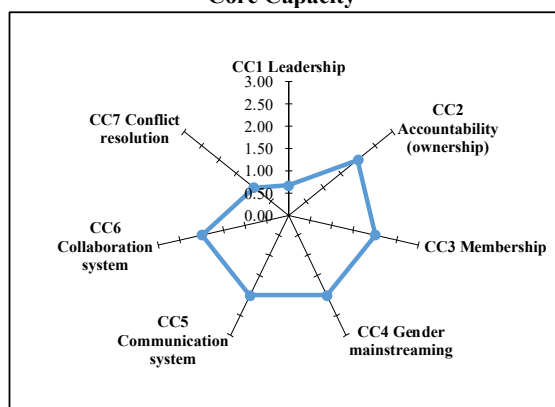
The total scores of CA for RAB stations are between 30% to 40%. As for EE, all the Districts evaluated that the supporting system from the central government is insufficient. As mentioned above, one of the reasons is considered to be the limited number of personnel in the central organisation.

By stations, the result of Ngoma station shows that TC is very limited but CC is relatively good except CC1 and CC7. TC of Rubirizi station shows similar characteristics as Ngoma station. TC is very limited and CC is better than TC. The result of Rubona station differs from other two stations'. They have advantages on the procurement system and capacity of farm management, and capacity on conflict resolution is the weakest point.

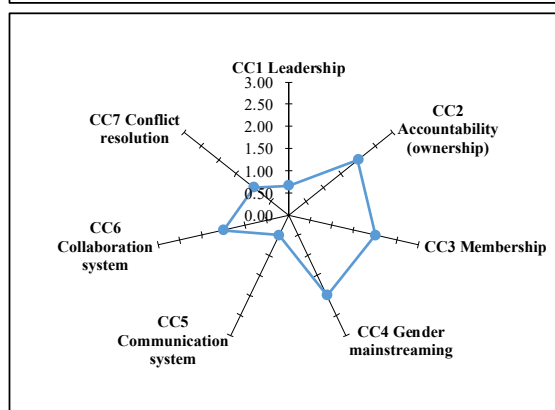
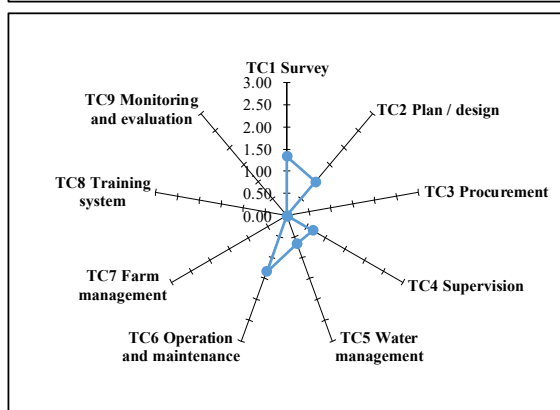
In common, all stations do not have sufficient training system. As for CC, all stations have relatively good evaluations on accountability and membership.

Table 1.7 Result of CA for RAB Stations

Capacity	Assessment Item		Average Score		
			Ngoma Station	Rubirizi Station	Rubona Station
Enabling Environment	EE1	Policy framework	2.00	1.00	0.00
	EE2	Legal system	2.00	2.00	1.00
	EE3	Supporting system by central government	0.50	0.50	0.00
Technical Capacity	TC1	Survey	1.33	1.33	1.00
	TC2	Plan and design	1.00	1.00	1.00
	TC3	Procurement	0.00	0.00	2.00
	TC4	Supervision	0.67	0.67	1.00
	TC5	Water management	0.67	0.67	0.33
	TC6	Operation and maintenance	1.33	1.33	0.33
	TC7	Farm management	0.67	0.00	2.00
	TC8	Training system	0.00	0.00	0.00
	TC9	Monitoring and evaluation	0.00	0.00	1.00
Core Capacity	CC1	Leadership	0.67	0.67	1.00
	CC2	Accountability (ownership)	2.00	2.00	2.00
	CC3	Membership	2.00	2.00	2.33
	CC4	Gender mainstreaming	2.00	2.00	1.00
	CC5	Communication system	2.00	0.50	1.00
	CC6	Collaboration system	2.00	1.50	1.50
	CC7	Conflict resolution	1.00	1.00	0.00
Total Score (%)			38.30	31.87	32.46

Technical Capacity**Core Capacity**

Ngoma Station



Rubirizi Station

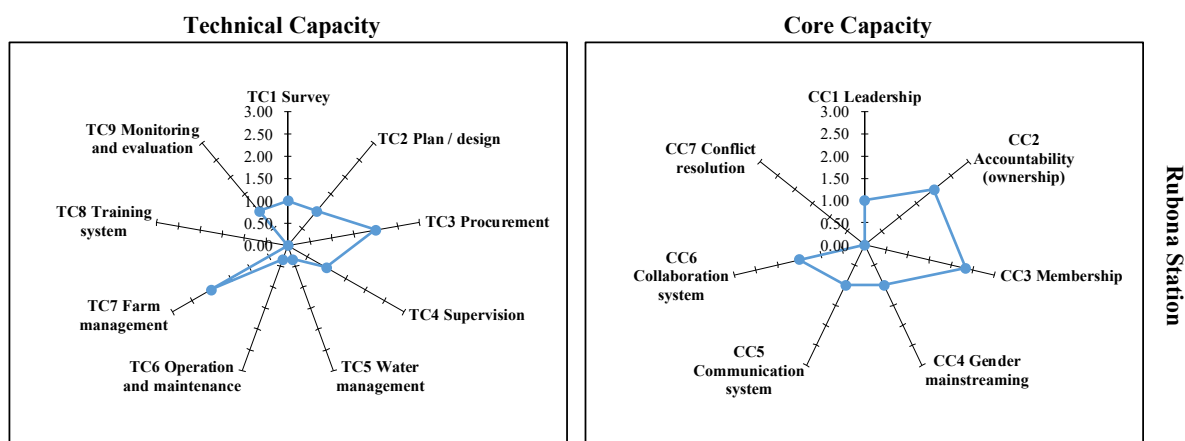


Figure 1.3 TC and CC of RAB Stations

(3) Districts

The total scores of CA for districts are between 40% to 50%. Although EE is relatively fair in all the districts, Ngoma district gives lower evaluations than other two districts.

The result of TC differs by districts. Ngoma district has low evaluation especially on TC9, TC10 and TC11, and apparently CC7 compared to other CCs. Rwamagana district has weak points on TC2, TC9 and TC10. CC of Rwamagana district is relatively sufficient, but CC4 is still challenging. Gisagara district has a good evaluation of TC3 because they have a certain committee for procurement, but it is not only for irrigation schemes. CC of Gisagara district is well-balanced, but collaboration system is lower than other CCs.

In common, the training system and M/E are weak points for all districts. Compared to TC, CC is close to the circle shape, which means the capacity is well-balanced.

Table 1.8 Result of CA for Districts

Capacity	Assessment Item		Average Score		
			Ngoma District	Rwamagana District	Gisagara District
Enabling Environment	EE1	Policy framework	1.00	2.00	2.00
	EE2	Legal system	1.00	2.00	2.00
Technical Capacity	TC1	Survey	1.67	2.00	0.67
	TC2	Plan and design	1.33	0.67	0.67
	TC3	Procurement	2.00	2.00	2.33
	TC4	Supervision	1.00	2.00	2.00
	TC5	Water management	1.00	1.33	1.33
	TC6	Operation and maintenance	1.33	1.33	1.33
	TC7	Farm management	2.00	2.00	1.00
	TC8	IWUO organisational management	1.50	1.50	1.67
	TC9	Training system	0.25	0.00	0.50
	TC10	Monitoring and evaluation	0.00	0.00	1.00
	TC11	Financial management (budgeting)	0.00	1.00	2.00
Core Capacity	CC1	Leadership	1.50	2.00	2.00
	CC2	Ownership	2.00	2.00	2.00
	CC3	Membership	1.33	2.00	2.00
	CC4	Gender mainstreaming	2.00	1.00	2.00
	CC5	Communication system	2.00	2.00	2.00
	CC6	Collaboration system	1.33	2.00	1.33
	CC7	Conflict resolution	0.00	2.00	2.00
Total Score (%)			40.42	51.39	53.06

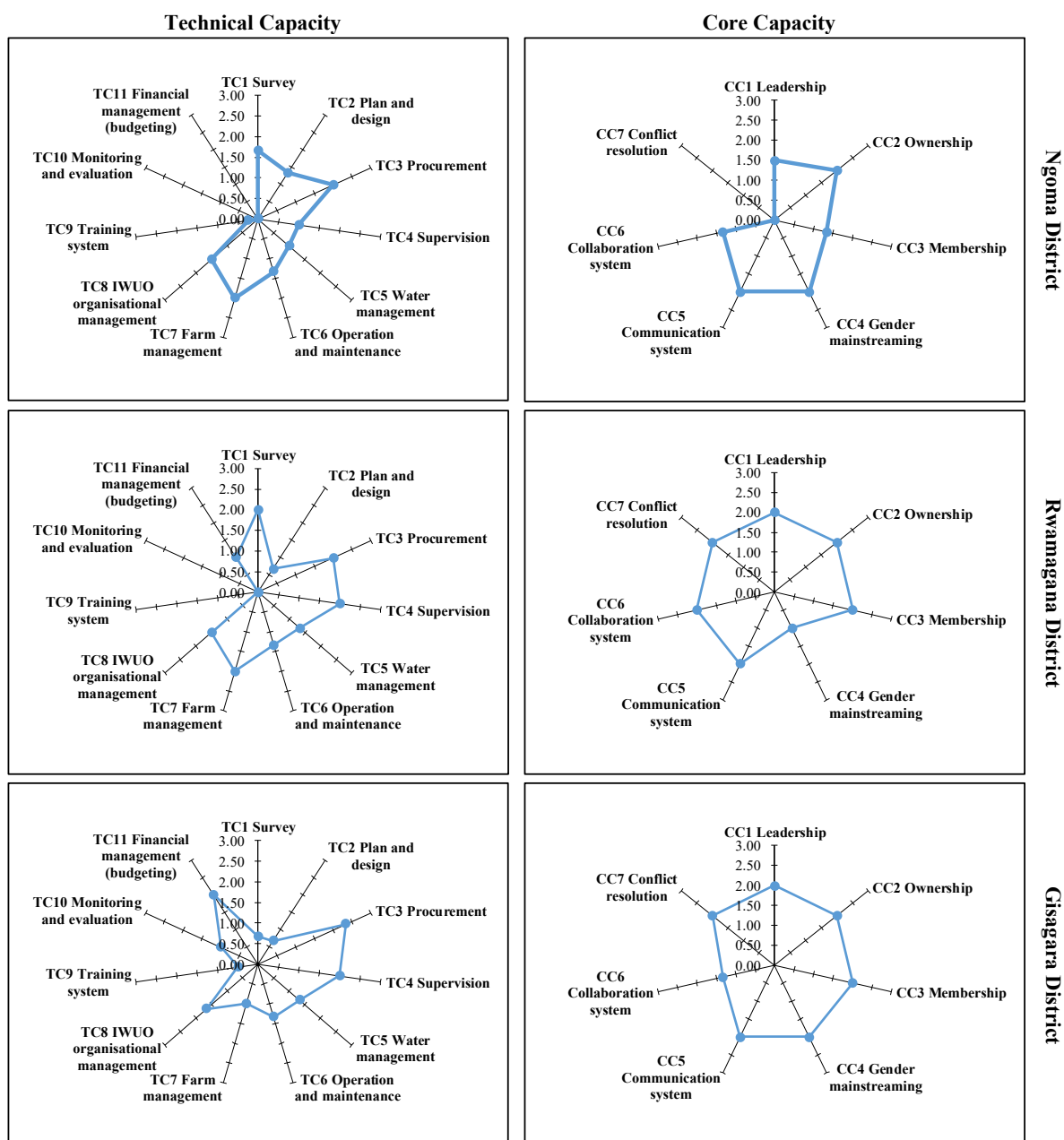


Figure 1.4 TC and CC of Districts

Current Condition of District Irrigation Steering Committee (DISC)

In general, DISC is a committee made up of different stakeholders at the district level whose responsibility is the overall management and supervision of irrigation infrastructures. According to the Ministerial Order No 001/11.30 of 23/12/2011, the DISC is composed of all stakeholders operating in irrigation within the district. Its mandate is to orient and supervise IWUOs activities in all irrigation schemes within the district. The responsibilities of DISC are as follows.

Table 1.9 Responsibilities of DISC

Responsibilities of DISC	
•	Provide a technical and managerial support to IWUOs;
•	Monitor and evaluate the operation and maintenance of all irrigation infrastructures;
•	Financial audit of IWUOs;
•	Share and coordinate responsibilities between stakeholders operating in irrigation schemes;
•	Coordinate implementation of the land lease and management agreements, the water permit, the irrigation

Responsibilities of DISC	
	management transfer agreement;
•	Draft an evaluate, every growing season, the performance contract between the District and the IWUOs and the Cooperatives;
•	Resolve any differences of opinion between IWUOs and the cooperatives;
•	Approval of the IWUOs annual plans and budgets; annual activities and financial reports;
•	Any other responsibility specified in internal regulation of the Committee.

Source: Final Report on Data Collection Survey on Irrigation Development at Lowland Swamp in Eastern Province, 2015

IWUO-SU has managed to establish DISCs in following districts namely Gatsibo, Nyagatare, Ngoma, Nyamagabe, Gakenke, Muhanga, Rulindo, Ruhango, Kamonyi, Nyamasheke, Karongi Nyanza, Bugesera, Kirehe, Ngororero, Huye, Gisagara, Rwamagana and Rusizi, where irrigation schemes are developed.

As mentioned above, DISC was established in all the targeted districts. However, all DISCs are not necessarily active.

In Ngoma and Rwamagasa districts, although seasonal preparation meetings are regularly held, DISC do not hold any meetings and not discuss on irrigation schemes or IWUOs. This is because Ngoma and Rwamagana do not have a big number of IWUOs in the district as Gisagara, and the irrigation schemes were recently developed.

On the other hand, Gisagara district holds the DISC meeting once a quarter. It is held at the same time with seasonal preparation meeting for the efficiency. Gisagara's DISC is supervising the management of water fees for IWUOs, communicating with IWUOs well, and contributing in establishment of SISC (Scheme Irrigation Steering Committee), which is also functioning. The reasons why DISC in Gisagara district is more active than other districts are as follows. Still, it is hard to say that DISC in Gisagara is fully functioning for the management of irrigation schemes and IWUOs.

- There are a large number of IWUOs, and this can also be a factor to seriously consider the DISC as crucial to deal with the issues related to IWUOs and its management;
- Gisagara district is endowed of a large number of developed irrigation schemes since many years ago (developed in eighties), and many projects have been implemented such as RSSP, LWH by World Bank and QWMDP by MINAGRI/RAB. Thus, the local authorities have much interest to make DISC active for management of developed schemes; and
- Gisagara district mainly relies on growing paddy, which requires much irrigation water.

As mentioned above, DISC is one of the key organisations for management of irrigation schemes or IWUOs. It is necessary to make DISC active and capacitate the members of DISC in the Project.

(4) Model IWUOs

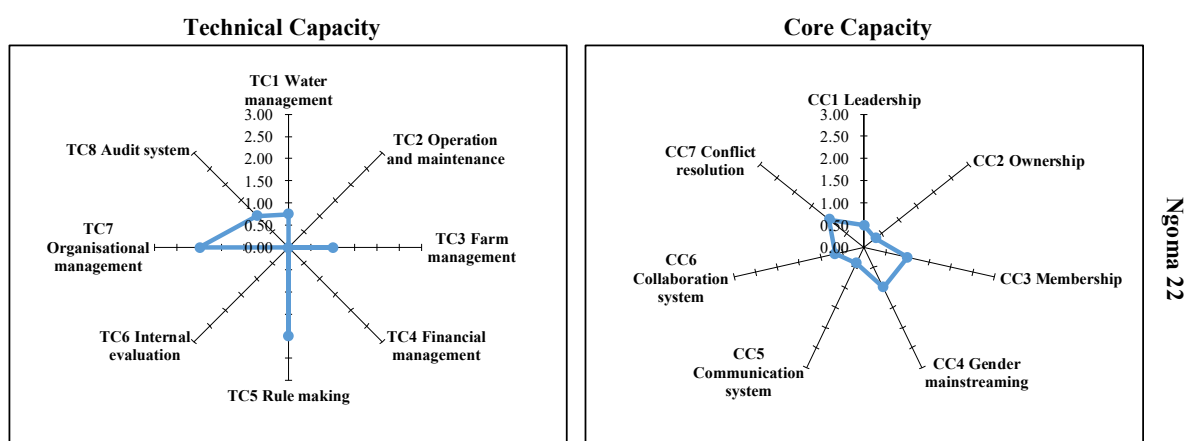
1) Ngoma 22 in Ngoma District

The total score of CA for Ngoma 22 is below 40%. EEs of Ngoma 22 are good enough except EE3. This is because several donors have intervened in Ngoma 22. Both irrigation infrastructures and IWUO were established by those donors' support. However, IWUO is still in the infant stage. The general capacity combining three aspects is insufficient.

Although the results of TC5 and TC7 are seemed to be slightly good, TC of Ngoma 22 is very limited. As a result of CC shows, the basic capacity such as ownership and membership is very low, therefore, the acceptability of the IWUO is insufficient. For this IWUO, rebuilding of the organisation is necessary and basic organisational training is firstly needed.

Table 1.10 Result of CA for Ngoma 22

Capacity	Assessment Item		Average Score
Enabling Condition	EE1	Policy framework	3.00
	EE2	Legal system	3.00
	EE3	Administrative support system	0.50
	EE4	Environmental condition	3.00
Technical Capacity	TC1	Water management	0.75
	TC2	Operation and maintenance	0.00
	TC3	Farm management	1.00
	TC4	Financial management	0.00
	TC5	Rule making	2.00
	TC6	Internal evaluation	0.00
	TC7	Organisational management	2.00
	TC8	Audit system	1.00
Core Capacity	CC1	Leadership	0.50
	CC2	Ownership	0.33
	CC3	Membership	1.00
	CC4	Gender mainstreaming	1.00
	CC5	Communication system	0.40
	CC6	Collaboration system	0.67
	CC7	Conflict resolution	1.00
Total Score (%)			37.11

**Figure 1.5 TC and CC of Ngoma 22**

2) Ngiriyi and Nyabuyogera in Gisagara District

The results of CA are different between Ngiriyi and Nyabuyogera. Both Ngiriyi and Nyabuyogera schemes are located in the north part of Gisagara district, however, the total capacity of Ngiriyi is better than that of Nyabuyogera. It may be because Ngiriyi has established in 1993 and it has longer experience while Nyabuyogera was established in 2013. On the other hand, the result of Nyabuyogera shows that the IWUO and cooperative are still in the infant stage especially in terms of technical aspect. In the training activities, Nyabuyogera IWUO can learn from Ngiriyi IWUO. The other reasons of Nyabuyogera power performance are associated to insufficiency of water storage facilities, poor infrastructures.

Table 1.11 Result of CA for IWUO-SU

Capacity	Assessment Item		Average Score	
			Ngiriyi	Nyabuyogera
Enabling Condition	EE1	Policy framework	3.00	3.00
	EE2	Legal system	3.00	3.00
	EE3	Administrative support system	0.50	0.50
	EE4	Environmental condition	3.00	3.00
Technical Capacity	TC1	Water management	1.25	0.25
	TC2	Operation and maintenance	1.80	0.60
	TC3	Farm management	1.50	0.00

Capacity	Assessment Item		Average Score	
			Ngirya	Nyabuyogera
	TC4	Financial management	1.86	0.29
	TC5	Rule making	1.50	2.00
	TC6	Internal evaluation	2.00	1.00
	TC7	Organisational management	1.33	0.67
Core Capacity	TC8	Audit system	2.00	1.00
	CC1	Leadership	1.75	1.50
	CC2	Ownership	1.33	2.00
	CC3	Membership	2.00	1.50
	CC4	Gender mainstreaming	1.25	2.00
	CC5	Communication system	1.80	1.20
	CC6	Collaboration system	1.33	1.33
Total Score (%)			58.26	43.57

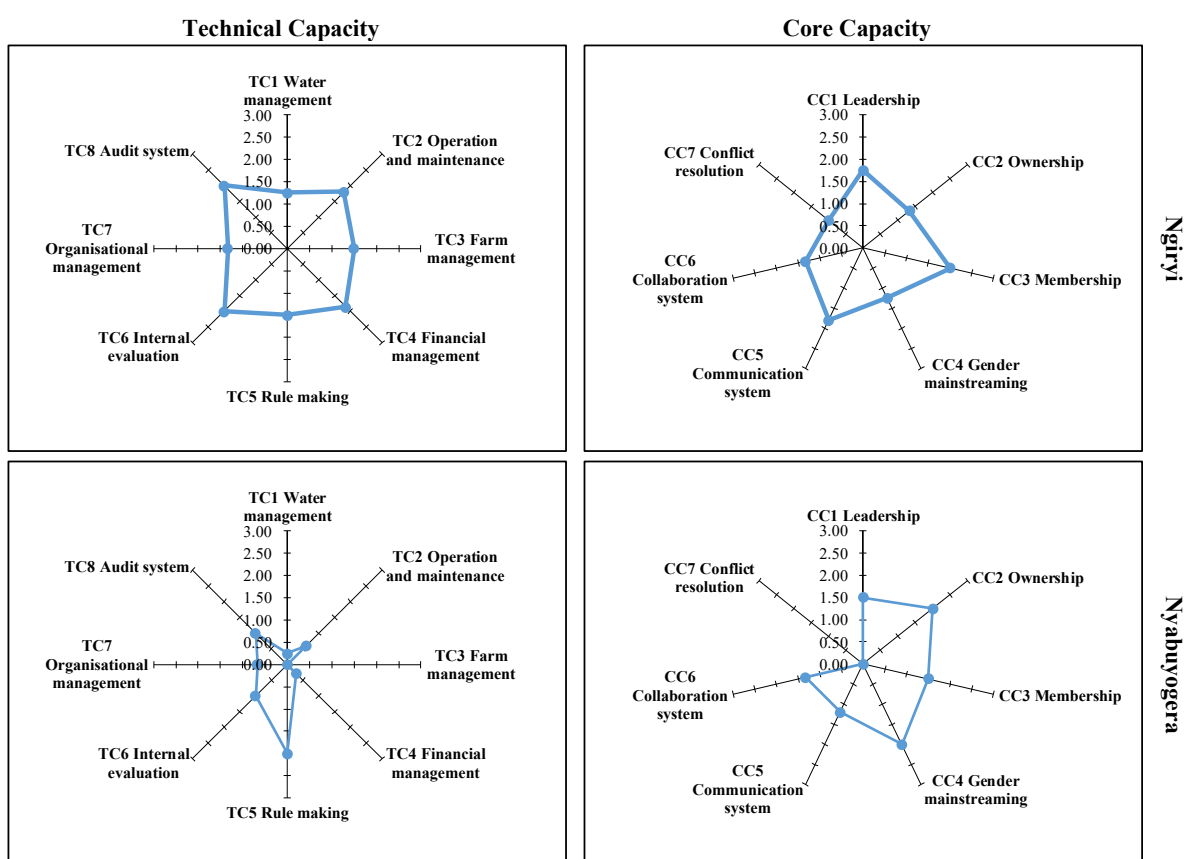


Figure 1.6 TC and CC of Ngirya and Nabuyogera

Report of Second Capacity Assessment for IWUOs

1.1 Background

Capacity Assessment (CA) is defined as the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels - including the individual, organizational and societal level - and the extent to which development process has brought about positive changes (Capacity Development: CD), and then sharing the results from this with concerned parties in order to formulate CD strategies.

1.2 Objective

The objectives of CA in WAMCAB project are summarized as below:

1. To diagnosis on the capacity and needs of C/Ps in the related organizations, and to formulate the Improvement Plan / Training Plan;
2. To measure the transition of the capacity by implementing CA in the period of baseline survey, at the end of the 2nd Phase and at the end of the 3rd Phase of the Project;
3. Based on the results of CA implemented in the period of baseline survey, to share the scenario of the capacity development and goals with C/Ps, and to clarify the role of the Project and its positioning;
4. Based on the results of CA implemented at the end of the 2nd Phase (Technical Guidance Phase), to confirm the achievement of the Improvement Plan / Training Plan, and to review necessary inputs and supports with C/Ps; and
5. By sharing the result of CA implemented at the end of the 3rd Phase (Institutionalization and Extension Preparation Phase) with C/Ps, to utilize them for the part of evaluation of the Project and preparation of actions toward after completion of the Project.

1.3 Method

(1) Target and Implementer

Targets of CA are i) IWUO-SU, ii) targeted RAB stations namely Ngoma, Rubirizi and Rubona, iii) targeted districts namely Ngoma, Rwamagana and Gisagara and iv) selected model IWUOs. Although the respondents are individual C/Ps, the Project focuses on the overall capacity of target organization. In this report, only the result of CA for IWUOs is presented. The results for other organizations will be presented in a separate report.

In order to measure the effect of training, CA will be implemented for IWUOs in the model sites. The first CA was implemented by using the result of baseline survey. For missing information, a supplemental survey was conducted. Regarding IWUOs in Rwamagana district, which had not been organized yet at the timing of baseline survey, the first CA was conducted after their establishment in January 2021.

The main implementer of CA is IWUO-SU for ii) targeted RAB stations, iii) targeted districts and iv) selected model IWUOs. Only for i) IWUO-SU, the JICA experts conducts CA by interviewing with IWUO-SU.

(2) Timing

The Project conducted the first CA from August to September 2019, and the second CA was conducted from January to February 2023.

- Baseline survey in the 1st Phase (August to September 2019) * Only for IWUO in Rwamagana

district, it was conducted in January 2021

- The end of the 2nd Phase (January - February 2023)
- The end of the 3rd Phase (Fourth quarter of 2024)

(3) Components of Capacity in WAMCAB

Capacity only comes about once the following three elements have been integrated. Technology, particular knowledge and tacit knowledge on the part of the organization is referred to as “Technical Capacity (TC)”. The will, attitude, leadership and management capabilities to activate technical capacity are referred to as “Core Capacity (CC)”, serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the “Enabling Condition (EC)” that encompasses the organization.

(4) Assessment Item

Each component has several assessment items as follows. For instance, TC1 is “Knowledge Management” which means that IWUO-SU shall manage the necessary knowledge such as water management, O&M and farm management by preparing the guidelines and/or manuals. These assessment items differs by organisations and basically are based on its role and responsibility. The same assessment items were used in the first and second CAs, but clear criteria were set for the second CA, taking advantage of the lessons learnt from the first CA, where no clear criteria were set. As shown in **Annex 1**, each assessment item has more detailed indicators aiming at the proper evaluation.

1) Model IWUOs

Table 1 Assessment Items for Model IWUO

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」	Pre-condition (external condition). Necessary resources provided by government.
	EC2 「Legal Framework」	
	EC3 「Administrative Supporting System」	
	EC4 「Environmental Condition」	
TC	TC1 「Water Management」	Necessary techniques, certain knowledge, and systems for the proper scheme management.
	TC2 「O&M」	
	TC3 「Farm Management」	
	TC4 「Financial Management」	
	TC5 「Rule Making」	
	TC6 「Internal Evaluation」	
	TC7 「Organizational Management」	
	TC8 「Audit System」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatively by utilizing the techniques, knowledge, and systems. Administrative systems for the smooth operation of IWUO.
	CC2 「Accountability (Ownership)」	
	CC3 「Membership」	
	CC4 「Gender Mainstreaming」	
	CC5 「Communication System」	
	CC6 「Collaboration System」	
	CC7 「Conflict Resolution」	

(5) Evaluation

As mentioned above, each assessment item has one or several indicators (*questions*). Evaluators score with four grades such as Excellent (3pt.), Good (2pt.), Fair (1pt.) and Poor (0pt.) for each indicator. Average scores for each assessment item will be calculated and indicated in a spider chart as below.

Table 2 Example of Indicators for Assessment Item

Assessment Item	Indicator	Result	Score	Average Score
-----------------	-----------	--------	-------	---------------

TC1 「Survey」	TC1-1 <i>Manuals or reference documents for survey are prepared.</i>	Good	2	1
	TC1-2 <i>Team or committee in charge of surveying in the district is clear.</i>	Poor	0	
	TC1-3 <i>Existence of competent human resource who can utilize the manuals. (who has academic background and/or practical experience)</i>	Fair	1	
TC2 「Plan and Design」	...	...	...	1.5
TC3 「Procurement」	...	...	...	2
...

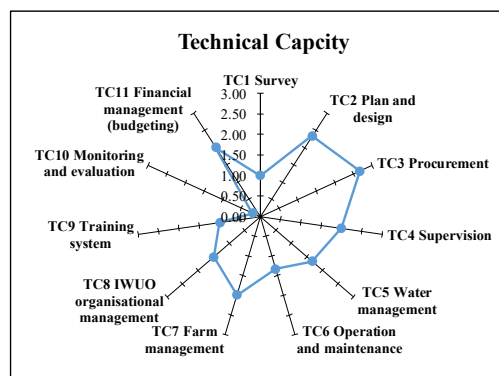


Figure 1 Example Result of Technical Capacity

According to the example result of technical capacity, this organisation has advantages on “TC2 Plan and Design”, “TC3 Procurement” and “TC7 Farm Management”. On the other hand, “TC1 Survey”, “TC9 Training System” and “TC10 M/E” are the weak points of the organisation. The results can be used to redevelop strategies to improve each organisation's capacity. Also, by tracking changes in capacity, the effectiveness of training and activities can also be measured, and the necessary inputs and support can be reviewed.

1.4 Result and Discussion

(1) Model IWUOs

Comparison of the results of the first and second CA shows significant improvements in all IWUOs. All assessment item was improved compared to the first CA, and the average total of Technical Capacity (TC) and Core Capacity (CC) score achieved the target of 70% in all IWUOs. It can be said that these results can be attributed to the training and activities conducted by the WAMCAB. Items with lower scores will be reflected in future activity plans, with the aim of ensuring that further improvements are identified in the CA to be conducted at the end of the project.

1) Ngoma 22

The total score of CA for Ngoma 22 is 73.8, an increase of 54.2 compared to the first CA.

The average % of EC increased from 29.2 to 41.7. The policy is being developed by the central government, but it has not been formally announced yet and is not well known at the field level. The legal system is not established yet. These situation is same as other IWUOs. On the other hand, administrative support system in EC3 improved its score from 0.5 to 2.0, as the support system is being established and staffed, although timely support has not been realized.

The average % of TC increased from 32.3 to 85.3. Irrigation calendar and annual action plan including O&M plans, which are essential for field activities, are now documented and properly stored in the scheme office. In particular, improvement was seen in the feedback on the plans, which was not confirmed at the first CA, but now the activities are reported at general assembly meeting and audited by audit committee to review the activities and reflect them in the activity plans for the next year (TC6). On the other hand, the collection of water fees varied greatly between hillside and marshland,

ranging from 25-30% for hillside areas and 90% for marshland. This was the lowest collection rate among IWUOs.

The average % of CC increased from 23.3 to 79.0. IWUO president well understands IWUO activities and is trusted by the members, but he is not fulfilling his responsibilities adequately because he is busy with his other business, which affects his activities, including delays in signing and installing documents (CC1). Farmers' participation in IWUO activities has improved, but is still low among hillside farmers.

Table 3 Result of CA for Ngoma 22

Capacity	Assessment Item		1st CA		2nd CA		Increasement
			Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	0.00	29.2	0.00	41.7	+12.5%
	EC2	Legal system	0.00		0.00		
	EC3	Administrative support system	0.50		2.00		
	EC4	Environmental condition	3.00		3.00		
Technical Capacity	TC1	Water management	0.75	32.3	1.75	85.3	+53.0%
	TC2	Operation and maintenance	0.00		2.20		
	TC3	Farm management(*)	2.00		3.00		
	TC4	Financial management	0.00		1.86		
	TC5	Rule making	2.00		3.00		
	TC6	Internal evaluation	0.00		3.00		
	TC7	Organisational management	2.00		2.67		
	TC8	Audit system	1.00		3.00		
Core Capacity	CC1	Leadership	0.50	23.3	2.25	79.0	+55.7%
	CC2	Ownership	0.33		2.00		
	CC3	Membership	1.00		3.00		
	CC4	Gender mainstreaming	1.00		2.00		
	CC5	Communication system	0.40		3.00		
	CC6	Collaboration system	0.67		2.33		
	CC7	Conflict resolution	1.00		2.00		
Total Score (%)			28.3	28.1	73.8	82.3	+54.2%

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

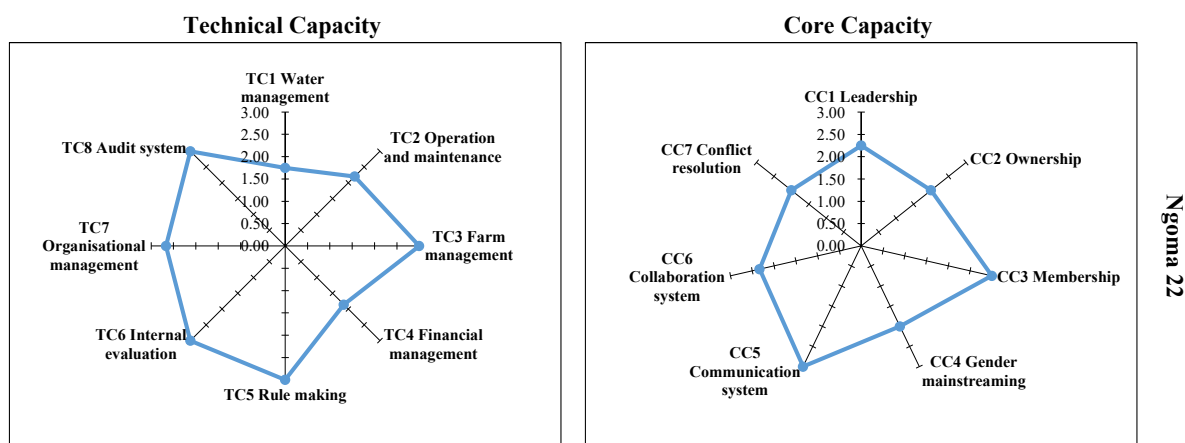


Figure 2 TC and CC of Ngoma 22

2) Cyaruhogo

The total score of CA for Cyaruhogo is 85.3 (94.7%), an increase of 64.3% compared to the first CA.

The average % of EC increased from 33.3 to 50.0. The situation of policy framework and legal system are same as described in Ngoma 22. Administrative support system and environmental condition is improved. Cyaruhogo IWUO has support from Rwamagana District such as signing of expense order and performance contract timely, support of community work and organizing DISC reguraly etc. on a daily basis.

The average % of TC increased from 23.5 to 96.2. Particularly significant improvements were confirmed in financial management (TC4), internal evaluation (TC6), and audit system (TC8). Water

fee collection was more than 80% regardless of marshland or hillside, and furthermore, water fee increases was succeeded through appropriate processes. On the other hand, although water fee is set based on the balance of revenues and expenditures, the reality is that the past two years have seen a deficit due to a number of unforeseen problems and higher-than-planned expenses.

The average % of CC increased from 38.3 to 92.9. When we asked the IWUO president about his vision, he immediately responded, “To distribute water equitably to all farmers”. This response was confirmed by all IWUOs except Ngoma 22, indicating that the organization is working as one to achieve its goals. Performance contracts have also been signed for season C with farmers who grow fruit trees in hillside (CC6).

Table 4 Result of CA for Cyaruhogo

Capacity	Assessment Item		1st CA		2nd CA		Increasement
			Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	0.00	33.3	0.00	50.0	+16.7%
	EC2	Legal system	0.00		0.00		
	EC3	Administrative support system	2.00		3.00		
	EC4	Environmental condition	2.00		3.00		
Technical Capacity	TC1	Water management	1.00	23.5	3.00	96.2	+72.7%
	TC2	Operation and maintenance	0.80		3.00		
	TC3	Farm management(*)	0.00		3.00		
	TC4	Financial management	0.00		2.43		
	TC5	Rule making	1.50		3.00		
	TC6	Internal evaluation	0.00		3.00		
	TC7	Organisational management	2.33		2.67		
	TC8	Audit system	0.00		3.00		
Core Capacity	CC1	Leadership	0.25	38.3	3.00	92.9	+54.6%
	CC2	Ownership	0.67		3.00		
	CC3	Membership	1.00		2.50		
	CC4	Gender mainstreaming	2.25		2.00		
	CC5	Communication system	1.20		3.00		
	CC6	Collaboration system	1.67		3.00		
	CC7	Conflict resolution	1.00		3.00		
Total Score (%)			31.0	30.4	85.3	94.7	+64.3%

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

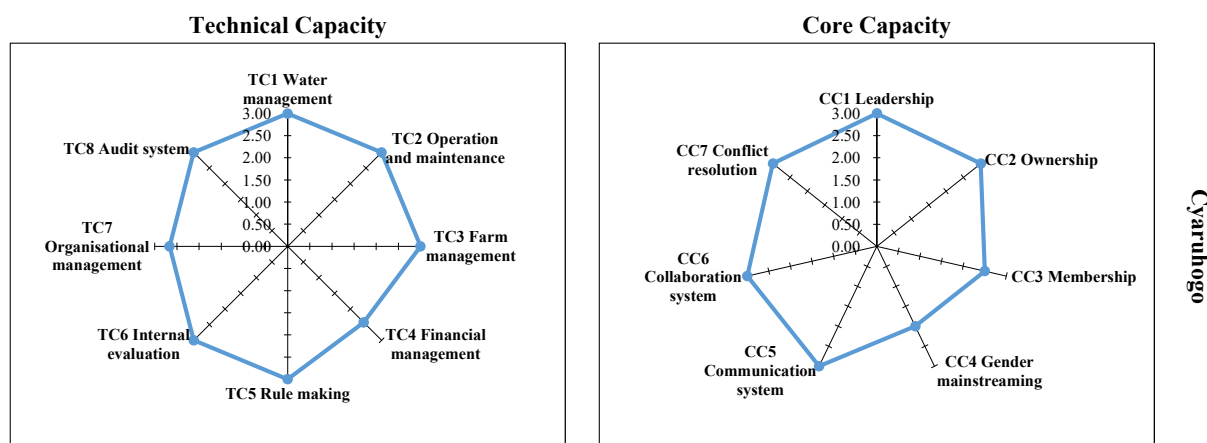


Figure 3 TC and CC of Cyaruhogo

3) Ngiriyi and Nyabuyogera

[Ngiriyi]

The total score of CA for Ngiriyi is 80.2 (98.3%), an increase of 49.0% compared to the first CA.

The average % of EC increased from 4.2 to 12.5. At the last DISC (as of end of January 2023), IWUO requested assistance from District regarding establishment of IWUO, but the situation has not progressed (EC2). In addition, they have not received sufficient technical support from District

because an irrigation engineer is not allocated (EC3), although they have requested a field visit. This is a common issue consistent with the results of interviews with Gisagara District.

The average % of TC increased from 48.9 to 97.8. The situation was similar to that of Cyaruhogo IWUO, but what was distinctive was that the action plans and expense orders submitted to District explained the current issues with photos, and were designed to be materials that would enable an overview of the situation without having to go to the field. Also, revenues and expenditures have been in the black for the past two years, this was accomplished only by Ngiriyi IWUO.

The average % of TC increased from 49.8 to 98.8. If a member has a request or consultation with the IWUO and submit a letter to IWUO, IWUO visit site the following week, it means feedback system is well established (CC2). A distinctive feature was the high participation rate of women in the training, which exceeded that of men (CC4).

Table 5 Result of CA for Ngiriyi

Capacity	Assessment Item		1st CA		2nd CA		Increasement
			Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	0.00	4.2	0.00	12.5	+8.3%
	EC2	Legal system	0.00		0.00		
	EC3	Administrative support system	0.50		0.50		
	EC4	Environmental condition	0.00		1.00		
Technical Capacity	TC1	Water management	1.25	48.9	2.75	97.8	+48.9%
	TC2	Operation and maintenance	1.80		3.00		
	TC3	Farm management(*)	0.00		3.00		
	TC4	Financial management	1.86		2.71		
	TC5	Rule making	1.50		3.00		
	TC6	Internal evaluation	2.00		3.00		
	TC7	Organisational management	1.33		3.00		
	TC8	Audit system	2.00		3.00		
Core Capacity	CC1	Leadership	1.75	49.8	3.00	98.8	49.0%
	CC2	Ownership	1.33		3.00		
	CC3	Membership	2.00		3.00		
	CC4	Gender mainstreaming	1.25		2.75		
	CC5	Communication system	1.80		3.00		
	CC6	Collaboration system	1.33		3.00		
	CC7	Conflict resolution	1.00		3.00		
Total Score (%)			39.8	49.3	80.2	98.3	49.0%

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

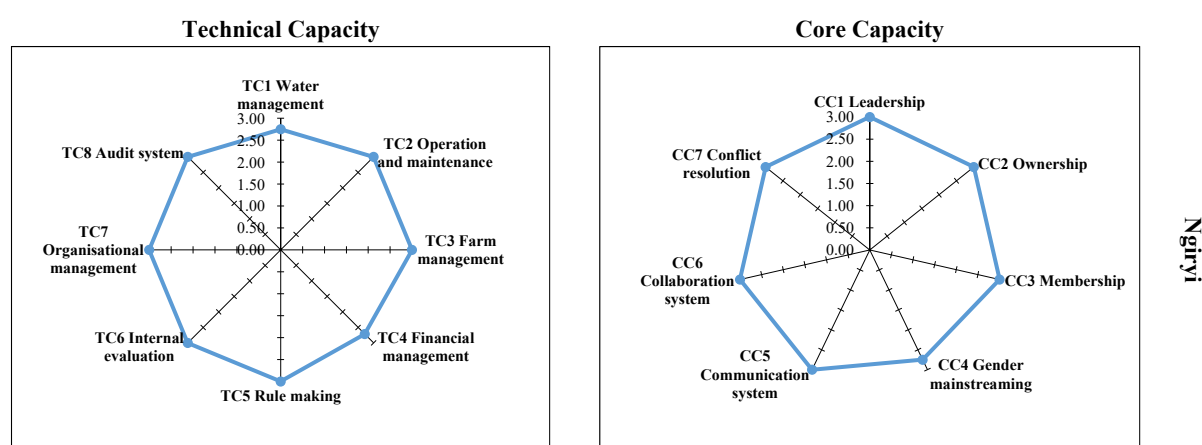


Figure 4 TC and CC of Ngiriyi

[Nyabuyogera]

The total score of CA for Nyabuyogera is 72.7 (89.8%), an increase of 54.2% compared to the first CA.

The average % of EC increased from 4.2 to 8.3. EC has improved slightly. It is due to the different

organizational structure. Although IWUO existed in Nyabuyogera at time of the 1st CA, IWUO was dismantled and Scheme Management Committee (SMC) was established under the cooperative as a replacement by WAMCAB's proposal in September 2020. The central government is preparing a policy and framework for IWUO, but there is no documentation on SMC, resulting in a low score on policy framework and legal system (EC1 and EC2). There is no established support system from the government (EC3) and it is still facing water shortage because of insufficient irrigation facility (EC4).

The average % of TC increased from 24.2 to 82.4. Water management (TC1) had the lowest score among IWUOs. The average of 60% of marshland is facing water shortage. To solve it, additional measures should be taken in terms of internal regulations such as frequency of spring water use, prohibited activities, etc. However, due to lack of support from the local government (EC3), this has not been implemented. Therefore, there is an urgent need for technical support and clarification of the responsibilities of local government in SMC.

The average % of CC increased from 48.6 to 98.4. In the past, problems were caused by IWUO's mismanagement, but now IWUO members take some actions toward problems or challenges (CC2). For capacity of conflict resolution, now zone leaders under cooperative has responsibility to solve problems occurring within zone and IWUO members responded "leaders need to be fair for solving problems" (CC7).

Table 6 Result of CA for Nyabuyogera

Capacity	Assessment Item		1st CA		2nd CA		Increasement
			Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	0.00	4.2	0.00	8.3	+4.1
	EC2	Legal system	0.00		0.00		
	EC3	Administrative support system	0.50		0.00		
	EC4	Environmental condition	0.00		1.00		
Technical Capacity	TC1	Water management	0.25	24.2	0.25	82.4	+58.2%
	TC2	Operation and maintenance	0.60		2.80		
	TC3	Farm management(*)	0.00		3.00		
	TC4	Financial management	0.29		1.71		
	TC5	Rule making	2.00		3.00		
	TC6	Internal evaluation	1.00		3.00		
	TC7	Organisational management	0.67		3.00		
	TC8	Audit system	1.00		3.00		
Core Capacity	CC1	Leadership	1.50	48.6	3.00	98.4	+49.8%
	CC2	Ownership	2.00		2.67		
	CC3	Membership	1.50		3.00		
	CC4	Gender mainstreaming	2.00		3.00		
	CC5	Communication system	1.20		3.00		
	CC6	Collaboration system(**)	2.00		3.00		
	CC7	Conflict resolution	0.00		3.00		
Total Score (%)			29.0	35.6	72.7	89.8	+54.2%

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

(**) Indicator CC6-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

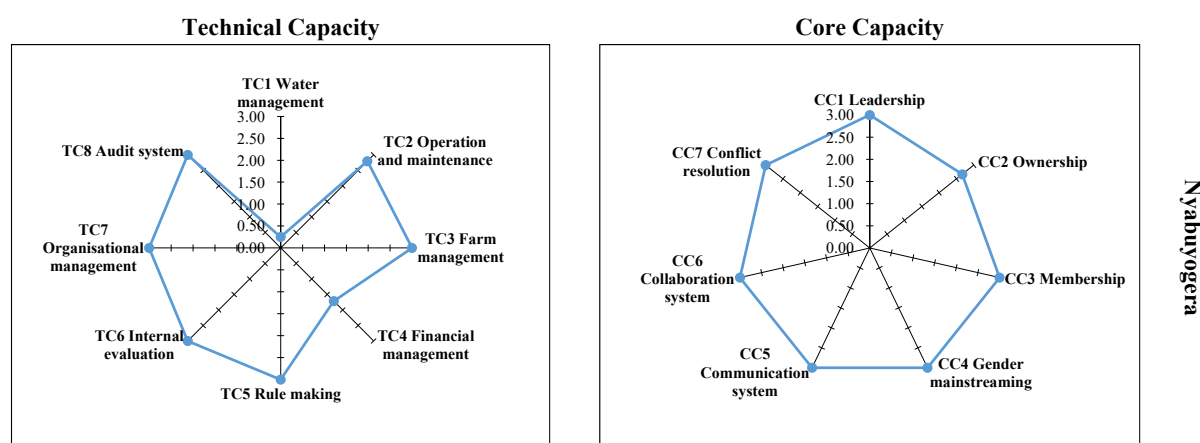


Figure 5 TC and CC of Nyabuyogera

Report of Third Capacity Assessment for IWUOs

1.1 Background

1.1.1 Country

Capacity Assessment (CA) is defined as the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels - including the individual, organizational and societal level - and the extent to which development process has brought about positive changes (Capacity Development: CD), and then sharing the results from this with concerned parties in order to formulate CD strategies.

1.2 Objective

The objectives of CA in WAMCAB project are summarized as below:

1. To diagnosis on the capacity and needs of C/Ps in the related organizations, and to formulate the Improvement Plan / Training Plan;
2. To measure the transition of the capacity by implementing CA in the period of baseline survey, at the end of the 2nd Phase and at the end of the 3rd Phase of the Project;
3. Based on the results of CA implemented in the period of baseline survey, to share the scenario of the capacity development and goals with C/Ps, and to clarify the role of the Project and its positioning;
4. Based on the results of CA implemented at the end of the 2nd Phase (Technical Guidance Phase), to confirm the achievement of the Improvement Plan / Training Plan, and to review necessary inputs and supports with C/Ps; and
5. By sharing the result of CA implemented at the end of the 3rd Phase (Institutionalization and Extension Preparation Phase) with C/Ps, to utilize them for the part of evaluation of the Project and preparation of actions toward after completion of the Project

1.3 Method

(1) Target and Implementer

Targets of CA are i) IWUO-SU, ii) targeted RAB stations namely Ngoma, Rubirizi and Rubona, iii) targeted districts namely Ngoma, Rwamagana and Gisagara and iv) selected model IWUOs. Although the respondents are individual C/Ps, the Project focuses on the overall capacity of target organization. In this report, only the result of CA for IWUOs is presented. The results for other organizations are presented in Project Final Report.

In order to measure the effect of training, CA was implemented for IWUOs in the model sites. The first CA was implemented by using the result of baseline survey. For missing information, a supplemental survey was conducted. Regarding IWUOs in Rwamagana district, which had not been organized yet at the timing of baseline survey, the first CA was conducted after their establishment in January 2021.

The main implementer of CA is IWUO-SU for ii) targeted RAB stations, iii) targeted districts and iv) selected model IWUOs. Only for i) IWUO-SU, the JICA experts conducts CA by interviewing with IWUO-SU.

(2) Timing

The Project conducted the first CA from August to September 2019, the second CA was conducted from January to February 2023 and the third CA in October 2024.

- Baseline survey in the 1st Phase (August to September 2019) * Only for IWUO in Rwamagana district, it was conducted in January 2021

- The end of the 2nd Phase (January - February 2023)
- The end of the 3rd Phase (October 2024)

(3) Components of Capacity in WAMCAB

Capacity only comes about once the following three elements have been integrated. Technology, particular knowledge and tacit knowledge on the part of the organization is referred to as “Technical Capacity (TC)”. The will, attitude, leadership and management capabilities to activate technical capacity are referred to as “Core Capacity (CC)”, serve as core elements for capacity. The systems, societies and so on which underpin such capacities are referred to as the “Enabling Condition (EC)” that encompasses the organization.

(4) Assessment Item

Each component has several assessment items as follows. For instance, TC1 is “Knowledge Management” which means that IWUO-SU shall manage the necessary knowledge such as water management, O&M and farm management by preparing the guidelines and/or manuals. These assessment items differs by organisations and basically are based on its role and responsibility. The same assessment items were used in the first and second CAs, but clear criteria were set for the second CA, taking advantage of the lessons learnt from the first CA, where no clear criteria were set. As shown in Annex 1, each assessment item has more detailed indicators aiming at the proper evaluation.

1) Model IWUOs

Table 1 Assessment Items for Model IWUO

Capacity	Assessment Item	Explanation
EC	EC1 「Policy Framework」	Pre-condition (external condition). Necessary resources provided by government.
	EC2 「Legal Framework」	
	EC3 「Administrative Supporting System」	
	EC4 「Environmental Condition」	
TC	TC1 「Water Management」	Necessary techniques, certain knowledge, and systems for the proper scheme management.
	TC2 「O&M」	
	TC3 「Farm Management」	
	TC4 「Financial Management」	
	TC5 「Rule Making」	
	TC6 「Internal Evaluation」	
	TC7 「Organizational Management」	
	TC8 「Audit System」	
CC	CC1 「Leadership」	Willingness and attitude to solve the problem and achieve the goal initiatives by utilizing the techniques, knowledge, and systems. Administrative systems for the smooth operation of IWUO.
	CC2 「Accountability (Ownership)」	
	CC3 「Membership」	
	CC4 「Gender Mainstreaming」	
	CC5 「Communication System」	
	CC6 「Collaboration System」	
	CC7 「Conflict Resolution」	

(5) Evaluation

As mentioned above, each assessment item has one or several indicators (questions). Evaluators score with four grades such as Excellent (3pt.), Good (2pt.), Fair (1pt.) and Poor (0pt.) for each indicator. Average scores for each assessment item will be calculated and indicated in a spider chart as below.

Assessment Item	Indicator	Result	Score	Average Score
TC1 「Survey」	TC1-1 Manuals or reference documents for survey are prepared.	Good	2	1
	TC1-2 Team or committee in charge of surveying in the district is clear.	Poor	0	
	TC1-3 Existence of competent human resource who can utilize the manuals. (who has academic background and/or practical experience)	Fair	1	
TC2 「Plan and Design」	...	...	...
TC3 「Procurement」	...	...	...
...

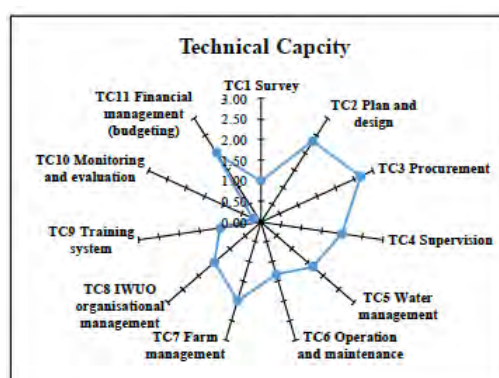


Figure 1 Example Result of Technical Capacity

According to the example result of technical capacity, this organisation has advantages on “TC2 Plan and Design”, “TC3 Procurement” and “TC7 Farm Management”. On the other hand, “TC1 Survey”, “TC9 Training System” and “TC10 M/E” are the weak points of the organisation. The results can be used to redevelop strategies to improve each organisation's capacity. Also, by tracking changes in capacity, the effectiveness of training and activities can also be measured, and the necessary inputs and support can be reviewed.

1.4 Result and Discussion

(1) Model IWUOs

Comparison of the results of the first, the second and the third CA shows significant improvements in all IWUOs. The average total of Technical Capacity (TC) and Core Capacity (CC) score achieved the target of 70% in all IWUOs. It can be said that these results can be attributed to the training and activities conducted by the WAMCAB.

1) Ngoma 22

The overall score for the 3rd CA was 80.3%, a significant improvement on the 1st CA's score of 37.1%.

The average EC score was 2.3, 1.2 and 1.3 in the order of 1st, 2nd and 3rd CA.

At the 1st CA, respondents stated that IWUO policies and policies were clear and that the administrative procedures for organising IWUOs were functioning well, with an average score of 2. However, when asked in more detail, there was a discrepancy between their answers and the current situation, and there was room for improvement in all cases.

At the 3rd CA, the administrative procedures for the organisation of IWUOs were approved more smoothly than in the previous CA and were functioning well enough. However, the score

for IWUO support was lower, as support from the administration has been limited since the replacement of the District official in charge of IWUOs, and the IWUOs are short-staffed due to the absence of an IWUO accountant. The score for environmental conditions also dropped as irrigation facilities are in place but repairs to canals are beyond the IWUO's capacity to cope.

The average TC score made a significant leap from 0.8 to 2.5 to 2.6 in the order of the 1st, 2nd and 3rd CA.

At the 2nd CA, the irrigation calendar and annual activity plan (including O&M plan) which are essential for field activities were documented and properly stored in the office. PDCA cycle is now functioning, and the members are being held accountable for their activities through the General Assembly meeting. On the other hand, the collection of water fee differs greatly between hillside and marshland, with 25-30% in hillside and 90% in marshland as of February 2023, which is the lowest collection rate among IWUOs. The reason for the low rate in the hillside is that the deduction of the water charge was not made in a timely manner due to delays in payment from the contractor of chia seed, which was being grown under contract at the time, and the significance of the water fee payment was not fully understood by the cooperative members. For season C, IWUO income has fallen as fewer farmers grow crops and the system is based on collecting from individuals. In response, WAMCAB made efforts to improve the collection rate of IWUOs by starting the operation of the deduction of water charges from the proceeds of growing and shipping vegetables and sales through agricultural cooperatives on a trial basis from 2023 season C. As a result, in 2024 season C, vegetables were grown mainly by the cooperative and water fee was deducted from sales proceeds, providing a new source of income for the IWUO.

The items that showed improvement at the time of the 3rd CA were TC4: financial management, followed by TC2: O&M. For TC4, the increase in score was due to the increase in water fee collection in the hillside from 25% to 40-60%, and the fact that the IWUO had been operating at a loss but has been profitable over the past two years. On the other hand, improvements are needed as funds have not been allocated.

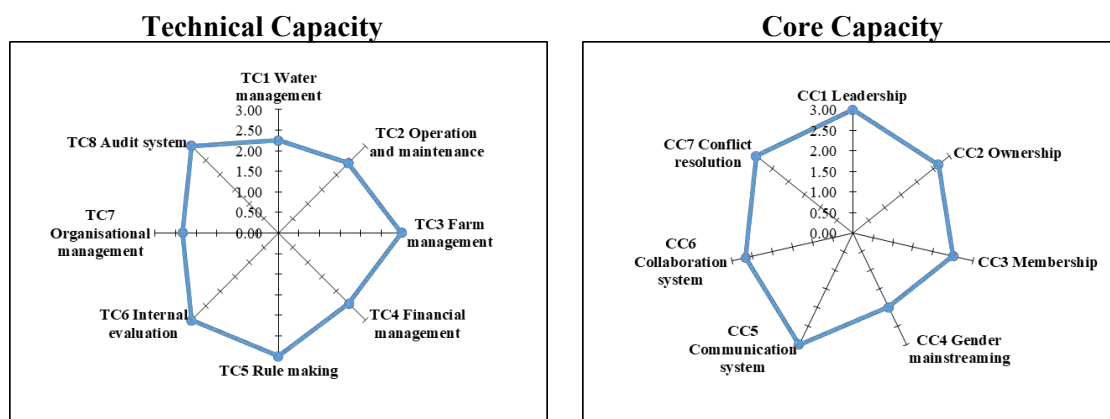
Scores were down in TC2: Water management and TC5: Internal regulations, due to the fact that water conflicts have not been resolved due to chronic water shortages downstream and that internal regulations are not recognised by all farmers.

The average CC score was 0.7, 2.3 and 2.7 in the order of the 1st, 2nd and 3rd CA, with an overall increase in the bottom line. The person who was the IWUO leader at the time of the 2nd CA was not fulfilling his responsibilities adequately due to his other business, including delays in signing and attaching documents (CC1: Leadership). The new leader as of October 2024 had been working with the IWUO since the start of WAMCAB. And, he has participated in the identification of hillside owners, so he is familiar with the activities and appears to be well trusted by the members. In fact, CC1 went from a score of 2.6 to a perfect score of 3.0, and it can be said that his high level of leadership has contributed to the increase in CC score. CC2: Ownership has not been a functioning feedback system from cooperative members to IWUOs in some zones, but now all zones The IWUO-cooperative information transmission system and cooperation has been strengthened.

The score downgrade was in CC3: Membership, where the participation rate in community work in the hillside decreased from over 80% in the 2nd CA to 40-60% in the 3rd CA. However, when IWUO officials were asked to give a sense, they commented that farmers' understanding of IWUO activities has increased since the farmers started to grow vegetables in season C and the participation rate in community work has increased.

Table 2 Result of CA for Ngoma 22

Capacity	Assessment Item		1st CA		2nd CA		3rd CA		Increase 3rd CA - 1st CA
			Average Score	%	Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	3.00	79.2	0.0	41.7	0.00	45.8	-33.3
	EC2	Legal system	3.00		0.0		3.00		
	EC3	Administrative support system	0.50		2.0		1.50		
	EC4	Environmental condition	3.00		3.0		1.00		
Technical Capacity	TC1	Water management	0.75	32.3	2.3	86.0	2.25	89.2	56.9
	TC2	Operation and maintenance	0.00		2.2		2.40		
	TC3	Farm management	2.00		3.0		3.00		
	TC4	Financial management	0.00		1.9		2.43		
	TC5	Rule making	2.00		3.0		3.00		
	TC6	Internal evaluation	0.00		3.0		3.00		
	TC7	Organisational management	2.00		2.3		2.33		
	TC8	Audit system	1.00		3.0		3.00		
Core Capacity	CC1	Leadership	0.50	23.3	2.3	79.0	3.00	89.7	66.3
	CC2	Ownership	0.33		2.0		2.67		
	CC3	Membership	1.00		3.0		2.50		
	CC4	Gender mainstreaming	1.00		2.0		2.00		
	CC5	Communication system	0.40		3.0		3.00		
	CC6	Collaboration system	0.67		2.3		2.67		
	CC7	Conflict resolution	1.00		2.0		3.00		
Total Score (%)			37.1	27.8	74.1	82.7	80.3	89.4	61.6

**Figure 2 TC and CC of Ngoma 22**

2) Cyaruhogo

The overall score for the 3rd CA was 93.7%, a significant improvement on the 1st CA's score of 38.0%.

The average EC score was 2.0, 1.5 and 2.2 in the order of the 1st, 2nd and 3rd CA. Support from the local administration used to be inadequate, but now a support system has been established and good relations have been established. In addition, the law on the establishment of IWUOs was not stipulated, but now it is legal and administrative procedures are well-functioning. Support from the District has been very generous, and the attendance of Vice Mayor of District to General Assembly meeting is notable.

The average TC score was 0.7, 2.9 and 2.9 in the order of the 1st, 2nd and 3rd CA. The overall level was raised at the 2nd CA, but particularly significant improvements were made in Financial management (TC 4), Internal evaluation (TC 6) and Audit systems (TC 8). The water fee collection rate at the time of the 2nd CA was maintained above 80%, regardless of marshland or hillside, and the water fee was further increased through appropriate processes. One of the improvements observed between the 2nd and 3rd CA was that, although the water fee price was set in consideration of the balance between income and expenditure in the 2nd CA, the cost was higher than planned due to damage to facilities caused by unexpected flooding, resulting in a deficit from 2022 to 2023. However, in 2024, the balance of payments remained in

the black due to an increase in income from aquaculture, grazing and fines other than water fee. Furthermore, the water fee collection rate has increased to 92%, and farmers without access to bank accounts pay IWUO directly. In addition, funds (long-term planning and repair reserves) are properly allocated and non-institutionalised irrigation trust contributions are deposited in a separate account with no access to reserves. This type of fund management was only observed in Cyaruhogo IWUO. Other audit committee meetings, which did not take place before the project, now take place on a regular basis.

The average CC score was 1.1, 2.8 and 2.9 in the order of the 1st, 2nd and 3rd CA. Improvements were seen in CC3: Membership and CC4: Gender. In the 2nd CA, only a certain number of farmers knew the zones and intake areas to which they belonged, but now they are able to answer which zone they belong anyone who asks. In terms of gender, the proportion of women in committee membership has increased, as well as women's participation in IWUO activities such as community work. On the other hand, opportunities for women to participate in training are also improving, although participation rates remain low as the husband tends to be given priority.

CC1: When asked about the vision of IWUO showing leadership, the leaders responded 'equitable water distribution to all farmers' in the 2nd CA and 'Being number one IWUO in Africa' in the 3rd CA, which is also displayed on the office wall. Although this is a somewhat ambitious goal, as hosts, they have gained confidence in embracing other Districts and countries.

Table 3 Result of CA for Cyaruhogo

Capacity	Assessment Item		1st CA		2nd CA		3rd CA		Increase 3rd CA - 1st CA
			Average Score	%	Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	2.00	66.7	0.0	50.0	0.00	75.0	8.3
	EC2	Legal system	2.00		0.0		3.00		
	EC3	Administrative support system	2.00		3.0		3.00		
	EC4	Environmental condition	2.00		3.0		3.00		
Technical Capacity	TC1	Water management	1.00	23.5	3.0	96.2	3.00	98.6	75.1
	TC2	Operation and maintenance	0.80		3.0		3.00		
	TC3	Farm management	0.00		3.0		3.00		
	TC4	Financial management	0.00		2.4		3.00		
	TC5	Rule making	1.50		3.0		3.00		
	TC6	Internal evaluation	0.00		3.0		3.00		
	TC7	Organisational management	2.33		2.7		2.67		
	TC8	Audit system	0.00		3.0		3.00		
Core Capacity	CC1	Leadership	0.25	38.3	3.0	92.9	3.00	98.8	60.6
	CC2	Ownership	0.67		3.0		3.00		
	CC3	Membership	1.00		2.5		3.00		
	CC4	Gender mainstreaming	2.25		2.0		2.75		
	CC5	Communication system	1.20		3.0		3.00		
	CC6	Collaboration system	1.67		3.0		3.00		
	CC7	Conflict resolution	1.00		3.0		3.00		
Total Score (%)			38.0	30.9	85.3	94.7	93.7	98.7	67.8

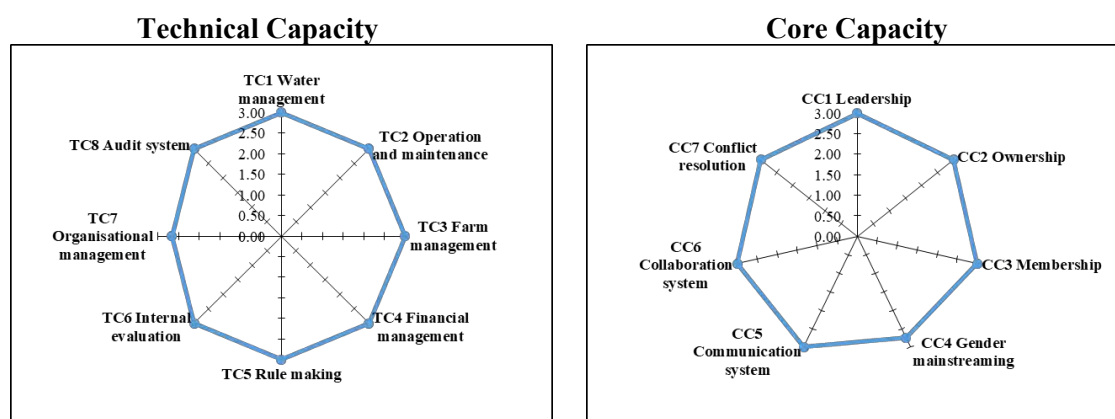


Figure 3 TC and CC of Cyaruhogo

3) Ngiriyi and Nyabuyogera SMC

[Ngiriyi]

The overall score for the 3rd CA was 91.6%, a significant improvement compared to 58.3% in the 1st CA.

The average EC score was 2.3 to 0.3 to 2.0 in the order of the 1st, 2nd and 3rd CA.

There was a significant drop from 2.3 to 0.3 points from the 1st to the 2nd CA, but this was due to overestimation in the 1st CA. It went up from 0.3 to 2.0 points from the 2nd to the 3rd CA. This is due to the IWUO being officially registered and the more generous support from the District and RAB station. In the past, requests for technical assistance from the District and RAB station were not met with a responsive workforce, but now both organisations are responding diligently. For example, sediment and erosion in hillside were reported to both organizations and RAB station raised the issue. In particular, the impression was that District officials have a stronger sense of responsibility and work well with service providers.

The average TC score was 1.6, 2.9 and 2.9 in the order of the 1st, 2nd and 3rd CA, with a near perfect score at the 3rd CA. Significant improvements were seen in Water management (TC1), where the AWD approach reduced the area under water shortage and achieved a high water fee collection rate of 90% in the last two years. In addition, the activity plans and Expense orders submitted to the District explained current issues with photos, and were designed to provide a general overview of the situation without having to go to the field (TC2: Planning and design). As of February 2023, income and expenditure had been in surplus for the past two years, which was achieved only by Ngiriyi IWUO (TC3: Income and expenditure). and is a significant achievement (TC4: Financial management).

At the 3rd CA, the capacity at the 2nd CA was maintained, but further improvement was confirmed in financial management (TC4) that were not seen in other IWUOs. The original approval process for activity expenses involved IWUOs preparing an Expense Order for each activity, submitting it to the District and obtaining approval, but this increased correspondence with the District and required more effort on both sides, so to save on the approval process, an Expense Order for the year was submitted to the District once and the activity expenses were received in one go. Whenever an activity money is required, an internal Expense Order is submitted to the IWUO President and it is contributed.

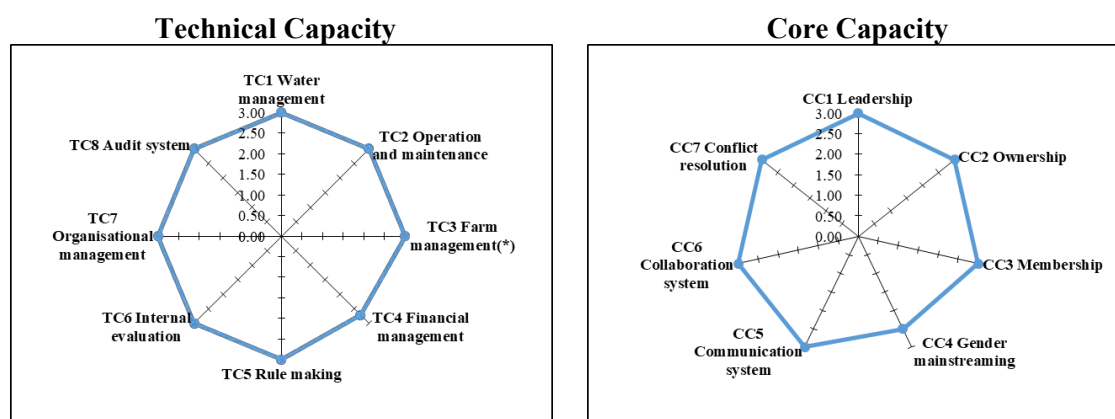
The average CC score was 1.5, 2.9 and 2.9 in the order of the 1st, 2nd and 3rd CA, with a near perfect score at the 2nd and the 3rd CA.

IWUO plans weekly activities and report back to stakeholders. If a member has a request or consultation with IWUO, a letter can be sent to IWUO and they visit the site the following week. A feedback system was established (CC2: Ownership). In season C, it was possible to identify individual vegetable farmers and collect water fees, and it can be said that this move that is based on the good relationship between the cooperative and IWUO (CC6: Cooperation). The same situation continued in the 3rd CA, and another achievement observed was that when funds were insufficient for rehabilitation, 28,000,000 Rwf was contributed by cooperative (CC2: Ownership). In terms of gender, it is also unique in that it is set at 40% women's participation, which is above the national policy setting (CC4: Gender mainstreaming). The current sources of income are water fee and compost sales proceeds, but it is noteworthy that there are plans to sell sugarcane planted in the buffer zone in the near future, which will also diversify the sources of income and solve problems.

Table 4 Result of CA for Ngiriyi

Capacity	Assessment Item		1st CA		2nd CA		3rd CA		Increase 3rd CA - 1st CA
			Average Score	%	Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	3.00	79.2	0.0	12.5	0.00	66.7	-12.5
	EC2	Legal system	3.00		0.0		3.00		
	EC3	Administrative support system	0.50		0.5		3.00		
	EC4	Environmental condition	3.00		1.0		2.00		
Technical Capacity	TC1	Water management	1.25	48.9	2.8	97.8	3.00	98.8	49.9
	TC2	Operation and maintenance	1.80		3.0		3.00		
	TC3	Farm management(*)	0.00		3.0		3.00		
	TC4	Financial management	1.86		2.7		2.71		
	TC5	Rule making	1.50		3.0		3.00		
	TC6	Internal evaluation	2.00		3.0		3.00		
	TC7	Organisational management	1.33		3.0		3.00		
	TC8	Audit system	2.00		3.0		3.00		
Core Capacity	CC1	Leadership	1.75	49.8	3.0	98.8	3.00	97.6	47.8
	CC2	Ownership	1.33		3.0		3.00		
	CC3	Membership	2.00		3.0		3.00		
	CC4	Gender mainstreaming	1.25		2.8		2.50		
	CC5	Communication system	1.80		3.0		3.00		
	CC6	Collaboration system	1.33		3.0		3.00		
	CC7	Conflict resolution	1.00		3.0		3.00		
Total Score (%)			58.3	49.4	80.2	98.3	91.6	98.3	48.9

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

**Figure 4 TC and CC of Ngiriyi**

[Nyabuyogera SMC]

The overall score for the 3rd CA was 76.7%, a significant improvement on the 1st CA's score of 43.6%.

The average EC score was 2.3, 0.2 and 0.5 in the order of the 1st, 2nd and 3rd CA. The highest score in the 1st CA was due to overestimation. Unlike IWUO, SMC is characterised by an overall low EC score because they are a new form of organisation integrated with cooperatives, therefore have no set laws, policies or policies. The slight increase from 0.2 to 0.5 from the 2nd to the 3rd CA was due to increased support from District and station.

The average TC score was 0.7 to 2.4 to 2.6 in the order of the 1st, 2nd and 3rd CA.

At the time of the 2nd CA, the score for Water management (TC2) was the lowest among IWUOs. An average of 60% of land was under water shortage, but after night reservoirs were developed, an irrigation calendar was developed, which resulted in a reduction in the area under water shortage from 60% to 40% and an increase in water fee (from 600 Rwf to 1,000 Rwf) was also achieved. Furthermore, ownership of irrigation facilities provided an opportunity to motivate farmers. Water conflicts, which could not be resolved in the 2nd CA, could be resolved amicably through discussions in the 3rd CA. In O&M (TC2), the participation rate of farmers rose from 60-80% to more than 80%. This can be attributed to the fact that cooperatives and

SMCs have stipulated common bylaws and imposed obligations and penalties for participation in O&M.

On the other hand, the items where scores fell were in Regulation making (TC5) and Financial management (TC4), where farmers' awareness of internal regulations fell from more than 80% to 60-80%. Although the bylaws are announced through the zone, it appears that a certain number of farmers are not aware of them. The score for financial resources was lowered due to the fact that water use expenses were found to be spent for other purpose.

The average CC score was 1.3, 2.9 and 2.9 in the order of the 1st, 2nd and 3rd CA. If any problems arise, the farmers are interviewed by the cooperative and the results are given to the Management Committee, which decides how to deal with the problem. In addition, zone leaders are responsible for solving problems, and if a problem arises, a system is in place whereby the farmers' association leaders and SMCs listen to the opinions of both sides and propose a solution (CC7). The general assembly meeting is a delegated system, but IWUO tries to hear opinions and requests directly from farmers who did not participate in the community work. This moves are being taken to actively build trust with the cooperative members (CC3: Membership).

Table 5 Result of CA for Nyabuyogera SMC

Capacity	Assessment Item		1st CA		2nd CA		3rd CA		Increasement 3rd CA - 1st CA
			Average Score	%	Average Score	%	Average Score	%	
Enabling Condition	EC1	Policy framework	3.00	79.2	0.0	8.3	0.00	16.7	-62.5
	EC2	Legal system	3.00		0.0		0.00		
	EC3	Administrative support system	0.50		0.0		1.00		
	EC4	Environmental condition	3.00		1.0		1.00		
Technical Capacity	TC1	Water management	0.25	24.2	0.3	80.3	2.00	87.8	63.6
	TC2	Operation and maintenance	0.60		2.8		3.00		
	TC3	Farm management(*)	0.00		3.0		3.00		
	TC4	Financial management	0.29		1.7		1.57		
	TC5	Rule making	2.00		2.5		2.50		
	TC6	Internal evaluation	1.00		3.0		3.00		
	TC7	Organisational management	0.67		3.0		3.00		
	TC8	Audit system	1.00		3.0		3.00		
Core Capacity	CC1	Leadership	1.50	48.6	3.0	98.4	3.00	98.4	49.8
	CC2	Ownership	2.00		2.7		2.67		
	CC3	Membership	1.50		3.0		3.00		
	CC4	Gender mainstreaming	2.00		3.0		3.00		
	CC5	Communication system	1.20		3.0		3.00		
	CC6	Collaboration system	2.00		3.0		3.00		
	CC7	Conflict resolution	0.00		3.0		3.00		
Total Score (%)			43.6	36.4	71.8	90.4	76.7	92.8	56.4

(*) Indicator TC3-2 was removed to align with the actual situation. Therefore, the score of the first CA has also been modified.

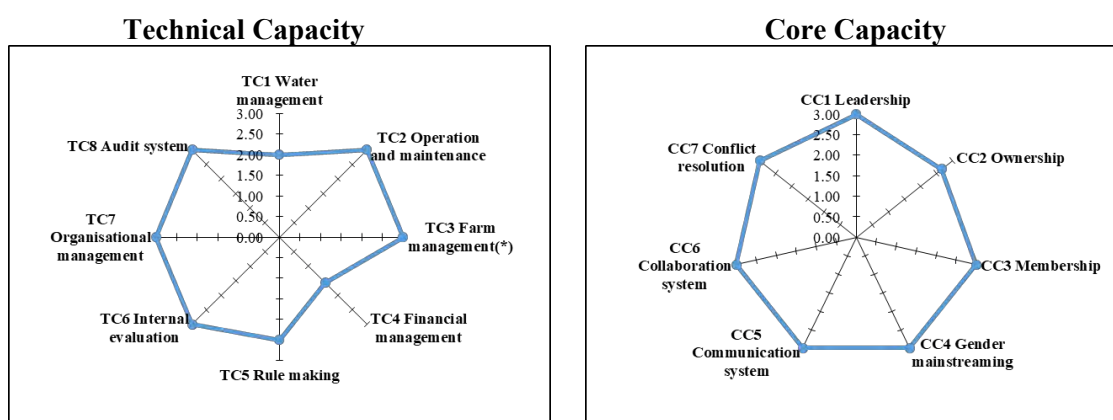


Figure 5 TC and CC of Nyabuyogera SMC

Annex 2: Results of Capacity Assessment (1st, 2nd and 3rd)

Capacity Assessment of IWUO

Capacity	#	Assessment Item	Indicator		Criteria	Evaluation				Score	Average Score
		English	##	English	English	⊗Excellent	○Good	△Fair	✕Poor		
Enabling Condition	EC1	Policy framework	EC1-1	National policy and strategy for IWUO is clear.	⊗Relevant policy/strategy in place and well recognised by stakeholders. ○Relevant policy/strategy exist, but they are not well recognised by stakeholders. △Relevant policy/strategy exist, but are insufficient. ✕ There are no relevant policy/strategy.						
	EC2	Legal system	EC2-1	IWUO establishment is legally defined.	⊗Legally prescribed, and the administrative procedure is fully functioning. ○Legally prescribed, but administrative procedures are not fully functioning. △Legally prescribed, but administrative procedures are not functioning. ✕Not legally prescribed.						
	EC3	Administrative support system	EC3-1	Supporting system for IWUO is established.	⊗Administrative support systems exist, are recognised by stakeholders and are fully functioning. ○Administrative support systems exist, but they are not well recognised by stakeholders and are not fully functioning. △Administrative support systems are inadequate, or they are not functioning adequately. ✕ There is no administrative support system.						
			EC3-2	Human resource for IWUO support is secured.	*Comprehensive assessment of the current situation in the district/sector, station, etc is needed. ⊗Necessary and sufficient personnel are in place. ○A certain level of personnel is in place, but it is not fully functioning. △Insufficient personnel, or even if personnel are secured, they are hardly functioning. ✕Not secured at all (chronically understaffed).						
	EC4	Environmental condition	EC4-1	Water resource and irrigation facility is established.	⊗Water resources and facilities are in place and fully functioning. ○Water resources and facilities are in place but not fully functioning (room for repair but not a critical problem). △Water resources and facilities are sufficiently maintained, or they are only partially functioning even if they are in place. ✕Water resources and facilities are not well maintained or not functioning at all even if they are maintained.						
	TC1	Water management	TC1-1	Existence of water distribution plan (including irrigation map and irrigation calendar)	⊗Water distribution plans, irrigation maps and irrigation calendars have all been prepared and are regularly updated. ○Documents similar to water distribution plans, irrigation maps and irrigation calendars have been prepared, but are not sufficiently accurate or updated. △Any of the water distribution plans, irrigation maps or irrigation calendars are lacking. ✕Neither water distribution plans, irrigation maps nor irrigation calendars have been prepared.						
			TC1-2	The percentage of water shortage area.	The actual irrigated area is. ⊗80% or more (water deficit area is less than 20%) ○60-80% (water deficit area is 20%-40%) △40-60% (water deficit area is 40-60%) ✕Less than 40% (water deficit area is more than 60%)						
			TC1-3	IWUO initiatively manages water distribution.	⊗IWUO recognises themselves as the main body of water distribution management (water management) and they are fully functioning. ○IWUO recognises themselves as the main body of water distribution management (water management), but they are not fully functioning. △IWUO recognises themselves as the main body of water distribution management (water management), but they are not functioning well. ✕IWUO does not even recognise themselves as the main body of water distribution management (water management).						
			TC1-4	There is no conflict among farmers and no regional disparity (e.g. upstream and downstream).	⊗Equitable water allocation is being implemented and none of regional disparity or water conflicts are occurring, or are being resolved quickly. ○Efforts are being made to correct water allocation imbalances, and the regional disparity and water conflicts have been or are being resolved. △Water conflicts have been resolved on an ad hoc basis, but the underlying water allocation imbalance has not been resolved. ✕Water allocation imbalances are left unresolved and water conflicts occur frequently.						
	TC2	Operation and maintenance	TC2-1	IWUO has O&M plan.	⊗O&M plan is in place and updated, and activities are clear and realistic. ○O&M plan is in place and updated, but the activities need to be improved. △O&M plan is not prepared/updated, but discussions are underway to develop a plan. ✕O&M plan is not prepared/updated, and any discussions are not underway to develop a plan.						
			TC2-2	IWUO conduct O&M as planned.	⊗80% and above. ○60-80%. △40-60%. ✕Less than 40%.						
			TC2-3	The participation rate of farmers.	⊗80% and above. ○60-80%. △40-60%. ✕Less than 40%.						
			TC2-4	IWUO has a rule regarding O&M.	⊗IWUO has a rule of O&M and it is fully functioning. ○IWUO has a rule of O&M, but it is not fully functioning. △IWUO has a rule of O&M, but it is not functioning at all. ✕IWUO has no rules of O&M.						
			TC2-5	IWUO records the O&M activity.	⊗IWUO always records the O&M activity and they are properly processed and stored. ○IWUO always records the O&M activity, but the way of processing and storing is not always appropriate. △IWUO sometimes records the O&M activity. ✕IWUO never records the O&M activity.						
	TC3	Farm management	TC3-1	IWUO has cropping calendar.	⊗Crop calendar has been prepared over the past year and the content is clear and realistic. ○Crop calendar has been prepared over the past year, but the content needs improvement. △Crop calendar has not been prepared, but discussions are underway to prepare one. ✕Crop calendar has not been prepared, and no discussions are made.						
	TC4	Financial management	TC4-1	The collection rate of water fee.	⊗80% and above. ○60-80%. △40-60%. ✕Less than 40%.						
			TC4-2	Water fee setting and planning is fair.	⊗The water fee is set and reviewed with a view to balancing income and expenditure, and the set amount has been approved by the general assembly meeting. ○The water fee has been approved by the general assembly meeting, but the balance of income and expenditure is not sufficiently good (poor planning). △The water fee has not been approved by the general assembly meeting, but there is a customary set amount of the water fee. ✕There is no water fee setting.						
			TC4-3	Collection of water fee and balance is recorded and managed properly. (There is a person in charge, and there is their own bank account.)	⊗An accountant has been assigned, a bank account has been opened, and the income and expenditure, including the collection of water fee, are properly recorded and managed. ○An accountant has been assigned, a bank account has been opened, and the income and expenditure are recorded and managed, but there is room for improvement in terms of accuracy, etc. △An accountant has been assigned and a bank account has been opened, but income and expenditure are not recorded and managed. ✕Neither the assignment of an accountant, the opening of a bank account, nor the recording and management of income and expenditure are being carried out.						
			TC4-4	The income source of IWUO is secured and the balance is positive.	*It is a prerequisite for an assessment of ⊗ or ○ that the income and expenditure are recorded and managed. In addition, In addition, not only water fee but also their additional income (e.g. aquaculture) must be taken into account. ⊗IWUO has been in surplus for the past two years or more and is managed in accordance with the budget plan. ○IWUO has been in surplus for the past two years or more, but has not developed an appropriate budget plan. △IWUO has had a deficit situation for the past two years. ✕IWUO is not recording income and expenditure, or has been in a deficit situation for the past two years or more.						
			TC4-5	Budget and settlement is reported to the IWUO members.	⊗The budget and settlement are properly reported at general assembly meeting and approved by the members. ○The budget and settlement are reported at general assembly meetings and approved by members, but the contents of the budget/settlement and the approval process are not always appropriate. △The budget and settlement are compiled, but shared only with some stakeholders and not reported to members. ✕The budget and settlement are NOT compiled.						
			TC4-6	Financial report is approved by DISC.	⊗Financial report is prepared, presented and approved by the DISC. ○Financial report is prepared, presented and approved by the DISC, but there is room for improvement (e.g. the content is not accurate). △Financial report is prepared, but not presented and approved by the DISC. ✕Financial report is not prepared.						
			TC4-7	Maintenance Fee, Reserve Fee and Irrigation Trust Fund are allocated from collected water fee.	⊗ Both Maintenance Fee, Reserve Fee and Irrigation Trust Fund have adequate allocations. ○Both Maintenance Fee, Reserve Fee and Irrigation Trust Fund are available, but not sufficient. △No allocation of either Maintenance Fee, Reserve Fee or Irrigation Trust Fund. ✕No allocation of any of Maintenance Fee, Reserve Fee or Irrigation Trust Fund.						

Annex 2: Results of Capacity Assessment (1st, 2nd and 3rd)

TC5	Rule making	TC5-1	The internal rule (bylaws) is prepared and members are aware of it.	⊗The internal rule is prepared and well recognised by members (more than 80% of members recognise) ○The internal rule is prepared and somewhat recognised by members (60% - 80%) △The internal rule is prepared but not well recognised by members (40% - 60%) XThe internal rule is not prepared, or not recognised by members (less than 40%)						
		TC5-2	The way of making rules is fair and the rule can be changed on the request from IWUO members.	⊗The rules have been formulated with the approval of the members at the general assembly meeting and can be amended if (1) the content of the rules is in line with the situation in the district and (2) the conditions are met through discussions in response to the members' requests. ○The rules have been formulated with the approval of the members at the general assembly meeting, but do not meet either of the above conditions (1) or (2). △Although the rules have been formulated with the approval of the members at the general assembly meeting, neither (1) nor (2) above conditions are met. XApproval of the members has not been obtained when formulating the rules (even if both above conditions (1) and (2) are met).						
	Internal evaluation	TC6-1	Actual achievement toward plan is grasped, evaluated and reported.	⊗Actual achievements against the plan are properly grasped and evaluated (annual activity reports and annual income and expenditure reports are organised) and reported to members at general assembly meetings ○Actual achievements against the plan are grasped and evaluated (annual activity reports and annual income and expenditure reports are organised) and reported to members at general assembly meetings, but there is room for improvement (e.g. insufficient information and inaccurate content). △Actual achievements against the plan are grasped and evaluated, but are not reported to members. XActual achievements against the plan are not grasped at all.						
	Organisational management	TC7-1	The stage of IWUO registration.	⊗Final stage. ○Stage in which the required documents have been submitted to the RGB. △Stage in which the collaboration letter from the District has been received. XStage before application is submitted.						
TC7-2		IWUO has management committee. The selection method of the members of management committee is appropriate.	⊗The management committee is organised, the president and members are elected, and each is fully aware of his or her role. ○The management committee is organised, the president and members are elected, but each is not fully aware of his or her role. △The management committee is organised, but the election process is not adequate (elections are not held, members are not convinced, etc.). XThe management committee is not organised.							
TC7-3		There is a lower group under the IWUO.	⊗There is a lower group based on irrigation facilities organised, and each is fully aware of their role. ○There is a lower group based on irrigation facilities organised, but each is not fully aware of their role. △There is a lower group, but the way it is organised and the recognition of each is not sufficient. XThere is no lower group.							
TC8	Audit system	TC8-1	There is an audit system. It is functioning.	⊗There is an audit system, which is fully functioning (audits have been carried out regularly during the past year). ○There is an audit system, but it is not fully functioning. △There is an audit system, but it is not functioning at all. XThere is no audit system.						
CC1	Leadership	CC1-1	Chairperson has vision and goal.	* Ask the president or committee members whether they have a vision and goal, and if 'yes', ask further about the contents. ⊗The goal or vision is clear, (1) the current situation in the scheme is understood, (2) it is realistic, and (3) it is shared with stakeholders (at least the committee members). ○The goal or vision is clear, but any of (1) to (3) is insufficient. △The goal or vision is clear, but but none of (1) to (3) is inadequate. XThey do not have any goals or visions.						
		CC1-2	Chairperson gains confidence of district officers.	*Ask the president or committee members whether the president has the trust from the members or not, and if he/she has, ask for further questions. ⊗He/she has the trust and is in a situation where (2) he/she has been elected fairly, (2) there are no problems in the relations with committee members/IWUO members, and (3) members are willing to respond to his/her requests. ○He/she has the trust, but any of (1), (2) or (3) is insufficient. △He/she has the trust, but all of (1), (2) and (3) are insufficient. XHe/she does not have the trust, and all of (1), (2) and (3) are insufficient.						
		CC1-3	Chairperson fulfills their responsibility.	*Ask the president or committee members whether or not they are fulfilling their responsibilities, and if "yes", ask further questions (1) the contents of their responsibilities and (2) the specific activities they are carrying out. ⊗They can explain the content of their responsibilities and are carrying out specific activities. ○They can explain the content of their responsibilities, but they are not sufficiently carrying out specific activities. △They can explain the content of their responsibilities, but they are not carrying out specific activities. XThey cannot explain the content of their responsibilities, or even if they can explain their responsibilities, they are not carrying out any activities at all.						
		CC1-4	Chairperson is responsible for the IWUO members.	*Note: Ask the question "Who is ultimately responsible for any serious problems that arise within IWUO committee members or irrigation scheme? (e.g. Accountant is found to have embezzled water fee.)" ⊗A person in a position (the president or a member of the committee) will take responsibility. ○Someone in a position takes responsibility, but do not clearly mention who it is. △Acknowledges the need for involvement of those in a position to take responsibility, but do not answer that they will take responsibility. XThey do not know any clear answer (responsibility is unclear).						
CC2	Ownership	CC2-1	IWUO members actively participate in the IWUO activities.	⊗Many IWUO members are active with ownership (reference criteria: voluntary commitment to daily cleaning and maintenance of facilities, understanding of the significance of water fee, etc.). (more than 80% IWUO members) ○A certain number of IWUO members are active with ownership (60% - 80%). △Some IWUO members are active with ownership (40% - 60%). XMost IWUO members are not active with ownership (less than 40%).						
		CC2-2	IWUO members take some actions toward problems or challenges.	⊗Constructive action is being taken to solve the problem and members are cooperating with it (e.g. Sharing information with zone leaders, setting up a consultation meeting, putting it on the agenda of the general assembly meeting). ○Some action is being taken to solve the problem, and the members are cooperating with it. △Some action is being taken to solve the problem, but the members are not cooperating with it. XThe problem/issue is left unresolved.						
		CC2-3	IWUO members givefeedback to the board members (management committee).	⊗Mechanisms for feedback from IWUO members to board members are in place and fully functioning. ○Mechanisms for feedback from IWUO members to board members are inadequate, but most of IWUO members are willing to provide feedback in some form. △Mechanisms for feedback from IWUO members to board members are inadequate, and only a part of IWUO members is willing to provide feedback. XThere is no mechanism for feedback from IWUO members and none of them are willing to provide feedback.						
CC3	Membership	CC3-1	IWUO members aware of the member of the organization.	⊗Many IWUO members understand and can fully explain the organisational structure of IWUO (the units and zones they belong to) and their individual roles. ○Some IWUO members understand more or less the organisational structure of IWUO and their roles, but are not able to explain them well enough. △Some IWUO members know that IWUO exists and that they are members of the organisation, but do not understand the organisational structure of IWUO and their individual roles. XMost IWUO members do not even know that IWUO exists or that they are members of the organisation, or are uncertain if they do.						
		CC3-2	IWUO members are cooperative for IWUO activities.	⊗A large number of members participate in meetings and community work (80% or more) ○A certain number of members participate in meetings and community work (60%-80%) △Some members participate in meetings and community work (40%-60%) XMost members do not participate in meetings and community work (less than 40%).						
Core Capacity	Gender mainstreaming	CC4-1	Gender balance regarding decision making.	*Take into account both the male/female ratio of committee members and the members participating in the general assembly meeting. ⊗Equal ratio of men and women (50%) ○There is an uneven gender ratio, but a certain number of men/women are ensured (30-40%) △The gender ratio is unbalanced (10-30%) XThe gender ratio is significantly unbalanced (below 10%).						
		CC4-2	Gender balance regarding IWUO activities.	⊗Equal ratio of men and women (50%) ○There is an uneven gender ratio, but a certain number of men/women are ensured (30-40%) △The gender ratio is unbalanced (10-30%) XThe gender ratio is significantly unbalanced (below 10%).						
		CC4-3	Gender balance regarding training opportunities if any.	⊗Equal ratio of men and women (50%) ○There is an uneven gender ratio, but a certain number of men/women are ensured (30-40%) △The gender ratio is unbalanced (10-30%) XThe gender ratio is significantly unbalanced (below 10%).						
		CC4-4	Station has rules(by laws) regarding gender.	⊗IWUO has a rule regarding gender and it is fully functioning. ○IWUO has a rule regarding gender, but it is not fully functioning. △IWUO has a rule regarding gender, but it is not functioning at all. XIWUO has no rules regarding gender.						

Annex 2: Results of Capacity Assessment (1st, 2nd and 3rd)

	CC5	Communication system	CC5-1	General assembly is functioning. (frequency, attendance rate, etc.)	<p>⊙General assembly meetings have been held at least twice (regularly) in the past year and attendance was good (more than two thirds of those expected to attend)</p> <p>○General assembly meetings have been held at least twice (regularly) in the past year but the attendance rate was not good (one third to two thirds of those expected to attend), or only one General assembly meeting has been held in the past year but the attendance rate was good.</p> <p>△Only one General assembly meeting has been held in the past year and attendance was poor (one third to two thirds of those expected to attend)</p> <p>×No General assembly meetings have been held in the past year, or if they have been held, attendance was poor (less than one third of those expected to attend).</p>						
			CC5-2	Minutes of the general assembly are always taken.	<p>⊙Minutes of GA are always kept and are properly processed and archived.</p> <p>○Minutes of GA are always kept, but the way they are processed and archived is not adequate.</p> <p>△Minutes of GA are sometimes kept.</p> <p>×Minutes of GA are not kept.</p>						
			CC5-3	Management committee meeting is functioning. (frequency, attendance rate, etc.)	<p>⊙Management committee meetings have been held at least twice (regularly) in the past year and attendance was good (more than two thirds of those expected to attend)</p> <p>○Management committee meetings have been held at least twice (regularly) in the past year but the attendance rate was not good (one third to two thirds of those expected to attend), or only one Management committee meeting has been held in the past year but the attendance rate was good.</p> <p>△Only one Management committee meeting has been held in the past year and attendance was poor (one third to two thirds of those expected to attend)</p> <p>×No Management committee meetings have been held in the past year, or if they have been held, attendance was poor (less than one third of those expected to attend).</p>						
			CC5-4	Minutes of the management committee's meetings are always taken.	<p>⊙Minutes of management committee's meeting are always kept and are properly processed and archived.</p> <p>○Minutes of management committee's meeting are always kept, but the way they are processed and archived is not adequate.</p> <p>△Minutes of management committee's meeting are sometimes kept.</p> <p>×Minutes of management committee's meeting are not kept.</p>						
			CC5-5	Decided matters are informed to all the IWUO members.	<p>⊙The method of communication with the IWUO members and the person in charge are clear and well-functioning.</p> <p>○The method of communication with the IWUO members and the person in charge are defined, but it is not functioning adequately.</p> <p>△The method of communication with the IWUO members and the person in charge are defined, but it is not functioning.</p> <p>×The method of communication with the IWUO members and the person in charge are unclear and not functioning at all.</p>						
	CC6	Collaboration system	CC6-1	There is a contact system with cooperative, and they contact to the cooperative on a regular basis.	<p>⊙The method of communication with the Cooperative and the person in charge are clear and well-functioning.</p> <p>○The method of communication with the Cooperative and the person in charge are defined, but it is not functioning adequately.</p> <p>△The method of communication with the Cooperative and the person in charge are defined, but it is not functioning.</p> <p>×The method of communication with the Cooperative and the person in charge are unclear and not functioning at all.</p>						
			CC6-2	Performance contract is signed with cooperative. *No need to ask to Nyabuyogera	<p>⊙Contracts with Cooperatives are signed on a regular basis (every season) and the contracts are properly implemented.</p> <p>○Contracts are generally being properly implemented, although there are some problems with the contracting procedures and the status of implementation.</p> <p>△Contracts have not been signed, but discussions are underway towards the signing of contracts, or contracts have been signed but the contents of the contracts are not being properly implemented.</p> <p>×Contracts have not been signed and discussions towards the signing of contracts are not underway.</p>						
			CC6-3	There is a contact system with district/sector, and they contact to the district/sector on a regular basis.	<p>⊙Participated in meetings such as DISC during the past year, and there are regular interactions with the District/Sector (contact person, person in charge, and means of communication are clear).</p> <p>○Participated in meetings such as DISC during the past year, but there is no or insufficient regular interactions with the District/Sector.</p> <p>△No participation in meetings such as DISC during the past year, but there are interactions with the District/Sector.</p> <p>×No participation in meetings such as DISC in the past year and no interactions with the District/Sector.</p>						
	CC7	Conflict resolution	C7-1	There is a conflict resolution system.	<p>⊙Process for dealing with conflicts when they occur is clear and fully functioning.</p> <p>○Process for dealing with conflicts is in place, but it is not functioning adequately.</p> <p>△Process for dealing with conflicts when they occur is not in place, so conflicts are dealt with on an ad hoc basis.</p> <p>×Conflicts are left unresolved.</p>						

1. Action Plan in Ngoma District by 2028

#	Name of scheme	Present condition of IWUO	Major Activity 1: Define scheme service Area						
			Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibile entity	Indicator	Assumption
1	RUKIZI-KIBAYA irrigation scheme developed by KWIIMP	IWUO has been established in 2012 and it is active but no bottom-up structure was formulated and no supporting staff	To assess the current condition of IWUO(Irrigation Water Users Organization) (IWUO structure,Financial management, Irrigation facilities conditions)	Field Visit, FGD(Focus Group Discussion) and Auditing	742,000	2025-2026	SP(Service Provider), RAB ,District and IWUO	Produce report The capacity of IWUO confirmed The existig facility condition is determined	Secure budget District assign staff including auditor as needed Full participation of focused group
			Checking the availability of water for irrigation	Field work Office work Checking the design document	266,000	2025-2026	RAB and District	The scheme service area determined	Availability of skilled staff (irrigation Engineer) Availability of Design document (MINAGI, RAB)
			Hiring supporting staffs	Checking the financial capacity of IWUO through auditing	550,000	2025-2026	IWUO, RAB, SP and District	The financial capacity of IWUO confirmed	Financial capacity of IWUO is enough Willingness to hire suport staff
2	RWAKAGANZA IRRIGATION SCHEME	IWUO has been established in 2016 but it's not active and only top committee was elected	To assess the current condition of IWUO (IWUO structure,Financial management, Irrigation facilities conditions)	Field Visit, FGD and Auditing	742,000	2025-2026	SP, RAB and District	Produce report The capacity of IWUO confirmed The existig facility condition is determined	Secure budget District assign staff including auditor as needed Full participation of focused group
			Checking the availability of water for irrigation	Field work Office work Checking the design document	266,000	2025-2026	RAB and District	The scheme service area determined	Availability of skilled staff (irrigation Engineer) Availability of Design document (MINAGI, RAB)
			Hiring supporting staffs	Checking the financial capacity of IWUO through auditing	550,000	2025-2026	IWUO, RAB, SP and District	The financial capacity of IWUO confirmed	Financial capacity of IWUO is enough Willingness to hire suport staff

Major Activity 2: Prepare Database and Organize Irrigation Block						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibile entity	Indicator	Assumption
Preparation of Irrigation Map	Field work Office work	1,008,000	2025-2026	SP, District, IWUO and RAB	Irrigation Map is prepared	Assignment of GIS expert by the District Availability of Irrigation Engineer The status of irrigation infrastructure
Preparation of Irrigation block	Field work Office work Meeting	1,008,000	2025-2026	SP, District, IWUO and RAB	Irrigation Block is prepared	Irrigation map is prepared
Preparation of Water Users List	Field work Office work	1,732,000	2025-2026	IWUO, SP, District and RAB	Water users list prepared	Full participation of Cooperative leader (Farmer Producing Group) Availability of District and RAB staff Assignment of SP to this site
Preparation of Irrigation Map	Field work Office work	1,008,000	2025-2026	SP, District, IWUO and RAB	Irrigation Map is prepared	Assignment of GIS expert by the District Availability of Irrigation Engineer The status of irrigation infrastructure
Preparation of Irrigation block	Field work Office work Meeting	1,008,000	2025-2026	SP, District, IWUO and RAB	Irrigation Block is prepared	Irrigation map is prepared
Preparation of Water Users List	Field work Office work	1,732,000	2025-2026	IWUO, SP, District and RAB	Water users list prepared	Full participation of Cooperative leader (Farmer Producing Group) Availability of District and RAB staff Assignment of SP to this site

Major Activity 3: Reorganize of IWUO structure						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Reorganization of IWUO structure (Bottom -up)	Field work (Work shop, Election)	742,000	2025-2026	SP, Cooperative, District, IWUO and RAB	IWUO structure is updated	Full participation stakeholders Assignment of SP to teh scheme Availability of District staffs
Reorganization of IWUO structure (Bottom -up)	Field work (Work shop, Election)	742,000	2025-2026	SP, Cooperative, District, IWUO and RAB	IWUO structure is updated	Full participation stakeholders Assignment of SP to teh scheme Availability of District staffs
Explanation of irrigation blocks to all member	Field work (WS)	476,000	2025-2026	SP, Cooperative, District, IWUO and RAB	XX% of member aware of the irrigation block	Full participation of beneficiaries Irrigation block is prepared
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Major Activity 4: Clarify Roles, Responsibility and Internal Regulation						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Set a clear roles and responsibilities of stakeholders	Field work which include Farmer Group Discussion (FGD)	742,000	2025-2026	SP, IWUO, Disrict and RAB,SP	Farmer Group Discussion (FGD) conducted	Full participation of stakeholders
Amendment of internal rules and Regulations	Field work which include Farmer Group Discussion (FGD)	742,000	2025-2026	SP, IWUO, Disrict and RAB,SP	Farmer Group Discussion (FGD) conducted	Full participation of stakeholders
Set a clear roles and responsibilities of stakeholders	Field work which include Farmer Group Discussion (FGD)	742,000	2025-2026	SP, IWUO, Disrict and RAB,SP	Farmer Group Discussion (FGD) conducted	Full participation of stakeholders
Amendment of internal rules and Regulations	Field work which include Farmer Group Discussion (FGD)	742,000	2025-2026	SP, IWUO, Disrict and RAB,SP	Farmer Group Discussion (FGD) conducted	Full participation of stakeholders
Link IWUO with Local govnrnement	conducting sensitization workshop (1 day)	369,000	2025-2026	SP, IWUO & District	FDG conducted	It is included in the action plan of the District

Major Activity 5: Call for General Meeting and ratification of by-law						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Validate the amended internal rules and regulations	General Asseblee (GA) meeting	654,000	2025-2026	IWUO, Cooperative, Disrict and RAB,SP	Validated amanded document	At least 3/4 of delegates participate and agree
Follow-up on implementation of those laws	Fieldwork (Participatory Monitering&Evaluation)	566,000	2026-2027	Monitoring and Evaluation team (IWUO, District, Sector and Cooperative)	Field report	Monitoring and Evaluation team available IWUO is active
Validate the amended internal rules and regulations	General Asseblee (GA) meeting	654,000	2025-2026	IWUO, Cooperative, Disrict and RAB,SP	Validated amanded document	At least 3/4 of delegates participate and agree
Follow-up on implementation of those laws	Fieldwork (Participatory Monitering&Evaluation)	566,000	2026-2027	Monitoring and Evaluation team (IWUO, District, Sector and Cooperative)	Field report	Monitoring and Evaluation team available IWUO is active

Major Activity 6: Conduct Necessary Training (Output 2)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Training on Financial management of IWUO (4days)	Training	1,508,000	2026-2027	SP, District and RAB	Training Conducted	Availability of budget Full participation of the committee Availability of baseline data Availability of training material Availability of trainer (Financial officer)
IWUO strengthening (2days)	Training	786,000	2026-2027	SP, District and RAB	Training Conducted	Availability of budget Full participation of the committee Availability of baseline data Availability of training material Availability of trainer (Disrict staffs).
Preparartion of Sensitization document (3 days)	Office work	124,000	2026-2027	SP, District and RAB	Training Conducted	Avavailability of skilled staff Set up of irrigation block Layout map Good picture showing the situation of the scheme
Sensitization on responsibilities of IWUO to lower levels (1 day)	Workshop	577,500	2026-2027	SP, District and RAB	Workshop conducted	Full participation of leaders Availability of sensitization material Availability of staffs
· Participatory Monitoring &Evaluation (1day)	Training	900,000	2026-2027	District, SP and RAB	Training Conducted	Full participation of leaders Availability of Training material and staffs
Training on Financial management of IWUO (4days)	Training	1,508,000	2026-2027	SP, District and RAB	Training Conducted	Availability of budget Full participation of the committee Availability of baseline data Availability of training material Availability of trainer (Financial officer)
IWUO strengthening (2days)	Training	786,000	2026-2027	SP, District and RAB	Training Conducted	Availability of budget Full participation of the committee Availability of baseline data Availability of training material Availability of trainer (Disrict staffs).
Preparartion of Sensitization document (3 days)	Office work	124,000	2026-2027	SP, District and RAB	Training Conducted	Avavailability of skilled staff Set up of irrigation block Layout map Good picture showing the situation of the scheme
Sensitization on responsibilities of IWUO to lower levels (1 day)	Workshop	577,500	2026-2027	SP, District and RAB	Workshop conducted	Full participation of leaders Availability of sensitization material Availability of staffs
· Participatory Monitoring &Evaluation (1day)	Training	900,000	2026-2027	District, SP and RAB	Training Conducted	Full participation of leaders Availability of Training material and staffs

Major Activity 6: Conduct Necessary Training (Output 3 & 4)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Training on facility Inspection	Lecture and Practice	1,171,000	2027-2028	SP, District and RAB	Training Conducted	Availablitt of Baseline data Active participation of traineers Availability of training materials Skilled staff
Basic civil work training	Lecture and Practice	2,780,000	2027-2028	SP, District and RAB	Training Conducted	Availability of tools and materials Availability of experienced Mason and Lecturer
Proper water managenent	Training (theory and practice)	762,000	2027-2028	SP, District and RAB	Training Conducted	Availability of baseline data Availability of demo plots
Water distribution plan	Training	936,000	2027-2028	SP, District and RAB	Training Conducted	Availability of irrigation infrastructures Active participation of members
Training on facility Inspection	Lecture and Practice	1,171,000	2027-2028	SP, District and RAB	Training Conducted	Availablitt of Baseline data Active participation of traineers Availability of training materials Skilled staff
Basic civil work training	Lecture and Practice	2,780,000	2027-2028	SP, District and RAB	Training Conducted	Availability of tools and materials Availability of experienced Mason and Lecturer
Proper water managenent	Training (theory and practice)	762,000	2027-2028	SP, District and RAB	Training Conducted	Availability of baseline data Availability of demo plots
Water distribution plan	Training	936,000	2027-2028	SP, District and RAB	Training Conducted	Availability of irrigation infrastructures Active participation of members

Major Activity 6: Conduct Necessary Training (Output 5)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Cooperative Management and Gender mainstreaming	Training	1,420,500	2026-2027	SP, District and RAB	Training conducted	Active participation of members(men and women) District assigns staff
Crop calendar	Training	356,500	2025-2028	SP, District and RAB	Training conducted	Active participation traineers
Farmer Field School(FFS)	Lecture and Practice	5,851,400	2025-2027	SP, District and RAB	Training conducted	Availability of baseline data Active participation of traineers
Cooperative Management and Gender mainstreaming	Training	1,420,500	2026-2027	SP, District and RAB	Training conducted	Active participation of members(men and women) District assigns staff
Crop calendar	Training	356,500	2025-2028	SP, District and RAB	Training conducted	Active participation traineers
Farmer Field School(FFS)	Lecture and Practice	5,851,400	2025-2027	SP, District and RAB	Training conducted	Availability of baseline data Active participation of traineers

2. Budget Plan

No .	Name of scheme	2025-2026	2026-2027	2027-2028	Total
1	RUKIZI_KIBAYA	6,048,000	11,523,900	5,649,000	23,220,900
2	RWAKAGANZA	6,524,000	11,523,900	5,649,000	23,696,900
Total		12,572,000	23,047,800	11,298,000	46,917,800

3. Implementation Schedule for Action Plan (Medium Term)

#	Name of scheme	Major Activity	Details of the activities (Intervention)	2025-2026				2026-2027				2027-2028				
1	RUKIZI_KIBAYA	Define scheme service Area	To assess the current condition of IWUO (Irrigation Water Users Organization) (IWUO structure,Financial management, Irrigation facilities conditions)	■		■										
			Checking the availability of water for irrigation		■		■									
			Hiring supporting staffs			■										
		Prepare Database and Organize Irrigation Block	Preparation of Irrigation Map		■											
			Preparation of Irrigation block		■											
			Preparation of Water Users List			■										
		Reorganize of IWUO structure	Reorganization of IWUO structure (Bottom -up)				■									
		Clarify Roles, Responsibility and Internal Regulation	Set a clear roles and responsibilities of stakeholders					■								
			Amendment of internal rules and Regulations					■								
		Call for General Meeting and ratification of by-law	Validate the amended internal rules and regulations					■								
			Follow-up on implementation of those laws						■							
		Conduct Necessary Training (Output 2)	Training on Financial management of IWUO (4days)							■						
			IWUO strengthening (2days)							■						
			Sensitization on responsibilities of IWUO to lower levels (1 day)								■					
			· Participatory Monitoring &Evaluation (1day)									■				
		Conduct Necessary Training (Output 3 & 4)	Training on facility Inspection											■		
			Basic civil work training											■		
			Proper water managenent												■	
			Water distribution plan												■	
Conduct Necessary Training (Output 5)	Cooperative Management and Gender mainstreaming						■									
	Crop calendar		■		■		■		■		■		■			
	Farmer Field School(FFS)			■		■		■		■		■		■		
2	RWAKAGANZA	Define scheme service Area	To assess the current condition of IWUO (IWUO structure,Financial management, Irrigation facilities conditions)	■		■										
			Checking the availability of water for irrigation		■		■									
			Hiring supporting staffs	■		■										
		Prepare Database and Organize Irrigation Block	Preparation of Irrigation Map		■											
			Preparation of Irrigation block		■											
			Preparation of Water Users List			■										
		Reorganize of IWUO structure	Reorganization of IWUO structure (Bottom -up)				■									
			Explanation of irrigation blocks to all member					■								
		Clarify Roles, Responsibility and Internal Regulation	Set a clear roles and responsibilities of stakeholders					■								
			Amendment of internal rules and Regulations					■								
			Link IWUO with Local govnmement						■							
		Call for General Meeting and ratification of by-law	Validate the amended internal rules and regulations						■							
			Follow-up on implementation of those laws						■							
		Conduct Necessary Training (Output 2)	Training on Financial management of IWUO (4days)							■						
			IWUO strengthening (2days)							■						
			Preparartion of Sensitization document (3 days)								■					
			Sensitization on responsibilities of IWUO to lower levels (1 day)									■				
			· Participatory Monitoring &Evaluation (1day)											■		
		Conduct Necessary Training (Output 3 & 4)	Training on facility Inspection											■		
Basic civil work training												■				
Proper water managenent													■			
Water distribution plan													■			
Conduct Necessary Training (Output 5)	Cooperative Management and Gender mainstreaming						■									
	Crop calendar		■		■		■		■		■		■			
	Farmer Field School(FFS)			■		■		■		■		■		■		

1. Action Plan for Rwamagana District 2025 to 2028

#	Name of scheme	Present condition of IWUO	Major Activity 1: Define Scheme Service Area							Major Activity 2: Prepare Database and Organize Irrigation Block						
			Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption	Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
1	Rugende Irrigation scheme	IWUO has been established in 2018 and it's active. The top organization structure was formulated. There is supporting staff but not enough	Confirm irrigation facilities	Field Work	607,000	2025-2026	SP, Didtrict, IWUO &RAB	Report about the condition of the facilities	Availability of irrigation engineer Availability of budget	· Complete the draft Irrigation Map	Field Work	832,000	2025-2026	SP, District, IWUO &RAB	Field Records	Availability GIS technician, GPS Machine, Availability of budget
			Confirm the available Water for irrigating the command area	Field WorkOffice work	732,000	2025-2026	SP, District&RAB	Define the command area	Availability of design document Availability of irrigation engineer Availability of Budget	· Complete the drafted of Irrigation Map	Office Work	108,000	2025-2026	GIS Technician	Produced map	Availability GIS technician, Availability of budget
			Checking finance capacity of the IWUO to hire the additional staff	Audit Discussion	55,000	2025-2026	SP, District&RAB	Comfirm the capacity of IWUO(Hire additional staff)	District assign auditors IWUO agree to the plan and Availability of budget	· Prepare the Water users list	Field Work	997,000	2025-2026	SP, District, IWUO &RAB	Field Records	Availability of farmers producing group leader, Availability of budget
										· Prepare the Water users list	Office Work	108,000	2025-2026	SP, IWUO	Produced water user list	
										· Reorganization of Irrigation block	Meeting	186,000	2025-2026	SP, IWUO	Irrigation block created	Irrigation facilities are functional Beneficiaries agreement, Availability of budget
					1,394,000							2,231,000				
2	Mutukura irrigation scheme	No IWUO has established and there are no organizational structure	Confirm irrigation facilities	Field Work	607,000	2025-2026	SP, District, IWUO &RAB	Report about the condition of the facilities	Availability of irrigation engineer Availability of budget	· Complete the draft Irrigation Map	Field Work	647,000	2025-2026	SP, Didtrict, IWUO &RAB	Field Records	Availability GIS technician, GPS Machine
			The decision to form an IWUO or other structure	Focus Group Discussion(FGD) Arrange field visit to other schemes Check financial capacity	402,000	2025-2026	RAB, District and SP	Establishment of an organ Marging with Rugende IWUO	Agreement with Mutukura beneficiaries Availability of budget	· Complete the drafted of Irrigation Map	Office Work	108,000	2025-2026	SP, District,&RAB	Produced map	Availability GIS technician, Availability of budget
			Confirm the available Water for irrigating the command area	Field WorkOffice work	732,000	2025-2026	SP, District&RAB	Define the command area	Availability of design document Availability of irrigation engineer Availability of budget	· Prepare the Water users list	Field Work	633,000	2025-2026	SP, District, IWUO &RAB	Field Records	Availability of farmers producing group leader, Availability of budget
										· Prepare the Water users list	Office Work	108,000	2025-2026	SP, IWUO	Produced water user list	
										· Reorganization of Irrigation block	Meeting	186,000	2025-2026	SP, IWUO	Irrigation block created	Irrigation facilities are functional Beneficiaries agreement, Availability of budget
					1,741,000							1,682,000				

3	Musha SSIT scheme	No IWUO established and there is no organizational structure. Presence of cooperative with Service area covered by 10Ha	· Confirm the availability of irrigation facilities and water for irrigating the command area	Field WorkOffice work	89,000	2025-2026	RAB, District and SP	Field report	Availability of irrigation engineer Availability of Budget	· Complete the draft Irrigation Map	Field Work	193,000	2025-2026	District, Cooperative &RAB	Field Records	Availability of GIS technician, GPS Machine and secured budget.
			The decision to form an IWUO or other structure	Focus Group Discussion(FGD) Arrange field visit to other schemes Check financial capacity	602,000	2025-2026	RAB, District and SP	Establishment of an organ	Agreement Musha SSIT beneficiaries, Availability of Budget	· Complete the drafted of Irrigation Map	Office Work	36,000	2025-2026	GIS Technician	Produced map	Availability GIS technician and secured budget.
										· Prepare the Water users list	Field Work	193,000	2025-2026	District, Cooperative &RAB	Field Records	Availability of farmers producing group leader. Availability of secured budget.
										· Prepare the Water users list	Office Work	36,000	2025-2026	District, Cooperative &RAB	Produced water user list	
										· Reorganization of Irrigation block	Meeting	71,000	2025-2026	District, Cooperative &RAB	Irrigation block created	Irrigation facilities are functional Beneficiaries agreement. Availability of secured budget.
					691,000							529,000				
4	Rwamagana 34	IWUO has been established in 2016 and it's active. The top organization structure was formulated. There is supporting staff but not enough	Confirm irrigation facilities	Field Work	607,000	2025-2026	SP, Didistrict, IWUO &RAB	Report about the condition of the facilities	Availability of irrigation engineer Availability of budget	· Draft Irrigation Map	Field Work	832,000	2025-2026	SP, District, IWUO &RAB	Field Records	Availability GIS technician, GPS Machine, Availability of budget
			Confirm the available	Field WorkOffice work	732,000	2025-2026	SP, District&RAB	Denine the command	Availability of design document	· Complete the drafted of Irrigation Map	Office Work	108,000	2025-2026	GIS Technician	Produced map	Availability GIS technician
			Checking finance capacity of the IWUO to hire the additional staff	Audit Discussion	55,000	2025-2026	SP, District&RAB	Comfirm the capacity of IWUO(Hire additional staff)	District assign auditors IWUO agree to the plan and Availability of budget	· Prepare the Water users list	Field Work	1,017,000	2025-2026	SP, District, IWUO &RAB	Field Records	Availability of farmers producing group leader, Availability of budget
										· Prepare the Water users list	Office Work	108,000	2025-2026	SP, IWUO	Produced water user list	
										· Reorganization of Irrigation block	Meeting	244,000	2025-2026	SP, IWUO	Irrigation block created	Irrigation facilities are funfunctional Beneficiaries agreement, Availability of budget
5	Gahengeri SSIT scheme	No IWUO established and there is no organizational structure. Presence of cooperative with Service area covered by 10Ha	· Confirm the availability of irrigation facilities and water for irrigating the command area	Field WorkOffice work	89,000	2025-2026	RAB, District and SP	Field report	Availability of irrigation engineer Availability of Budget	· Complete the draft Irrigation Map	Field Work	193,000	2025-2026	District, Cooperative &RAB	Field Records	Availability of GIS technician, GPS Machine and secured budget.
			The decision to form an IWUO or other structure	Focus Group Discussion(FGD) Arrange field visit to other schemes Check financial capacity	402,000	2025-2026	RAB, District and SP	Establishment of an organ	Agreement Musha SSIT beneficiaries, Availability of Budget	· Complete the drafted of Irrigation Map	Office Work	36,000	2025-2026	GIS Technician	Produced map	Availability GIS technician and secured budget.
										· Prepare the Water users list	Field Work	193,000	2025-2026	District, Cooperative &RAB	Field Records	Availability of farmers producing group leader.
										· Prepare the Water users list	Office Work	36,000	2025-2026	District, Cooperative &RAB	Produced water user list	
										· Reorganization of Irrigation block	Meeting	71,000	2025-2026	District, Cooperative &RAB	Irrigation block created	Irrigation facilities are functional Beneficiaries agreement. Availability of secured budget.
					491,000							529,000				

Major Activity 3: Reorganize IWUO Structure							Major Activity 4: Clarify Roles, Responsibility and Internal Regulation						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption	Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
Complete the lower level organ of IWUO (WUT& SWD)	Election	327,000	2025-2026	SP, District, IWUO&RAB	Low level organ established	Irrigation blocks are created	• Discuss on the roles and responsibility of each stakeholders	Focus Group Discussion	2,400,000	2026-2028	SP, IWUO	Minutes and attendace list	All stakeholders participate actively
							• Modify the internal rules and regulation	Focus Group Discussion	1,200,000	2026-2028	SP, IWUO	Draft internal rules and regulation	All stakeholders participate actively
							• Collect the inputs on prepared internal rules and regulation	Focus Group Discussion	1,500,000	2026-2028	SP, IWUO	Minutes and attendace list	Inputs are provided to stakeholders on time
							• Validate the prepared internal rules and regulation	GA	2,616,000	2026-2028	SP, District, RAB, IWUO	Final internal rules and regulation	All stakeholders agree to the final rules and regulations
							•						
•		327,000					•		7,716,000				
• Explanation of Irrigation Block to all members	Workshop	142,000	2025-2026	SP, District, Organ &RAE	report	Type of organization is agreed, Availability of budget	• Set a clear roles and responsibility of each stakeholders	Focus Group Discussion	600,000	2026-2028	SP, IWUO	Minutes and attendace list	Type of organization is agreed All stakeholders participate actively Availability of budget
• Election of leaders from bootom level up	Workshop	267,000	2025-2026	SP, District, Organ&RAE	Elected leaders	Type of organization is agreed, Availability of budget	• Prepare of internal rules and regulation	Focus Group Discussion	600,000	2026-2028	SP, IWUO	Draft internal rules and regulation	All stakeholders participate actively, Availability of budget
							• Collect the inputs on prepared internal rules and regulation	Focus Group Discussion	600,000	2026-2028	SP, IWUO	Minutes and attendace list	Inputs are provided to stakeholders on time, Availability of budget
							• Validate the prepared internal rules and regulation	GA	816,000	2026-2028	SP, District, RAB, IWUO	Final internal rules and regulation	All stakeholders agree to the final rules and regulations, Availability of budget
							•						
							•						
		409,000							2,616,000				

• Explanation of Irrigation Block to all member	Work Shop	87,000	2025-2026	District, Organ & RAB	report	Type of organization is agreed, Availability of Budget	• Set a clear roles and responsibility of each stakeholders	Focus Group Discussion	501,000	2026-2028	District, cooperative and RAB	Draft internal rules and regulation	All stakeholders participate actively, Availability of Budget
• Election of leaders from bootom level up	Work Shop	87,000	2025-2026	District, Organ & RAB	Elected leaders	Type of organization is agreed, Availability of Budget	• Prepare of internal rules and regulation	Focus Group Discussion	501,000	2026-2028	District, cooperative and RAB	Minutes and attendace list	Inputs are provided to stakeholders on time, Availability of Budget
							• Collect the inputs on prepared internal rules and regulation	Focus Group Discussion	501,000	2026-2028	District, cooperative and RAB	Final internal rules and regulation	All stakeholders agree to the final rules and regulations, Availability of Budget
							• Validate the prepared internal rules and regulation	Focus Group Discussion	816,000	2026-2028	District, cooperative and RAB	Getting final rules and regulations	Providing internal rules and regulation, Availability of budget
		174,000							2,319,000				
Complete the lower level organ of IWUO(WUT& SWD)	Election	297,000	2025-2026	SP, District, IWUO & RAB	Low level organ established	Irrigation blocks are created	• Set a clear roles and responsibility of each stakeholders	Focus Group Discussion	2,400,000	2026-2028	SP, IWUO	Minutes and attendace list	getting difined roles and responsibility of every stakeholders
							• Discuss on the roles and responsibility of each	Focus Group Discussion	1,200,000	2026-2028	SP, IWUO	Minutes and attendace list	All stakeholders participate actively
							• Modify the internal rules and regulation	Focus Group Discussion	450,000	2026-2028	SP, IWUO	Draft internal rules and regulation	All stakeholders participate actively
							• Collect the inputs on prepared internal rules and regulation	Focus Group Discussion	666,000	2026-2028	SP, IWUO	Minutes and attendace list	Inputs are provided to stakeholders on time
							• Validate the prepared internal rules and regulation	GA	2,616,000	2026-2028	SP, District, RAB, IWUO	Final internal rules and regulation	All stakeholders agree to the final rules and regulations
		297,000							7,332,000				
• Explanation of Irrigation Block to all member	WS	87,000	2025-2026	District, Organ & RAB	report	Type of organization is agreed, Availability of Budget	• Set a clear roles and responsibility of each stakeholders	Focus Group Discussion	501,000	2026-2028	District, cooperative and RAB	Draft internal rules and regulation	All stakeholders participate actively, Availability of Budget
• Election of leaders from bootom level up	WS	87,000	2025-2026	District, Organ & RAB	Elected leaders	Type of organization is agreed, Availability of Budget	• Prepare of internal rules and regulation	Focus Group Discussion	501,000	2026-2028	District, cooperative and RAB	Minutes and attendace list	Inputs are provided to stakeholders on time, Availability of Budget
							• Collect the inputs on prepared internal rules and	Focus Group	501,000	2026-2028	District, cooperative and	Final internal rules and	All stakeholders agree to the final rules and
							• Validate the prepared internal rules and	GA	816,000	2026-2028	District, cooperative and	Getting final rules and regulations	Providing internal rules and regulation,
		174,000							2,319,000				

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• Assist in preparation of the general assembly meeting to ratify the by-law	Meeting	282,000	2025-2028	District, RAB, Cooperative	GA minutes& Attendance list	Type of organization is agreed Attendance of 3/4 of delegates of general assembly, Availability of Budget	• Strengthening of established organ	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	Type of organization is agreed Baseline and Endline survey are done
• Attend the general assembly meeting to ratify the by-law	Meeting	816,000	2025-2028	District, RAB, Cooperative	GA minutes& Attendance list	The mandate is finished, Availability of Budget	• Finantial Management	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	The type of organization is agreed Baseline and Endline surveys are done, Availability of budget
•							• PM&E	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	Type of organization is agreed Baseline and Endline survey are done, Availability of Budget
•							• Preparation of sensitization document for low level leaders	Office work	72,000	2026-2027	District, RAB, Cooperative	Sensitation PPT prepared	Understanding the scheme lay out, existing problems Having good pictures, Availability of Budget
•							• Conduct sensitation workshorp to Lower level leaders	Work shop	293,000	2026-2027	District, RAB, Cooperative	Atleast 50% lower level leaders become active on the field	The elected leaders are active, Availability of Budget
		1,098,000					1,736,000						
Held of the general assembly meeting to ratify the by-law	Meeting	1,088,000	2025-2028	IWUO, SP, District, RAB, Cooperative	The by-law will be ratified	Attendance of 3/4 of delegates of general assembly, Availability of budget	• Strengthening of IWUO	Training	637,000	2026-2027	SP, District, RAB, IWU	Rate of Improved understanding level of the trainees (From% up%)	Baseline and Endline survey are done, Availability of budget
• Election of executive committee	Meeting	372,000	2027	IWUO, SP, District, RAB, Cooperative	Executive committee elected	The mandate is finished, Availability of budget	• Finantial Management	Training	537,000	2026-2027	SP, District, RAB	Rate of Improved understanding level of the trainees (From% up%)	Baseline and Endline survey are done, Availability of budget
•							• PM&E	Training	537,000	2026-2027	SP, District, RAB	Rate of Improved understanding level of the trainees (From% up%)	Baseline and Endline survey are done, Availability of budget
•							• Preparation of sensitization document for low level leaders	Office work	72,000	2026-2027	SP, District, RAB	Sensitation PPT prepared	Understanding the scheme lay out, existing problems Having good pictures, Availability of budget
•							• Conduct sensitation workshorp to Lower level leaders	Work shop	333,000	2026-2027	SP, District, RAB	Atleast 50% lower level leaders become active on the field	The elected leaders are active Availability of budget
		1,460,000					2,116,000						
• Assist in preparation of the general assembly meeting to ratify the by-law	Meeting	282,000	2025-2028	District, RAB, Cooperative	GA minutes& Attendance list	Type of organization is agreed Attendance of 3/4 of delegates of general assembly, Availability of Budget	• Strengthening of established organ	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	Type of organization is agreed Baseline and Endline survey are done
• Attend the general assembly meeting to ratify the by-law	Meeting	816,000	2025-2028	District, RAB, Cooperative	GA minutes& Attendance list	The mandate is finished, Availability of Budget	• Finantial Management	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	The type of organization is agreed Baseline and Endline surveys are done, Availability of budget
•							• PM&E	Training	457,000	2026-2027	District, RAB, Cooperative	Rate of Improved understanding level of the trainees (From% up%)	Type of organization is agreed Baseline and Endline survey are done,
•							• Preparation of sensitization document for	Office work	72,000	2026-2027	District, RAB, Cooperative	Sensitation PPT prepared	Understanding the scheme lay out, existing problems
•							• Conduct sensitation workshorp to Lower level leaders	Work shop	293,000	2026-2027	District, RAB, Cooperative	Atleast 50% lower level leaders become active on the field	The elected leaders are active, Availability of Budget
		1,098,000					1,736,000						

Major Activity 6: Conduct Necessary Training (Output 3 & 4)							Major Activity 6: Conduct Necessary Training (Output 5)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption	Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
• Facility Inspection	LectureField work	664,000	2027-2028	SP, District, RAB	IWUO will be able to produce the Facility inspection report	The participats should know how to read and write	• Cooperative Management and Gender mainstreaming	Training	1,158,000	2026-2027	SP, coop, Sector agronomist	Cooperative management will be improved	All stakeholders participated actively and work in transparency
• Basic Civil Work Training	LectureField practice	1,298,000	2027-2028	SP, District, RAB	Atleast 25% of participants are able to do the civil work	Availability of tools IWUO willing to use the trainees for rehabilitation works	• Cropping Calander	Training	1,254,000	2025-2028	SP, coop, Sector agronomist	Cropping calendar will be improved as well as cropping pattern in the scheme	Cropping calendar will be implemented by the beneficiaries
• O&M planning	Training	664,000	2027-2028	SP, District, RAB	IWUO will be able to prepare O&M Plan	IWUO will implement O&M plan	• FFS	Field work	6,762,000	2025-2028	SP, coop, Sector agronomist	Good agriculture practices will be improve	Budget for inputs and equipment will be available
• Basic Water management Training	Training	664,000	2027-2028	SP, District, RAB	Rate of Improved understanding level of the trainees (From% up%)	IWUO Will be able to implement the irrigation calender and water distribution plan							
• Erosion control training	LectureField practice	664,000	2027-2028	SP, District, RAB	Impact of erosion reduced at ...%	Erosion techniques will be implemented by the community							
Conduct M&E for OM and Water Management	Field work	618,000	2027-2028	District, RAB	M&E Report	Availability of the district and RAB Staff	•						
•		4,572,000					•		9,174,000				
• Facility Inspection	LectureField work	622,000	2027-2028	SP, District, RAB	IWUO will be able to produce the Facility inspection report	The participats should know how to read and write	• Cooperative Management and Gender mainstreaming	Training	658,000	2026-2027	SP, coop, Sector agronomist	Training report and attendance list	Coperative management will be improved
• Basic Civil Work Training	LectureField practice	1,007,000	2027-2028	SP, District, RAB	Atleast 25% of participants are able to do the civil work	Availability of tools IWUO willing to use the trainees for rehabilitation works	• Cropping Calander	Training	754,000	2025-2028	SP, coop, Sector agronomist	Training report and attendance list	Cropping calendar will be improved as well as cropping pattern in the scheme
• O&M planning	Training	457,000	2027-2028	SP, District, RAB	IWUO will be able to prepare O&M Plan	IWUO will implement O&M plan	• FFS	Field work	3,762,000	2025-2028	SP, coop, Sector agronomist	Field work report	Good agriculture practices will be improve
• Basic Water management Training	Training	197,000	2027-2028	SP, District, RAB	Rate of Improved understanding level of the trainees (From% up%)	IWUO Will be able to implement the irrigation calender and water distribution plan							
• Erosion control training	LectureField practice	457,000	2027-2028	SP, District, RAB	Impact of erosion reduced at ...%	Erosion techniques will be implemented by the community							
Conduct M&E for OM and Water Management	Field work	378,000	2027-2028	District, RAB	M&E Report	Availability of district and RAB Staff							
•													
		3,118,000							5,174,000				

• Facility Inspection	LectureField work	414,000	2027-2028	District, RAB,Coperative	Organ will be able to produce the Facility inspection report	The participats should know how to read and write, Secured budget	• Cooperative Management and Gender mainstreaming	Training	378,000	2026-2027	coop, Sector agronomist	Training report and attendance list	Coperative management will be improved, Secured budget
• Basic Civil Work Training	LectureField practice	598,000	2027-2028	District, RAB, Secured budget	Atleast 25% of participants are able to do the civil work	Availability of tools Organ willing to use the trainees for rehabilitation works, Secured budget	• Cropping Calander	Training	474,000	2025-2028	coop, Sector agronomist	Training report and attendance list	Cropping calendar will be improved as well as cropping pattern in the scheme, Secured budget
• O&M planning	Training	414,000	2027-2028	District, RAB, Secured budget	Organ will be able to prepare O&M Plan	Organ will implement O&M plan, Secured budget	• FFS	Field work	2,082,000	2025-2028	SP, coop, Sector agronomist	Field work report	Good agriculture practices will be improve
• Basic Water management Training	Training	414,000	2027-2028	District, RAB, Secured budget	Rate of Improved understanding level of the trainees (From% up%)	Organ Will be able to implement the irrigation calender and water distribution plan, Secured budget							
Conduct M&E for OM and Water Management	Field work	378,000	2027-2028	District, RAB, Secured budget	M&E Report	Availability of district and RAB Staff, Secured budget							
		2,218,000							2,934,000				
• Facility Inspection	LectureField work	664,000	2027-2028	SP, District, RAB	IWUO will be able to produce the Facility inspection report	The participats should know how to read and write	• Cooperative Management and Gender mainstreaming	Training	658,000	2026-2027	SP, coop, Sector agronomist	Coperative management will be improved	All stakeholders participated actively and work in transparency
• Basic Civil Work Training	LectureField practice	1,298,000	2027-2028	SP, District, RAB	Atleast 25% of participants are able to do the civil work	Availability of tools Organ willing to use the trainees for rehabilitation works, Secured budget	• Cropping Calander	Training	754,000	2025-2028	SP, coop, Sector agronomist	Cropping calendar will be improved as well as cropping pattern in the scheme, Secured budget	Cropping calendar will be improved as well as cropping pattern in the scheme, Secured budget
• O&M planning	Training	664,000	2027-2028	SP, District, RAB	IWUO will be able to prepare O&M Plan	IWUO will implement O&M plan	• FFS	Field work	3,762,000	2025-2028	SP, coop, Sector agronomist	Good agriculture practices will be improve	Budget for inputs and equipment will be available
• Basic Water management Training	Training	664,000	2027-2028	SP, District, RAB	Rate of Improved understanding level of the trainees (From ...% up ...%)	IWUO Will be able to implement the irrigation calender and water distribution plan							
• Erosion control training	LectureField practice	664,000	2027-2028	SP, District, RAB	Impact of erosion reduced at ...%	Erosion techniques will be implemented by the community							
Conduct M&E for OM and Water Management	Field work	618,000	2027-2028	District, RAB	M&E Report	Availability of the district and RAB Staff							
		4,572,000							5,174,000				
• Facility Inspection	LectureField work	414,000	2027-2028	District, RAB,Coperative	Organ will be able to produce the Facility inspection report	The participats should know how to read and write, Secured budget	• Cooperative Management and Gender mainstreaming	Training	378,000	2026-2027	coop, Sector agronomist	Training report and attendance list	Coperative management will be improved, Secured budget
• Basic Civil Work Training	LectureField practice	598,000	2027-2028	District, RAB, Secured budget	Atleast 25% of participants are able to do the civil work	Availability of tools Organ willing to use the trainees for rehabilitation works, Secured budget	• Cropping Calander	Training	474,000	2025-2028	coop, Sector agronomist	Training report and attendance list	Cropping calendar will be improved as well as cropping pattern in the scheme, Secured budget
• O&M planning	Training	414,000	2027-2028	District, RAB, Secured budget	Organ will be able to prepare O&M Plan	Organ will implement O&M plan, Secured budget	• FFS	Field work	2,082,000	2025-2028	SP, coop, Sector agronomist	Field work report	Good agriculture practices will be improve
• Basic Water management Training	Training	414,000	2027-2028	District, RAB, Secured budget	Rate of Improved understanding level of the trainees (From% up%)	Organ Will be able to implement the irrigation calender and water distribution plan, Secured budget							
Conduct M&E for OM and Water Management	Field work	378,000	2027-2028	District, RAB, Secured budget	M&E Report	Availability of district and RAB Staff, Secured budget							
		2,218,000							2,934,000				

2. Budget Plan

#	Name of scheme	2025-2026	2026-2027	2027-2028	Total
1	Rugende	6,210,000	9,677,667	11,464,667	27,352,333
2	Mutukura	5,503,333	6,641,333	6,097,333	18,242,000
3	Rwamagana 34	5,868,000	8,680,000	10,106,000	24,654,000
4	Musha SSIT scheme (10 Ha)	2,060,000	4,491,500	4,229,500	10,781,000
5	Gahengeri SSIT schem (10 Ha)	2,412,000	4,113,500	4,595,500	11,121,000
Total		22,053,333	33,604,000	36,493,000	92,150,333

3. Impelementation Schedule of the Action Plan (Medium Term)

#	Name of scheme	Major Activity	Details of the Activities (Intervention)	2025-2026	2026-2027	2027-2028
1	Rugende	Defining scheme service area	Confirm irrigation facilities			
			Confirm the available Water for irrigating the command area			
			Checking finance capacity of the IWUO to hire the additional staff			
		Database Preparation and Organizing Irrigation Block	• Complete the draft Irrigation Map			
			• Complete the drafted of Irrigation Map			
			• Reorganization of Irrigation block			
		Formation of IWUO Structure	Complete the lower level organ of IWUO (WUT& SWD)			
		Clarify Roles, Responsibility and Internal Regulation	• Discuss on the roles and responsibility of each stakeholders			
			• Modify the internal rules and regulation			
			• Collect the inputs on prepared internal rules and regulation			
			• Validate the prepared internal rules and regulation			
		Call for General Meeting and ratification of by-law	Held of the general assembly meeting to ratify the by-law			
			Election of executive commitee			
		Conduct Necessary Training Output 2	• Preparation of sensitization document for low level leaders			
			• Conduct sensitation workshorp to Lower level leaders			
		Conduct Necessary Training Output 3&4	• Facility Inspection			
			• Basic Civil Work Training			
			• O&M planning			
			• Basic Water management Training			
			• Erosion control training			
2	Mutukura	Defining scheme service area	Confirm irrigation facilities			
			The decision to form an IWUO or other structure			
		Database Preparation and Organizing Irrigation Block	• Complete the draft Irrigation Map			
			• Complete the drafted of Irrigation Map			
			• Prepare the Water users list			
			• Reorganization of Irrigation block			
		Formation of IWUO Structure	• Explanation of Irrigation Block to all members			
		Clarify Roles, Responsibility and Internal Regulation	• Election of leaders from bootom level up			
			• Set a clear roles and responsibility of each stakeholders			
			• Prepare of internal rules and regulation			
			regulation			
		Call for General Meeting and ratification of by-law	• Validate the prepared internal rules and regulation			
			Assist in preparation of the general assembly			
		Conduct Necessary Training for Output 2	Attend the general assembly meeting to ratify the by-law			
			• Strengthening of established organ			
			• Finantial Management			
		Conduct Necessary Training for Output 3&4	• PM&E			
			• Preparation of sensitization document for low level leaders			
			• Facility Inspection			
			• Basic Civil Work Training			
			• O&M planning			
3	Rwamagana 34	Defining scheme service area	• Basic Water management Training			
			• Erosion control training			
		Database Preparation and Organizing Irrigation Block	Cooperative management and Gender			
			• Cropping Calander			
		Formation of IWUO Structure	• FFS			
			Confirm the availability of irrigation facilities and			
		Database Preparation and Organizing Irrigation Block	• The decision to form an IWUO or other structure			
			• Complete the draft Irrigation Map			
			• Complete the drafted of Irrigation Map			
			• Prepare the Water users list			
		Formation of IWUO Structure	Complete the existing irrigation block for lower level organization (WUT, HD)			
			• Explanation of Irrigation Block to all member			
		Clarify Roles, Responsibility and Internal Regulation	• Election of leaders from bootom level up			
			• Set a clear roles and responsibility of each stakeholders			
			• Prepare of internal rules and regulation			
			• Collect the inputs on prepared internal rules and			
		Call for General Meeting and ratification of by-law	regulation			
			• Validate the prepared internal rules and regulation			
		Conduct Necessary Training for Output 2	Assist in preparation of the general assembly			
			Attend the general assembly meeting to ratify the by-law			
			• IWUO Strengthening			
		Conduct Necessary Training for Output 3&4	• Finantial Management			
			• PM&E			
			Sensitization on responsibility to Lower level leaders (WUT)			
			• Facility Inspection (3days)			
			• Basic Civil Work Training (4days)			
		Conduct Necessary Training for Output 5	• O&M planning (2days)			
			• Basic Water management Training (2days)			
		Conduct Necessary Training for Output 5	Cooperative management and Gender			
			• Cropping Calander			

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1. Action Plan in Gisagara by 2028

#	Name of scheme	Present condition of IWUO	Major Activity 1: Define Scheme Service Area						
			Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
1	MIRAYI	IWUO created already but only overall committee in place and poorly functioning	Introduction session	Two workshop	1,500,000	2025 to 2026	SP,RAB AND DISTRICT	Number of workshop conducted	Availability of budget, staff and beneficiaries (timing)
			Command area determination (availability of water, facility status , management status , irrigable area)	Field works and office work	500,000	2025 to 2026	SP, RAB and District	Command area identified	availability of GPS, engineer and experienced agronomist, budget
			proposal of management model	FGD	300,000	2025 to 2026	SP, RAB and District	management model agreed	availability of budget, staff and beneficiaries, government agreement
			.						
2	NYIRAMAGENI	IWUO functioning and got some trainings from WAMCAB at starting but the journey disrupted before full capacitated	Introduction session	Two workshop	1,500,000	2025 to 2026	SP,RAB AND DISTRICT	Number of workshop conducted	Availability of budget, staff and beneficiaries (timing)
			Command area determination (availability of water, facility status , management status , irrigable area,)	Field works and office work	500,000	2025 to 2026	SP, RAB and District	Command area identified	availability of GPS, engineer and experienced agronomist, budget
			proposal of management model	FGD	300,000	2026 to 2026	SP, RAB and District	management model agreed	availability of budget, staff and beneficiaries, government agreement
			.						
3	MIGINA	Overall IWUO committee created but lower level organization (Migina covers six cooperatives and touches three districts)	Introduction session	Two workshop	6,000,000	2025 to 2026	SP,RAB AND DISTRICT	Number of workshop conducted	Availability of budget, staff and beneficiaries (timing)
			Command area determination (availability of water, facility status , management status , irrigable area,)	Field works and office work	3,000,000	2025 to 2026	SP, RAB and District	Command area identified	availability of GPS, engineer and experienced agronomist, budget
			proposal of management model	FGD	3,000,000	2025 to 2026	SP, RAB and District	management model agreed	availability of budget, staff and beneficiaries, government agreement

Major Activity 2: Prepare Database and Organize Irrigation Block						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Preparation of irrigation map	field work and office work	500,000	2025 to 2026	SP, RAB	Irrigation map prepared,	Availability of budget, trained staff, GIS expert, GPS machine
Preparation of water user list	Field works and office work	200,000	2025 to 2026	SP, IWUO, District	water user list prepared according to facility	Availability of budget, trained staff,
Preparation of Irrigation block for lower level organization	Field work and office work, FGD	500,000	2025 to 2026	SP, FPG, IWUO	Irrigation blocks formed	Availability of budget, active participation of FPG and IWUO leaders,
Preparation of irrigation map	field work and office work	500,000	2025 to 2026	SP, RAB	Irrigation map prepared,	availability of budget, trained staff, GIS expert, GPS machine
Preparation of water user list	Field works and office work	200,000	2025 to 2026	SP, IWUO, District	water user list prepared according to facility	availability of budget, trained staff,
Preparation of Irrigation block for lower level organization	Field work and office work, FGD	500,000	2025 to 2026	SP, FPG, IWUO	Irrigation blocks formed	availability of budget, active participation of FPG and IWUO leaders,
Preparation of irrigation map	field work and office work	2,000,000	2025 to 2026	SP, RAB	Irrigation map prepared,	availability of budget, trained staff, GIS expert, GPS machine
Preparation of water user list	Field works and office work	15,000,000	2025 to 2026	SP, IWUO, District	water user list prepared according to facility	availability of budget, trained staff,
Preparation of Irrigation block for lower level organization	Field work and office work, FGD	2,500,000	2025 to 2026	SP, FPG, IWUO	Irrigation blocks formed	availability of budget, active participation of FPG and IWUO leaders,

Major Activity 3: Reorganize IWUO Structure						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
Reorganization of existing structure	WS and meetings	1,000,000	July 2025	SP, RAB and District	The new organization structure is agreed	Availability of budget, agreement of beneficiaries,
Election of leaderships	meeting		August 2025	SP, RAB and District	Lower level leaders are elected	agreement of beneficiaries
Reorganization of existing structure	WS and meetings	1,000,000	July 2025	SP, RAB and District	The new organization structure is agreed	Availability of budget, agreement of beneficiaries,
Election of leaderships	meeting		August 2025	SP, RAB and District	Lower level leaders are elected	agreement of beneficiaries
Reorganization of existing structure	WS and meetings	1,000,000	July 2025	SP, RAB and District	The new organization structure is agreed	Availability of budget, agreement of beneficiaries,
Election of leaderships	meeting		August 2025	SP, RAB and District	Lower level leaders are elected	agreement of beneficiaries

Major Activity 4: Clarify Roles, Responsibility and Internal Regulation						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Drafting role and responsibility of stakeholders	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	draft roles and responsibility of stakeholder prepared	availability of budget, staff, active participation of stakeholders
Clarification of role and responsibility of each stakeholder	workshop	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	number of workshop conducted	availability of budget, staff, active participation of stakeholders
Amendment of internal rule and regulation	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	Internal rule and regulation amended	availability of budget, staff, active participation of stakeholders
drafting role and responsibility of stakeholders	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	draft roles and responsibility of stakeholder prepared	availability of budget, staff, active participation of stakeholders
clarification of role and responsibility of each stakeholder	workshop	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	number of workshop conducted	availability of budget, staff, active participation of stakeholders
Amendment of internal rule and regulation for both IWUO and Cooperative and refinement process	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	Internal rule and regulation amended	availability of budget, staff, active participation of stakeholders
•						
•						
drafting role and responsibility of stakeholders	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	draft roles and responsibility of stakeholder prepared	availability of budget, staff, active participation of stakeholders
clarification of role and responsibility of each stakeholder	workshop	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	number of workshop conducted	availability of budget, staff, active participation of stakeholders
Amendment of internal rule and regulation for both IWUO and Cooperative and refinement process	office work and FGD	500,000	October 2025 to march 2026	SP, RAB and District , IWUO leaders	Internal rule and regulation amended	availability of budget, staff, active participation of stakeholders
•						
•						

Major Activity 5: Call for General Meeting and ratification of by-law						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
call for general assembly	meeting	500,000	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Availability of budget, two third delegates should attend
Election of overall committees	GA	0	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Two third delegates should attend
Ratification of internal rule and regulation	G.A	0	October 2026 to March 2027	SP, RAB and District,IWUO	By-law ratified	Two third delegates should attend
call for general assembly	meeting	500,000	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Availability of budget, two third delegates should attend
Election of overall committees	GA	0	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Two third delegates should attend
Ratification of internal rule and regulation	G.A	0	October 2026 to March 2027	SP, RAB and District,IWUO	By-law ratified	Two third delegates should attend
call for general assembly	meeting	500,000	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Availability of budget, two third delegates should attend
Election of overall committees	GA	0	October 2026 to March 2027	SP, RAB and District,IWUO	G.A held, MM taken, attendance list	Two third delegates should attend
Ratification of internal rule and regulation	G.A	0	October 2026 to March 2027	SP, RAB and District,IWUO	By-law ratified	Two third delegates should attend

Major Activity 6: Conduct Necessary Training (Output 2)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsible entity	Indicator	Assumption
Sensitization on responsibility of lower level leaders	One workshop	1,000,000	2026 to 2027	SP, RAB and District	Number of workshop conducted	availability of budget, sensitization materials prepared, active participation of trainees
IWUO strengthening	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Financial management	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Participatory monitoring and evaluation	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Sensitization on responsibility of lower level leaders	One workshop	1,000,000	2026 to 2027	SP, RAB and District	Number of workshop conducted	availability of budget, sensitization materials prepared, active participation of trainees
IWUO strengthening	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Financial management	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Participatory monitoring and evaluation	training	3,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Sensitization on responsibility of lower level leaders	One workshop	2,000,000	2026 to 2027	SP, RAB and District	Number of workshop conducted	availability of budget, sensitization materials prepared, active participation of trainees
IWUO strengthening	training	6,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Financial management	training	6,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees
Participatory monitoring and evaluation	training	6,000,000	2026 to 2027	SP, RAB and District	Number of training conducted	availability of budget,training materials prepared, active participation of trainees

Major Activity 6: Conduct Necessary Training (Output 3 & 4)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
Proper water management	Theory and practice	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Water distribution plan trainings	Theory and practice	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
PIM (Participatory Irrigation Management)	lecture session	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Training on basic repair work (basic civil work training)	Theory and practice	7,500,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)	Theory and practice	2,500,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Proper water management	Theory and practice	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Water distribution plan trainings	Theory and practice	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
PIM (Participatory Irrigation Management)	lecture session	1,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Training on basic repair work (basic civil work training)	Theory and practice	7,500,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)	Theory and practice	2,500,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Proper water management	Theory and practice	3,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Water distribution plan trainings	Theory and practice	3,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
PIM (Participatory Irrigation Management)	lecture session	3,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Training on basic repair work (basic civil work training)	Theory and practice	25,000,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff
Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)	Theory and practice	6,500,000	2026 to 2028	SP, RAB and District	Training conducted	avaialability of budget, training materials and trained staff

Major Activity 6: Conduct Necessary Training (Output 5)						
Intervention needed (Activities)	Method	Budget (RWF)	Time frame	Responsibility of each entity	Indicator	Assumption
Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)	workshop and demonstrati on plot	3,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training and number of demo plot	availability of budget, trained staff, agriculture inputs, active participation of beneficiaries
Cooperative management , gender mainstriming and finicial literacy and family badgeting training	theory, focus group discussion, workshop	3,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training	availability of budget, trained staff, active participation of beneficiaries
Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)	workshop and demonstrati on plot	3,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training and number of demo plot	availability of budget, trained staff, agriculture inputs, active participation of beneficiaries
Cooperative management , gender mainstriming and finicial literacy and family badgeting training	theory, focus group discussion, workshop	3,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training	availability of budget, trained staff, active participation of beneficiaries
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Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)	workshop and demonstrati on plot	9,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training and number of demo plot	availability of budget, trained staff, agriculture inputs, active participation of beneficiaries
Cooperative management , gender mainstriming and finicial literacy and family badgeting training	theory, focus group discussion, workshop	3,000,000	2026 to 2028	SP, RAB and District ,cooperative and sector	number of training	availability of budget, trained staff, active participation of beneficiaries

2. The Proposed Budget Plan

No.	Name of scheme	2025 / 2026	2026 / 2027	2027 / 2028	Total
1	MIRAYI	6,000,000	10,500,000	19,000,000	35,500,000
2	NYIRAMAGENI	5,500,000	10,500,000	19,000,000	35,000,000
3	MIGINA	32,000,000	20,500,000	52,500,000	105,000,000
Total		43,500,000	41,500,000	90,500,000	175,500,000

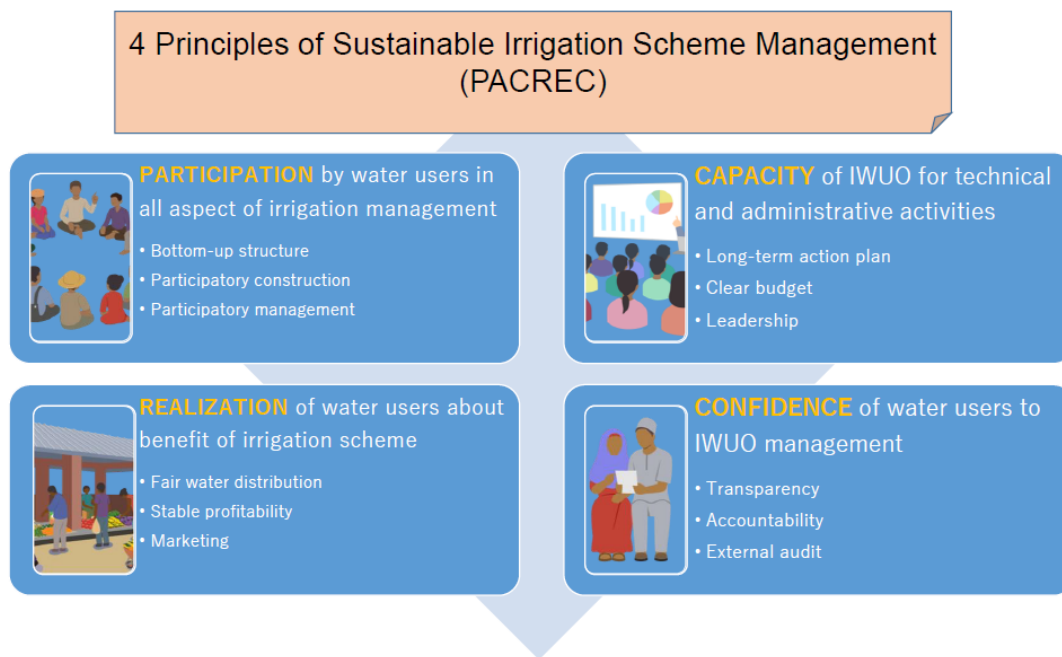
3. Implementation Schedule for Action Plan (Midium Term)

#	Scheme Name	Major Activity	Details of the activities (Intervention)	2025-2026	2026-2027	2027-2028
1	MIRAYI	Define Scheme Service Area	Introduction session			
			Command area determination (availability of water, facility status , management status , irrigable area)			
			proposal of management model			
		Prepare Database and Organize Irrigation Block	Preparation of irrigation map			
			Preparation of water user list			
			Preparation of irrigation block for lower level organization			
		Reorganize IWUO Structure	Reorganization of existing structure			
			Election of leaderships			
		Clarify Roles, Responsibility and Internal Regulation	Drafting role and responsibility of stakeholders			
			Clarification of role and responsibility of each stakeholder			
			Amendment of internal rule and regulation			
		Call for General Meeting and ratification of by-law	call for general assembly			
			Election of overall committees			
			Ratification of internal rule and regulation			
		Conduct Necessary Training (Output 2)	Sensitization on responsibility of lower level leaders			
			IWUO strengthening			
			Financial management			
			Participatory monitoring and evaluation			
		Conduct Necessary Training (Output 3 & 4)	Proper water management			
			Water distribution plan trainings			
			PIM (Participatory Irrigation Management)			
			Training on basic repair work (basic civil work training)			
			Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)			
		Conduct Necessary Training (Output 5)	Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)			
			Cooperative management , gender mainstriming and finincial literacy and family badgeting training			
2	NYIRAMAGENI	Define Scheme Service Area	Introduction session			
			Command area determination (availability of water, facility status , management status , irrigable area,)			
			proposal of management model			
		Prepare Database and Organize Irrigation Block	Preparation of water user list			
			Preparation of irrigation block for lower level organization			
			Reorganization of existing structure			
		Clarify Roles, Responsibility and Internal Regulation	drafting role and responsibility of stakeholders			
			clarification of role and responsibility of each stakeholder			
			Amendment of internal rule and regulation for both IWUO and Cooperative and ratification process			
		Call for General Meeting and ratification of by-law	call for general assembly			
			Election of overall committees			
			Ratification of internal rule and regulation			
		Conduct Necessary Training (Output 2)	Sensitization on responsibility of lower level leaders			
			IWUO strengthening			
			Financial management			
			Participatory monitoring and evaluation			
		Conduct Necessary Training (Output 3 & 4)	Proper water management			
			Water distribution plan trainings			
			PIM (Participatory Irrigation Management)			
			Training on basic repair work (basic civil work training)			
			Operation and maintenance trainings (Facility inspection, Preparation of OM plan,)			
		Conduct Necessary Training (Output 5)	Good agriculture practices trainings (workshop on rice seed selection, installation of demo farm)			
			Cooperative management , gender mainstriming and finincial literacy and family badgeting training			
3	MIGINA	Define Scheme Service Area	Introduction session			
			Command area determination (availability of water, facility status , management status , irrigable area,)			
			proposal of management model			
		Prepare Database and Organize Irrigation Block	Preparation of water user list			
			Preparation of irrigation block for lower level organization			
			Reorganization of existing structure			
		Clarify Roles, Responsibility and Internal Regulation	drafting role and responsibility of stakeholders			
			clarification of role and responsibility of each stakeholder			
			Amendment of internal rule and regulation for both IWUO and Cooperative and ratification process			
		Call for General Meeting and ratification of by-law	call for general assembly			
			Election of overall committees			
			Ratification of internal rule and regulation			
		Conduct Necessary Training (Output 2)	Sensitization on responsibility of lower level leaders			
			IWUO strengthening			
			Financial management			
			Participatory monitoring and evaluation			
			Proper water management			
			Water distribution plan trainings			

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Manual for Implementation Procedure of IMT Agreement



February 2025

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1. Reference Documents and Information
2. Modified IWUO Management Model
3. Sample of IMT Agreement

Abbreviations

DISC	:	District Irrigation Steering Committee
GFI	:	Government Fund for Irrigation
GoR	:	Government of Rwanda
IMIS	:	Irrigation Management Information System
IMP	:	Irrigation Master Plan
IMT	:	Irrigation Management Transfer
IMTA	:	Irrigation Management Transfer Agreement
IWUA	:	Irrigation Water Users Association
IWUO	:	Irrigation Water Users Organization
JICA	:	Japan International Cooperation Agency
KWAMP:		Kirehe Community-based Watershed Management Project
LII&TT	:	Land Husbandry, Irrigation, Innovation and Technology Transfer
LWH	:	Land Husbandry, Water Harvesting and Hillside Irrigation Project
MINAGRI:		Ministry of Agriculture and Animal Resources
MOU	:	Memorandum of Understanding
M&E	:	Monitoring and Evaluation
NAEB	:	National Agricultural Export Development Board
NGO	:	Non-Governmental Organization
O&M	:	Operation and Maintenance
OMM	:	Operation, Maintenance and Management
PIM	:	Participatory Irrigation Management
PPP	:	Public Private Partnership
RAB	:	Rwanda Agriculture and Animal Resource Development Board
RCA	:	Rwanda Cooperative Agency
RGB	:	Rwanda Governance Board
RSSP	:	Rural Sector Support Project
SISC	:	Scheme Irrigation Steering Committee
SSIT	:	Small-Scale Irrigation Technology
ToR	:	Terms of Reference
WUA	:	Water Users Association

Chapter 1 Importance of IMT

1.1 Background and Objectives of IMT

Starting in the 1960s, many countries began to turn over the management authority for irrigation systems from government agencies to farmer cooperatives or water user groups (FAO, 2007). Management transfer has taken many forms, ranging from total privatization, where all management functions of irrigation infrastructure are transferred to the users (Irrigation Management Transfer: IMT) to co-management or Participatory Irrigation Management (PIM), where responsibilities are shared between public sector agencies and water user groups. The technical differences between IMT and PIM have been discussed by many scholars such as FAO (2007), Hatcho and Tsutsui (1998), Van Vuren et al. (2004) and Svendsen et al. (1997), however, in practice the terms are used almost interchangeably and here also we consider both processes together using the term IMT/PIM.

PIM means that all stakeholders, especially farmers participate in activities and discussions about irrigation management. More precisely, PIM is an approach of irrigation management and development with the participation of all stakeholders, especially farmers, relating to “all aspects of irrigation management, at all levels of irrigation facilities”. All aspects of irrigation management means Planning, Design, Construction, Operation & Maintenance (O&M), Financing, Making rules and so forth. And all levels of irrigation facilities means from Headwork, Main Canal, Secondary Canal up to On-farm Canal. With regard to the proper irrigation system management, Irrigation Facility and Irrigation Management are like the two wheels of a vehicle, so Irrigation System cannot function well if even one of them is lacking.

Irrigation Facilities and Irrigation Management System are required for proper management of the Irrigation Scheme. All stakeholders means not only main water user, i.e. farmers, but also other water users and government from central to sector level are also included. So farmers and those other stakeholders are necessary to participate in proper irrigation management actively.

The requirement for successful PIM is “active participation of farmers in the management of irrigation scheme”. It can be said that the two pre-requirements for satisfying this condition are: (1) fair water distribution; and (2) ensuring the stable profitability of irrigated agriculture. Since “Vitalization of Irrigation Water Users Organization (IWUO)’s activities” is the foundation of the success of PIM, it is important to strengthen capacity for organizational management and system for water fee collection. It is also important to foster a sense of ownership, with irrigation schemes being managed by IWUO.

In addition, there are two essential aspect for sustainable scheme management, such as (1) a sense of participation and cooperative management by all water users, and (2) an understanding of the need and importance of equitable water distribution and water fee. Ideally, farmers should be involved from the planning stage of the initiative when new irrigation scheme are developed or existing schemes are rehabilitated, and their opinions should be taken into account to foster their ownership of the project and irrigation scheme. But even in already developed scheme, PIM can be achieved by explaining the importance of PIM and the benefits of irrigated agriculture to them, promoting their understanding and gradually encouraging their participation and understanding of the importance of irrigation facilities and their involvement in IWUO activities.

In Rwanda irrigation management, awareness of water users is low and farmers in general are dependent

on support from the central and/or local government. Farmers do not have any idea that they are the main actor to maintain irrigation scheme. But through PIM, farmers' awareness can be improved. They will participate actively in the planning and carry out the necessary activities by themselves. By the participation of stakeholders and water users in irrigation management, it is expected to produce the following outcomes:

➤ **Relationship among Stakeholders**

Relationships between water users are weak and conflicts in water use and other aspects are likely to occur frequently. However, as PIM becomes more common, relationship is developed through participation in activities, problems are less likely to occur, and when conflicts occur, they are resolved through discussion and the application of rules in IWUO (*Gacaca* method¹).

➤ **Water Distribution**

The upstream and downstream farmers will be consulted by the IWUO through PIM to ensure fair water distribution in the scheme where there is no consultation on water distribution and the upstream farmers take as much water as they want.

➤ **Efficiency of Water**

In terms of water use, the current situation is that water is taken unnecessarily and wasted. However, with PIM, farmers will be more aware of fair water distribution, more conscious of water saving and will use what they need, which will result in improved water use efficiency in the entire scheme.

➤ **Irrigation Facilities**

Ideally, farmers should be involved from the planning stage when new irrigation scheme are developed or existing schemes are rehabilitated, and their opinions should be taken into account to foster their ownership of the project and irrigation scheme. But even in already developed scheme, PIM can be achieved by explaining the importance of PIM and the benefits of irrigated agriculture to them, promoting their understanding and gradually encouraging their participation and understanding of the importance of irrigation facilities and their involvement in IWUO activities.

➤ **Budget of O&M**

Due to the low collection rate of water fees, the budget for IWUO activities and maintenance for the irrigation facility is limited and the participation of farmers is not expected. Also, limitations in central and local government budgets mean that the necessary maintenance and management cannot be carried out properly. But with the proper collection of water fees, IWUO will have the necessary budget to properly operate and maintain their facilities. Farmers will also actively participate in the O&M activities conducted by the IWUO and as a result, the overall activities of the IWUO will be carried out smoothly and effectively.

➤ **IMT Agreement**

IMT agreement (IMTA) should be mutually arranged by all direct concerned organizations such as the

¹ At Gacaca irrigation scheme in Kayonza district, Cooperative and IWUO are working together in planning, implementing all activities related to increasing crop production (water distribution and facility maintenance is one of the important part of activities that help them increase crop production, according to the result of the discussion). "*Gacaca*" is traditional method to sit around firework in the night and discuss about local issue

government represented by the Rwanda Agriculture and Animal Resource Development Board (RAB), the District and the concerned IWUO. Proper IMTA can be organized based on sustainable irrigation scheme management by IWUO with necessary minimum support by RAB and District. To materialize this point, PIM is the foundation for IWUO's activities, and the key to realize the sustainable irrigation scheme management are Operation, Maintenance and Management (OMM) that can easily be defined as:

- Good Operation for Fair Water Distribution by IWUO
- Good Maintenance of Irrigation Facility with IWUO
- Good Management of Organization and Finance of IWUO

1.2 IMTA and the Experience in Other Country

According to the report produced by FAO in 2007², IMTA is defined as the “transfer of responsibility and authority for management of irrigation systems from government agencies to private-sector organizations that are meant to represent the interests of water users”. Most commonly, these are IWUOs which provide a forum whereby water users act collectively to govern an irrigation system or subsystem. This may include the roles of deciding which irrigation services should be provided, how and by whom they will be provided, and under what terms and conditions. The actual management of the irrigation system, i.e. delivery of services, may be done by the IWUO or third parties. After IMT has been adopted, such services may be financed entirely by farmers or with some combination of resources provided by farmers and government.

Asian Development Bank introduced, in its document in 2008³, definition of IMT by Vermillion and Sagardoy (1999) as “relocation of responsibility and authority for irrigation management from government agencies to NGOs (Non-Governmental Organizations)” such as IWUOs. It may include all or partial transfer of management functions. It includes full or only partial authority, and may be implemented at sub-system levels such as distributary canal commands or for entire irrigation systems.

The philosophy behind IMT lies in the perception that increased ownership, decision-making authority and active participation in O&M of irrigation systems would create or force a binding commitment from water users to be more effective and responsible towards their obligations. Therefore, IMT emerged in response to the need for sector reform, the merits of self-sufficiency and the drive for increased participation of water users in irrigation system management.

The following table shows the number of cases where each of the potential steps in implementing IMT has been included in IMT programs. Many steps are common across the world. Part of the reason for this commonality in approaches across countries is the extensive involvement of international financing agencies and technical assistance agencies in IMT programs. Less common in IMT are actions to restructure or reform the irrigation agency (implemented in Mexico, Colombia and the United States of America), issuance of new water rights (Mexico), transfer of ownership or clear legal use and repair rights for irrigation infrastructure (the United States of America, New Zealand and transfer of use/repair rights in Indonesia), and building an effective support system for Water Users Association (WUA) in irrigated agriculture. Both Mexico and Colombia have developed WUA networks that provide support services to WUAs. Although agency reform and support services for WUAs are also important to ensuring success,

² Irrigation management transfer, FAO Water Reports 32, December 2007

³ Irrigation Management Transfer, ADB, 2008

they are more sensitive or complex and are often not implemented. The following table provides an example on the process followed for IMT implementation.

Table 1.1 Process of Implementing IMT

Steps included in implementing IMT	Number of countries
Creation of WUAs	35
Democratic selection of WUA leaders	33
Technical training in O&M for WUA leaders/staff	32
Farmer contribution to cost of repairs/rehabilitation works (money, labour and/or materials)	32
Farmer participation in identifying repairs/rehabilitation works	31
Training for WUA leaders & staff in finance & administration	30
Training for irrigation agency staff	27
Repair, rehabilitation and/or modernization of infrastructure	27
Formation of an IMT programme steering/coordination committee	24
Planning & review meetings with farmer participation	23
Monitoring & evaluation programme	23
Agency O&M staff previously in units that were transferred have been assigned new jobs or moved to other locations after IMT	17
Agency O&M staff have remained in units transferred to WUAs but have been put under direction of WUAs after IMT	13

Source: FAO Water Reports 32

Creating a WUA normally involves adopting a constitution (or charter of authority or articles of association) and by-laws. This is often followed by the preparation and adoption of a transfer agreement. These constitute the essential rights, responsibilities, authority and rules that guide WUAs, the government and third parties. WUA may prepare irrigation service plans on an annual basis, these detail responsibilities, schedules and budgets for O&M works to be undertaken. Both the WUAs and third-party service providers may prepare where third parties help in providing management services, irrigation service agreements.

The following figure is a schematic representation of the decision-making process adopted in Colombia for the implementation of the IMT program. At some point, if the farmers do not agree with the plan proposed by the government, the negotiations will continue until agreement reached or the system concerned is left out of the IMT program.

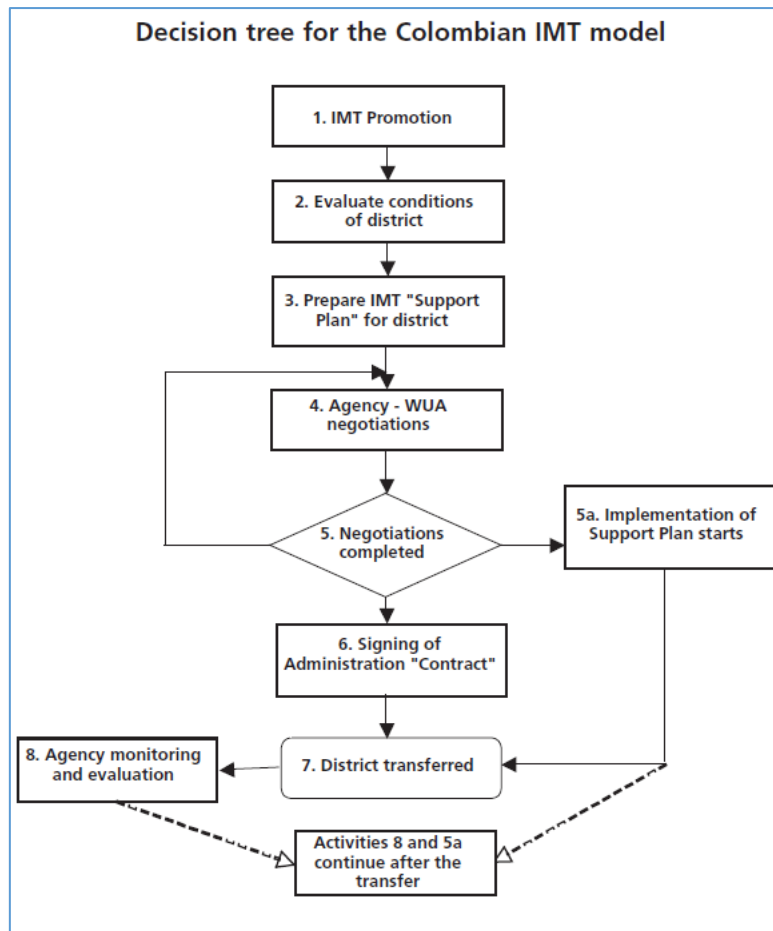


Figure 1.1 Decision-making process (Colombia), FAO water reports 32

The following table shows the kinds of support services needed by WUAs after IMT. Significantly, the top six identified are all concerned with training and consultation. Improvement of irrigation infrastructure was still needed in 16 cases. Availability of credit for farmers and WUA was noted in 12 cases. This is frequently inaccessible to farmers in many countries.

Table 1.2 Support Services needed by WUAs after IMT

Support services needed	Asia (21)	Latin America (7)	Africa (9)	Eastern Europe (3)	United States of America, Australia, New Zealand (3)	Worldwide (43)
Train WUA in technical aspects	19	7	8	1	1	36
Train WUA in financial aspects	20	6	6	0	1	33
Train WUA in administration	17	6	6	0	1	30
Technical consultation	16	6	3	0	2	27
Extension, agribusiness, marketing	8	5	6	0	3	22
Train & motivate agency for IMT	16	0	1	0	0	17
Rehabilitation & modernization	11	1	3	1	0	16
Credit for WUA & farmers	4	2	5	0	1	12
Legal support / dispute resolution	5	3	0	0	1	9
M & E of management performance	7	0	1	0	0	8
Subsidy for cost of water	3	0	1	1	1	6
Private-sector extension service	0	3	3	1	2	9
Communications with agency	4	0	0	0	0	4
Govt. ensures fair WUA elections	4	0	0	0	0	4
Formation of WUA networks	3	1	0	0	0	4

Source: FAO Water Reports 32

Additional support services that were needed include:

- environmental monitoring and regulation (Colombia, China, and Indonesia);
- private-sector management service providers (Niger, Tunisia and Argentina);
- crop price supports (Nigeria and Uzbekistan);
- technical/managerial auditing (Andhra Pradesh and Madhya Pradesh in India, and Indonesia);
- assistance to develop a capital replacement fund (Australia and Indonesia).

1.3 Present Situation of IMT in Rwanda

IMT has been introduced in Rwanda very recently together with the implementation of donor-led irrigation development. The very common case in Rwanda related to IMT has focused only on the establishment of IWUO and signing of it without consideration to the capacity and know-how of the beneficiary farmers. The idea of contributing for the water service fee in irrigation scheme, as part of IMT, is not yet well penetrated into the mindset of the beneficiaries of the scheme. There is no clear procedure and guidance set in the country on how to implement the IMT for successful OMM of irrigation scheme. Often, after the completion of the installation of irrigation scheme, the government requested IWUO to sign an IMTA. The beneficial farmers set up an IWUO in name only for finalization of the IMTA, but the farmers do not know what to do about the OMM of the scheme and the farmers do not have enough budget or management capacity to maintain the IWUO as their own organization. The farmers also think that they do not need to manage the irrigation facilities by themselves because the scheme has been developed by the government and/or donors without full involvement and clear explanation to the beneficiaries beginning from the inception of the project. Some farmers still believe that the government should assign budget to be used to maintain and manage the facilities in the irrigation scheme.

According to the survey on IWUO by the Project for Water Management and Capacity Building in Rwanda

(WAMCAB) in 2022, out of 118 IWUOs in 29 Districts (except one District in Kigali), status of IWUOs are summarized as follows:

Table 1.3 Summary of Status of IWUO

Item	No. of Scheme	Percentage
IWUOs received Collaboration Letter from District	99	83.9
IWUOs having Water Permit	57	48.3
IWUOs signed IMT Agreement	17	14.4

Among the entire District visited, Bugesera has the highest number of scheme that has signed IMTA. This is because most of the irrigation schemes in this district were developed under the Rural Sector Support Project (RSSP) of WB and it was one of the condition of the project to make IMTA before hand over of the project. Similar situation has been occurred in the other districts. Most of IMTA made in developed irrigation scheme ended at paper work (with no proper training, lack of follow up and M&E mechanism). It is highly necessary not only to achieve IMTA in form but also to develop management capacity of IWUO and create a mechanism on how to follow up and M&E system. The breakdown of the result per each district is presented in the following table.

Table 1.4 Breakdown of Survey Result on IWUO in Each District

Number	District	No. of IWUOs	Received Collaboration Letter from District	Has water permit	Signed IMT Agreement	Remarks
1	Bugesera	6	6	6	6 (100%)	5/6 were under RSSP
2	Burera	1	1	1	1 (100%)	
3	Gakenke	0	0	0	0 (-)	
4	Gasabo	3	3	0	1 (33%)	
5	Gatsibo	3	2	1	0 (0%)	
6	Gicumbi	0	0	0	0 (0%)	
7	Gisagara	12	12	11	0 (0%)	Quick Win project
8	Huye	12	12	8	0 (0%)	
9	Kamonyi	8	7	2	0 (0%)	
10	Karongi	2	2	0	0 (0%)	
11	Kayanza	3	3	3	0 (0%)	
12	Kicukiro	1	1	0	1 (100%)	
13	Kirehe	17	4	4	0 (0%)	
14	Muhanga	3	3	0	2 (67%)	
15	Musanze	1	0	0	0 (0%)	
16	Ngoma	2	1	1	1 (50%)	
17	Ngororero	1	0	0	0 (0%)	
18	Nyanihu	1	0	0	0 (0%)	
19	Nyagatare	6	6	6	0 (0%)	
20	Nyamagabe	4	4	0	0 (0%)	
21	Nyamasheke	5	5	5	0 (0%)	
22	Nyanza	9	9	4	2 (22%)	
23	Nyaruguru	3	3	1	0 (0%)	

Number	District	No. of IWUOs	Received Collaboration Letter from District	Has water permit	Signed IMT Agreement	Remarks
24	Rubavu	0	0	0	0 (-)	
25	Ruhango	8	8	1	0 (0%)	
26	Rulindo	3	3	1	0 (0%)	
27	Rusizi	1	1	0	1 (100%)	
28	Rutsiro	0	0	0	0 (-)	
29	Rwamagana	3	3	2	2 (67%)	
	Total	118	99 (83.9%)	57 (48.3%)	10.61 (14.4%)	

In addition, the survey have identified the following issues to be common in most of the districts:

1. DISC (District Irrigation Steering Committee)

Generally, Vice Mayor/ED is the President of DISC, Director of Agriculture & NR is the Vice President and the District Agriculture Officer is the Secretary, though the Vice President was supposed to be the president of one of IWUOs in the district.

DISC meeting is not organized regularly in all districts. The main purpose of the DISC meeting is to analyze the applications for SSIT and to approve eligible applicants. The topic of IWUO or status of irrigation scheme are not part of the agenda of discussed in most of DISC meetings.

DISC in most of the district are not functioning as directed in the Ministerial Order, rather it is district meeting held for season preparation focusing only in agricultural activities. Focusing on the performance of cooperatives, excluding irrigation and the activities of IWUO though the participants are the same.

2. District staff in charge of irrigation

In some districts, there is no staff in charge of irrigation. Lack of qualified staff (Irrigation Officers with irrigation background) at the district level is common. The lack of district staffs is manifested in the lack of properly managed database related to irrigation scheme within the districts and their status. Education background of some staff in charge of irrigation is not corresponding to irrigation;

Only three districts (Rwamagana, Kamonyi and Nyanza) have District Irrigation Officers, and only four districts have staff with an irrigation background:

- Nyamasheke District: Irrigation & Drainage, Bachelor's Degree
- Nyabihu District: Soil & Water Management, Bachelor's Degree
- Rusizi District: Soil & Water Management, Bachelor's Degree
- Rwamagana District: Irrigation and Drainage, Bachelor Degree

3. Imihigo of the staff in charge of irrigation

Generally, District Imihigo (performance contract) have focused mainly on implementation of Small Scale Irrigation Technology (SSIT) and support to cooperative management. Support to IWUO management and irrigation scheme management are not part of the District Imihigo or its staffs. In some district, agriculture officers and cash-crop officers are working as staff in charge of irrigation (in addition to its assignment) and they are busy with many other activities in their Imihigo;

4. Database on irrigation

In almost all the districts, there is no organized database related to irrigation scheme, status, area, IWUO etc. In some district, the collected data during this survey was made through on-spot communication with cooperative presidents or IWUO leaders through telephone means

5. SSIT

SSIT seems the main targets of each district when one talk about irrigation, however the program is not decentralized, for example, service providers sign contracts with RAB in Kigali without the involvement of the districts as an implementer. SSIT kits are subsidized at the same rate (50%) to farmers belonging to different social categories. SSIT equipment is very expensive and operation costs of SSIT kit/equipment is beyond farmers' capacity

In Western Province (Ngororero, Nyabihu and Rubavu districts), SSIT program is impeded by limited water sources /rivers, and steep slopes that increase the operation cost of SSIT applicability

6. Support to IWUO

In most district, there is no intervention from the district in the activities of IWUO. For example expense order (supposed to be approved by each district) is not known by most of the districts, only Rwamagana, Gisagara and Kamonyi districts practiced the approval of the IWUO's expense order

Auditing have never been conducted on all IWUOs in the entire districts.

Chapter 2 Present Regulations concerning IMT

2.1 Present Legal Framework and Strategy

2.1.1 Establishment and Registration of IWUO and IMT

The existing IWUOs in Rwanda are established based on the decree made by the Ministerial Order No. 001/11.30⁴ of 23 November 2011 and the Law No. 04/2012⁵ of 17 February 2012. The decree requires the IWUO to be register as a non-government organization by Rwanda Governance Board (RGB). Accordingly, they are registered and some of them have signed IMTA with the Ministry of Agriculture and Animal Resources (MINAGRI). With the signing of IMTA, it was believed that the IWUO will take full responsibility of OMM of the irrigation schemes.

However, most of the IWUOs established lacks proper implementation skill and strategy to properly operate and manage the schemes. It is clear that, for IWUOs to successfully achieve its vision/goal, they need to have at least skilled man-power and sustainable financial flow.

On the other hand, the types of irrigation schemes established in the country varies from small to large scale irrigation scheme having various characters of structures and water resources for crop production. Irrigation management structure should be carefully organized in accordance with its physical and operational character of each scheme. With this background, establishing an IWUO for every irrigation scheme that can be managed by farmers' skill alone is a difficult task that needs proper and realistic consideration.

2.1.2 Organization and Function of IWUO

IWUO which is established in accordance with the Ministerial Order consists of the necessary committees at higher level (such as executive committee, conflict resolution committee and audit committee) and zonal leaders at lower level structure. However, the method how the lower level structure, where most of the operation and maintenance of the scheme needed, should be organized is not clear. Hence, implementing the roles and responsibility of the lower level leaders is difficult.

For an irrigation scheme to be operated and managed by the beneficiaries, the water users must be organized according to operational unit of the irrigation facilities within the scheme. As it is clearly stated in the Ministerial Order before establishing IWUO in an irrigation scheme, it is necessary to prepare an Irrigation Map and Water Users List according to the facilities the members get water from. The lower level structure of IWUO must be organized based on these data. These basic database is lacking in most of the IWUO established except some developed by development partners such as WB, IFAD and the Japan International Cooperation Agency (JICA).

Necessary and appropriate water distribution should be arranged based on its actual and practical needs at the field-level requirement. Once a clear bottom-up IWUO structure is established starting from the lower level unit, a clear role and responsibility of each member and leader can easily be established and understood

⁴ Ministerial Order establishing irrigation water users associations in irrigation schemes

⁵ Law governing the organisation and the functioning of national non-governmental organisations

by the IWUO members.

2.1.3 Relationship between IWUO and Cooperative

According to the Ministerial Order, the responsibility of these two entities is clearly stated that cooperative is solely engaged in business activity in the scheme, while IWUO is responsible for the management of the scheme. However, there is still resistance from cooperatives leadership in the importance of creating another organization like IWUO while they think they can manage the scheme (mostly due to the conflict of interest on collected water fee or income from fish farming on reservoir). IWUO is a NGO but they can create the profit in order to manage the irrigation scheme referred from the Ministerial Order.

With the intervention from local official, the cooperative leadership agreed to accept the formation of IWUO to deal with scheme management. Performance Agreement is also signed between the two during every season. This agreement is supposed to cover the size of the land to be irrigated depending on the amount of available water that IWUO can provide. But mostly there is no clear indication on the amount of available water that can irrigate the land prepared by the cooperatives. This situation leads to reduction of irrigated land that was not stated in the performance agreement. There is no clear way of estimating the amount of water in the reservoir as the design document or H-V curves are not available for reference.

On the other hand, the responsibility of lower level leaders of IWUO overlaps with it of cooperatives (group leaders). It creates confusion to the members of the scheme and make it difficult for the members to follow whose order especially during community works. Lower level leaders of IWUO usually complain that the member does not obey their order and instruction unless the group leaders of cooperatives involve/support

2.1.4 Support for IWUO

According to many studies in IMTA implementation, the common recommendation given are that IWUO and irrigation agencies need substantial and prolonged capacity development. Commonly, IMT programs provide training and other complementary activities to IWUOs only during their establishment period, but many survey respondent say that all activities should be part of the long-term program that eventually evolves into a consultative, problem-solving process

It is clear to all that the skill of the existing IWUOs in operation and management of the scheme is very poor. Proper instruction or capacity development support are necessary for IWUOs to conduct appropriate water management, operation and maintenance of the irrigation scheme. Support for IWUO from different stakeholders usually focus on crop production and maintenance of canal though community work. However, capacity building in OMM of the irrigation scheme and the organization is totally absent or neglected.

This is manifested from the fact that stakeholders involved in supporting IWUO lack the basic knowledge on determining the amount of water needed per each season, the available water compared to the command area, the basis for preparation of irrigation calendar, the layout of the scheme and the irrigation facilities that are essential for operation of the scheme. For example, the amount of water inside a reservoir at different season, at different scheme developed by different development partners, are not clearly known by stakeholders who are responsible for water management.

Even after completion of irrigation project and IMT, periodical and practical intervention by the

governmental organizations are essential for sustainable management of the irrigation scheme. However, mostly the Imihigo of stakeholders are focused only on achieving at the formation and registration of IWUO. In most case, RAB and district staffs lack the means to perform their activity on time and efficiently (lack of staffs, means of transportation and necessary fund). Therefore, role of IWUO Supports Unit (IWUO-SU) at RAB HQs and DISC is very much crucial.

On the other hand, private service organization like HoReCo are efficient in establishing proximity coaching by assigning staffs on the site. However, as explained above they are mostly engaged in capacitating the crop production, registration of IWUO, mobilizing for water fee collection and maintenance work either through community work or through assigning budget for repair work. A clear ToR and M&E mechanism should be set for successful IWUO management to be implemented so that the performance of stakeholders (private service organizations) can be evaluated.

The existing IWUO support structure, adapted from IWUOs Policy & Strategy 2014-20, is presented below. The structure mainly covers supervision (by IWUO-SU at national level), overseeing IWUO activities (DISC at district level) and operation and maintenance (IWUO at scheme level).

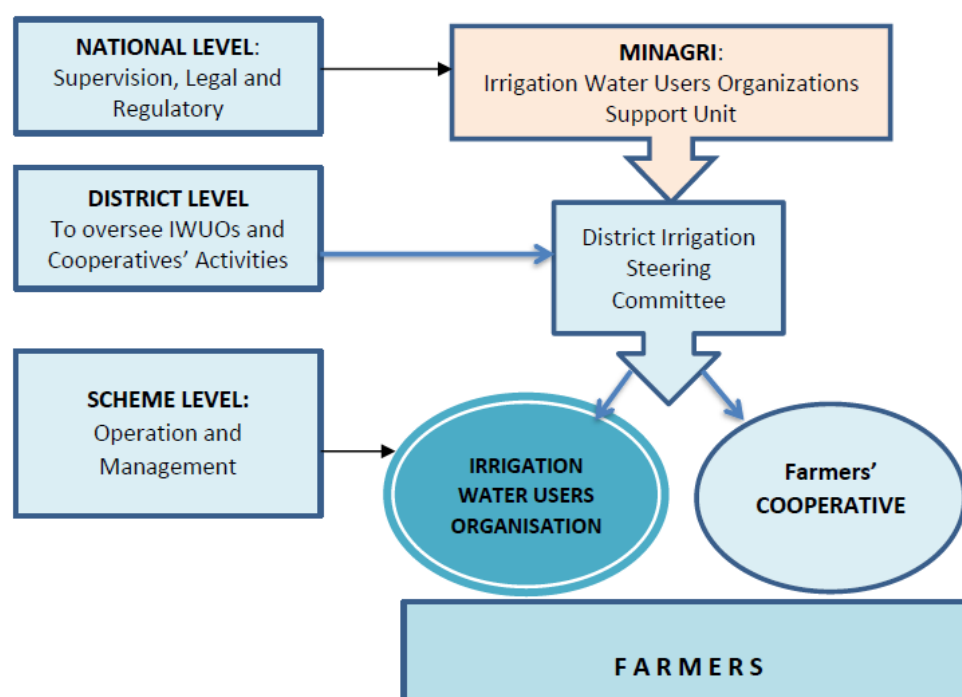


Figure 2.1 IWUOs' Institutional Relationship Structure

From the existing support structure of IWUO, one can see that the important part of the activity related to the formation of functional IWUO and strengthening its capacity is not clearly presented. The role of strengthening and functionality of IWUO should be clarified in the above structure at each level to support IWUO that is already established or newly formed.

IWUO-SU has been transferred from MINAGRI to RAB in 2013. However, due to the limited number of the available staff at RAB, only one staff are assigned to IWUO-SU in February 2023, and lack of proper knowledge on irrigation system, it become difficult to attain the expected role. Therefore, a properly working irrigation sector support structure must be established in the country that must be equipped with

necessary staffs.

2.1.5 Law and Regulation concerning IWUO and IMT

Ministerial Order defines IMTA as “the document by which the Ministry of Agriculture and Animal Resources, acting for the Government, transfers the responsibility for the operation and maintenance of irrigation scheme to the Irrigation Water Users Association (which is now “Irrigation Water Users Organization”) and lists the obligations of both parties. The respective District also co-signs the Irrigation Management Transfer Agreement”

And also, Irrigation Water Users Association is defined as “It is an association formed by all water users of a defined irrigation scheme. It is endowed with a legal personality in view of the management, enhancement and sustainability of the water resource and irrigation scheme”. It is stated in the Ministerial Order that, in the formation of IWUO, an irrigation map and water users list must be prepared so that IWUO will know which farmer gets water from which irrigation facilities. However, it is not clear who is responsible for the preparation of these important database. There is lack of staffs at RAB and/or district level that could take the responsibility of this activity.

There are many questions that should be tackled under the present law for successful implementation of IWUO management; such as:

- Who is responsible for establishing IWUO that can achieve the responsibility bestowed by the Ministerial Order?
- With the existing poor managerial skill of farmers at each scheme, is it practical to request the water users’ association to perform as non-governmental organization through complicated formulation process? There must be a time frame given for this decree to be practical.
- Who is responsible for strengthening IWUO until the time when they are capable of managing the organization, M&E of their activities, routine follow-up and training, even with the help of supporting staffs?
- How small scale irrigation scheme that cannot afford to pay for O&M of the scheme let alone hire supporting staffs could be treated under this law?
- How about those marshland schemes that have poor irrigation infrastructure and scarce water resource be treated under this law structure?

In most cases, engineers who participated in the scheme design & construction (Project Coordinator) leave the job immediately after the completion of the construction (due to contract base employment or other opportunity) with all the information he has. There is lack of proper data transfer, data management and necessary follow-ups in some of the existing irrigation scheme. Getting the H-V curve of a reservoir (basic information for water management), the O&M plan at design stage, the layout of the scheme is in most cases are cumbersome.

This might be due to the poor institutional ability of IWUO-SU and the Land Husbandry, Irrigation, Innovation and Technology Transfer (LII&TT) Department under RAB and DISC under each district related to structure, manpower, budget line and autonomy. Since irrigation scheme management is complicated and complex subject, it is recommendable to assign higher officials with irrigation background in the senior management in order to explore practical solutions.

With the ambition of the country to expanding the irrigated land to more than 100,000ha and with the available potential of water resource the country has, it is better to consider institutionalizing irrigation sector in better way that could perform its activities efficiently.

Although IMT are not mentioned in the basic documents concerning irrigation, such as Irrigation Master Plan (IMP, 2020), Rwanda Irrigation Policy & Action Plan (2013) and Rwanda Irrigation Policy and Strategy (2014), “IRRIGATION WATER USERS ORGANIZATIONS POLICY AND STRATEGY 2014-2020” consists many article related IMTA as indicated in the following Box:

Box 1

Reference articles related to IMTA from

“IRRIGATION WATER USERS ORANIZATION POLICY AND STRATGY 2014-2020”

(2.2 Coherence of IWUOs with national policies)

- **7) IWUOs with Water Resource Policy and Irrigation Policy:** through IWUOs development, efficiency and sustainability water resource will be better used and managed with local community involvement and financial participation on the basis of IMTA between IWUOs and MINAGRI.

(2.3 IWOs legal status and institutional arrangements)

- IWUOs are governed by by-laws and should possess a legal registration from the Rwanda Governance Board (RGB) and sign an IMTA involving the IWUO, MINAGRI and the District.

(4. IWUOS DEVELOPMENT IN OTHER COUNTRIES)

- Major donors and development banks have increasingly advocated participatory approach and projects, whereby water users/beneficiaries would build a sense of ownership of infrastructure and organizations and co-manage irrigation systems, with emphasis on the concepts of Participatory Irrigation Management (PIM) and IMT. Such policies emerged in a neo-liberal context of structural adjustment and broke away from the idea that water has to be exclusively managed by the state and its institutions.
- The new participatory arrangements ranged from increasing water users’ involvement in irrigation management as a supplement to state management (PIM) to transferring full responsibility and control over resources to organized users (IMT).
- Donors and governments supported the transfer of responsibilities to farmers and their organizations, with the aim of improving the accountability of the irrigation service to farmers, making maintenance and management services more cost-effective and irrigation systems more productive and sustainable, through farmers’ self-motivation and investment. Therefore, it was of great wish to transfer the irrigation management responsibility to farmer’s Organizations for improved and sustainable irrigation service”. The formation of water user organizations came to be seen as standard dispositive on any development project

(5.5 Challenges and Constraints to IWUOs policy implementation)

- **5) Low level of collaboration with local authorities:** As indicated above, local authorities do not sufficiently collaborate with IWUOs. This leads IWUOs to not apply scheme bylaws and IMTA. It leads to reduced IWUOs credibility and performances.

(6.4.2 IWUOs endowed with adapted and performing infrastructures)

- It is very desirable that, where possible at the time of the IMTA and handover, the IWUO profits from a reliable irrigation infrastructure meeting the producers’ basic needs to ensure a normal level of production lasting middle time of duration. If not, the IWUO begins its responsibilities and its action under inefficient conditions which handicap its credibility and its notoriety in front of partners and its own members.
- If it is true that the IMT process does not stop once the management transfer has occurred, it may be a starting point for more and greater endowments including infrastructure enhancing irrigation system and its sustainability. This will be included amongst the IMTA clauses about irrigation infrastructure and its heavy rehabilitations, water storage, fight against sedimentation in dams and against erosion and flooding in irrigated watershed. This is perceived as very important and urgent issue for IWUOs, manly the old ones where infrastructure are already damaged and in new Quick Win incomplete irrigation schemes.

(6.4.6 Irrigation water resources sustainably managed)

- IMTA will be signed between beneficiaries and land developers with involvement of local government authorities who will play great role in the management of water resources use bylaws enforcement.

(7.2 Endowing IWUOs adapted and performing infrastructure)

- Handing over irrigation infrastructure IMTA will be negotiated for good status, conditions favoring irrigation infrastructure quality maintenance, heavy rehabilitations and future infrastructure development.

(9.6 Institutional Arrangement for IWUOs Strategy implementation and coordination)

- Functional relationship and regulatory instruments should be negotiated, updated and monitored between actors at different levels. IMTA between MINAGRI, Local Government and IWUO at National level, Performance Contract between DISC, District and Scheme Steering Committee (SISC) at District level, Performance Contract between SISC, Sector and IWUO at Sector level, Mutual Performance contract between Cooperative and IWUO at scheme level, Statutes/ Constitution and scheme by-laws amongst irrigators within the scheme. Also financing system should be discussed through this coordination chain, for example about the land tax and irrigation fees.

2.2 Existing Management Model of Irrigation Scheme

According to the IMP 2020, five types of management model were pointed out as existing management model of irrigation schemes. However, in most of the surveyed irrigation scheme visited the existing management system established are mainly IWUO management model. The other management model such as “private commercial farmer model”, “specialized operator model”, “direct public management” and “PPP model” are not clearly established. They are either totally absent or overlapped with other model. Some of the existing management model is explained below.

2.2.1 IWUO Management Model

This model is commenced under the Ministerial Order made on 2011/12. After the establishment of the decree of Ministerial Order, all irrigation schemes are required to form IWUO for the operation and management of the irrigation system and conduct its activity as NGO regardless of its capacity, scale, existence of irrigation facilities etc. However, the Ministerial Order has never been implemented properly and there is no clear role and responsibility of each stakeholder in the decree. For example, the decree stated that IWUO should contribute to Trust Fund from the water fee collected, but there is no mention of where the trust fund account is managed, no IWUO has never contribute to the trust fund since the establishment of the decree and IWUO in the country.

Most of the irrigation project in the country are established or rehabilitated by the central government and development partners such as: GFI, WB, IFAD and JICA. Accordingly, as a criteria for handover of the project, most of the IWUOs are established immediately after the completion of the project and IMTA signed without clear knowledge on what it is and without capacitating the beneficiaries. During the interview with IWUO leadership, they often explained that IMTA is signed but they do not understand the purpose of the signed document.

Compared to the agricultural cooperative, which has RCA that often conduct monitoring and auditing of each cooperatives in the country, most of IWUO have never been audited by any government entity or external auditing. There is no practice of transparency and accountability related to financial management by IWUO that might be due to lack of proper training and monitoring by the government.

Some of the irrigation scheme lack properly installed irrigation facilities that does not require a separate organization (like IWUO) that consumes the little water fee collected from the beneficiaries solely for administrative purpose (meeting allowance, transportation allowance etc.) resulting in lack of financial capacity for O&M of the available facilities.

Lack of cooperation or rivalry between IWUO and cooperative is common in most of the scheme, the reason being the use of collected water fee. Mostly, there is no clear action plan by IWUO on the use of collected fee to the satisfaction of the cooperative leaders. It is important to point out that prior to the establishment of IWUO, the water fee has been collected by cooperative and being used to unclear purpose.

2.2.2 Private Commercial Farmer Model



In many hillside schemes, there are private commercial farmers who engaged in land lease farming activities. However, they are totally not engaged in the management of the scheme, except contributing the water fee at the rate similar to the other local farmers. In actual sense, there is no management model that fits this category. Still the IWUO are responsible for O&M of the irrigation scheme.

2.2.3 Specialized Operator Model

Generally, this model has been focusing in proximity coaching where RAB hire consultant company to coach the farmers and IWUO to capacitate their knowledge on running the scheme properly so that the farmer produce more and increase their income from the scheme. HoReCo is one of the company hired by RAB to undertake this activities. However, from the field survey and interview made on the visited scheme, the consultant is focusing on capacitating the farmer on agronomic activities and mobilizing of beneficiaries together with IWUO on water fee collection. There are no clear ToR that guides the consultant to deal in O&M of the scheme. In addition they lack capacity in the field of irrigation, operation and maintenance, management issues etc. Absence of O&M manual, clear ToR, systematic monitoring and evaluation by RAB, etc. make some of the problem that might contribute to unsuccessful implementation of this model.

2.2.4 Direct Public Management Model

Most of GFI implemented projects are found to have high specification that requires good knowledge of modern irrigation management skill that is difficult for farmers who have less or no irrigation experience in irrigated agriculture. For example, Kagitumba irrigation scheme consists of pivot irrigation, sprinkler irrigation and drip irrigation that are not fully exploited by the beneficiaries. This types of schemes are difficult to function sustainably without the intensive involvement of support from the government. Private investors exists but not actively participating in the operation and management of the scheme.

	
<p>Pile of unused drip irrigation materials at</p>	<p>Center pivot irrigation system watering dried maize field for a piece of potato plantation,</p>

Kagitumba scheme, May 2022	May 2022
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Figure 2.2 Present Situation in Kagitumba Irrigation Scheme

2.2.5 PPP Model

Public Private Partnership (PPP) in irrigation can take on several forms, ranging from O&M contracts to full private investment in infrastructure. Although there are relatively few examples of fully-implemented irrigation PPP in Africa, there are several innovative projects underway which aim to increase private sector involvement in a domain that has been dominated by public investment. This model is still at planning stage and yet to be tested in the country at Gabiro Agribusiness Hub (GAH) project.

In general, one can find staffs of “specialized operator model” at scheme managed by “direct support model” or “IWUO management model” sites. This means, in real sense, there is no single management model in the country as stated in IMP. The combination of the above-mentioned scheme could be arranged due to the actual situation of the scheme.

2.3 Existing Procedure of IMTA

According to the information gather from IWUO officers in the country, there is no clear procedure for implementing IMTA at each scheme. The general practice is that, before signing IMTA, it is necessary to officially register IWUO as a local NGO under RGB with following process such as; IWUO request the district for recommendation letter and submit this letter to RGB attaching notarized status, internal regulation and a proof of non-refundable payment of 50,000RwF. The detail procedure and its content is presented in the table below.

Table 2.1 Detail Procedure and Contents for IMTA

Step	Necessary document	Explanation of the content of the document
Step 1: IWUO request district to issue District Recommendation Letter that includes;		
1)	Notarized Minutes of GA Meeting	It is the recorded discussion among participants of the General Assembly (GA) before and during the election of IWUO leaders, the recorded discussion and list of participants is signed and notified by the government notary at the district level
2)	Notarized IWUO Status	The Ministerial Order governing IWUOs in Rwanda will be downloaded by IWUO and will fill the location of IWUO, the name of IWUO and name of Legal Representative (LR) and Vice Legal Representatives (VLR) and their signature after that the document will be signed and notified by the government notary
3)	Action Plan	The IWUO will prepare the annual action plan summarizing activities to be done and identifying source and responsible. After preparation, the action plan is presented to the GA and the GA make the comments/inputs and they confirm the action plan, After confirmation by GA, if the DISC is functioning, it will check and approve.
4)	Elected IWUO Leaders	The list of elected leaders is prepared identifying the responsibility of each, the list is signed and notified by the government notary
5)	List of GA Participants	It is the list of people who attended the GA during the establishment of the IWUO, it will be signed and notified
6)	CVs of LR and VLRs of IWUO	The curriculum vitae of the LR and VLR is prepared showing their birthday, where they were born, level of education, their job, it will be signed by them (LR & VLR) and notified by the government notary
7)	Criminal Records Certificate of LR and VLRs of IWUO	It is do document from the Ministry of Justice confirming that they have not been in jail or if they have not been in jail more than six month
8)	Statement of Appointment of LR and VLRs from IWUO	
9)	Notarized Declaration of LR and VLRs confirming Readiness to Assume Responsibility	It is a little word written by themselves by accepting the responsibilities (Responsibilities of being leaders and performing their duties as they swore in front of the GA)
Step 2: IWUO submit Application Letter to RGB through its website, online, that includes;		
1)	District Recommendation Letter	The document prepared in Step 1
2)	Proof of Payment of a non-refundable fees of 50,000 RWF	It is the cost to be paid in order to apply for the legal personality of IWUO
3)	Notarized Statutes and Internal Regulations	The internal regulation is prepared by the IWUO and presented to the GA to be approved and be notified by the notary. The status is notified
4)	Collaboration Letter	The IWUO write a letter addressed to the district asking for collaboration with the district
Step 3: Processing of the Application by RGB which includes		
1)	Issue Provisional Certificate	Document identification of IWUO by in preparation for issuing provisional certificate
2)	Site visit by RGB	RGB staffs will confirm the non-profit status of the IWUO including confirming the location of the scheme, office of IWUO, its organization status, etc.
3)	Final Certification	After confirming all the necessary information from the field visit and the submitted documents, RGB will provide the final certificate of IWUO registration.

After register the IWUO which can manages irrigation scheme, IMTA process can be arranged as follows:

1. Irrigation scheme and RAB prepare the document showing responsibilities of each party

2. Consultation meetings between district and IWUO to explain roles & responsibilities
3. Organization of the signing event
4. IWUO, district (DISC) and MINAGRI (RAB) sign IMT Agreement

Whereas, according to the Ministerial Order, condition for IMTA are as follows:

1. Registration of IWUO that follows the same procedure stated above
2. Annual Performance Contract with MINAGRI which is supposed to have the following contents
 - i. Action Plan consists of the following items
 - Water Distribution Calendar: to be prepared by IWUO
 - Crop Calendar (for marshland the crop is only rice, hence Agricultural Activity Calendar)
 - Annual Yield Target approved by Scheme Irrigation Steering Committee (SISC): to be prepared by Cooperative
 - ii. Financial Reports approved by DISC: to be prepared by IWUO
 - iii. Water Service Fee
3. Performance Contract with Cooperatives: signed between IWUO and Cooperatives every season

However, in actual practice the above process has not been fulfilled because of lack of the capacity of IWUO to prepare the above documents without support from either district staffs or the project that develop the scheme.

Although it is not a prerequisite to IMTA, every irrigation scheme in Rwanda must possess a Water Permit from the Rwanda Water Resource Board (RWB) for the utilization of water resource from the developed irrigation scheme. Similar to IMTA procedure, one of the criteria for application of water permit is the legal registration of IWUO under RGB. Linkage among each procedures are indicated in the following figure.

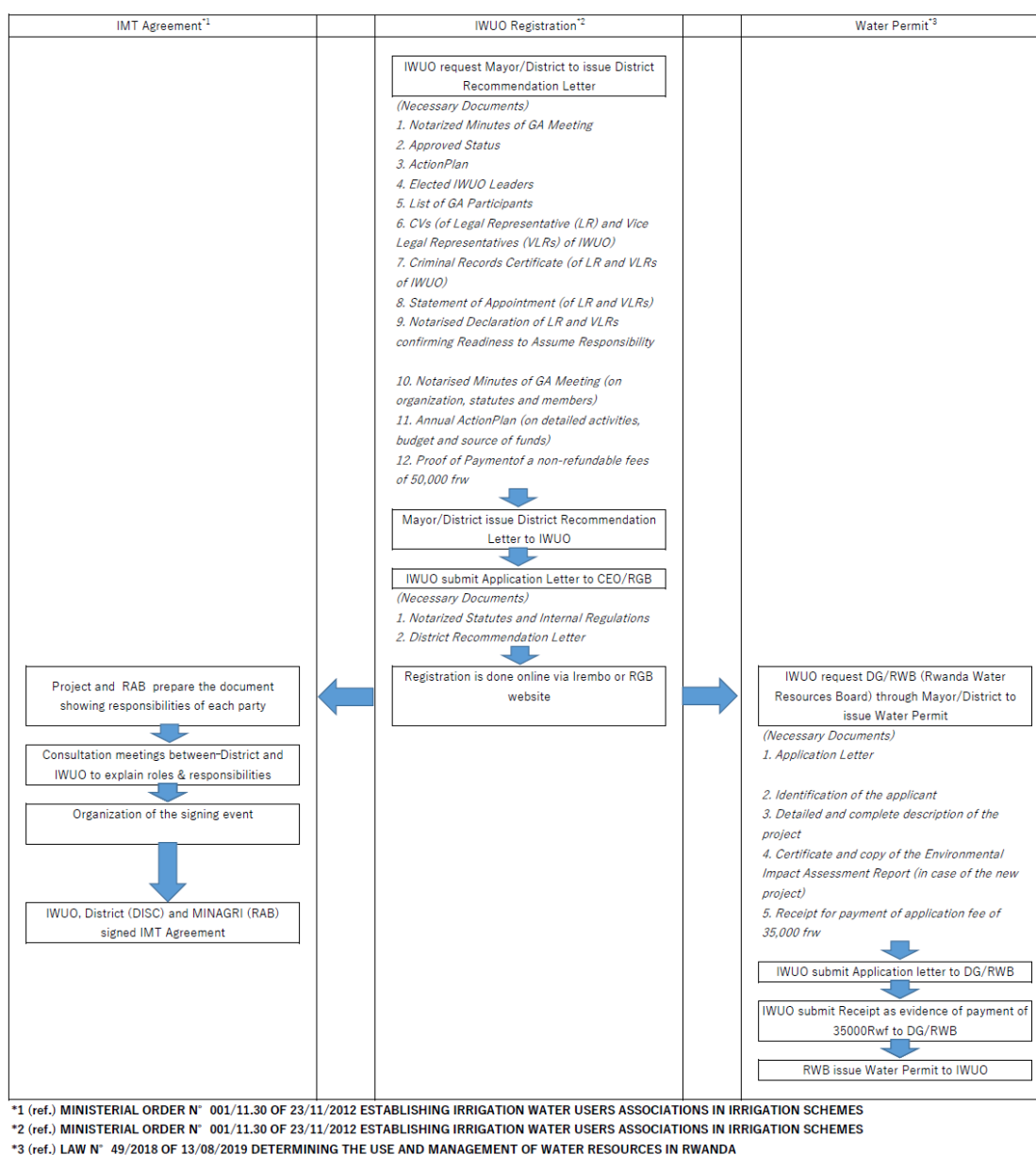


Figure 2.3 Procedure among IWUO, IMTA and Water Permit

Chapter 3 Proposed IMT Procedure

3.1 Importance of IMT in Government Policy and Expectations

In the preparation of IMTA procedure, it would be paramount to understand the importance of IMT in government policy and government expectation from the implementation of IMT. Without a clear policy framework and guidance from the government, it would be futile attempt to achieve the expectation of the government related to IMT. The government policy related to IMT should clearly indicate the roles and responsibility of each stakeholders in the implementation of IMT and management of irrigation development.

(Policy Issue related to IMT)

In the irrigation policy of the country, the government must address issues related to irrigation sector institutional and governance framework, roles and responsibility of stakeholders in the sector.

IMT is one of the fundamental procedure to improve irrigation scheme management with appropriate cost sharing between the government and the beneficiaries. Irrigation development can contribute not only to improve agricultural productivity and welfare of the beneficiaries but also to realize sound national budget and conservation of natural resources of the country.

(Expectation of the government from IMT)

What is the expectation of the government from the implementation of IMT? The government should set the goal of implementing it clearly. This will dictate the policy makers on how to tackle and address the issue that hinder the fulfilment of the expectation from implementation of IMT in irrigation sector of the country.

With this background, the expected roles and responsibility of stakeholders in the implementation of IMT can be presented in the following section.

(Role of District)

In accordance with the Ministerial Order, the respective District co-signs the IMTA as witness. However, role and responsibility of the District for sustainable irrigation scheme management is essential especially for monitoring and backstopping of activities of IWUO. Continuous support through DISC activities and emergency support for disaster prevention and rehabilitation is significant.

In this regards, some Districts proposes to become a signer rather than a witness of IMTA, in order to officially clarify its role and responsibility. This description is useful and sometimes necessary to explain reasons for the budget expenditures by the District to the authority concerned such as Audit General.

3.2 Role and Responsibility of related Organizations in IMT Process

The development of irrigation system is a huge investment that consumes enormous budget of any country. These expensive project should be treated as any other public property that serves the population like road, hospital, school etc. However, this survey reveals that most of the irrigation projects visited are left for the beneficiaries to handle its management and O&M issue provided that the beneficiaries were having little or no knowledge of irrigation management at all. For this purpose, the Ministerial Order established in 2011/12 require the establishment of IWUO at each irrigation scheme and this organization is expected to perform its obligation acting like an NGO registered at RGB.

Although the concept of establishing a self-governing entity at each irrigation scheme seems good, the idea of expecting the beneficiary farmers performing as NGO without support from outside and capacitating the organization is a futile attempt that need a thorough revision. On the other hand, in the Ministerial Order, there is no clear guidance on the responsibility of other stakeholders in the scheme like the district, sector, cooperatives, RAB, etc.

In all visited scheme, what is stated on Ministerial Order was not seen implemented because there is no clear responsibility on who should do what among the stakeholders. For example, trust fund, reserve fund, O&M fund, or the preparation of irrigation map, water users list, etc. are stated in the Ministerial Order in the establishment of IWUO, but one cannot find them and no clear guidance on who must do what and who should be responsible for the monitoring and evaluation of the implementation of the activities as stated in the Ministerial Order.

On top of this, the government staffs responsible for establishing IWUO, giving support, guidance, monitoring and evaluation of the activities of irrigation in the country is very few or sometimes non-existence. For the entire country only one staff is responsible at RAB for support of IWUO, and most of the districts does not have staff in the field of irrigation.

Therefore, there is a need to prepare a clear guidance on the implementation of the Ministerial Order for IWUO and explicitly explained responsibility of stakeholders should also be put in place for better management of irrigation scheme in the country.

Generally, it is not recommended to handover a huge public investment like irrigation scheme and leave it to the beneficiary alone for its management. A simple role and responsibility of stakeholders on an irrigation scheme management is presented below for reference.

Table 3.1 Sample Role and Responsibility of Irrigation Scheme

No	Essential task	Responsible body	Monitoring mechanism	Who should pay for the task
1	Maintenance of dam (pump house) and catchment protection	District, Government	RAB (District, Government) shall monitor annually	Reserve fund or other financial source shall be secured by the government
2	Maintenance of valve house (intake valve)	District, Government	DISC and RAB shall monitor seasonally	Reserve fund or other financial source shall be secured by the government

No	Essential task	Responsible body	Monitoring mechanism	Who should pay for the task
3	Maintenance of weir	District, Government	DISC and RAB shall monitor annually	IWUO (Reserve fund) or other financial source shall be secured by the district
4	Maintenance of main canal	District, Government	District, Government	District, Government
5	Operation of intake valve or pump house	IWUO	IWUO and support staff	IWUO (O&M fund)
6	Operation of gates at weir	IWUO	IWUO through irrigator	IWUO (O&M fund)
7	Maintenance of secondary canal and tertiary	IWUO	IWUO and cooperative	IWUO (O&M fund)
8	Cleaning of all canals and drains	IWUO	IWUO and cooperative	IWUO
9	Collection of water fee	IWUO/ Cooperative	MoU or Performance Agreement	Support from district, sector is necessary

[Reference]

The Irrigation Master Plan summarize role of the related organization as follows:

Stakeholders	Roles and Responsibility
MINAGRI (with affiliated agencies-RAB and NAEB)	Lead the overall coordination of the policy, institutional and legal reforms needed for efficient implementation of new Irrigation Master Plan and ensure their implementation. These reforms include the review of the current irrigation schemes operation and management models, irrigation projects planning, operation and management, promotion of delivery of GoR irrigation services via a private-led entrepreneurial model, improvement of farmers' access to irrigation equipment/materials, proximity extension services, inputs, training of irrigation personnel in public and private sectors, establishment of a professional irrigation association in Rwanda to further irrigation profession, and ensure a robust and functional M&E and accountability mechanisms is in place through establishment of an Irrigation Management Information System (IMIS) for timely and reliable data collection at central and decentralized levels
MINALOC/District (with affiliated agency RGB)	Mobilize farmers and support in strengthening governance in farmers' irrigation cooperatives and/or associations and community-based irrigation schemes through capacity building programs in cooperatives management, entrepreneurship and business development and ensure decentralized proximity extension services and capacity building to farmers

Stakeholders	Roles and Responsibility
Development Partners namely, FAO, EU, WB, DFID, IFAD, USAID, Enabel (BTC), GIZ, Netherlands, JICA, Swiss, etc.	Provide funding, capital investment and technical support for the development of irrigation projects
Private Sector including individual farmers, farmers' organizations/cooperatives, inputs dealers, agro-processing industries, traders, consumers, agri-business enterprises, private Higher Learning Institutions, financial institutions	Support in provision of extension and advisory services, financial services, technical support, information for agricultural markets, linking farmers to markets, capacity building, and provision of services for the operation and maintenance of irrigation schemes infrastructures
Community-Based Organizations, Civil Society Organizations including Local and International NGOs and Faith-Based Organizations	Support in providing training to farmers in good and innovative agronomic practices, assist farmers with new agricultural technologies, linking farmers with viable markets

3.3 Proposed IMTA Process

The important point to consider here is to pass through the necessary steps of establishing IWUO before running into registering the organization and signing IMTA. And also, after signing IMTA, minimum necessary support for IWUO is very much important to manage irrigation scheme properly and sustainably. Of course one of the purpose of IMTA to reduce the government contribution to the individual irrigation scheme. However, in order to avoid investing unnecessary countermeasures against huge damage of the irrigation structures by the government, it is essential to support IMTA to conduct daily OMM properly by IWUO in order to keep appropriate function of irrigation structures through a period of their service life.

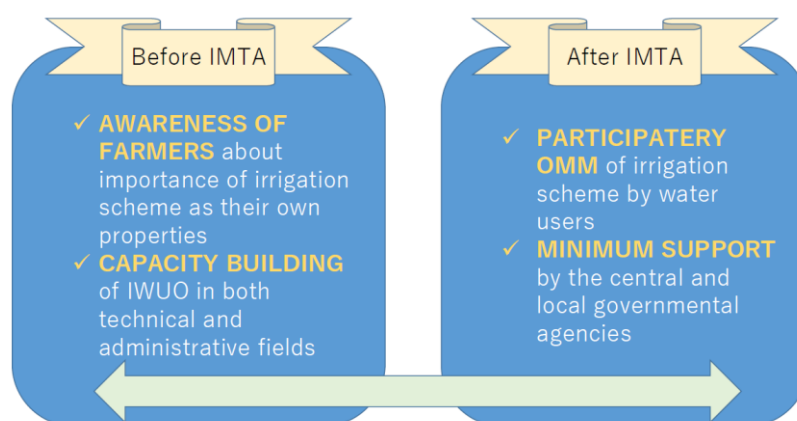


Figure 3.1 Necessary Measure before and after IMTA

In addition, the type and structure of IWUO must be in consideration of the type and scale of the irrigation scheme. As explained before, for an organization to successfully achieve its goal, it needs to have skilled man-power and sustainable financial flow. Accordingly, large scale irrigation scheme can afford to hire skilled man-power as support staff, i.e. Manager, Accountant, Security Guard, Irrigator and/or Engineer, to the elected leaders who will be replaced after every three years. Whereas, small scale irrigation scheme

obviously cannot afford to hire required number of support staff in addition to covering the O&M of the scheme.

Therefore, depending on the type, size and scale of the irrigation scheme, applying the decree as stated in Ministerial Order will be difficult or even if applied the established IWUO will not be performed well by the farmer's knowledge alone. As a proposal for the small scale irrigation scheme with scarce water resource and for poor irrigation facilities, it will be better to create Scheme Management Committee (SMC) under the existing cooperative instead of creating a separate IWUO.

(Improvement of IMTA procedure)

The following countermeasures to the present Ministerial Order on IMTA should be seriously reviewed and considered:

- The Ministerial Order that request all irrigation scheme to have IWUO regardless of the scale of the scheme should be reconsidered.
- The respective Districts should be included as one of the signers of IMTA, in order to officially clarify its role and responsibility to be explained to the authority concerned about reasons for the budget expenditures by the District for rehabilitation of damaged irrigation structures.
- Signing IMTA without insuring the capability of IWUO to be able to manage the irrigation scheme by itself with little support from the government is not recommended.
- A proper criteria and procedure must be set to realize IMTA.
- Even after IMTA, a mechanism must be set to provide routine training, monitoring and evaluation of the performance of IWUO.

Irrigation scheme generally requires huge initial investment that must not be left to be operated and managed by the farmers (IWUO). The responsibility of each stakeholder should be clearly set under the irrigation sector policy of the country. PIM requires the full participation of the scheme users in the management of the irrigation scheme. However, considering the capability of the water users and IWUO, it should be necessary for government intervention in the management of the irrigation scheme that will gradually reducing through long term implementation plan.

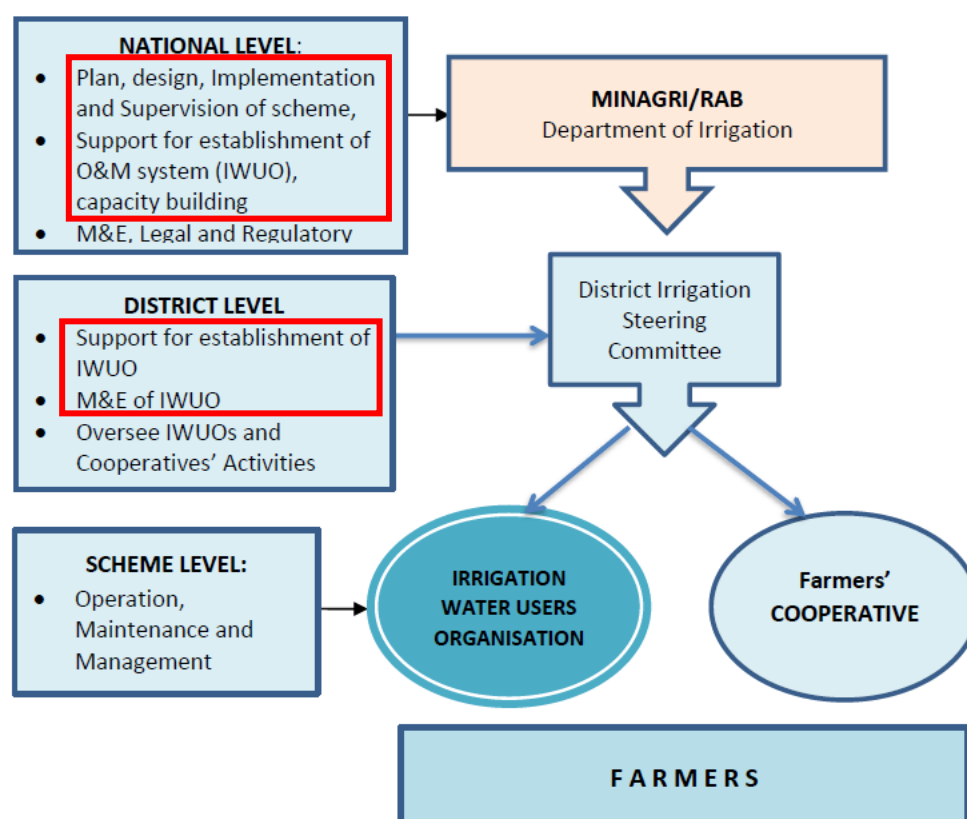


Figure 3.2 Proposed Irrigation Sector Governance Structure (red square)

Irrigation sector development is expected to have experts with experience mainly in the field of Irrigation Engineering, Agronomy and Community Organization. However, under the present governance system of the Country, irrigation sector under RAB seems to focus mainly on the field of crop production. The decision makers of RAB, in which IWUO-SU is involved, are specialist and researchers mainly in the field of crop/animal production. The lack of understanding in the importance of having necessary staffs of irrigation engineers and community organization experts under the LII&TT Department seems very clear.

(Benefit and Role of the Country)

Irrigation sector development consumes huge financial resource of the country. Every installed irrigation facility (infrastructure) must be able to provide the intended benefit to the country effectively and efficiently during its service life. In order to arrange nation-wide irrigation scheme management, it is worth to consider to establish a strong irrigation-focused department in MINAGRI instead of IWUO-SU in RAB, which should have following functions:

- Plan, design, implementation and supervision of irrigation scheme;
- Support for establishment of OMM system, capacity building of IWUO; and
- M&E, legal and regulatory.

Most of the engineers are working on contract basis during the supervision of the infrastructure. At the completion of the construction, they will be forced to leave RAB and/or the project with all the information

they have with them related to the irrigation scheme. IWUO established during or after the completion of the construction are left alone to operate and manage the scheme with little to none support related to strengthening of their capacity mainly by the district engineer who himself has little experience in the O&M of irrigation system. These many factors leads to the reconsideration of institutional restructuring of irrigation sector in the country.

3.4 Proposed Management Model of Irrigation Scheme

According to the outcomes of WAMCAB, it is recommended that the basic irrigation management model being implemented in the country runs around IWUO/cooperative management model, except PPP (that is not yet tested). In all the other management model explained above (in IMP), IWUOs are considered the main actor in the management of the schemes. Either it is a Private Farmers' Model, Specialized Operator Model or Direct Support Model, all work under IWUO/cooperative Management Model in the ground. On the other hand, most of the irrigation scheme in the country are of marshland type that is relatively easy to be managed by IWUO provided dependable water source and intact irrigation facilities are available. Therefore, it is strongly recommended to first formulate a better way of managing the marshland irrigation scheme under IWUO Management Model that can be copied to the other type of scheme (e.g. hillside scheme).

As a recommendation, WAMCAB has proposed a stepwise establishment or reorganization of IWUO with clear role and responsibility of each stakeholders, the necessary training and manual before the commencement of the scheme and routine monitoring of IWUO by the stakeholders. The proposed management model is still under piloting stage at model sites and undergoing improvement. The summary of the proposed model is presented below and described in details in the Annex 2 "Modified IWUO Management Model", the explanation of each steps shall be available from WAMCAB.

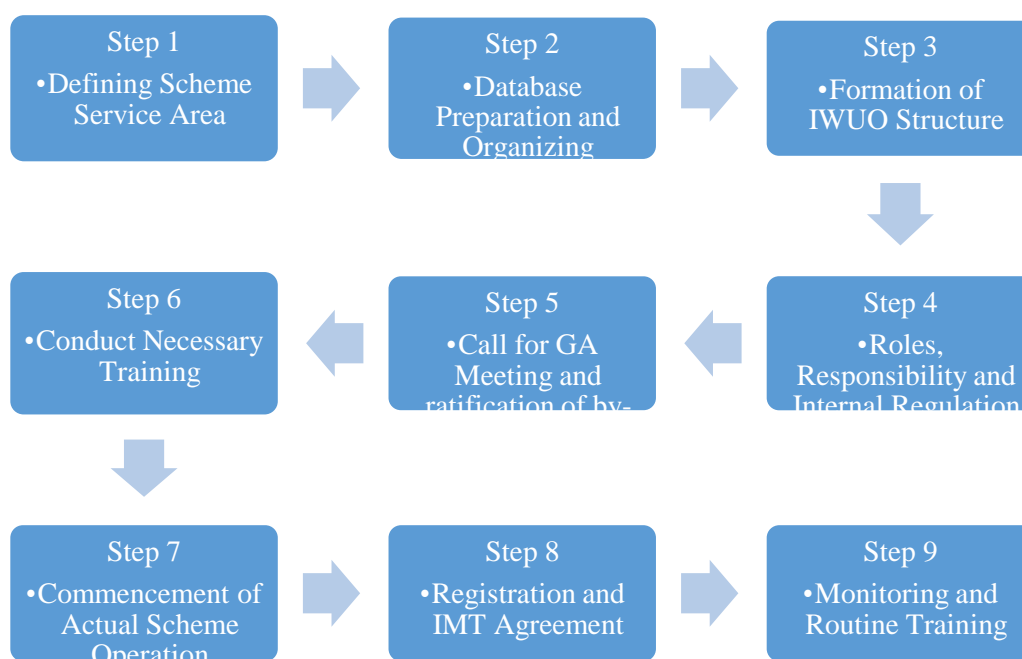


Figure 3.3 9 step for IWUO Management Model

Table 3.2 Summary of 9 step of IWUO Management Model proposed by WAMCAB

Step	Content of the activities	Responsible stakeholder
Step 1: Defining Scheme Service Area	Confirm the location, size of area, availability of irrigation facilities, and cross-check available water to irrigable land. The decision to form an IWUO or other structure can be decide at this stage	RAB; irrigation engineer, hydrology, IWUO officer
Step 2: Database Preparation and Organizing Irrigation Block	Preparation of Irrigation Map, water users list, irrigation block for lower level organization	RAB engineers. The help from One Stop Centre might be needed
Step 3: Formation of IWUO Structure	Depending on the condition of the scheme IWUO structures can be proposed	RAB and District Involve cooperative
Step 4: Roles, Responsibility and Internal Regulation	A clear roles and responsibility of each stakeholders is set Internal regulation prepared	RAB, District, irrigation engineer and IWUO officer (community organizer)
Step 5: Call for GA Meeting and ratification of by-law	After series of workshop held starting from block level to GA meeting shall be called to ratify the by-law	RAB, District, irrigation engineer and IWUO officer (community organizer)
Step 6: Conduct Necessary Training	At all steps above explanation of layout and irrigation block formation should be given to the beneficiaries. At this stage training package in all aspect of management should be given.	RAB, District, irrigation engineer, agro-economist, etc.
Step 7: Commencement of Actual Scheme Operation	Provide the O&M manual to IWUO Prepare financial management system Establish performance agreement with cooperative and district Application of water permit can be done before the commencement	IWUO together with Field Collaborator (FC) and district and RAB Where possible, FC will initially be hired by government and gradually become the employee of IWUO
Step 8: Registration and IMT Agreement	Apply for IWUO registration where needed. For scheme that doesn't qualify to form IWUO, the scheme management committee under cooperative is suitable. Explanation about IMTA before signing. Preparation of roles and responsibility of stakeholders. Signing of IMTA	IWUO, District and Cooperative (if needed)
Step 9: Monitoring and Evaluation, conduct Routine Training	Conduct routine training, monitoring and evaluation of the performance of IWUO and Cooperatives	RAB, District

Note: The detail explanation of each steps can be found in the training manual (01 Manual for WUO Management Model)

As a summary, all irrigation schemes developed will not qualify to the establishment of IWUO. The size of the scheme, the availability of enough water and intact irrigation facilities and the number of member should be considered in the formation of IWUO.

Generally, marshland schemes are relatively easy to be managed provided cooperation from the cooperative side is available. Most hillside irrigation schemes remain operational when support is provided by some kind of project. On the other hand, with a view of phase-out of a project, it is important to strengthen the capacity of IWUOs and cooperatives, technically and administratively, to ensure the sustainability of the scheme and full functionality of the irrigation facilities. The biggest challenge being poor water fee collection rate for which the active involvement and support of the local authority to the IWUO is very important for the sustainability of the scheme.

The issue of landownership in the hillside also is affecting the control of cropping patterns for better management of irrigation water. Most landowner does not obey the directive set by IWUO or cooperatives claiming that “no one can dictate us to plant this or that crop on our own land,” which indicates that still sensitization on the benefit of irrigated agriculture and the need to follow cropping calendar and contribute to water fee.

It was also reconfirmed the importance of the following principles that were also identified within the WAMCAB model sites, in particular:

- (1) Establishing a sense of ownership of the facility and functional aspects of the irrigation schemes of IWUOs or cooperatives depending on physical condition of the irrigation scheme;
- (2) IMTA should clearly state the division of responsibility of irrigation facilities (Dam, Pump Station, Main Canal and other facilities) in addition to existing roles and responsibility,
- (3) Recognition of the role of cooperatives in their own irrigation schemes for the collection of irrigation service fees (perception that fee collection is the role of IWUOs is not always correct);
- (4) Establishing good relations between IWUOs and cooperatives based on both trust and understanding;
- (5) Involvement of the district, sector and other local authorities that ensure the functioning of the scheme;
- (6) Activation of DISC, encouraging IWUOs share ideas and experience by allowing them to make presentation of their activities during DISC meeting;
- (7) Increasing the number of staffs in irrigation field at RAB or districts and capacitating the staffs to be able to guide, monitor and evaluate the activity of the IWUO and cooperative; and
- (8) The existing hillside irrigation system are found to be not easy to operate (carrying 100m hose pipe). Hydrants are very far from each other, the application of water using hose damage the product by washing the nutrient inside the soil. A different method of irrigation should be introduced for hillside irrigation system, such as gated pipe furrow irrigation, micro sprinkler etc.

3.5 Principles to achieve Sustainable Irrigation Management (PACREC)

Necessary procedures are summarized as the following principles named “PA (Participation) C (Capacity building) RE (Realization) C (Confidence)” in order to achieve proper and appropriate irrigation management mechanism, based on the results and experience of WAMCAB under assistance of JICA and in coordination with MINAGRI and RAB.

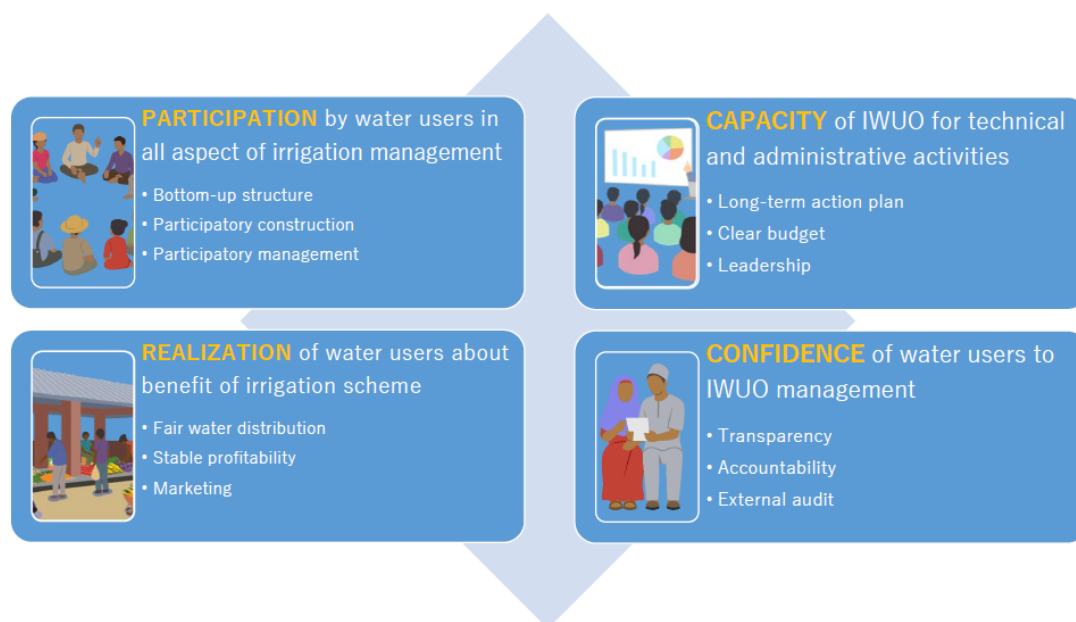


Figure 3.4 4 Principles of Sustainable Irrigation Scheme Management (PACREC)

3.6 Examples of Capacity Development of IWUO

3.6.1 Creation of Self-help (Management Model: Step 6)

Heavy rains and floods can damage concrete structures and make farm roads muddy, making it impossible to transport harvests. These can be difficult to repair through community work by ordinary farmers. In the model scheme of WAMCAB, “O&M team” and “Farmers' Repair Team” have been established within the IWUO to take responsibility for the maintenance of the facilities, and to lead the work to carry out simple repair works that require a certain level of technical skill.

The teams are responsible for repairing damaged, old and leaking concrete canals, repairing collapsed canal walls, and rehabilitate and building new turnout. In the past, the IWUO outsourced these simple civil works to local contractors to carry out the repair work, but by using the human resources within the IWUO, it is now possible to reduce the cost by 1/3.

While it is important for IWUO to be able to respond to sudden damage to the irrigation facility within the scheme, repairs of a certain scale need to be planned and carried out based on the condition and priority of those facility. At the end of the cropping season, the O&M and Farmers' Repair Teams conduct a status survey of the irrigation facility within the scheme to determine the condition and level of damage to key irrigation facilities, and to prioritize and formulate repair work plan in order to allocate the limited budget

available. It is necessary to carry out these works during the limited dry season, as work cannot be carried out when it rains, especially for carrying out civil works. A plan will be developed to determine which facilities will be repaired, when and how much will be spent on them.

In the event of disaster-level rainfall or flooding, there may be damage on a scale that the IWUO cannot handle. In such cases, the IWUO may submit a report on the situation to the district or RAB station, and they may be able to provide technical and financial assistance. However, due to limited government budgets, it is not always possible to respond timely and flexibly.

The IWUO has also established a “reserve fund” for future major repairs, so that in the event of serious damage to the facilities, the IWUO will be able to carry out these repairs on its own, without having to rely on the government.

3.6.2 Benefit of Routine Repair (Management Model: Step 7)

This is a way of preparing for the possibilities of the future, just as we save for our children's education.

Let us think about why it is needed to maintain irrigation scheme. Let us start with an example that might be familiar with. It is said that early detection and treatment of diseases is important. This can be achieved by visiting the hospital before the symptoms become severe, having regular check-ups, receiving advice from the doctor and receiving the necessary treatment.

However, if the disease is detected too late, it may progress without the patient realizing it, and one day the patient may suddenly experience symptoms that interfere with daily life, require a long period of treatment or major surgery. Or in the worst scenario, the disease can leave serious sequelae that make it impossible to live as before, or even lead to death.

The same applies to the various facilities that exist in irrigation scheme. By regularly checking the condition of the facilities and detecting any damage at an early stage, it is possible to identify the cause of the damage and take measures to prevent it from spreading, or if the damage is small enough, simple repairs can be done to reduce the damage and keep the facilities functioning.

However, if no action is taken and the damage is left unrepaired, facilities that were previously usable will suddenly break down and lose their function one day. For example, what happens if an irrigation canal, turnouts and gate suddenly stop functioning during the growing season? The crop that has been growing well may dry up and not be able to be harvested. In addition, if you are unable to close the intake gates during a flood, sediment can flow into the main canal or fill the diversion works with sediment, eventually making the facility unusable.

In general, if preventive repairs are not carried out, major rehabilitation will be required on a regular basis, which will be costly in the long term. In addition, these major rehabilitations cannot be carried out by the IWUO itself, and without external support, such as from the government, it will be difficult to use the irrigation facilities.

On the other hand, when preventive repairs are carried out, instead of requiring annual O&M costs, major damage is prevented from occurring and consequently less major rehabilitation is required. Over the long

term, the cost is less than if no preventive repairs were carried out. Just like human health care, preventive and early-stage treatment of irrigation facilities is crucial.

Annex 1

Reference documents and information

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Modified IWUO Management Model (WAMCAB Model)

Prepared by RAB-JICA under WAMCAB Project

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Abbreviations

CV	Curriculum Vitae
DISC	District Irrigation Steering Committee
EIA	Environmental Impact Assessment
FC	Field Collaborator
GABH	Gabiro Agribusiness Hub
GFI	Government Fund for Irrigation development
GoR	Government of Rwanda
GPS	Global Positioning System
HoReCo	Horticulture in Reality Corporation Ltd
ID	Identification Code
IMHIGO	Performance Agreement (Kinyarwanda)
IMP	Irrigation Master Plan
IMTA	Irrigation Management Transfer Agreement
IU	Irrigation Unit
IWR	Irrigation Water Requirement
IWUO	Irrigation Water User's Organization
JICA	Japan International Cooperation Agency
KWAMP	Kirehe Community-based Watershed Management Project
LR	Legal Representative
LWH	Land Husbandry, Water Harvesting and Hillside Irrigation Project
MINAGRI	Ministry of Agriculture and Animal Resource
MO	Ministerial Order
NGO	Non-Governmental Organization
OJT	On the Job Training
OMM	Operation, Maintenance and Management
PM&E	Participatory Monitoring and Evaluation
PPP	Private Public Partnership
RAB	Rwanda Agricultural and Animal Resource Board
RCA	Rwanda Cooperative Agency
RGB	Rwanda Governance Board
FPG	Farmers Producing Group
RSSP	Rwanda Rural Sector Support Project
RWB	Rwanda Water Resource Board
SMC	Scheme Management Committee

SWD	Seasonal Water Distributor
ToR	Terms of Reference
VLR	Vice Legal Representative
WAMCAB	Water Management Capacity Building Project
WUT	Water User Team
ZC	Zonal Committee

1. Introduction

The Project for Water Management and Capacity Building (WAMCAB) was implemented from March 2019 to February 2025 through the support from the Japan International Cooperation Agency (JICA). The main objective of the project was capacitating the stakeholders related to the management of irrigation scheme, such as IWUO, so that they could achieve the sustainable management of irrigation schemes in Rwanda. The implementation of the project was conducted in collaboration with the staffs of Rwanda Agriculture Development Board (RAB).

In this project, different training modules, management model and IMTA manual were prepared that will be applied to capacitate the stakeholders related to sustainable management of irrigation scheme in Rwanda. According to the Ministerial Order of Rwanda, every irrigation scheme must establish an IWUO that shall perform as a non-governmental organization in the management of the irrigation scheme it operates. In the same decree, RAB is given the mandate of the formation and capacitating of the IWUO. However, a clear procedure and step in establishing and capacitating the IWUO has been lacking. To fill this gap RAB and WAMCAB project have collaborated and prepared this manual that depict the necessary step for establishing, organizing and capacitating the IWUO so that sustainable management of irrigation scheme can be achieved.

All stakeholders who are responsible for supporting IWUO activities, such as RAB, Districts and Service Providers, shall adopt this manual.

2. Background

Since the year 1970 and 80's irrigated agriculture has been introduced in Rwanda through the cultivation of marshland land by small landowners organized into cooperatives producing rice. The formation of cooperatives as an institution to manage schemes was largely as a response to the Governments developments of large-scale and small-scale rice producing schemes with more complex infrastructure and marketing systems. The cooperatives have established in accordance with the cooperatives law of Rwanda and registered under Rwanda Cooperative Agency.

By 2008, the GoR felt that cooperatives were not putting enough emphasis on irrigation maintenance, so there was need to separate business (farm production) activities from service activities (OMM). With this realization, MINAGRI decided to split the functions of OMM from that of production management, thus the IWUO model was established through the pronouncement of the Ministerial Order No. N°001/11.30 OF 23/11/2011, to be separate from the cooperative. Every irrigator was to be mandatory member of the IWUO. The IWUO is a legal entity (duly registered with the Rwanda Governance Board) and has powers to enter into an Irrigation Management Transfer Agreement (IMTA) with MINAGRI and is also empowered as the sole entity to collect water fees from the members of an irrigation scheme. IWUO is endowed with a legal personality in view of the management, enhancement and sustainability of the water resource and irrigation scheme.

Since the IWUO was mandated by the Ministerial Order, the model is widely applied to most schemes

(both hillside and marshland) in Rwanda. Hence in one scheme, the two organizations, i.e. the IWUO and cooperative are supposed to co-exist through the signing of a cooperative/IWUO performance agreement, whereby the cooperative handles all production activities and IWUO handles all maintenance services of the scheme infrastructures. The reasoning is that funds for scheme OMM are deducted from the sales realized by the cooperative. The envisaged advantages of having an independent IWUO included: (i) separation of IWUO financial accounts from the cooperative ring-fences the IWUO account from commercial risks since the IWUO is a non-profit organization; (ii) the IWUO creates an environment focused on water management and is conducive for upskilling of OMM; (iii) District authorities would be able to monitor performance of the irrigation schemes. However, since the beginning of the establishment of IWUO at all developed irrigation scheme the model is not performing well as expected. Since then many approaches were introduced for successful implementation of sustainable irrigation scheme management. Some of the existing management model being applied in Rwanda is summarized below.

3. The existing management model

According to the IMP 2020, five types of management model were pointed out as existing management model of irrigation schemes. However, in most of the surveyed irrigation scheme visited the existing management system established are mainly IWUO management model. The other management model such as “private commercial farmer model”, “specialized operator model”, “direct public management” and “PPP model” are not clearly established. They are either totally absent or overlapped with other model. Some of the existing management model is explained below.

1) IWUO management model

After the establishment of the decree of Ministerial Order in 2011/12, all irrigation schemes are required to form IWUO for the operation and management of the irrigation system and conduct its activity as NGO regardless of its capacity, scale, existence of irrigation facilities etc.

The irrigation project established in the visited area are established or rehabilitated by KWAMP, RSSP, LWH, GFI and JICA. Accordingly, most of the IWUOs are established immediately after the completion of the project and IMTA has been signed with the beneficiary after conducting capacity building that was not sufficient. During the interview with IWUO leadership, they often explained that IMTA is signed but they don't have enough capacity to perform their responsibility.

Compared to the agricultural cooperative that has RCA that often conduct monitoring and auditing of each cooperatives in the country, most of IWUO have never been audited by any government entity (DISC) or external auditing. There is no practice of transparency and accountability related to financial management by IWUO that might be due to lack of proper training and monitoring by the government.

Some of the irrigation scheme lack properly installed irrigation facilities that doesn't require a separate organization (like IWUO) that consumes the little water fee collected from the beneficiaries solely for

administrative purpose (meeting allowance, transportation allowance etc.) resulting in lack of financial capacity for OMM of the available facilities.

Lack of cooperation or rivalry between IWUO and Cooperative is common in most of the scheme, the reason being the use of collected water fee, no clear action plan by IWUO on the use of collected fee to the satisfaction of the Cooperative leaders. It is important to point out that prior to the establishment of IWUO the water fee has been collected by Cooperative and being used to unclear purpose.

Generally, marshland scheme are easy to operate by farmers (basin irrigation) compared to hillside scheme that requires experience in the field of irrigated agriculture. Hillside irrigation system seems difficult to be implemented by farmers since it requires equipment such as hose, watering can, valves, etc. that is difficult for farmers to acquire (purchase) by themselves without having confidence in the irrigated agriculture and market of the produce. Water fee collection from hillside schemes is generally a challenge to IWUO, especially those that are not part of the cooperatives of hillside

2) Private commercial farmer's model

In many hillside schemes there are private commercial farmers who engaged in land lease farming activities, however, they are totally not engaged in the management of the scheme, except contributing the water fee at the rate similar to the other local farmers. In actual sense, there is no management model that fits this category. Still the IWUO are responsible for OMM of the irrigation scheme.

3) Specialized operators model

Generally, this model has been focusing in proximity coaching where RAB hire consultant company to coach the farmers and IWUO to capacitate their knowledge on running the scheme properly so that the farmer produce more and increase their income from the scheme. HoReCo is one of the company hired by RAB to undertake this activities. However, from the field survey and interview made on the visited scheme, the consultant is focusing on capacitating the farmer on agronomic activities and mobilizing of beneficiaries together with IWUO on water fee collection. The ToR that guides the consultant to deal in OMM of the scheme focused mainly on agronomy part than capacitating IWUO on facility maintenance skills. In addition they lack capacity in the field of irrigation, operation and maintenance field, management issues etc. Absence of OMM manual, clear ToR, systematic monitoring and evaluation by RAB, etc. can be some of the problem that might contribute to unsuccessful implementation of this model.

4) Direct support model

Most of GFI implemented projects are found to have high specification that requires good knowledge of modern irrigation management skill that is difficult for farmers who have less or no irrigation experience in irrigated agriculture. For example, Kagitumba irrigation scheme consists of pivot irrigation, sprinkler irrigation and drip irrigation that are not fully exploited by the beneficiaries). This types of schemes are difficult to function sustainably without the intensive involvement of support from the Government.

Private investors exists but not actively participating in the operation and management of the scheme.

5) PPP model

This model is still at planning stage and yet to be tested in the country at Gabiro project as GABH

4. The Main Pillars of the Proposed Management Model

WAMCAB has been implementing a management model on targeted three Districts namely: Ngoma, Rwamagana and Gisagara District. The project analyzed the status of the existing management model applied in Rwanda and proposed a modified approach to IWUO Management Model implementation.

The main pillars in strengthening existing IWUO Model are summarized as follows:

1) Implementation Manual to support Ministerial Order

The baseline survey conducted by WAMCAB has found out that the Ministerial Order established in the country is not being implemented properly during the establishment of IWUO in developed irrigation scheme in the country. The survey has also found that the Ministerial Order needs modification for practicality of the decree. WAMCAB has since prepared a draft implementation manual covering aspects on IMT, IWUO management (9-steps of IWUO Management), water management, Operation & Maintenance and Farm Management.

2) Introduction of Field Collaborator and Seasonal Water Distributor

Experience shows that IWUO needs some capable support staffs, especially the manager, for the proper implementation of OMM of the scheme. Most projects (LWH, RSSP, etc.) create a system of hiring staffs to be the manager of IWUO paid by the project and expected to eventually become the employee of the IWUO (fully paid by IWUO). However, most of the staffs hired by the project do not remain with IWUO after the termination of the project (this may be since the recruited person is not coming from the immediate community and is often a university/college graduate and hence cannot live with little salary paid by IWUO). Under the modified (WAMCAB) IWUO model it is proposed that a **Field Collaborator (FC)** is recruited at the inception of the formation of IWUO. This FC should be selected from within the beneficiaries or one who lives and works with them, one who has a moderate educational background and who accepts the salary scale of IWUO or cooperative. Once selected, FC will be capacitated and trained together with IWUO on different subject related to irrigation OMM. Salary of FC will be covered by the project at the beginning on the basis of cost sharing and eventually become the employee of the IWUO or cooperative.

In addition, **Seasonal Water Distributor (SWD)** shall be introduced on the basis of incentive after discussing with the beneficiaries. As all knows, IWUO will hire irrigator to achieve fair distribution of water along the main canal to the secondary canal. However, water distribution in the secondary canal is left to the members of each Irrigation Unit. Experience have shown that distribution of water

within a secondary canal need proper follow up by an individual that can be elected among the IU at each season. Therefore, the main purpose of introducing SWD is attain fair distribution of water to every plots of land from a secondary canal. The role of SWD will be to irrigate each plot of land from a secondary canal and the farmers shall be convinced to give an incentive, willingly, to the SWD for the work he perform. This approach has been tried and become successful at Nyigri model site where SWD is paid a kg of rice for irrigating one plot of paddy field.

3) Aggregating schemes for Sustainable Management

The baseline survey conducted by WAMCAB has found out that there are many IWUOs established at every marshland scheme resulting in weak IWUO, which cannot perform well and sustain support staffs. Such small and weak IWUO end up with mismanagement of fund collected as water service fee. Typical examples of such scheme include Kibaya, which is located in Ngoma/Kirehe District where under one strong cooperative there are six small and weak IWUOs. Under modified (WAMCAB) IWUO model, such scheme shall be aggregated and organized into one strong IWUO that can hire support staff and work side by side with the existing cooperative. WAMCAB has piloted this merging of small marshland schemes at the four schemes of Cyaruhogo Model Site into one strong IWUO, having four different cooperatives. Similarly, at Ngoma Model Site, three schemes are merged to create one strong IWUO that can hire support staffs and be able to pay for operators and electricity bill.

4) Categorizing schemes for management system

Under the Ministerial Order, every scheme is expected to form one IWUO for the management of the irrigation scheme, regardless of its size, farmer's capability, and availability of functional irrigation infrastructures. The modified (WAMCAB) Model will categorize schemes for best-fit management models. For example, medium size marshland would best suit the modified (WAMCAB) model; large, mechanized schemes would best suit PPP model or commercial farmer model and small marshlands would best suit cooperative management model.

In the cooperative management-model, a special committee shall be established under the existing cooperative. There is no need to establish a separate IWUO. This special committee will be made responsible for the management of the scheme in general. The committee can be called Scheme Management Committee (SMC). For example, under WAMCAB project, this model was applied at Nyabyogera Mode Site. The FC shall be hired by the Cooperative and will be responsible to support the activities of the cooperative and SMC.

5) Stakeholders engagement to perform their responsibility

According to the Ministerial Order, DISC was to be established at each District for monitoring and evaluation of the activities of IWUO. However, in almost all Districts, DISC was not existing or not functional. At the time of the inception of WAMCAB, except Gisagara District, where the District creates a system of approving expense order presented by IWUO every three months, there was no

District that involve in the activity of IWUO. It is important that DISC becomes functional at districts.

6) The creation of participatory rehabilitation/construction by IWUO

IWUOs that have the financial capacity of rehabilitating small structures or construction of new one has been outsourcing the work. For sustainability it is important that scheme beneficiaries be capacitated to carry out their own OMM. Under the modified (WAMCAB) IWUO model a maintenance team from within the beneficiaries will be trained to conduct proper masonry and concrete repair works. These trained farmers will be engaged in rehabilitating and constructing some structures on their own. Such an initiative is valuable to improve farmers' ownership to maintain and manage irrigation system as their own properties.

7) Long-term capacity development of IWUO for IMT

Management of irrigation scheme by the participation of the beneficiaries is a long-term process that requires capacitating IWUO before the scheme is transferred to farmers. As such MINAGRI/RAB need to have within its organization a team to prepare training materials and upskill farmers on various aspects of scheme management before a final IMT is achieved.

The modified (WAMCAB) model is best suited to marshland schemes and LWH established hillside scheme (provided the issue of land tenure, market and active participation of local leaders in IWUO activities is fulfilled).

5. The Introduction of Field Collaborator

- 1) **Background:** In the management of irrigation scheme, IWUO needs to have experts as supporting staffs that will organize the members, conduct the OMM of the irrigation facilities and help in agricultural activities of the scheme. This has been done through the support from RAB or service providers like HoReCo. The focus has been to hire experts that deal in organization, irrigation and agronomic activities. In light of sustainability of the management system, it would be better to create this supporting staffs from within the member of the beneficiaries so that they will remain as part of IWUO support staffs. Initially, the field collaborator will be operated as staff of WAMCAB and gradually transferred to be the staffs of IWUO during the project period.
- 2) **Objective:** The main objective of the introduction of field collaborator in WAMCAB project is to contribute to capacitating future supporting staffs of IWUO so that they can perform the proper management of the scheme after completion of the project.
- 3) **Approach:** Considering the field collaborators that are planned to work as WAMCAB field staffs during the project period who then are going to be part of IWUO (the supporting staffs of the Organization), number of the field collaborators per each model site shall be as minimum as possible.

One staff is considered to cover at least two or more field activities necessary for the managing the scheme (among Organization (output 2), Irrigation management (output 3&4) and Agronomy (output 5)). The fields of specialization required for management of irrigation scheme (output 2, 3 & 4) is considered to cover community mobilization, operation and maintenance, water management, agronomy related work, financial management and overall management of IWUO. In addition, the agronomist hired by the cooperatives of the scheme can also be capacitated in dealing with the agricultural activities covering output-5 which will help in the harmonization of IWUO and Cooperative of the scheme. Once the IWUO is capacitated and become strong, there is also a need to consider the inclusion of fishery where there is reservoir water.

- 4) **Criteria:** in selecting the field collaborators, the important criteria will be the status of the individual such as where he lives, his background on agriculture related activities and education background. The individual must come from within the community or are living with the beneficiary communities. If she/he is a farmer inside the scheme, it will be the best choice. As much as possible, one who is graduated from higher institute (university or college), studied or have education background in agricultural field. Knowledge on irrigation related subject will be an important asset. The experience in community mobilization will also be considered as important.

6. The Modified IWUO Management Model

The development of irrigation system is a huge investment that consumes enormous budget of any country. These expensive projects should be treated as any other public property that serves the population like road, hospital, school etc. However, this survey reveals that most of the irrigation projects visited are left for the beneficiaries to handle its management and OMM issue provided that the beneficiaries were having little or no knowledge of irrigation management at all. For this purpose, the Ministerial Order established in 2011/12 require the establishment of IWUO at each irrigation scheme and this organization is expected to perform its obligation acting like an NGO registered at RGB.

Although the concept of establishing a self-governing entity at each irrigation scheme seems good, however, the idea of expecting the beneficiary farmers performing as NGO without support from outside and capacitating the organization is a futile attempt that need a thorough revision. On the other hand, in the Ministerial Order, there is no clear guidance on the responsibility of other stakeholders in the scheme like the District, Sector, Cooperatives, RAB, etc.

In all visited scheme, what is stated on Ministerial Order was not seen implemented because there is no clear responsibility on who should do what among the stakeholders. For example, trust fund, reserve fund, OMM fund, or the preparation of irrigation map, water users list, etc. are stated in the Ministerial Order in the establishment of IWUO, but one can't find them and no clear guidance on who must do what and who should be responsible for the monitoring and evaluation of the implementation of the activities as stated in the Order.

On top of this, the government staffs responsible for establishing IWUO, giving support, guidance, monitoring and evaluation of the activities of irrigation in the country is very few or sometimes nonexistence. For the entire country, only one staff is responsible at RAB for support of IWUO, and most of the districts does not have staffs in the field of irrigation.

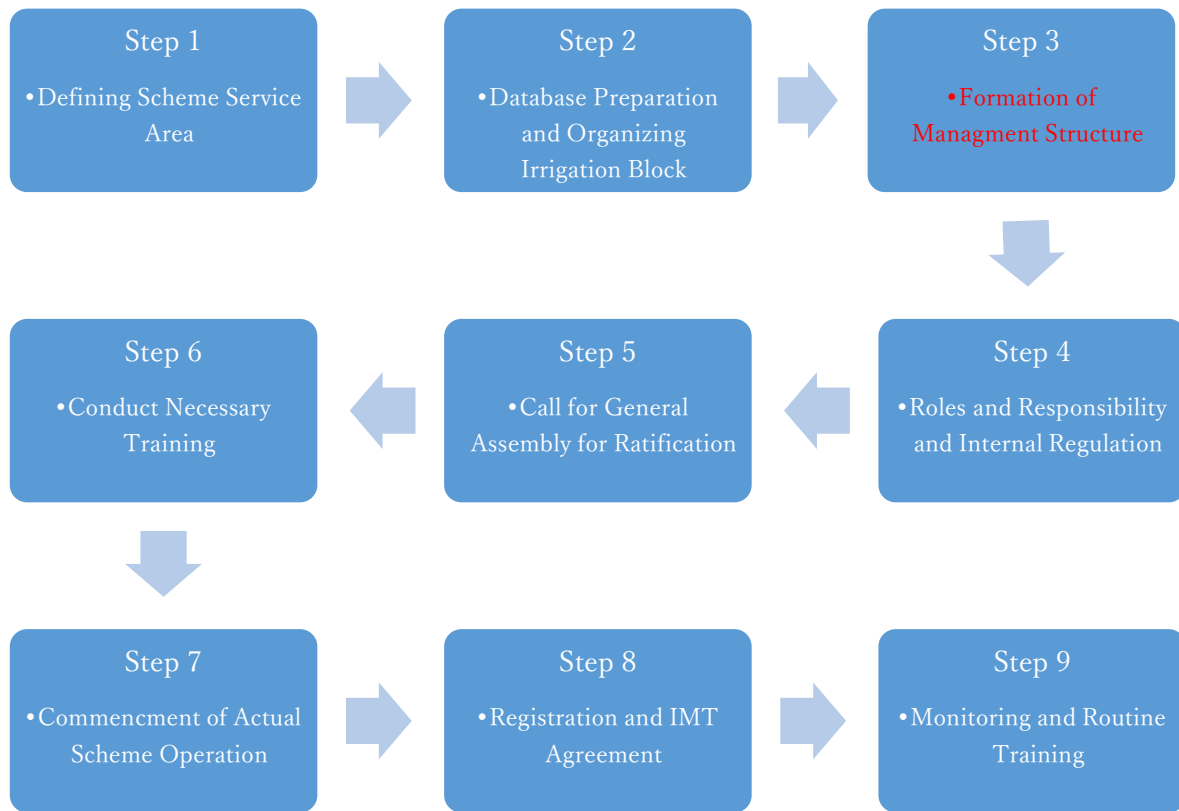
Therefore, there is a need to prepare a clear guidance on the implementation of the Ministerial Order for IWUO and explicitly explained responsibility of stakeholders should also be put in place for better management of irrigation scheme in the country. Generally, it is not recommended to handover a huge public investment like irrigation scheme and leave it to the beneficiary alone for its management. A simple role and responsibility of stakeholders on an irrigation scheme is presented below for reference.

According to this survey the team found out that the basic irrigation management model being implemented in the country runs around IWUO/cooperative management model, except PPP (that is not yet tested). In all the other management model explained above (in IMP) IWUOs are considered the main actor in the management of the schemes. Either it is a Private Farmers' Model, Specialized Operator Model or Direct Support Model, all work under IWUO/cooperative Management Model in the ground. On the other hand, most of the irrigation scheme in the country are of marshland type that is relatively easy to be managed by IWUO provided dependable water source and intact irrigation facilities are available. Therefore, it is strongly recommended to first formulate a better way of managing the marshland irrigation scheme under IWUO Management Model that can be copied to the other type of scheme (e.g. hillside scheme).

In Rwanda, the existing practice in the formation and management of IWUO generally ends at the election of the management committee after calling for a general meeting of the members and the explanation of its objective. Although different modulus of training is given to the elected member after the formation of the management committee, mostly, the intended message is not translated well to most of the member existing at the lower level of the organization. There is a need to reach as many as possible IWUO's member in explaining all the issue related to the need for formation of IWUO starting from the basics of irrigation and layout of the irrigation system itself. For this purpose, the expert must first understand the scheme layout, how water is distributed starting from the source up to the field level (or distribution points). To address the above issue the following procedure (steps) of IWUO management proposed. Stakeholders can anytime, modify the proposed procedures as the need might arises. The detail explanation of steps to follow in IWUO management explained below. These nine steps are categorized into four stages of activities. Such as, Stage 1 covers the activities at step 1 and 2 focusing in database collection and irrigation blocking followed by Stage 2 that covers the activities at steps 3, 4 and 5, which mainly focus on formation of the organization with its internal regulation ratified. Stage 3 covers the activities at Step 6 and 7 that focus on conducting full package training and commencement of the actual operation, at last stage (Stage 4) IMT agreement (step 8) and step 9 (setup of M&E system with routine training) will be covered. During the implementation of this modified IWUO model an introduction of a Field Collaborator is paramount in the sustainability and functionality of IWUO that always need a support staffs.

The detail explanation of the activities of each steps are presented in the following section.

Figure 1: Schematic Flow Showing the Proposed Nine Step for IWUO Management Model



Step 1: Defining Scheme Service area

1.1 Undertake preliminary survey of the scheme

Before establishing any IWUO for an irrigation scheme, the expert (IWUO officer or Irrigation Engineer) must perform preliminary survey of the scheme so that he fully understands the scheme itself such as:

- ✧ The layout of the scheme that will help in blocking the irrigation field for management
- ✧ The location and status of the irrigation system (size, condition of the scheme)
- ✧ Type and number of member of the beneficiaries of the scheme. Other water users (if any, such as fishers, tree seedling preparation, brick making, farmers using water on area outside the scheme)
- ✧ The existing potential water resource in relation to the planned command area
- ✧ Existing farmers group and how the group is organized (e.g. Rice Producing Group)
- ✧ Type of produce in season A, B and C including crop calendar (full irrigation season and supplemental irrigation period)

- ✧ Existing practice of OMM and water management. (How OMM conducted in the scheme? who is responsible for what in OMM of the scheme?)
- ✧ Identify the felt need of members, cooperatives and other stakeholders (major problem of the scheme and how it can be addressed)
- ✧ identification of natural hazard in the scheme location such as flooding and location of erosion from the hillside.

1.2 Defining the IWUO service area

In most cases of irrigation scheme in the country, the amount of available irrigation water does not much the size of the command area. In delineating the service area of water user's organization, one must take into account the following points:

- ✧ Confirm that the service area (marshland or hillside) must have infrastructure (intact) developed,
- ✧ Make sure irrigation water is provided within the boundary of the service area, solely from the irrigation infrastructure developed,
- ✧ Cross check the available water resource and the developed irrigation area is matching (refer to the design document for the size of available water and the estimated IWR: Irrigation Water Requirement)
- ✧ The irrigation area outside of the service area must be treated as indirect beneficiary of the scheme (E.g., in Cyaruhogo model site, Bugugu, Gashara and Cyimpima schemes have permanent irrigation infrastructure (such as: dam, canal, turnout etc.) and are located upstream of Cyaruhogo scheme. Whereas, Cyaruhogo scheme does not have properly established irrigation facilities and the source of water is the stream (drain) where water from the three-scheme discharge into. Therefore, Cyaruhogo scheme must be treated as the indirect beneficiary of the three scheme above.)

1.3 Determination of the Organization Structure for management of the scheme

Once the status of the scheme related to the scale of the scheme, the existing and potential financial capability of the organization and status of irrigation infrastructure a decision to create/reform the IWUO or establish SMC under the existing cooperative of the scheme must be determined. The ability to hire FC from the local youth should also be assessed. The possibility of setting cost-sharing arrangement through RAB, District or Service Provider shall be analyzed and determined.

Step 2: Database preparation & organizing the Irrigation blocks

According to the Ministerial Order, a scheme must have an irrigation map and water users list for efficient management of the irrigation system. The preparation of this database will help to organize the users according to the irrigation facilities that will be the basis of operation and maintenance of the scheme and

the IWUO management model.

2.1 Preparation of Basic Scheme Information

1) Irrigation Map

Irrigation Map is one of the important database required for good management of irrigation scheme (also indicated in the Ministerial Order). Normally, irrigation maps are part of the output of the design document of the irrigation scheme, but most of the scheme in the country lacks such basic database, hence need to be prepared anew. The map should include

- The exact layout of the scheme (position of dam, canal layout, drainage layout, road network etc.)
- Position of weir (including properly developed one and locally made), turnout, and other water source such as springs, farm ponds, etc.
- Each facility (weir, turnout) shall be given an ID number
- A plot ID corresponding to the landowners (land users), the weir or turnout from which the land gets its water
- Area irrigated by each weir, turnout and other water source.

The use of GPS and Google Earth is an important tool in the preparation of the irrigation map. When it is difficult to prepare Irrigation Map professionally, a rough scheme layout indicating infrastructures within the system is helpful. This rough scheme map can be prepared with the help of local people and site visit. If the ability to prepare rough sketch of the scheme is difficult the preparation of water users list per each turnout can be used as database of the scheme.

In preparation of the Irrigation Map, one must clearly understand the layout of the scheme or the distribution irrigation water to each plots such that one knows which plots gets its water from which facility. Starting from each weir, walking along the main canal, check the turnouts (secondary canal) and write down the names of the water users that gets water from the same turnout and secondary canal

2) Water Users List

This exercise is conducted after the preparation of irrigation map and the exercise will include:

- Using the prepared irrigation map, identify the area irrigated per each turnout, weir or canals (field canal such as: secondary, tertiary)
- Organize the plot identification (plot coding) corresponding to the land users and list members per each turnout or weir (Owner name, turnout/weir ID, number and size of plot, group name etc.) that will form Irrigation Units (IU) or Water Users Team (WUT) whose member gets irrigation water from the same point (turnout, weir etc.)
- Confirmation of the prepared water user list with the beneficiaries
- The Irrigation Unit (IU) or Water Users Team (WUT) shall form the lower level structure of IWUO depending on the size and number of members per each unit (team)

Typical example of the irrigation map, plot coding and water users list is shown below.

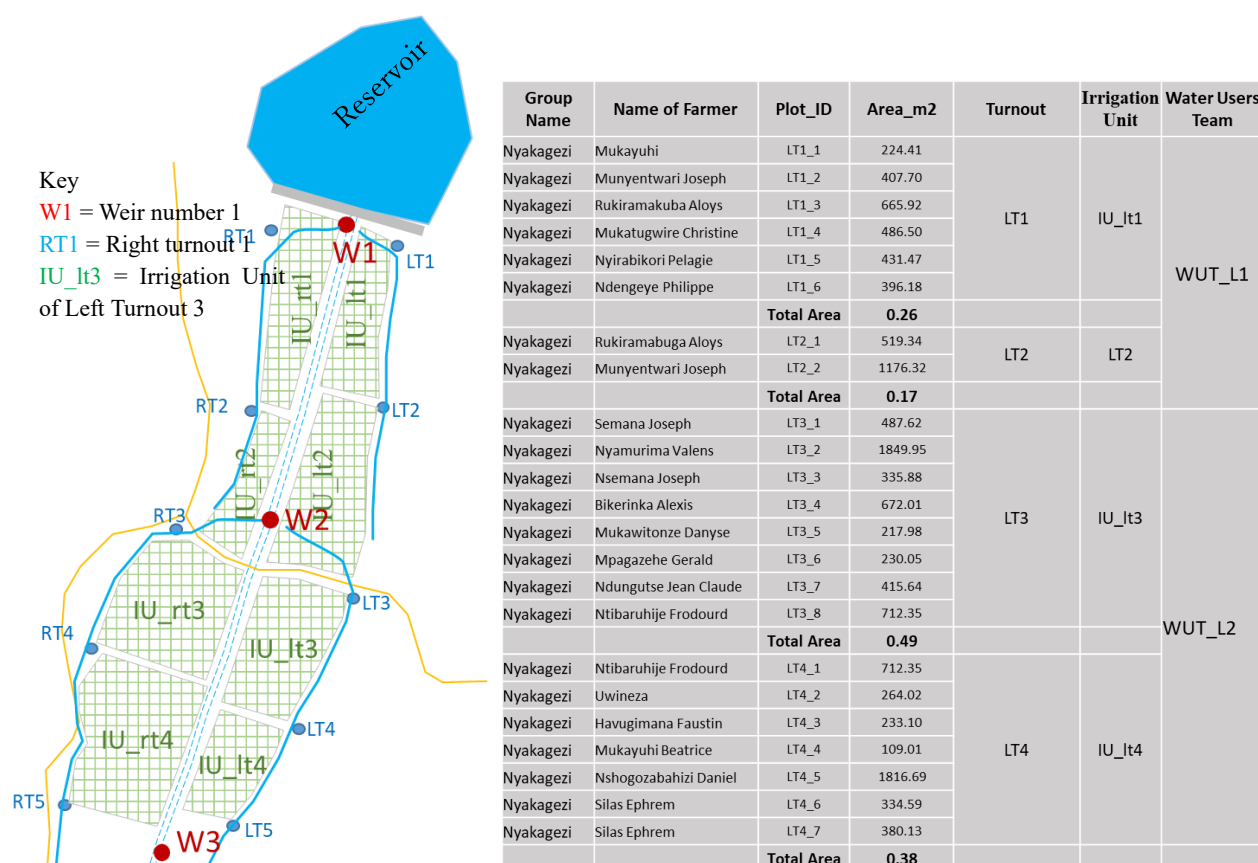


Figure 2: Sample irrigation map and water users list

2.2 Organizing the lower level structure and selecting leaders

Once the water users list is prepared, the scheme should be organized into irrigation block as explained above; such as an Irrigation Unit (IU) and/or Water Users Team (WUT) that help ease the operation and maintenance of the scheme. The water users in one block shall be responsible for the OMM of the facilities where they get water from.

During this exercise, the proposed lowest level unit (Irrigation Unit or Water User's Team) of the IWUO will be organized depending on

- Source of water such as turnouts, weirs, main canal (left or right). E.g. for weir it will be organized into WUT, for turnout = IU for main canal Zonal Committee (ZC) etc.
- Size of unit area (If the area served by one weir or turnout is bigger or the number of member per each WUT/IU is larger it is advisable to divide them into smaller size.)
- Existing producing group (FPG): it is also better to consider the boundaries of the existing producing group formed under cooperative so that the leaders of WUT or IU could collaborate with the group

leaders in performing the responsibility of each members (group member, WUT member or IU member).

Once the members are organized into IU, WUT, ZC, SMC etc., the IWUO structure will be formulated or reorganized in the next step.

Step 3: Formation / Reorganization of Management Structure

3.1 Explanation to members

Ask the following question

What kind of organization is practical for the scheme? Can't the existing cooperative or establishment of a simple scheme management committee under cooperative operate it? The possibility of merging more than one scheme to form a workable WUO that can hire a supporting staff (manager, accountant, operator etc., WUO is treated as NGO in Rwanda)

A series of workshop and focused group discussion must be conducted at all level of members of the irrigation block, group or zonal level before calling for the general assembly.

- Request farmers to identify problems related to irrigation, water distribution, etc.
- Who must solve those problems that can be mitigated by the farmers themselves?
- Explain to the members the need for the formation/reorganization of the appropriate structure of IU, WUT etc.
- At this point there is a need for the introduction of Field Collaborator under IWUO or Cooperative (the determination of income)

Once the explanation is made and awareness is created on the benefits and roles of IWUO, the formation/reorganization of IWUO shall start from lowest level of the structure as follow:

- Seasonal Water Distributor (SWD) for each IU assigned seasonally (turnout level)
- Water User's Team (WUT) (for each weir or number IU)
- Zonal committee (for long main canal or two or more weirs organized into one zone)
- Scheme management committee (where there is more than one scheme)

Explanation should be made on the structure and organs of IWUO, membership criteria, tenure of representatives, election procedure, rules and by-laws for effective functioning of the organization at different level of the system.

Depending on the size and number of water users from each turnout reorganizing according to small level canals (secondary/tertiary canal) will be considered. These water users are called the lowest level group in the scheme and termed as the Irrigation Unit (IU) where a seasonal water distributor (SWD) is assigned among the member to confirm the fair distribution of water from each turnout.

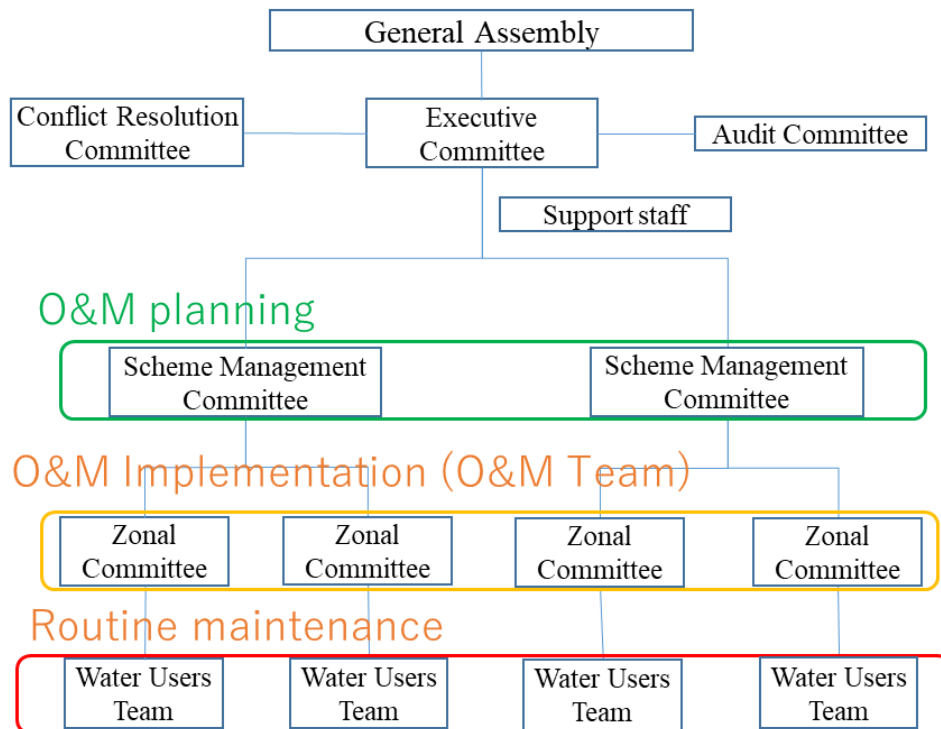
Depending on each weir or by organizing a number of IU (depending on the size, manageability of members) Water Users Team (WUT) shall be formed. (If there is an already establish producing group under the cooperative, it will be advantageous to consider organizing the WUT in accordance with the existing producing group, if matched with number of turnouts or intermediate weir). The Zonal Committee (ZC) shall be organized according to size of land and number of weirs depending on the scale of the scheme.

If two or more scheme agree to form one joint IWUO scheme management committee (SMC) shall be formed for each scheme that will be responsible for conflict resolution and planning of OMM of the scheme. A joint IWUO will be established for two or more irrigation scheme that will help to strengthen the ability to hire support staff under IWUO.

At this step the formulation of the roles and responsibility of each elected leaders at every level of the IWUO structure should be prepared including monitoring mechanism of each activities

3.2 Election of the overall IWUO committee

Considering the lower level representative of IWUO is already elected during the preparation of irrigation block (IU, WUT, ZC), it is imperative to elect the overall committee of the IWUO. The election should be made bottom-up. The first election is made for the leader of IU, from which WUT leaders should be picked. Zonal committee (ZC) will be elected from WUT leaders who will be substituted by the second scorer of the vote count. Similarly, the election of overall committee should be made from among the elected leaders of the lower level structure, mainly ZC and WUT leaders who should as well be substituted by the second scorer of the vote count. Typical structure of the proposed IWUO is presented in the figure below:



Once the election of all level IWUO leaders are completed, it will be important to conduct an initial WUT strengthening training as explained below.

3.3 Conduct the Introductory Training

The training shall be given to all stakeholders in the Cooperative and IWUO structure. The content of initial training shall focus the following points:

- Understanding the Irrigation Scheme (layout of the scheme),
- Explaining the number, location and purpose of each irrigation structures,
- The organization of each IU, WUT, ZC, SMC in relation to each infrastructure and group
- Responsibility of each body in the IWUO and Coop structure (FPG)
- Collaboration with cooperative, DISC and other stakeholders

Step 4: Preparation of Internal Regulation, Roles and Responsibility

4.1 Determine role and responsibility of each stakeholders

Address the question like; “what are the essential tasks? Who should perform those tasks and to whom should those performing tasks be accountable? Who would pay for that? How to monitor that the objectives are achieved?”

This will help demarcate the role/responsibility of cooperatives, IWUO, District and RAB. There is a need to explain the role of each stakeholders and all level of leadership under IWUO. Some of these responsibility shall be included as part of the internal regulation (by-law) of the IWUO. Sample role and responsibility of stakeholders in an irrigation scheme can be summarized as follow.

Table 1: Sample list of roles and responsibility of stakeholders in irrigation scheme

No	Essential task	Responsible body	Monitoring mechanism	Who should pay for the task
1	Maintenance of dam body (pump house)	District Government	RAB (District Government) shall monitor annually	Trust fund or other financial source shall be secured by the Government
2	Maintenance of valve house (intake valve)	District Government	DISC and RAB shall monitor seasonally	IWUO (Reserve fund) or other financial source shall be secured by the District
3	Operation of intake valve or pump house	IWUO though operator (support staff)	IWUO and support staff through irrigation calendar	IWUO (OMM fund)
4	Operation of gates at weir	WUT in collaboration with ZC	SMC and IWUO through support staff	IWUO (OMM fund) Voluntary work
5	Operation of turnouts	SWD	WUT leader everyday	IWUO (OMM fund) Voluntary work
6	Fair water distribution at weir/ main canal level	WUT in collaboration with ZC	IWUO and support staff through irrigation calendar	IWUO (OMM fund) Voluntary work
7	Maintenance of weir	IWUO	DISC and RAB shall monitor annually	IWUO (Reserve fund) or other financial source shall be secured by the District
8	Maintenance of Main Canal	District, Government	District, Government	District, Government
9	Maintenance of secondary canal	IU member	WUT	Community work
10	Collection of water fee	Cooperative in collaboration with IWUO	Performance agreement	Part of the agreement
11	Conflict resolution, auditing, action plan etc.	DISC, IWUO committee, Support staff	DISC through monthly visit and seasonal repotting	District, IWUO (OMM fund) Voluntary work
12	Updating WUL, daily activity, monitoring	Support staffs	IWUO and DISC	IWUO (OMM fund)
13	Fishery production (where there is Dam)	IWUO with the support from support staff	DISC and RAB	IWUO can give the contract to another individual

4.2 Prepare internal regulations (by-law)

After preparing and listing the roles and responsibility of stakeholders in irrigation scheme, the water users should be consulted about the following issues as preparation for internal regulation:

- ✓ Who should be the potential members of the IWUO (all types of users having the right to take water should be proposed as equal members to start discussion),
- ✓ How many representatives should be elected from each WUT into the general assembly? When they should be elected? How and Who should elects them?
- ✓ How many people should be elected to the IWUO council out of the representative or general assembly? When they should be elected? How? Who elects them?
- ✓ What should be the characteristics of the representatives/leaders
- ✓ How many members should be in each committee? What should be the role of each committee? Who elect them? How?
- ✓ The mechanism to involve women member in the leadership at all level
- ✓ To include the roles and responsibility of each stakeholders
- ✓ The tenure of each elected members and how they are replaced?

A series of workshops, focus group discussion should be conducted to come up with concrete internal regulation that should be followed by all beneficiaries of the IWUO. It should be distributed to all member of the IWUO for comment and modification before ratifying in the general assembly

4.3 Prepare future activity plan

The activity plan must answer the questions such as; What to do? Who will do what? and When to do what? The plan must be prepared in collaboration with the activities of the cooperative. The future activity includes detail farm activity (land preparation, seedling preparation, transplanting, watering, harvesting), irrigation schedule (water distribution and its plan), water management (measuring discharge or water level), infrastructure facility management (canal maintenance, cleaning, inspection), financial management (audit reporting), conflict management (if any)

The prepared by-laws and details of future plan should be discussed by the members to find some feedbacks on its contents. The discussion should be made through a series of set of meeting conducted at group level or watercourse level so that active involvement of most of the member is achieved as much as possible.

Step 5: Call the General Assembly meeting (Ratification)

5.1 Ratification of by-law and action plan

At this step, a general assembly shall be called to ratify the prepared internal regulation and action plan. The representative elected, the cooperative leaderships, the Sector and District staffs shall be invited during the General Assembly meeting. The main purpose of this meeting will be;

- Ratify the by-law resolute
- Ratify future activity plan

The main issue of internal regulation and action plan shall be explained to the participants for final confirmation and ratification.

After the ratification of the internal regulation a serious of workshop must be conducted to disseminate the approved regulation to the beneficiaries of the scheme. The workshop can be set at zonal level or at each irrigation blocks.

5.2 Application for Collaboration letter from District

Experience has shown that the formation of IWUO alone is not enough for the leaders of Cooperative and the members to fully cooperate and work hand in hand with IWUO unless the organization is legally known by local officials in the District. For this purpose, a collaboration letter must be requested by IWUO from the District. The letter will give a temporary legal status to IWUO that makes it functional and acceptable by the community including Cooperatives and Union.

Collaboration letter should be secured so that temporary legal status of IWUO is confirmed. Otherwise, cooperatives and union doesn't recognize the legal existence of the organization and farmers will not obey rules and regulation without the recognition of IWUO by cooperative leadership which will be translated to the members.

5.3 Apply for water permit

The Water Law n°49/2018 of 13/08/2018 gives the Rwanda Water Resources Board (RWB) the authority to give 'water permit' to any users of water resource in the country.

For water permit application, each IWUO need to submit their application file to the Minster in charge of water resources. The application file has to be comprised of the following items:

- ✓ Certification of Registration in the country
- ✓ Filled application form (<https://www.waterpermit.rwb.rw>)
- ✓ Proof of payment of an non-refundable application fee of thirty five thousand (35,000) Rwandan Francs
- ✓ Project Brief (how much water per year, means of abstraction, how to use, project area and crop type, source of water etc)
- ✓ An Environmental Impact Assessment report and EIA Certificate

- ✓ Map indicating the irrigation area (Site map)
- ✓ An application letter addressed to Minister in charge of water resources and has to be endorsed by the Mayor of the District where the project will be located
- ✓ Letter from the Ministry responsible for intended intervention (MINAGRI)

In the application process, IWUO should be supported technically by District or RAB staffs where the capacity of IWUO is still insufficient. Especially in the preparation of project brief, EIA, letter from relevant organization (Mayor and MINAGRI) and location map that is beyond the capacity of the IWUO staffs.

5.4 Performance agreement

Performance agreement between the cooperative and the IWUO should be made before each production season or annually depending on the capacity of the management organ. The agreement should include the schedule of agricultural activities of next season, irrigation scheduling, size of irrigable area (depending on the amount of available water during each season), number of farmers, expected amount of water fee to be transferred after harvest, roles and responsibilities of each entity, etc

In this performance agreement, the District should be included through DISC as a witness and supervising agent in the implementation of the stated roles and responsibility of both IWUOs and Cooperatives.

Step 6: Conduct the necessary training and prepare OMM manual

6.1 Full package training

Once the IWUO is established and ready to commence its activity, it should be capacitated in different field. A full package training session should be prepared and implemented. The training can be given during any phases of the nine step explained, but after the election of leaders at different level of IWUO. These training should give the IWUO the ability to implement the operation, maintenance and management of the irrigation scheme. The content of the training must include, but not limited to: OMM of the scheme, Civil work training, Water management, Facility management, Book keeping, Financial management, Gender mainstreaming, Leadership skill, Monitoring and Evaluation Skill, office management, good agricultural practice and so on.

Although this step is set after the ratification of the internal regulation, training of the beneficiaries should start anytime once the IWUO structure is formed and leaders are elected.

6.2 Preparation of OMM manual

For successful implementation of OMM of irrigation scheme, a workable, easy to understand and practical operation and maintenance manual must be prepared for each scheme. The manual should be prepared with

the participation of IWUO leaderships starting from bottom level of the structure. The content of the manual can include but not limited to the following items.

Table 2: Sample content for OMM manual

Chapter	Sub-title	
Chapter 1: INTRODUCTION	1.1 General Features of the Project	
Chapter 2: ORGANIZATIONAL STRUCTURE	2.1 General background 2.2 Organizational Structure and its Function 2.3 Constitution and By-laws 2.4 Office and Facilities 2.5 Performance Agreement 2.6 Meetings (Seasonal, Annual, DISC, etc.)	
Chapter 3: IRRIGATION PLAN AND OPERATION	3.1 General 3.2 Procedure of Irrigation Operation 3.2.1 The major infrastructure (1) Headwork's (Dam, Pump house or Diversion Weir) (2) Main Canals (3) Secondary and Field Canals (4) Other irrigation facilities (turnouts, drop, division boxes etc.) 3.2.2 Regular Operation under Normal Condition (1) Headwork's (Dam, Pump house or Diversion Weir)	(2) Main Canals (3) Secondary and Field Canals (4) Other irrigation facilities (turnouts, drop, division boxes etc.) 3.2.3 Operation under Emergency Condition (1) Heavy Rain or Flood Time (2) Drought period 3.3 Irrigation Schedule 3.3.1 General 3.3.2 Preparation of Rotational Irrigation Schedule for Sample Irrigation Block
Chapter 4: MAINTENANCE OF PROJECT FACILITIES	4.1 General 4.1.1 Main Functions 4.1.2 Type of Maintenance 4.2 Inspection 4.2.1 Routine Inspection (1) Headwork's (2) Canals and Related Structures (3) Drainage (4) Roads	(3) Drainage (4) Roads 4.4 Method of Maintenance 4.4.1 Canal Cleaning (1) Weeding (2) Desilting (3) Dredging 4.4.2 Protection Works (1) Backfilling around structures (2) Rubble packing 4.4.3 Minor Repair to Structures

	<p>4.2.2 Damage inspection</p> <p>(1) Cause of Damages (2) Inspection and Action</p> <p>4.3 Maintenance Activities</p> <p>4.3.1 Maintenance Activities</p> <p>(1) Headwork's (2) Canals and Related Structures</p>	<p>(1) Cement mortar (2) Concrete work</p> <p>4.4.4 Earth Filling</p> <p>(1) Stripping of top soil (2) Heightening and widening of canal bank and farm road</p>
<p>Chapter 5:</p> <p>PROJECT BUDGET, WATER FEE AND OTHER ACCOUNTING PROCEDURE</p>	<p>5.1 Budget of the Project</p> <p>5.2 Bank Account</p> <p>5.3 Accounting Book and Cash Receipt Systems</p> <p>5.3.1 Accounting Book</p> <p>5.3.2 Cash Receipt Systems</p> <p>5.4 Water Fee Collection</p> <p>5.5 Purchasing Procedure</p>	

Step 7: Commencement of Scheme operation

7.1 Provide the water management and OMM manuals

These manuals can be considered as part of specific manual as in Output 2, 3, 4 and 5 of WAMCAB project. In addition, manual support should be made for IWUO to prepare a general manual with content as indicated in step 6 above.

The scheme operation and maintenance manual should be presented to the IWUO for them to apply in their daily activity. The proper training of the manual should be made to the leaders at all level, especially lower level leaders such as IU and WUG leaders depending on their level of understanding and responsibility.

7.2 Start the scheme operation and management activities

According to the operation and maintenance manual (trained) the operation of the scheme and water management activities shall be commenced.

In all technical matter of OMM and water management of the scheme an irrigation technician (proximity coach or IWUO manager) must assist the management committee of the scheme. For this purpose, a Field

Collaborator (FC) will be procured during the implementation of the whole exercise (especially during Step 6) so that he got OJT and become ready to take the responsibility of managing the scheme once support from RAB or a project terminates.

7.3 Establish the system of collecting water service fee

The existing cooperative of rice producers have the practice of collecting water fee from member during harvest of product (deductible from the sale of the product directly). This deducted fee shall be transferred from cooperative treasure to the account of IWUO. However, for hillside scheme and member who produce and sell their crops by themselves, a different system of fee collection shall be designed. Continuous awareness creation and sensitization on the need to pay water service fee must be conducted on hillside farmers. One of the important activity that need in collecting water service fee from hillside farmers is the preparation of water users list and the area irrigated during every season (Season A, B and C) since all farmers doesn't produce in all season. The involvement of local government in mobilizing service fee collection using the prepared water users lists and its corresponding fee is paramount important. Proposed water service fee collection that can be applied to hillside scheme are (provided awareness is created and proper sensitization is done);

- Directly collecting from individual farmers employing a fee collector with the help of the prepared water users list and the involvement of local leaders (where necessary)
- Creating a system of fee payment by anyone who want irrigation before planting any crop on his land (Mostly applicable for contract farming practice when investor is involved)
- Strengthening the cooperative and make all farmers to be the member of the cooperative so that service fee can easily be deducted from the sale of the product by cooperative. For this to be practical, the cooperative must create a consistent and secure market link, cultivating the same crops at the same time (according to crop calendar prepared by cooperative), irrigating according to the agreed schedule and so on.

7.4 Prepare financial management system

A properly functional organization must have clearly organized financial management system that includes the opening of bank accounts, preparation of bank book, cash book and a properly designed cash flow. According to the Ministerial Order (M.O.) N°001/11.30 OF 23/11/2011 (article 5) established IWUO in all irrigation schemes in Rwanda. The M.O. stipulates that irrigator(s) must pay a 'water service fee' to cover for the operation and maintenance of the scheme. The collected fund should be divided into 3 parts as; one part-targeting immediate scheme operation and maintenance; one part deposited a reserve fund and another part to be deposited as trust fund (never materialized) with the mother Ministry (MINAGRI). The M.O. mandates the IWUO as the only entity to collect the fee and the M.O. institutionalizes scheme constitution & by laws that aims to deal with compliance in the payment of water fee.

Accordingly, the IWUO should open at least two bank account for OMM fund and Reserve Fund. The

OMM fund shall be used for daily activities of the scheme including salary of staffs. While the Reserve Fund shall be used during the occurrence of unexpected huge damage caused by flood or erosion that is beyond the capacity of the community work. A properly agreed cash withdrawal flow must be set with the approval of activity and budget b Executive committee and DISC. At any stage of the OMM of the scheme by IWUO, expense order shall be prepared for approval by DISC before withdrawal of money from bank.

At office level, the IWUO should prepare financial and accounting stationeries to record daily and monthly flow of fund using Bank Book, Cash book and proper arrangement of receipt and other important document for future auditing (Minutes of Meeting, etc.)

Generally, as part of the OMM manual of the scheme the financial management system of the IWUO should be clearly stated and explained in the manual that should be prepared at each scheme.

Step 8: Registration and IMT Agreement

8.1 Apply for Registration of IWUO

For IWUO to function as an entity that operates irrigation scheme management it must be registered by the Rwanda Governance Board (RGB) as requested by the Ministerial Order. Once the IWUO secures its legality from RGB it can sign the agreement of taking over of the irrigation infrastructure (IMTA).

On the other hand, it is the regulation of the country to get water permit from the Ministry of Natural Resource of Rwanda, especially where there are reservoir dams or other facilities that extract water from nature for the purpose of farming or other uses. This water permit can only be requested by an organization or legal entity that must be registered by the concerned government office. Therefore, the IWUO must be helped in securing the water permit for the purpose of irrigation development. The necessary procedure for the application of legal registration of IWUO is summarized below

Table Procedure for registration of IWUO

Step	Necessary document	Explanation of the content of the document
Step 1: IWUO request District to issue- District Recommendation Letter that includes;		
1)	Notarized Minutes of GA Meeting	It is the recorded Discussion among participants (GA) before and during the election of IWUO leaders, the recorded discussion and list of participants is signed and notified by the government notary at the district level
2)	Notarized IWUO Status	The Ministerial Order governing IWUOs in Rwanda will be downloaded by IWUO and will fill the location of IWUO, the name of IWUO and name of LR and VLR and their signature after that the document will be signed and notified by the government notary
3)	Action Plan	The IWUO will prepare the annual action plan precising a single activity to be done and precise the source and responsible, after preparation the action plan is presented to the GA and the GA make the comments, inputs and they confirm the action plan, after the confirmation of GA, if the DISC is functioning, he will check and approve.
4)	Elected IWUO Leaders	The list of elected leaders is prepared precising the responsibility of each, the list is signed and notified by the government notary
5)	List of General Assembly Participants	It is the List of people who attended the GA during the establishment of the IWUO , it will be signed and notified
6)	CVs of Legal Representative (LR) and Vice Legal Representatives (VLRs) of IWUO	The curriculum vitae of the LR and VLR is prepared showing their birthday, where they were born, level of education, their job, it will be signed by them (LR & VLR) and notified by the government notary
7)	Criminal Records Certificate of LR and VLRs of IWUO	It is do document from the Ministry of Justice confirming that they have not been in jail or if they have not been in jail more than six month
8)	Statement of Appointment of LR and VLRS from IWUO	
9)	Notarized Declaration of LR and VLRs confirming Readiness to Assume Responsibility	It's a little word written by themselves by accepting the responsibilities (Responsibilities of being leaders and performing their duties as they swore in front of the GA
10)	Notarized Declaration of LR and VLRs confirming	

Step	Necessary document	Explanation of the content of the document
	readiness to assume responsibility	
Step 2: IWUO submit Application Letter to RGB through its website, online, that includes;		
1)	District Recommendation Letter	The document prepared in Step 1
2)	Proof of Payment of a non-refundable fees of 50,000 RWF	It is the cost to be paid in order to apply for the legal personality of IWUO
3)	Notarized Statutes and Internal Regulations	The internal regulation is prepared by the IWUO and presented to the GA to be approved and be notified by the notary. The status is notified
4)	Collaboration Letter	The IWUO write a letter addressed to the district asking for collaboration with the district
Step 3: Processing of the application by RGB which includes		
1)	Issue Provisional Certificate	Document identification of IWUO by in preparation for issuing provisional certificate
2)	Site visit by RGB	RGB staffs will confirm the non-profit status of the IWUO including confirming the location of the scheme, office of IWUO, its organization status, etc.
3)	Final Certification	After confirming all the necessary information from the field visit and the submitted documents, RGB will provide the final certificate of IWUO registration.

8.2 IMT Agreement

IMT has been introduced in Rwanda very recently together with the implementation of donor led irrigation development. The very common case in Rwanda related to IMT has focused only on the establishment of IWUO and signing of it without consideration to the capacity and know-how of the beneficiary farmers. The idea of contributing for the water service fee in irrigation scheme, as part of IMT, is not yet well penetrated into the mindset of the beneficiaries of the scheme. There is no clear procedure and guidance set in the country on how to implement the IMT for successful operation, maintenance and management of irrigation scheme. Often, after the completion of the installation of irrigation scheme, the Government requested IWUO to sign an Irrigation Management Transfer Agreement (IMTA). The beneficial farmers set up an Irrigation Water Users Organization (IWUO) in name only and signed the IMT, but the farmers

do not know what to do about the OMM of the scheme and the farmers do not have enough finance or management capacity to maintain the IWUO as their own organization. The farmers also think that they do not need to manage the irrigation facilities by themselves because the scheme has been developed by the Government and/or donors without the full involvement and clear explanation to the beneficiaries beginning from the inception of the project. Some farmers still believe that the government should assign budget to be used to maintain and manage the facilities in the irrigation scheme.

According to many studies in IMTA implementation, the common recommendation given are that IWUO and irrigation agencies need substantial and prolonged capacity development. Commonly, IMT programs provide training and other complementary activities to IWUOs only during their establishment, but many survey respondent say that all activities should be part of the long-term program that eventually evolves into a consultative, problem-solving process.

It is clear that the skill of the existing IWUOs in operation and management of the scheme is very poor. Proper instruction or capacity development support are necessary for IWUOs to conduct appropriate water management, operation and maintenance of the irrigation scheme. Support for IWUO from different stakeholders usually focus on crop production and maintenance of canal through community work. However, capacity building in operation, maintenance and management of the irrigation scheme and the organization is not adequately implemented..

Once IWUO is registered and capacitated properly, it should sign an IMT agreement with the Ministry of Agriculture (MINAGRI/RAB) as requested by the Ministerial Order. With this agreement signed, IWUO shall be capable of operating and managing the irrigation scheme properly and with little involvement from the government.

According to the information gathered from RAB staffs- the practical procedure for signing of IMTA after registration of IWUO can be arranged as follows:

- (1) Irrigation scheme and RAB prepare the document showing responsibilities of each party
 - (2) Consultation meetings between District and IWUO to explain roles & responsibilities
 - (3) Organization of the signing event
 - (4) IWUO, District (DISC) and MINAGRI (RAB) sign IMT Agreement
- The detail information about this issue can be found in the IMT Manual of WAMCAB project.

Step 9: Routine training and Participatory Monitoring &Evaluation System (PM&E)

9.1 Prepare a follow up mechanism (PM&E system)

Presently, each District conduct season preparation meeting that involves all IWUO and Cooperative found in the District. Most of the time the content of the meeting focused on issue related to production, input distribution, achievement of last season and plan of next season. There is no mention of the activities of IWUO during such meeting. Therefore, there is a need to create a follow up mechanism by DISC so that the activities of IWUO are monitored and evaluated.

Stakeholders at all level of irrigation scheme shall perform their responsibility for successful management of IWUO.

Table 3: Sample for Responsibility of stakeholders on PM&E of Irrigation Scheme

Stakeholders (who)	What to monitor and evaluate	How to monitor	When	Feedback to
RAB	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Water use efficiency ✓ Implementation of Action plan ✓ Budget used ratio (Admin/OMM) ✓ Status of Reserve fund (trust fund), if any 	Using Forms 1-7 (see PM&E manual)	Once per season (year)	RAB headquarter
DISC (District)	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Action plan implementation ✓ Budget used ratio (Admin/OMM) ✓ Status of Reserve fund (trust fund), if any ✓ Auditing of IWUO ✓ Filing system of documents ✓ Status of water distribution ✓ Amount of available water for the season (where there is dam) ✓ Routine maintenance and cleanliness irrigation structures 	Using Forms 1-7 (see PM&E manual)	Once per season	District
SISC (Sector)	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Action plan implementation ✓ Status of water distribution ✓ Status of conflict resolution ✓ Routine maintenance and cleanliness irrigation structures 	Using Forms 1-7	Once per season	Sector and District
Cooperative leaderships	<ul style="list-style-type: none"> ✓ Water distribution issue ✓ Routine maintenance and cleanliness irrigation structures (canal, drainage etc.) ✓ Damage on irrigation facilities ✓ On-time implementation of agricultural calendar (land preparation, transplanting, fertilizer application, weeding, harvesting etc.) 	Using Forms 1-7	Once per season	IWUO and District
IWUO Manager	<ul style="list-style-type: none"> ✓ Daily activity of operators, irrigators etc. ✓ Water distribution ✓ Filing system of documents ✓ Financial management 	Using Forms 1-7	Everyday	DISC
Irrigator / Operator	<ul style="list-style-type: none"> ✓ Operation of gates, valve, pump etc. ✓ Implementation of irrigation rotation ✓ Reporting illegal use of water by farmers ✓ Checking excess loss of water into the drain from the each irrigation plot 	Using Forms 1-7	Everyday	IWUO
WUT leader	<ul style="list-style-type: none"> ✓ Cleaning of main canal and secondary canal among the team 	Using Forms 1-7	Once a week	ZC

	<ul style="list-style-type: none"> ✓ Water distribution among the turnout ✓ Checking excess loss of water into the drain from the each irrigation plot 			
Zonal Committee	<ul style="list-style-type: none"> ✓ Cleaning of main canal and secondary canal among the Zone ✓ Water distribution among the Zone ✓ Conflict resolution within the Zone ✓ Maintenance of irrigation facilities ✓ Implementation of irrigation rotation ✓ Reporting illegal use of water by farmers 	Using Forms 1-7	Once a week	SMC
SMC	<ul style="list-style-type: none"> ✓ Cleaning of main canal and secondary canal within the scheme ✓ Water distribution within the scheme ✓ Implementation of irrigation rotation ✓ Reporting illegal use of water by farmers ✓ Conflict resolution within the scheme ✓ Maintenance of irrigation facilities 	Using Forms 1-7	Once a week	IWUO
IWUO Executive committee	<ul style="list-style-type: none"> ✓ Discussion with Cooperatives on irrigation calendar, action plan etc. ✓ Held general assembly together with Cooperative (alternatively) ✓ Annual/Seasonal reporting of IWUO activities to DISC ✓ Signing of Performance Agreement ✓ Overall activities of IWUO (Manager, Operators, Zonal leader, WUT, SMC) 	Using Forms 1-7	Once a month	DISC
IWUO Audit committee	<ul style="list-style-type: none"> ✓ Conduct internal auditing of IWUO ✓ Prepare audit report annually 	Using Forms 1-7	Once every season	IWUO executive committee
IWUO Conf. Resolution committee	<ul style="list-style-type: none"> ✓ Resolve conflict among the beneficiaries ✓ Prepare annual report of the committee 	Using Forms 1-7	Once every season	IWUO executive committee

For detail explanation on participatory monitoring and evaluation, please refer to the “manual for the training of Participatory Monitoring and Evaluation (PM&E) of Irrigation Scheme”, Module-04.

9.2 Routine training

According to many studies in IMTA implementation, the common recommendation given are that IWUO and irrigation agencies need substantial and prolonged capacity development. Commonly, IMT programs provide training and other complementary activities to IWUOs only during their establishment, but many survey respondent say that all activities should be part of the long-term program that eventually evolves into a consultative, problem-solving process

On the other hand, as the leadership of IWUO often changes every three or six years, the newly elected leadership needs the training afresh. Therefore, for successful implementation and utilization of irrigation scheme in the country through IMT Agreement, routine training should be provided to IWUO by RAB or District staffs. This should be part of the IMIHIGO of the government staffs working in the field of irrigation.

7. Conclusion & Recommendation

As a summary, not all irrigation schemes developed will qualify to the establishment of IWUO. The size of the scheme, the availability of enough water and functional irrigation facilities and the number of member should be considered in the formation of IWUO.

Generally, marshland schemes are relatively easy to be managed provided cooperation from the cooperative side is available. Most hillside-irrigation schemes remain operational when support is provided by some kind of project. On the other hand, with a view of phase-out of a project, it is important to strengthen the capacity of IWUOs and Cooperatives, technically and financially, to ensure the sustainability of the scheme and full functionality of the irrigation facilities. The biggest challenge being poor water fee collection rate for which the active involvement and support of the local authority to the IWUO is very important for the sustainability of the scheme. The issue of landownership in the hillside also is affecting the control of cropping patterns for better management of irrigation water. Most landowner doesn't obey the directive set by IWUO or cooperatives claiming that "no one can dictate us to plant this or that crop on our own land," which indicates that still sensitization on the benefit of irri

Annex 3 (Sample of IMTA)

(Draft)

IRRIGATION MANAGEMENT TRANSFER AGREEMENT

(TRIPARTITE AGREEMENT)

BETWEEN

ABAHIZI BA RWAMAGANA (IWUO),

RWAMAGANA DISTRICT

&

MINAGRI (RAB)

FOR

THE OPERATION MANAGEMENT AND MAINTENANCE OF

CYARUHOGO IRRIGATION SCHEME

Date ... /.../2025

Cyaruho

Rwamagana, Rwanda

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1. Preamble

The existing Irrigation Water Users Organizations (IWUOs) in Rwanda are established based on the decree made by the Ministerial Order No. 001/11.306 of 23 November 2011 and the Law No. 04/20127 of 17 February 2012, which requires the IWUO to be register as a non-government organization by the Rwanda Governance Board (RGB).

Ministerial Order defines Irrigation Management Transfer Agreement (IMTA) as “the document by which the Ministry of Agriculture and Animal Resources (MINAGRI), representing the Government, transfers the responsibility for the operation management and maintenance of irrigation scheme to the IWUO and lists the obligations of both parties. The respective District also co-signs the Irrigation Management Transfer Agreement”, with no clear responsibilities to the District.

With the establishment of this decree, most of the IWUO in the country have registered and signed IMTA with MINAGRI. With the signing of IMTA, it was believed that the IWUO would take full responsibility of the operation management and maintenance of the irrigation schemes. However, due to lack of a workable procedure by the implementing agency, the Rwanda Agriculture and Animal Resources Development Board (RAB), most of the IWUO who signed the agreement are unable to implement IMTA as expected.

⁶ Ministerial Order establishing irrigation water users associations in irrigation schemes

⁷ Law governing the organization and the functioning of national non-governmental organizations

The Project for Water Management and Capacity Building in the Republic of Rwanda (WAMCAB) together with RAB has established a management model to capacitate the IWUO of an irrigation scheme before it graduates to be able to sign IMTA with the stakeholders so that it can take the full responsibility of the management of the irrigation scheme. The Project also established IMT procedure to be followed before signing of the agreement. According to the procedure, for a scheme to be graduated (sign IMT), it must fulfill at least the following criteria, such as:

- IWUO should have the legal personality from RGB (with water right, responsibility and authority of the scheme);
- Irrigation infrastructure, which is compatible with the water right and local management capacities. (All the irrigation facilities in the scheme should be intact and functional);
- IWUO should be fully capacitated in all aspect of the maintenance and management of the scheme
- The IWUO should have financial and human resource to manage the scheme (capacity to hire supporting staffs: operator, accountant, manager etc.)

To this effect, during the last three years, ABAHIZI BA RWAMAGANA, IWUO of Cyaruhogo Irrigation Scheme, has received the necessary training and capacity building needed to be able to graduate for taking the full responsibility of the operation and maintenance of the scheme. Accordingly, this IMT agreement is entered by and between the stakeholders of the irrigation scheme as stated below.

2. The Agreement

This Agreement is entered on the day of 2024, by and between the President of ABAHIZI BA RWAMAGANA IWUO, (hereinafter referred to as the First Party); the representative of Rwamagana District, (hereinafter referred to as the Second Party) and the representative of the Ministry of Agriculture and Animal Resource (MINAGRI) from Rwanda Agriculture and Animal Resource Development Board (RAB), (hereinafter referred to as the Third Party).

Whereas, the parties to this agreement are aware of the importance of the irrigation management transfer for operation management and maintenance of the irrigation scheme,

Whereas, the parties to this agreement are in full knowledge the need to separate the responsibility of each stakeholders in the irrigation management of the scheme,

Whereas, the parties to this agreement agree to combine their efforts in order to improve the management of the scheme by and for the community, through both improvements in water management, financial management, operation and maintenance of the facilities. Each of the parties also agree to fulfil its obligations and listed in Annex 1 and Annex 2, cooperate with

each other to ensure the smooth implementation of the operation, maintenance and management of the irrigation scheme.

Now, this agreement witnesses as follows:

Article 1: In this agreement, the following shall be deemed to form and be read and construed as part of this agreement:

Appendix 1: Definition of Terms

Appendix 2: Obligation of MINAGRI/RAB

Appendix 3: Obligation of Rwamagana District

Appendix 4: Obligation of ABAHIZI BA RWAMAGANA

Appendix 5: Legal Status of ABAHIZI BA RWAMAGANA

Appendix 6: Water Permits for Bugugu, Gashara and Cyimpima Dams

Appendix 7: OMM of ABAHIZI BA RWAMAGANA

Article 2: In this agreement, the First Party hereby covenants to fulfill its obligations as listed under Annex 2 and ensure the performance of both the Second and the Third Parties

Article 3: In this agreement, the Second Party, Rwamagana District has right to monitor the

performance and management of the developed scheme, in addition, it has rights to all activities in Cyaruhogo scheme.

Article 4: In case the government through the Third Party, MINAGRI (RAB), wants to take over the scheme due to public interest, it has all rights to terminate this agreement but will notify the IWUO and the District prior to two agricultural seasons.

Article 5: In case the First Party wants to extend the scheme or any other activity that may change its nature and/or infrastructure, it will request the Second Part by letter attached with technical design approved by professionals who recognized by Third Party, MINAGRI (RAB).

In witness whereof, the parties to this agreement thereto have caused this agreement to be executed on the date and the year first written before;

<u>Signatory</u>	<u>Description</u>	<u>Signature and Seal</u>
Representative of the First Party	<u>ABAHIZI BA</u> <u>RWAMAGANA IWUO</u>	
Name of signer	_____	
Affiliation (position)	_____	_____
Representative of the Second Party	<u>Rwamagana District</u>	
Name of signer	_____	
Affiliation (position)	_____	_____
Representative of the Third Party	<u>MINAGRI/RAB</u>	
Name of signer	_____	
Affiliation (position)	_____	_____

Appendices

Appendix 1: Definitions of Terms

Appendix 2: Obligations of ABAHIZI BA RWAMAGANA (IWUO)

Appendix 3: Obligations of the District

Appendix 4: Obligations of MINAGRI (RAB)

Appendix 5: Legal Status of ABAHIZI BA RWAMAGANA (IWUO)

Appendix 6: Water Permit for Bugugu, Gashara and Cyipmima Dams

Appendix 7: The Operation Maintenance and Management (OMM) Manual

Appendix 1: Definitions of Terms

In this agreement, the following terms are defined as follows:

- i. **Irrigation Management Transfer Agreement (IMTA):** the document by which the Ministry of Agriculture and Animal Resources, acting for the Government, transfers the responsibility for the operation and maintenance of irrigation scheme to the Irrigation Water Users Organization and lists the obligations of both parties. The respective District also co-signs the Irrigation Management Transfer Agreement;
- ii. **Irrigation Water Users Organization (IWUO):** shall refer to organization formed by all water users of a defined irrigation scheme governed by ministerial order No 001/11.30 of 23/11/2011 establishing Irrigation Water Users Association/Organization to developed schemes.
- iii. **ABAHIZI BA RWAMAGANA:** shall refer to an IWUO of Cyaruhogo Irrigation Scheme located in Rwamaga District, established in June 2020, registered and obtained its legal personality from RGB on Feb 2024.
- iv. **Cyaruhogo Irrigation Scheme:** shall refer to the irrigation scheme developed in Rwamagana District, Cyaruhogo marshland covering four sub-catchments namely Cyimpima, Gashara, Bugugu and Cyaruhogo with beneficiaries of four cooperatives such as CoCuRiCyi, CoCuRiGa, CoCuRIBu and CoCuRiCya, respectively.
- v. **Cooperative:** shall refer to a group of people who come together for a common purpose and are governed by law No 50/2007 of 18/09/2007 on cooperatives as amended and complemented to date,
- vi. **Irrigation Scheme:** It is a hydraulic network, whose principal use is irrigation and it consists of the head-works, conveyance and distribution systems that distribute water for field irrigation and terminates at the outlet of the command area in a drainage system
- vii. **Irrigation Infrastructures:** shall refer to dams, valve house, division weirs, primary and secondary canals, turnouts and any other facilities that help to convey water in to the field without creating any scouring to the existing natural ground. The infrastructures can be divided into major structures (such as Dam and its appurtenant , Valve house, Main canal, Diversion Weir) and minor structure (such as Secondary Canal, Tertiary canal, drops, chutes, drainage canal, canal crossings, aqueduct, culverts, etc.);
- viii. **Irrigation Map:** a digitized plot map whose list of landowners is updated periodically and the map shall show the layout of the irrigation system including the type and location of the main infrastructures.

- ix. **District Irrigation Steering Committee (DISC):** shall refer to a committee made up of different stakeholders at the District whose responsibility is the overall level in charge of monitoring of irrigation activities in developed scheme.
- x. **Water Service Fee:** the sum of money set by the IWUO and approved by the DISC. It is paid by all water users and it is composed of, operation management and maintenance of an irrigation scheme, reserve fund for major water infrastructure repairs and an irrigation trust fund for contributions to other Government irrigation programs;
- xi. **Performance Contract:** is an agreement with stipulated rights and responsibilities signed between the cooperatives and IWUO for achieving seasonally planned targets;

Appendix 2: Obligation of ABAHIZI BA RWAMAGANA (IWUO)

- i. Take the full responsibility of operating and maintaining of all irrigation infrastructures (Major and Minor).
- ii. Facilities such as secondary canal, tertiary canal drainage canals and other minor infrastructures in the scheme shall be owned by IWUO, hence fully responsible for its maintenance and management;
- iii. In collaboration with Cooperatives, mobilize community in routine maintenance of irrigation facilities such as all canals, drop structure, chute structure, weir etc.;
- iv. Write official letter to District, copied to RAB, on issues that needs the intervention of the Government;
- v. Signing seasonal performance agreement with all the cooperatives that are operating in the scheme, namely CoCuRiGa, CoCuRiCyi, CoCuRiBu and CoCuRiCya;
- vi. Preparation of annual action plan and budget to be approved by general assembly and presented to the DISC
- vii. Prepare financial statement and activity report to be presented during the general assembly to be held every season (twice a year);
- viii. Report to the DISC and provide a copy to RAB on annual basis on activities and financial statement of IWUO
- ix. Draw up a water distribution plan each season and adapt water distribution rules to emerging needs
- x. Establish and maintain reserve fund to cover emergency cases
- xi. Authorize RAB and District officials to have unlimited access to the scheme and the IWUO financial records
- xii. To engage its staff in training courses proposed by stakeholders, RAB and District
- xiii. Request for approval from RAB for major changes of the irrigation system
- xiv. Preparation and sign of performance agreement between IWUO and other water users who are not farmers but utilizing water from the scheme
- xv. Avoid any misconduct that can cause any disputes/ intrigues among water users and/ or cooperatives that operate in the scheme
- xvi. Prepare a book showing the water users list that should be updated on a regular basis
- xvii. Organize a technical meeting prior to the seasonal agriculture activities

Appendix 3: Obligations of the District

- i. Provide a technical and managerial support to the IWUO
- ii. Organize and hold seasonal DISC meetings and give direction to the improvement of IWUO activities
- iii. In collaboration with MINAGRI, build the capacity of elected leaders of IWUO and Cooperatives that operates in Cyaruhogo irrigation scheme, as the mandates of elected leaders ends every three years;
- iv. In collaboration with MINAGRI, withdraw responsibilities of IWUO under this agreement in case of failure of the IWUO to operate, maintain and manage the scheme, properly;
- v. In collaboration with MINAGRI, take the responsibility of maintaining the major irrigation structures such as the Dam, weirs, valve house and main canals when the damage is beyond the capacity of IWUO;
- vi. Monitor and evaluate the performance of IWUO ABAHIZI BA RWAMAGANA and formulate the recommendations
- vii. Coordinate activities between different stakeholders operating in developed scheme of Cyaruhogo
- viii. Monitor the operation of irrigation infrastructures, equipment and support IWUO in applying punishments to destroyers and vandalisms
- ix. Resolve amicably any differences/disputes between IWUO and cooperatives
- x. Provide support to IWUO to organize community work activities to protect irrigation scheme
- xi. Monitor water fees collection and its utilization in the irrigation scheme;
- xii. Approve expense order prepared by IWUO periodically (monthly or quarterly, as agreed) and monitor the utilization of budget according to the action plan;
- xiii. Organize and coordinate participatory monitoring and evaluation (PM&E) in the developed scheme of Cyaruhogo
- xiv. Determine and delineate the buffer zone of the scheme and reservoir and support IWUO to find trees for planting around buffers zone when needed
- xv. Fight against problems of erosion caused by hillside community activities
- xvi. Encourage local entities (villages, cells and sectors) to participate in the preparation of community works to fight against erosions from catchment areas around Cyaruhogo scheme
- xvii. Encourage local entities (villages, cells and sectors) to catch and hold all materials/objects (motor pumps, cars and/or cows) find in the scheme without approval by IWUO

Appendix 4: Obligations of MINAGRI (RAB)

- i. Help in preparing and modifying (when necessary) the Operation Maintenance and Management (OMM) manual of IWUO (Annex 5) for proper implementation of scheme management;
- ii. Transfer the responsibility of operation management and maintenance of irrigation facilities developed in Cyaruhogo irrigation scheme to ABAHIZI BA RWAMAGANA;
- iii. In collaboration with District, build the capacity of elected leaders of IWUO and Cooperatives that operates in Cyaruhogo irrigation scheme, as the mandates of elected leaders ends every three years;
- iv. Prepare and provide various trainings, study tours and advisory to the beneficiaries of Cyaruhogo Irrigation Scheme;
- v. Monitor and evaluate the performance and operationalization of the irrigation system, DISC and IWUO on regular basis;
- vi. In collaboration with District, withdraw responsibilities of IWUO under this agreement in case of failure of the IWUO to operate, maintain and manage the scheme, properly;
- vii. Support in updating internal rules and regulation on regular basis;
- viii. Prepare a mechanism of auditing the financial movement of IWUO on a regular basis;
- ix. In collaboration with District, take the responsibility of maintaining the major irrigation structures such as the Dam, weirs, valve house and main canals when the damage is beyond the capacity of IWUO;
- x. Conduct routine monitoring of the major irrigation infrastructures;
- xi. Support IWUO in the cleaning of water-hyacinth that grows in the reservoir which will block the ease flow of water into the intake, decrease the amount of freshwater that hider the growth of fish inside the reservoir;
- xii. Raise fund for protecting the catchment area of the reservoir so that the life span of the facilities increases by reducing the volume of sediment deposited in the dam.

Appendix 5: Legal Status of ABAHIZI BA RWAMAGANA

Appendix 6: Water Permit for Bugugu, Gashara and Cyipmima Dams

Appendix 7: The Operation Maintenance and Management (OMM) Manual

Please refer to the OMM Manual prepared separately



*Water Management and Capacity Building Project
(WAMCAB)*



Training Manual

for

Capacitating Irrigation Water Users Organization

February 2025

Prepared under WAMCAB in collaboration with RAB

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Abbreviation

DISC	District Irrigation Steering Committee
EIA	Environmental Impact Assessment
FC	Field Collaborator
GABH	Gabiro Agribusiness Hub
GFI	Government Fund for Irrigation Development
GoR	Government of Rwanda
GPS	Global Positioning System
HoReCo	Horticulture in Reality Corporation Ltd
IMHIGO	Performance Agreement (Kinyarwanda)
IMP	Irrigation Master Plan
IMTA	Irrigation Management Transfer Agreement
IU	Irrigation Unit
IWR	Irrigation Water Requirement
IWUO	Irrigation Water Users Organization
JICA	Japan International Cooperation Agency
KWAMP	Kirehe Community-based Watershed Management Project
LR	Legal Representative
LWH	Land Husbandry, Water Harvesting and Hillside Irrigation Project
MINAGRI	Ministry of Agriculture and Animal Resource
MO	Ministerial Order
NGO	Non-Governmental Organization
OJT	On the Job Training
OMM	Operation, Maintenance and Management
PM&E	Participatory Monitoring and Evaluation
PPP	Private Public Partnership
RAB	Rwanda Agricultural and Animal Resource Development Board
RCA	Rwanda Cooperative Agency
RGB	Rwanda Governance Board
FPG	Farmers Producing Group
RSSP	Rwanda Rural Sector Support Project
RWB	Rwanda Water Resource Board
SMC	Scheme Management Committee
SWD	Seasonal Water Distributor
ToR	Terms of Reference
VLR	Vice Legal Representative

WAMCAB	Water Management and Capacity Building Project
WUT	Water User Team
ZC	Zonal Committee

Executive Summary

The Project for Water Management and Capacity Building (WAMCAB) has been implemented from March 2019 to February 2025 through the support from the Japan International Cooperation Agency (JICA). The main objective of the project was capacitating the stakeholders related to the management of irrigation scheme, such as Irrigation Water Users Organization (IWUO), so that they could achieve the sustainable management of irrigation schemes in Rwanda. The implementation of the project was conducted in collaboration with the staffs of Rwanda Agriculture and Animal Resources Development Board (RAB).

In this project, different training modules, management model and IMTA manual were prepared that will be applied to capacitate the stakeholders related to sustainable management of irrigation scheme in Rwanda.

According to the Ministerial Order of Rwanda No. 001/11.30 of 23/11/2011, IWUO is expected to perform as a non-governmental organization in the management of the irrigation scheme it operates. The management capacity of the beneficiaries need to be improved in different aspect of IWUO management. This manual is prepared to improve the management capacity of the beneficiaries of irrigation scheme in Rwanda. The manual is organized into four chapter.

The first chapter covers the strengthening of IWUO. It covers issue related to understanding the role and responsibility of each member, the establishment of internal regulation, conflict resolution mechanism, leadership capacity, transparency and accountability, preparation of action plan and establishment of O&M manual to the scheme. The training has focused elected leaders (especially all the committees, support staffs (e.g. field collaborator) and leaders from the cooperative.

The second chapter target the training on financial management. It covers issue related to determination of water service fee, mobilization of fund, budget planning, preparation of accounting books, auditing system and other. The training should focus on elected leaders (especially audit committee and executive committee), supporting staffs (eg. Field collaborator) and leaders from the cooperative.

Chapter three focused on the training of participatory monitoring and evaluation (PM&E) of IWUO. It covers topic such as establishment of PM&E system, method of PM&E and implementation of PM&E.

The last chapter (chapter 4) explains the training on office management mainly focusing the filing system and its benefit for office management.

All the training manual are prepared under WAMCAB project in collaboration with RAB. The manuals are expected to be used in capacitating IWUO in the country and must be given to

the target trainees on routine basis as elected leaders are substituted every three years. The District and RAB should take the responsibility of the routine training

CHAPTER 1: STRENGTHENING OF THE IWUO

1.1 Objectives of the training

At the end of this session, participants are expected to understand roles and importance of IWUO and be able to strengthen IWUO and make a detailed Annual Work Plan and Budget (AWPB) and infrastructures Operation and Maintenance (O&M) plan through the support of District, Sector and own staffs (if any).

1.2 Target of the training

All level of IWUO (leaders and committee members), Cooperative including supporting staffs

1.3 Outputs

- Internal Rules and Regulations
- Organization Structure
- Annual Work Plan and Budget (AWPB)
- Infrastructures Operation and Maintenance (O&M) plan

1.4 Function and roles of IWUO

Basic Knowledge for the Facilitator

IWUO is defined as “**an organization that consists of group of farmers and/or water users, in a defined service area, who have common interest of utilizing water resource**”. IWUO members make joint efforts to participate in development, operation, maintenance and management of irrigation facilities for the benefit of all members.

The most important role of IWUO is to **ensure that water is supplied equally to all members operating in the irrigation scheme** . Therefore, the IWUO should be legally registered by the government to get water right as an independent unit for the guarantee of water utilization.

POINT

IWUO is,

An organization of water users who have common interest and water resource

The most important role of IWUO is,

To ensure equitable irrigation water supply to members and management of the scheme

The benefits of improved water supply for the increased farm income, and conflict resolution obtained through IWUO should offset the substantial time, materials, cash, and interpersonal transaction costs of being involved in the IWUO. This implies that **irrigated agriculture should be profitable enough to create a demand for water**, and IWUOs should have a demonstrable effect in improving farmers' control over water.

The key variables to be considered when forming IWUO are:

Group size/Scheme layout	Objectives	Leadership
Cohesiveness	Nature and motivation of members	Norms/ Rules and regulation
Individual interest	Cultural values	Individual roles

Some of the benefits from forming IWUO are listed below:

- IWUO may easily mention water related problems towards government through District or RAB office or extension units. Quick and well-targeted interventions can be expected to solve these problems.
- More efficient O&M of irrigation facilities can be secured.
- IWUO may stand stronger in negotiations with government and private sector that want to engage in irrigated farming (contract farming, lease farming, facility maintenance, etc.).
- Investments in the irrigation system can be optimized through discussion and coordination among members.
- IWUO can be a platform for conflict management between upstream and downstream farmers.
- Participation in watershed management (Erosion control, taking measures in the protection of streams or springs, etc.)

Training Session

Introductory Questions

“What kind of activity of O&M do you do in the scheme?”

“What kind of activity of O&M do you have to do in the scheme?”

Lecture

The facilitator explains why IWUO is necessary to implement the irrigation scheme and what kind of activity of O&M should be done by IWUO.

Practical

Theme [Roles of IWUO in the irrigation scheme]

Group discussion: the facilitator forms participant groups of 4-5 members and assign a topic from main components of IWUO's function to them. The groups discuss on the component assigned. Then the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Example)

Main components	Roles of IWUO
Maintenance of irrigation facilities	<ul style="list-style-type: none"> - Regular maintenance - Maintenance planning - Monitoring of irrigation facilities' condition - Request to the government for rehabilitation
O&M fund	<ul style="list-style-type: none"> - Contribution to O&M fund - Collection of Water service fee - Management of O&M fund - Pressure to the defaulters of Water service fee - Alternative source of fund for O&M
Water distribution	<ul style="list-style-type: none"> - Planning of water distribution - Operation of the irrigation facilities - Preparation of block rotation
Conflict management	<ul style="list-style-type: none"> - Intervention - Solution - Organize the meeting

Plenary discussion: each group presents the results of the discussion for the plenary discussion. Then, the facilitator summarizes the results.

1.5 Strengthening of IWUO management

1.5.1 Establishment or amendment of Rules and regulation (By-laws)

Basic Knowledge for the Facilitator

Following items are important knowledge of the rules and regulation to be established by the IWUO

Contents considered while formulating the rules and regulation include but not limited;

- Name of the IWUO
- Definition and interpretation of the IWUO
- Objectives
- Organization structure and roles
- Activities
- Membership
- Sources of funds
- Terms of the committees' members
- Meetings
- Operational regulation
- Conflict resolution mechanism
- Fines and sanctions
- Auditors
- Amendments

- | |
|--|
| <ul style="list-style-type: none">- Dissolutions- Record of amendments with authorization |
|--|

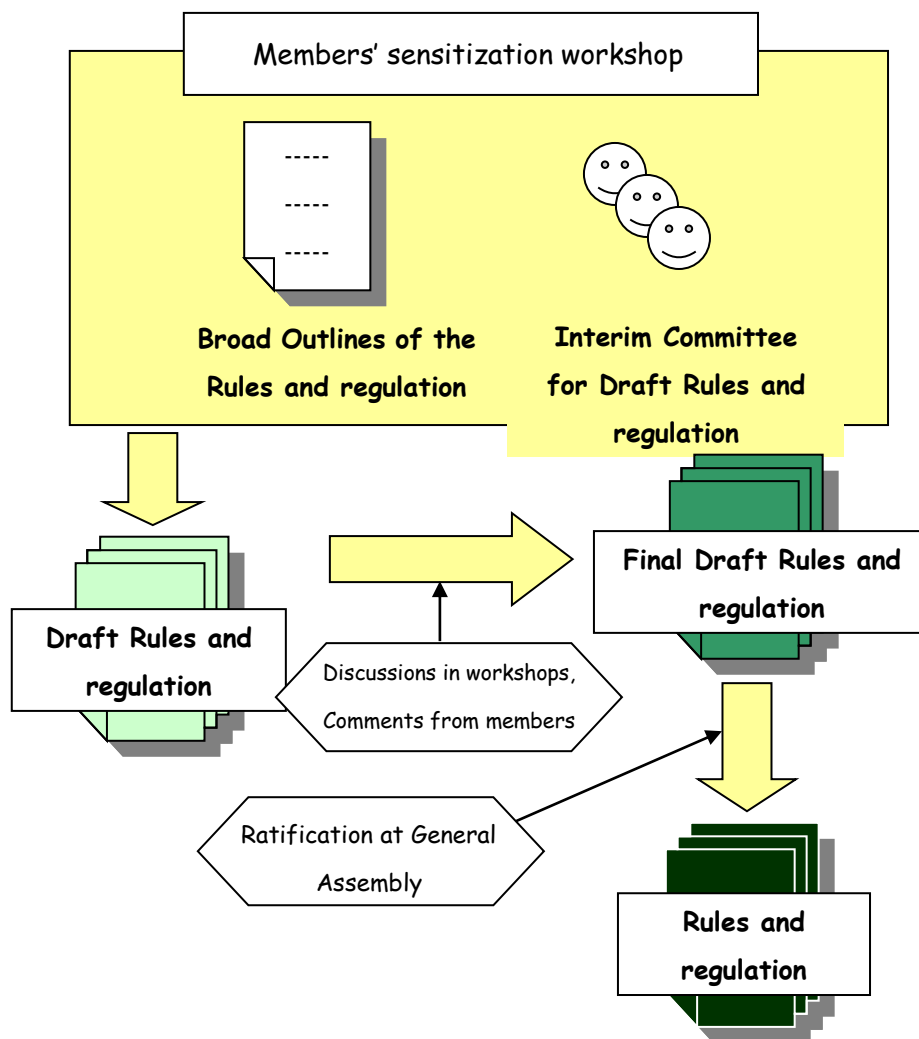
Note: The established Internal Regulation can be amended anytime as the capacity of IWUO improve.

Main features of Rules and regulation in O&M activities

- Farmers who utilize irrigation water from the scheme should be a member of IWUO.
- IWUO has the right to collect Water service fee from the members and the members have the duty to pay Water service fee to IWUO.
- The members have the duty to participate in the communal works on O&M which are planned by IWUO.
- IWUO has the right to apply internal rules and regulation (such as impose punishment) on the members who use irrigation water and facilities illegally and do not pay Water service fee and participate in the communal works of IWUO.
- The tenant farmers have an obligation to join IWUO and are in duty to pay Water service fee.
- Members of IWUO should follow common cropping calendar so that members shall share irrigation water as equally as possible.
- Make performance agreement with cooperative seasonally.

Procedure of Rules and regulation making or revision

- a) Members' sensitization workshop
- b) Determination of broad outline of content
- c) Formulation of the interim committee for a draft rules and regulation
- d) Draft rules and regulation
- e) Circulation of draft copies to members
- f) Deliberations on draft rules and regulation
- g) Incorporation of members' comments into the draft
- h) Deliberations on final draft
- i) Ratification of final draft (General assembly- by at least 2/3 of the members)
- j) Notarization



Training Session

Introductory Questions

“Do you have a rules and regulation in your irrigation scheme?”

“Do you think the rules and regulation is indispensable to IWUO?”

Lecture

The facilitator explains the basic concept of rules and regulation and its necessity. All the members of IWUO should know and understand to obey the rules and regulation with seriousness.

Practical

It is difficult to start making a rules and regulation from scratch for IWUO members therefore a sample rules and regulation in IWUO can be present as a reference. Also it may take substantial time to finalize because the rules and regulation is a basic law of the IWUO.

According to the procedure mentioned above the facilitator ask the IWUO committee to organize a sensitization workshop for all members to introduce a broad outline of content.

Then the interim committee for drafting rules and regulation shall be established to make or revise a draft rules and regulation.

After making the draft rules and regulation the committee shall distribute it to all members and organize a draft-workshop to get comments from the members to finalize the draft rules and regulation.

The IWUO committee shall organize a general meeting to approve the draft rules and regulation submitted by the interim committee.

A sample of rules and regulation is shown in **Annex-1**.

Action Plan

The interim committee shall prepare a proposal of the established or revised rules and regulation assisted by DISC and distribute to all members. Then the committee shall incorporate comments from them into the rules and regulation and submit it to the general meeting to finalize.

1.5.2 Preparation of IWUO members' list

Basic Knowledge for the Facilitator

IWUO members' list is a kind of inventory of the irrigation scheme. With the list, IWUO can easily know, for instance, who should take water from which facility, who belongs in which group/WUT, who should pay Water service fee and who should participate in O&M activities. Also IWUO can know area and location of members in the scheme with necessary information. So the list can be utilized for monitoring of O&M activities by IWUO management to maintain the irrigation facilities properly.

Like the national census, the list should be update regularly to get up-to-date information of IWUO members.

In case of our Model Sites, there is a need to prepare two types of lists such as the Water Users' List and IWUO Members' List depending on the layout and landowner distribution of the scheme (*This is because a farmer has land in different location where it gets water from different source*).

IWUO MANUAL shows the database preparation of the scheme.

IWUO

**Step 2: Database preparation,
Guidelines for IWUO Management Method**

Training Session

Introductory Questions

“Do you have IWUO Members’ list in your irrigation scheme?”

“Do you have Water Users’ List prepared per each water source in your irrigation scheme?”

“Do you think IWUO members’ list is useful in your irrigation scheme?”

Lecture

The facilitator draws the example of members’ list and water users list on a large size of paper then explains importance of the list of IWUO members with the necessary information such as name of the farmer, scheme, size of the area, group name, WUT name, Zonal name, Turnout number and plot ID (if available) when formulating IWUO. The members list (the master water user’s list) shall be organized into name of the member, size of the area, zonal name and Water service fee decided according to the regulation by IWUO.

Practical

At first, the purpose of the list should be discussed then items of the list should be discussed and decided by the participants referring to the example drawn. It is recommended that data useful for IWUO’s activities such as Water service fee collection and maintenance activities be collected. It is recommended to prepare the water users list

IWUOs with the large number of members shall be required to make the list all the more to unify the IWUO. Once the list was made IWUO can utilize it for O&M activities.

The following tables are an example of the IWUO members’ list and Water Users Team.

Example (IWUO Members List, *can be prepared by IWUO*):

Scheme Name	Zonal Name	Member Name	Area (acre)	Designation	Water service fee (RwF/season)
Bugugu	BLMC	Mr. A	1.2	WUT leader	2,400
Bugugu	BLMC	Mr. B	1.5	Member	3,000
Bugugu	BLMC	Ms. C	1.0	IWUO Chairperson	2,000
Bugugu	BLMC	Mr. D	2.0	IWUO secretary	4,000
Bugugu	BLMC	Mr. E	1.8	Member	3,600
	:	:	:	:	:
Gashara	GRMC	Mr. O	2.0	WUT leader	4,000
Gashara	GRMC	Ms. P	1.5	Member	3,000
Gashara	GRMC	Ms. Q	2.0	Member	4,000
Gashara	GRMC	Mr. R	1.2	Zonal Committee	2,400
Hillside	LUMC	Mr. S	2.3	Member	4,800
Other water use	NA	Mr. T	NA	member	5,000

Example (Water Users List, *must be prepared by expert*):

Scheme Name	Member Name	Area (acre)	Turnout ID	Plot ID	WUT Name	Zonal Name
Bugugu	Mr. A	1.2	BLT-1	BLT1_1	WUT _{BL} T _I	BLMC
Bugugu	Mr. B	1.5	BLT-1	BLT1_2		
Bugugu	Ms. C	1.0	BLT-1	BLT1_3		
Bugugu	Mr. D	2.0	BLT-2	BLT2_1		
Bugugu	Mr. E	1.8	BLT-2	BLT2_2		
	:	:				
Gashara	Mr. B	2.0	GRT-1	GRT1_1	WUT _{GL} T _I	GRMC
Gashara	Ms. F	1.5	GRT-1	GRT1_2		
Gashara	Ms. D	2.0	GRT-1	GRT1_3		
Gashara	Mr. G	1.2	GRT-1	GRT1_4		

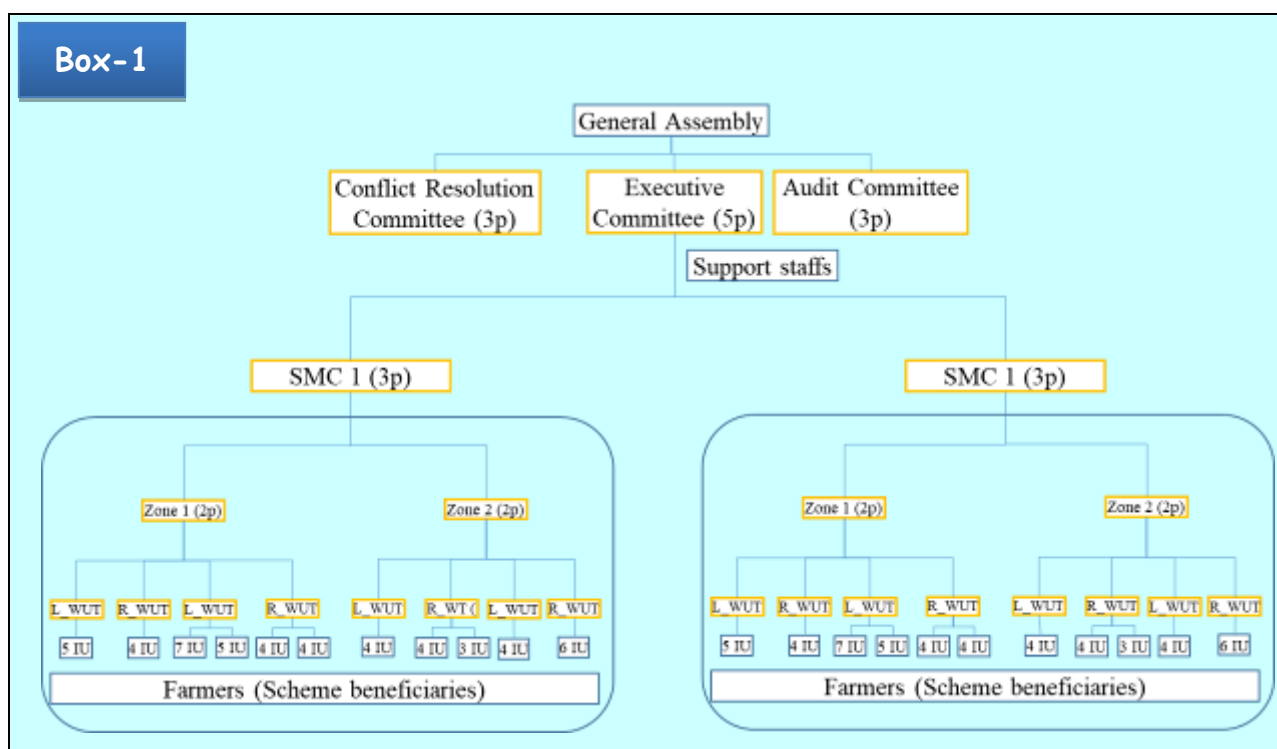
Action Plan

The IWUO committee shall prepare a list of the member to be approved in the general meeting.

1.5.3 Establishment of organization chart

Basic Knowledge for the Facilitator

The organization structure varies in the scheme to scheme depending on the locality. The typical organizational structure of IWUO is shown in **Box-1** below as an example (for two schemes).



Note: It is important to explain this point using the IWUO structure of the particular scheme

The number of members constituting the IWUO committee are estimated in the following

table as an example but it depends on the size of IWUO.

Example)

Executive committee	Number	Audit / Resolution committee	Number per each committee
Chairperson	1	Chairperson	1
Vice chairperson	1	Vice chairperson	1
Secretary	2	Secretary	1
Treasurer	1 or 2		
In Charge of Infrastructure			

The IWUO is managed and operated by them who are selected among the members, and has can hire supporting staffs (depending on the financial capability of IWUO). The payments of their allowances are decided by the general assembly. Terms of committees' members and groups should be stated in the rules and regulation.

Note: IWUO MANUAL shows the organizational structure.

IWUO

**Step 3: Organization of IWUO,
Guidelines for IWUO Management Method**

The governance of the IWUO is built up of four flagship organs and lower level leaderships namely:

- General assembly
- Executive committee
- Audit commission
- Dispute resolution committee
- Scheme management committee (SMC)
- Zonal Committee (ZC)
- Water Users Team (WUT)
- Seasonal Water Distributer (SWD) (IU level, responsible for one season only)
- Support Staffs

For roles and responsibility of each organ please refer to the internal regulation of the scheme prepared at Step 4 of Guidelines for IWUO Management Model

IWUO

**Step 4: Roles and responsibility
Guidelines for IWUO Management Model**

Training Session

Introductory Questions

“Do you have an organizational structure in the irrigation scheme?”

“Do you know the role of each leader at all level (SWD, WUT, ZC, SMC, IWUO)?”

Lecture

The facilitator draws the typical organizational structure on a large sheet of paper then explains the typical organizational structure and roles of each group with a drawing.

Practical

The facilitator asks the participants about some changes of the typical organizational structure showing the example.

Then the facilitator makes a table for all structures on a large sheet of paper to list up members and roles of each structure.

Example)

Structures	Members	Roles
General assembly	All members	<ul style="list-style-type: none">- Approval of the annual work plan and the annual budget- Approval of the annual report of IWUO in the previous year- Approval of new members
Executive Committee	<ul style="list-style-type: none">- Chairperson- Vice/Secretary- Treasurer- In charge of infra	<ul style="list-style-type: none">- Organize the IWUO management committee- Reporting of the annual work plan and budget during the general assembly
Conflict resolution Committee	<ul style="list-style-type: none">- Chairperson- Vice- Secretary	-
Audit committee	<ul style="list-style-type: none">- Chairperson- Vice chairperson- Secretary	-
SMC	<ul style="list-style-type: none">- Chairperson- Vice Chairperson- Secretary	-
ZC	<ul style="list-style-type: none">- Zonal leader	-
WUT	<ul style="list-style-type: none">- WUT leader	-
IU	<ul style="list-style-type: none">- SWD	-

The facilitator nominates participants to present the result to makes sure with all participants one by one.

Action Plan

The IWUO committee shall prepare a proposal of the organization chart for approval in the general assembly (*if they have different proposal or additional structure if any*).

1.5.4 Networking and collaboration with DISC and other stakeholders

Basic Knowledge for the Facilitator

District Irrigation Scheme Committee (DISC) was defined in Ministerial Order as necessary

organization for the irrigation scheme. The composition and roles of the DISC and other relevant organizations are described in IWUO MANUAL of the country.

The **RAB** provides technical assistance to DISC upon request from the District. The DISC shall create a networking system between the sector authority and the irrigation scheme to ensure smooth preparation and implementation of activities.

The **Support Staff (Field Collaborator: FC)** shall be set to deal with works under IWUO which includes the irrigation scheme development. The field collaborator is an interdisciplinary group to address cross cutting issues arising in the irrigation scheme development (gradually the FC will become support staff of IWUO, for detail on FC please refer to the proposed irrigation management manual attached to IMTA manual).

The private sector and development partners or Non-Governmental Organization (NGO) can be good partners for IWUO as external resources and training partner to strengthen IWUO. The FC (support staff) should work for establishment of the networking with these organizations. Example: in area where reservoir water is available the support staff can facilitate fish farming as an additional source of fund for O&M of the scheme.

Training Session

Introductory Questions

“What kind of networking do you have in the irrigation scheme?”

“What kind of partner do you want for the irrigation scheme?”

Lecture

The facilitator explains the DISC and other organization as partners of the networking and benefits of the networking.

Practical

Theme [Partners of IWUO for networking]

Group discussion: The facilitator forms participant groups of 4-5 members. The groups discuss and list up partners and benefits. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Example)

Partners	Benefits
DISC	<ul style="list-style-type: none">- Technical supports- Institutional supports- Conflict management- Monitoring and Evaluation- Auditing of the scheme
RAB	<ul style="list-style-type: none">- Technical supports- Institutional supports

Sector office	<ul style="list-style-type: none"> - Support in applying rules and regulation by those who fail to follow it - Conflict Management
Hotel/Restaurants	<ul style="list-style-type: none"> - Fish farming
Cooperatives	<ul style="list-style-type: none"> - Water fee arrangement - Mobilization of fund

Plenary discussion: Each group presents the results of the discussion. Then, the facilitator discusses with the participants to clarify current situation of the networks in the scheme and how to improve the networks and finally summarize the results.

1.5.5 Capacity development of Leadership

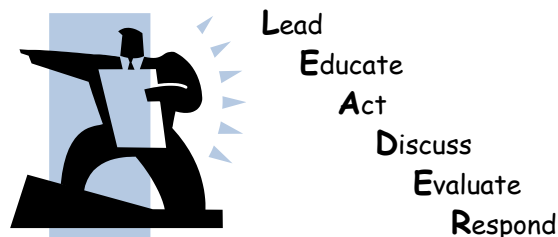
Basic Knowledge for the Facilitator

What is leadership?

Leadership is to lead the members by providing purpose, direction and motivation while operating to accomplish the objectives and improving the organization

Who is an IWUO leader?

A leader has ideas and ability of actions which guide the members to progress towards the common goals of the IWUO. it is said that meanings of letters of LEADER can be expressed as **L** means Lead, **E** means Educate, **A** means Act, **D** means Discuss, **E** means Evaluate and **R** means Respond. The leader must be a model of IWUO members.



Leader's role in IWUO members' motivation

Every Irrigation Scheme leader must be concerned with how to motivate his/her members. There are many approaches to do so depending on the nature of the organization. However, one or more of the following can be used:

Making members feel valued by:

- Regularly monitoring and evaluating their work fairly
- Sharing an interest in whatever they feel important
- Creating an atmosphere of mutual cooperation
- Providing scope for individuals to take greater responsibility
- Ensuring members to understand the importance of their contribution to the objectives, or
- Ensuring members understand the functions of the organization.

- PREPARATION STAGE -

Providing scope for development by:

- Setting goals and standards for all members
- Providing rules agreed by all members
- Providing effective trainings
- Encouraging members to train others in the specialist skills they may have, and
- Organizing group tasks to use peoples' skills to the maximum.

- IMPLEMENTATION STAGE -

Recognizing achievement by:

- Praising and communicating individual success
- Reporting regularly on the progress
- Regularly holding meetings to exchange opinions towards targets; and
- Explaining the organization's results and achievements

- MONITORING AND EVALUATION STAGE -

Training Session

Lecture

The facilitator explains expected leadership in the irrigation scheme referring to the “basic knowledge of the facilitator”. There are so many key issues for better leadership. Therefore, the facilitator summarizes them with his/her experiences.

Practical

Theme [What is good leadership?]

Group discussion: The facilitator forms participant groups of 4-5 members. The groups discuss and list up characteristic of good leadership in management of the irrigation scheme. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Example)

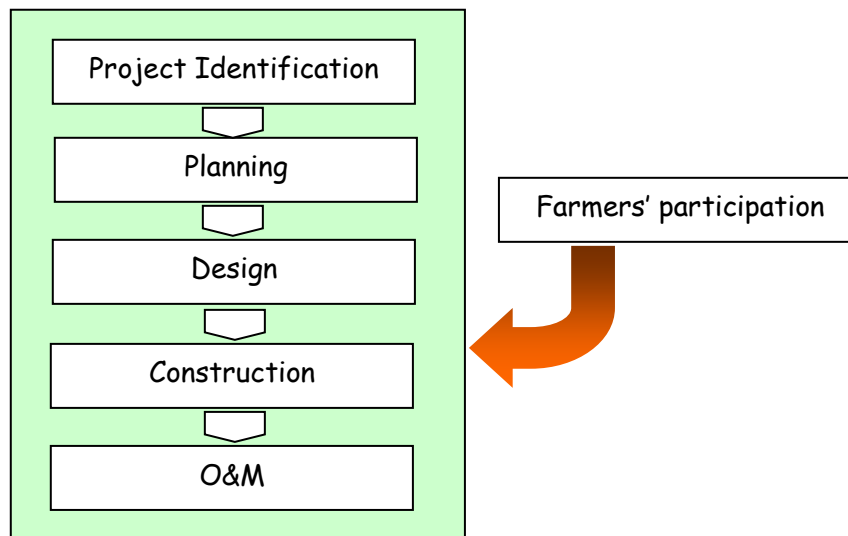
Characteristics of good leadership	Group A
<ul style="list-style-type: none">- To give a clear direction- Always motivating members to participate in IWUO activities- Negotiation skill is high.- Fairness	

Plenary discussion: Each group presents the results of the discussion for the plenary discussion. Then the facilitator summarizes the results.

1.5.6 Promotion of members' participation

Basic Knowledge for the Facilitator

Farmers' participation in irrigation scheme development is meant to ensure sustainability of the achievement. This participation should cover project identification, planning, design, construction and operation and maintenance.



Importance of farmers' participation

It is important to involve farmers in scheme development for the following reasons:

- To build capability and confidence
- To enhance self-propelled development
- To manage better and more sustainably
- To encourage networking
- To enhance social acceptability of a project, and hence ownership by the farmers

Effective farmers' participation

- For farmers' participation to be effective, it has to be in a structured manner.
- Farmers have to come together to be effective. "Coming together" means they create some form of institution through which to carry out their participation.
- The most common vehicle for farmers' participation is either an organization or association

Areas for farmers' participation

a) Project identification

- Farmers to identify irrigation or drainage development as a felt need
- Farmers make a request for assistance
- Carry out a needs assessment, objective analysis and prioritization of needs

b) Project preparation

- Feasibility studies
- Planning and designing
- Organizing farmers into IWUOs
- Conducting elections and formulation of rules and regulation
- Identifying the resources required and the potential sources
- Drawing a memorandum of understanding between farmers and stakeholders specifying commitments and responsibilities of all parties

c) Project appraisal

- Checking compatibility of project with the IWUO needs
- Strategy for sustaining farmers participation
- Sharing experience with stakeholders involved in similar projects to make improvements/changes
- Discuss and agree on all contentious issues

d) Project implementation

- Participation in administration of tendering process. (Interim committee or SISC). The involvement can be made in terms of being present and give idea during the tendering process in selecting the company. This is one of the important activity that creates ownership of the project by the beneficiaries.
- Translation of plans and designs into tangible components on the ground
- Honouring commitments on contributions as agreed in the MOU e.g. provision of finances, labour, land for structures, building materials etc.
- Monitoring progress of implementation according to programme of work

e) Operation and maintenance

- Preparation of operation plan, maintenance plan, financial plan, cropping calendar, water distribution plan, etc.
- Implementation of O&M activities with proper recording

f) Project evaluation

- Checking the achievements against the objectives set at the onset of the project
- Farmers, as project beneficiaries, should carry out internal evaluation

How to enhance farmers' participation

- Ensure a clear definition of roles and functions for all actors to avoid conflicts
- Carry out training for knowledge, attitude and skill building
- Ensure integration of local knowledge, experiences and technologies that are cost effective and easily understood by farmers.

Farmers' contribution in scheme development

As previously emphasized, farmers' participation in scheme development is an

all-encompassing process from project identification to O&M. The level of participation comes in various forms, nature and arrangement.

Training Session

Introductory Questions

“Do you think farmers’ participation in the management of irrigation scheme is important?”

Lecture

The facilitator explains importance of farmers’ participation in the irrigation scheme mainly areas for farmers’ participation.

Practical

Theme [What kind of O&M activity can you do?]

The facilitator asks the participants about the theme and draws a table below on a flip chart. Then, the facilitator leads them to summarize the results of the discussion.

Example)

O&M activities to be done by IWUO members
<ul style="list-style-type: none">- Properly operating turnouts or valves- Maintenance planning- Cropping calendar making- Maintenance of irrigation canals- Attain fair distribution of irrigation water among members at each unit- Avoid conflict through polite discussion or by reporting to their leaders- Abiding by the rules and regulation of the organization- Giving comment and suggestion in the improvement of the O&M of the scheme

1.5.7 Transparency and Accountability

Basic Knowledge for the Facilitator

Transparency

The IWUO is a democratic organization and the general assembly is located at the top of the IWUO in the structure. So every IWUO member has the right to vote and to know what is occurring in the irrigation scheme.

For example, the members have to ensure that money collected from the member as Water service fee have been spent for minor repair of the main canal damaged in the previous season

or for application process of the IWUO registration or water permit, etc.

Transparency may be even more important in financial accounting than in organizational politics. The IWUO committee collects fees which are generally supposed to be used in the scheme. But if the process is not transparent, most of members complain and may withdraw from the IWUO. On the contrary, if transparency is established with the IWUO committee, members can get a better understanding of how their money is being used. However, strict supervision and auditing of Water service fee collection and expenditures by an outside party is necessary to counter the possibility of money being diverted for unauthorized purposes. (Refer. Financial management training modules)

Accountability

Accountability is that responsibility for explanation of important issues such as how to revise the Water service fee and how to determine the annual work plan which should be known by all members. Officials of IWUO who are responsible for management should show records and reports as well for clear explanation.

Training Session

Introductory Questions

“Do you know who makes the annual work plan or the annual budget plan of the IWUO?”

Lecture

The facilitator explains importance of transparency and accountability of the IWUO and shows some consequences if the IWUO is not transparent and accountable.

Practical

Theme [Items to be Transparent and Accountable of the irrigation scheme]

The facilitator draws the table with the heading of “Items with Transparency and Accountability” on a large sheet of papers for discussion. The facilitator leads the participants to nominate the items.

Example)

Items with Transparency and Accountability
<ul style="list-style-type: none">- Water service fee (revenue) and expenditure- Annual work plan and budget- Budget allocation (if any)- Current membership

The facilitator summarises the results of the discussion and make a consensus of them with the participants. The way forward in transparency and accountability to the

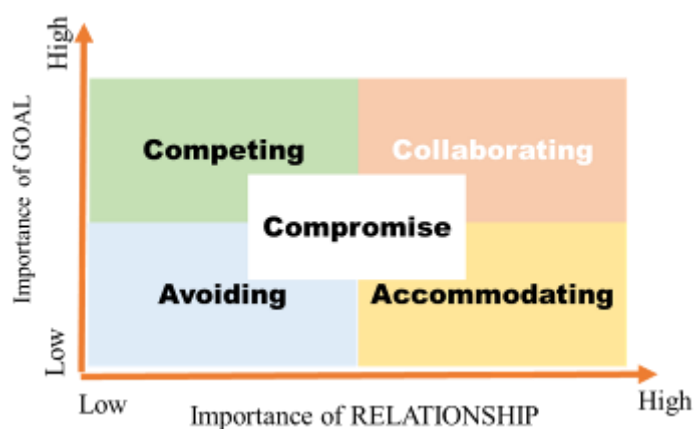
member shall also be proposed by the participant and summarized.

1.5.8 Conflict management

Basic Knowledge for the Facilitator

General (The five common strategies)

Different people use different methods to resolve conflict, depending on their personalities and preferences. The relationship between the importance of the goal to achieve and the importance of relationship is depicted in the figure below in relation to the five most common strategies applied to resolve conflicts.



i) *Avoiding*

This method involves simply ignoring that there may be a conflict. People tend to avoid conflict when they don't want to engage in it. Avoiding allows them to ignore that there is a problem. There are situations when avoiding conflict can be an appropriate response, such as when there is no clear solution or a frustrated party needs time to calm down before confrontation. However, avoidance can require more effort than merely facing the problem and can cause friction between the disagreeing parties. When conflict is avoided, nothing is resolved.

ii) *Competing*

Competing is an uncooperative, overly assertive method used by people who insist on winning the dispute at all costs. It's known as a win-lose strategy. This method is not often identified as bringing satisfactory resolutions, as it doesn't allow for collaborative problem-solving.

iii) *Accommodating*

This strategy, also known as smoothing, involves one party acquiescing, giving the opposing party exactly what it needs to resolve the problem. This method allows you to resolve a problem in the short-term while working toward a long-term solution. In some cases, accommodating can be an appropriate resolution to a conflict. For example, if your opinion on

the matter is not very strong, it is often easier to comply.

iv) Collaborating

Like the compromising method, collaboration involves working with the other party to find a mutually agreeable solution to a problem. It's known as a win-win strategy. For example, a salesperson and client may work together to negotiate contract terms until both parties find it agreeable.

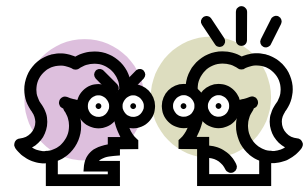
v) Compromising

This strategy, also known as reconciling, seeks a mutual agreement to settle a dispute. It's known as a lose-lose strategy since both parties willingly forfeit some of their needs in the interest of reaching an agreement. This can be a quick way to resolve a conflict without it becoming a bigger issue. Compromise can also be used as a temporary method to avoid conflict until the parties involved can implement a more permanent solution. It is appropriate to compromise when it would not be possible to make both sides completely happy while still moving forward.

Particular (minimizing Conflict)

Generally, to minimize conflicts relating to water distribution, the following rules are strictly observed:

- The members strictly follow the planned cropping calendar.
- The members strictly follow the schedules of water distribution.
- The SMC, ZC, WUT leaders regularly monitors the supply and demand of irrigation water.
- The SMC, ZC, WUT leaders takes immediate actions when inequity in water distribution is found.
- The SMC or conflict management committee organizes the meeting among the members concerned to resolve.



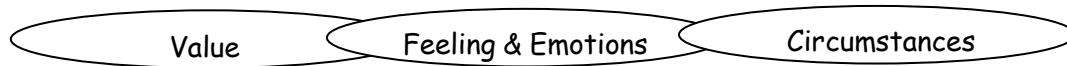
Conflict is defined as;

- Natural disagreement resulting from individuals or groups that differ in attitudes, beliefs, values or needs.
- A situation in which there are opposing ideas, opinions, feelings or wishes.

Conflicts arise when we ignore others' needs, our own needs or the other group's needs. Conflicts may create the need for a deeper analysis of facts to eliminate assumptions.

In conflicts, various management strategies are used and once decisions are made to resolve a conflict, the parties concerned should follow them. The member must be fully aware that he/she is a member of the IWUO.

Causes of conflict

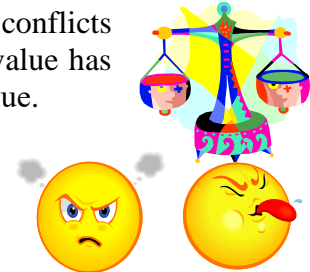


Values:

When values are incompatible or when values are not clear, conflicts often arise. Conflicts also arise when a party believes that its value has the sole righteousness and refuses to accept the other party's value.

Feeling & emotions:

Many people are controlled by emotions and feelings. This often brings anger, hatred and greed.



Circumstances:

Gap in education, wealth and other conditions as well as general awareness create conflicts no matter what they know or not know.

Source of conflicts inside IWUO

- Lack of leadership to maintain discipline and fairness.
- Lack of adequate communication. This is the biggest source of conflict.
- Insufficient or excessive laws. Laws without prescribing punishment are unenforceable.
- Insufficient irrigation water
- Improper irrigation facilities and O&M

Managing conflict

The first step is to go directly to the person who has offended others, then tell him/her clearly what he/she has done and how that has affected them.

The approach should be:

- Stick to the issues, don't get personal.
- Never assume that a person's motive was to hurt you deliberately.
- Opportunity to confront someone over wrong doing can be an opportune moment of reflection about our own failures.
- Explain the problem simply and why it is an important issue to you.
- Suggest a solution and action steps for resolving the issue. Like "let's get on the solution side".
- Forgive the one who has hurt you.
- Bring an arbitrator to make final decision legally if necessary.

Training Session

Introductory Questions

“Have you experienced any conflicts in the scheme and solved them, how?”

Lecture

The facilitator explains cause and management of conflicts in the irrigation scheme. It would be more realistic if the facilitator raises actual conflicts based on his/her experience.

Practical

The role play is introduced to discuss the resolution of conflicts in the irrigation scheme. The following role play is an example to simulate the actual situation possibly occurring in the scheme. (Assign people to represent each action below)

Cast:

WUT leader or ZC or SMC

Farmer-1: He/she takes much more irrigation water than allocated in the block and disturbs the neighbouring farmers. But he/she always pays Water service fee on time and fully participates in O&M activities.

Farmer-2: He/she is a neighbouring farmer of Farmer-1. He/she sometime failed to pay Water service fee and does not participate in O&M activities regularly.

Situation:

Farmer-2 came to the WUT leader or ZC or SMC to complain that Farmer-1 takes a lot of water from the common canal with Farmer-2 without following the water distribution plan.

The role play starts at this stage. Other participants watch action taken by three persons and express their opinion at the end of the role play. The facilitator organizes a plenary discussion to exchange opinions and make comments on it.

Prospective conclusion:

Lessons learned from this role play are a) listening to the all parties concerned, b) reminding right and responsibility of the IWUO member, c) strict implementation of the plan, d) common benefits among the members in the irrigation scheme etc. to resolve this conflict.

Evidences like the rules and regulation and the water distribution plan should be presented to them to be sitting on the same table.

REPEAT this act by creating another issue that result in conflict between different members from the trainee

1.5.9 Preparation of Action Plan for implementation

Basic Knowledge for the Facilitator

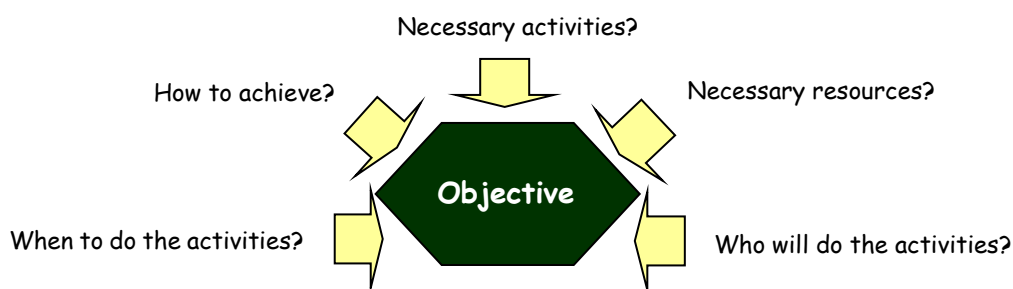
In order to implement the project effectively and efficiently, the **Action Plan** is commonly utilized as a useful tool.

The action plan indicates objectives, activities, necessary resources, responsible person, timeframe, and expected results. Also the action plan includes the monitoring and evaluation to check the progress of the implementation.

The action plan should be realistic for implementation. In many cases, farmers are apt to make unrealistic action plans where optimistic hope of external intervention is given.

Action planning helps to answer the following questions:

- What is our objectives?
- How will we achieve our objectives as a whole?
- What activities should we carry out to achieve our objectives?
- What resources do we require to carry out the activities?
- Who will carry out each activity?
- When will we carry out each activity?



Main components of the action plan are as follows:

[Objectives]

The objective is the project purpose and states what is expected to be achieved by the time the activity was completed.

[Activities]

These are the specific actions to be done intended to produce the outputs through effective use of the inputs.

[Necessary resources]

These include the personnel, facilities, equipment and necessary funding for pursuing the activities.

[Responsible Person]

The plan designates the specific person who is responsible for the activities to

make sure that the expected outputs are attained with judicious use of inputs.

[Timeframe]

The specific period covered by the plan to attain the objectives. This includes the duration to accomplish the different activities included in the plan.

[Expected results]

This is a kind of concrete achievements after implementation of activities like the water distribution plan and the maintenance plan.

Procedures in making an action plan

- a) Make a list of all activities that need to be done to achieve each of the set objectives.
- b) Arrange the activities in a chronological (time) sequence.
- c) Identify when each activity will start and estimate how long each will take to be fully implemented.
- d) Identify the resources that are required for each activity. (Materials, finances, labour)
- e) Identify personnel who will do each activity as responsible persons.
- f) List up the expected results obtained after implementation of activities.

Reviewing the action plan helps to answer the following questions

- What was achieved or not achieved?
- What are the lessons learnt?
- How will be corrective measures to be undertaken?

Note:

For example, the O&M training manual asks participants to make action plans in order that implementation shall be secured. Preparation of internal regulation also need action plan

Training Session

Introductory Questions

“Do you have an experience of the action plan making?”

Lecture

The facilitator explains importance of the action plan and the procedure of the action plan making step by step showing an example in session of Practice below.

Practical

Group discussion: The facilitator forms three participant groups of 4-5 members and assigns the following tasks to each group. The groups discuss and make an action plan for each task. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Task 1: To improve water distribution







Task 2: To establish the rules and regulation of IWUO

Task 3: To establish the basic operation and maintenance plan

Plenary discussion: The groups present their results to other groups for discussion. The facilitator summarizes the presentations by checking the following points.

- 1) Are responsible persons the IWUO members?
- 2) Can the activities achieve the objectives?
- 3) Is the timeframe feasible?
- 4) Is the action plan realistic?

An example of tasks for improvement of water management is shown below.

Example						
Problem: Uneven distribution of irrigation water by lack of proper water distribution plan and insufficient water resource						
Objective: Improvement of water distribution						
Action Plan:						
Activities	Necessary resources	Responsible persons	Timeframe			Expected results
			Nov	Dec	Jan	
Making irrigation unit	Irrigation layout (rough) Credit for communication Stationeries	WUT leader. Zonal Committee				Water user list of WUT or IU
Determination of water distribution method	Irrigation layout (rough) Stationeries	SMC, FC (O&M Team)				Method determined
Training for WUT leaders	Detail Map of WUT Stationeries	SMC, FC (O&M Team)				Understanding on water management
Training for water users	Irrigation SMS Stationeries	WUT, ZC, FC				Understanding on water management
Making water distribution plan	Irrigation SMS Stationeries	SMC, FC (O&M Team)				Water distribution plan
Implementation	Water	WUT, ZC,				

of the plan	distribution plan	FC				
Monitoring & evaluation	Monitoring record note	Executive Committee, DISC				Monitoring record

The Executive committee, the Audit committee, the financial conflict resolution committee, the scheme management committee, zonal committee, WUT leaders shall make action plans respectively during the on the job training.

1.6 Establishment of O&M manual

Basic Knowledge for the Facilitator

It is needless to say that the IWUO is a main body on O&M in the irrigation scheme for sustainability. In IWUO MANUAL, it is recommended that O&M manual be established by the IWUO members in consultation with the DISC. The IWUO members will be able to internalize the activities on O&M as well as their duty for them through the manual. Therefore, the manual should be agreed among the members.

The O&M manual instructs how to operate and maintain the irrigation scheme. Basically the members can do O&M activities if they follow the manual properly. Also the O&M manual should be written in Kingnarwanda to be understood and utilized by the IWUO members and as simple as possible.

A sample Operation, Maintenance and Management Manual is attached in **Annex-2**. The manual must vary from scheme to scheme to meet the particular conditions of the irrigation scheme.

Training Session

Introductory Questions

“Do you think that O&M activities would be easier for you, if you have an O&M manual?”

Lecture

The facilitator prepares copies of the contents of the O&M manual (**Annex-2**) and explains the importance of the O&M manual and meaning of each item. Also the facilitator explains how to use the manual in the scheme.

Practical

Based on **Annex-2** and lecture by the facilitator, the contents shall be reviewed and rearranged or originally made as a new O&M manual. Some parts of the O&M manual need technical support from DISC members e.g. irrigation schedule and method of maintenance.

The process of making O&M manual is as follows.

- 1) Determine the chapters suitable to the scheme.
- 2) Breakdown each chapter for useful manual.
- 3) Draft the manual with photos and figures for easily understanding.

Action Plan

The facilitator instructs the O&M team (SMC, ZC, WUT) to assigns the members to deal with each chapter of the manual. The facilitator assists the members giving useful suggestions.

The O&M team shall prepare a draft of the O&M manual assisted by DISC and submit to the IWUO committee for approval at the general meeting.

DISC members assist to print out the O&M manual so that all members can see and discuss during the general meeting. Photos are very effective for use of the manual.

1.7 Characteristics of successful IWUO

Basic Knowledge for the Facilitator

There are a number of organizational characteristics that provide a better chance for the success of a farmers' group. The list below gives the ideal situation. Experience of other organizational structures suggests that the more of these characteristics present, the more successful and sustainable the group is likely to be:

Characteristics of Successful IWUO

- A sustainable and measurable water right possessed
- Clearly defined and listed membership to the organization
- An agreed and measurable definition of its irrigation services and benefits to each member
- An ability to charge fees based upon actual service delivery and strict accounting practices
- Power to impose strong incentives and sanctions to ensure the solidarity
- Accountability of members to the agreed rules and policies
- Accountability of group leaders to the members of the group
- Accountability of any management staff to the group leaders
- Full control over the irrigation infrastructure, its operation and maintenance
- A balance of full responsibility and authority for all its key functions and members
- Clear policies, rules and regulations and adequate authority to enforce the regulations
- Transparent administration, operations and management
- Financial and technical audits performance by the government or other independent bodies
- Clear vision and objectives agreed by all members

Training Session

Introductory Questions

“What do you think about secrets of successful IWUOs?”

Lecture

The facilitator explains key factors for the successful IWUO in the “basic knowledge for the facilitator” above as well as from his/her experiences.

Practical

Theme [What is the definition of successful IWUO in the irrigation scheme?

The facilitator draws the table with the heading of “Definition of Successful IWUO” on a large sheet of papers for discussion. The facilitator leads the participants to nominate the items and summarises the results of the discussion and make a consensus of them with the participants. Then the facilitator asks the participants to compare their IWUO with the successful IWUO they described.

Example)

Definition of Successful IWUO
<ul style="list-style-type: none">- Irrigation facilities well maintained- Attain equitable water distribution to all members (zero water related conflict reported)- IWUO members always attend the meetings- Collection rate of Water service fee is more than 80%.- The general assembly is held at least once a year.- Proper auditing is conducted by audit committee and DISC regularly

CHAPTER 2: FINANCIAL MANAGEMENT

2.1 Objectives

At the end of this session the participants are expected to understand importance of the financial management and be able to prepare necessary financial materials.

2.2 Target group of the training

Finance sub-committee or IWUO committee

2.3 Expected Outputs

- Budget plan
- Water service fee account book

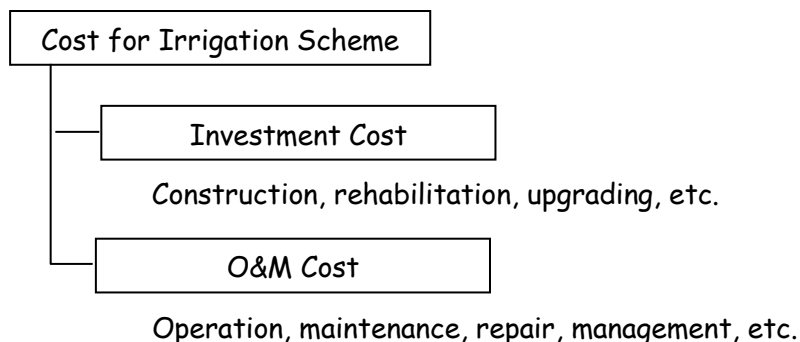
2.4 Topics of Training

2.4.1 Outline of financial management

2.4.1.1 Role and function of financial management

Basic Knowledge for the Facilitator

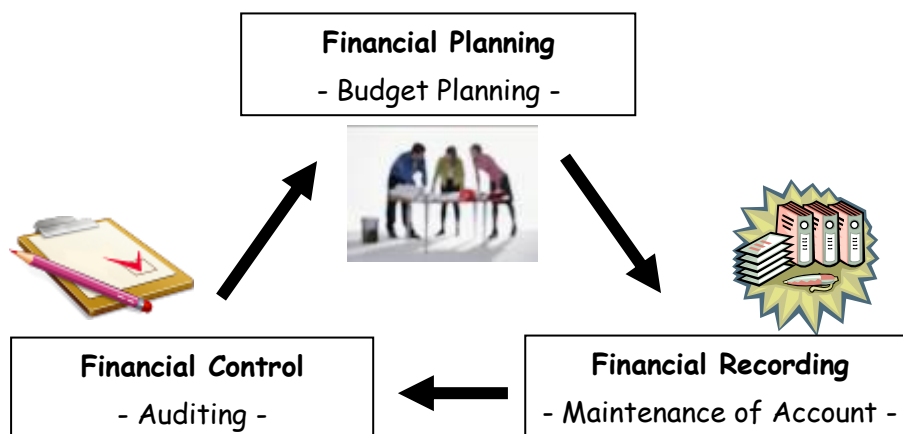
The irrigation scheme requires two main types of costs such as Investment costs and O&M costs.



Investment costs are expenditures for the construction, rehabilitation and upgrading of function of irrigation facilities as well as the salaries and wages of those involved in the design and construction with operation costs of all machineries used.

While O&M costs are expenditures for operating, maintaining and managing the scheme. These costs incur year after year, for as long as the scheme is kept in operation therefore they are also called recurrent costs. An important principle is that **O&M costs should be paid by the IWUO members.**

The financial management by IWUO consists of following three components:



For Financial planning, the IWUO shall:

- Identify and carry out assessment of sources of income – Water service fee collected from the members is a main source of income.
- Prepare estimates for expenditure over a specified period – usually, one or two seasons in a year.
- Agree on financial regulation.
- Develop a financial budget for the year (or season) to balance income and expenditure.

For Financial recording, the IWUO shall:

- Issue and record an official receipt for every income.
- Obtain and record a cash receipt for any expenditure.
- Maintain a Bankbook and a Cashbook properly.
- Classify all accounts properly.
- Produce financial statements on a regular basis.

For Financial controlling, it is recommended that the IWUO should:

- Procure a reputable agency or ask the governmental auditing office to do auditing (As per IWUO ministerial Order, the following agency are competent to the external auditing: RAB, RGB and District)..

Training Session

Introductory Questions

“What kind of financial management do you know?”

Lecture

The facilitator explains the roles and functions of financial management and emphasizes that users should cover full costs for operation and maintenance of the scheme.

2.4.1.2 Importance of financial management

Basic Knowledge for the Facilitator

Financial management is important for the following reasons:

- Financial resources are limited, and how best to utilize the limited resources can be decided through financial planning.
- In the proper financial management, IWUO can watch which are causing loss in the irrigation scheme. For example, a revenue and expenditure balance sheet shows facts causing mismanagement of the irrigation scheme.
- The proper financial management also can facilitate transparency and accountability to IWUO members and other relevant stakeholders in order to encourage their participation in O&M activities and the scheme implementation.

Training Session

Introductory Questions

“Do you implement financial management in your scheme?”

“Do you think the financial management is important for your scheme and why?”

Lecture

The facilitator explains importance of the financial management.

Practical

Theme [Components and advantages of the financial management in the irrigation scheme]

Group discussion: the facilitator forms participant groups of 4-5 members and presents the components of the financial management to discuss the theme. Each group discuss given components and its advantages of financial management. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Example)

Components of financial management	Advantages
Collection of Water service fee	- Source of proper O&M activities - Encouraging members' responsibilities
Annual budget planning	- Proper scheme implementation - Agreement among all members

Plenary discussion: each group presents the results of the discussion for the plenary discussion. Then, the facilitator summarizes the results.

2.4.2 Establishment of the O&M fund

2.4.2.1 Assessment of required amount for O&M activities

Basic Knowledge for the Facilitator

O&M costs can be mainly categorized into three items:

- Maintenance and repair
- Labour
- Energy



Usually canal cleaning in Rwanda is conducted through community work, but this activity is not enough to establish good maintenance and repair system of the scheme.

O&M costs are incurred regularly during the life of irrigation facilities. So more realistic and appropriate timing should be set so that the costs can be assessed, usually on seasonal or yearly basis.

The O&M costs are difficult to estimate and vary depending on the type of irrigation facilities. (Mostly, O&M cost is estimated as 1.5% of the total construction cost.)

Mostly the maintenance and repair costs should be burdened by IWUO members who are water users in the scheme. Some works need skilled labour with wages. Enumeration of the activities should be prepared to estimate the costs roughly at the initial then adjusted to meet actual costs later on.

Also labour cost for the operator (pump operator, valve operator and other labour cost) should be secured even though IWUO members are employed as operator.

Energy cost is sometimes very crucial to operate the irrigation scheme. Without fuel and electricity, the scheme cannot be operated in case of the pump irrigation method.

Training Session

Introductory Questions

“What is the largest cost item for O&M in your scheme?”

Cost of repair (earth canal, concrete structure, gates, cleaning, etc.)

Labour cost (valve operator, pump operator, pipe repair, etc.)

Energy cost (Fuel, electricity, other)

Lecture

The facilitator explains the main items of O&M costs and emphasize on responsibility of IWUO to cover the costs for sustainability of the scheme.

Example

- Cost of repair (earth canal, concrete structure, gates, cleaning, etc.)
- Labour cost (vale operator, pump operator, pipe repair, etc.)
- Energy cost (Fuel, electricity bill, depreciation of solar cell, etc.)

2.4.2.2 Determination of Water service fee

Basic Knowledge for the Facilitator

How to determine the Water service fee is a fundamental issue. There are several ways of the determination and the Water service fee collection should be feasible and understandable for the fee payers i.e. IWUO members. Consensus among them should be prioritized.

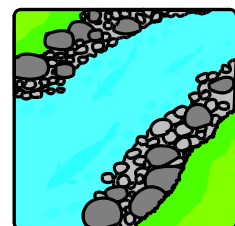
Following are typical methods of Water service fee determination.

- a) **Area-basis:** Water service fee charges on the size of irrigated farm. The bigger the farm is, the more the farmer pay for O&M activities. Also the charge depends on crop type. High water consumption crop such as rice and sugar cane is applied comparatively high fee. It is easy to determine the fee by standardizing the unit price multiplied by the size.



Other products such as vegetables are advantageous crops where there is irrigation scheme, because one can produce more than three times a year using irrigation water. Hence in determoining water fee the amount can be considered the same both for paddy field and upland crops (hillside).

- b) **Volume-basis:** Water service fee charges on the volume of irrigation water used by the farmer. The advantage of this method is that it encourages farmers to use irrigation water efficiently. On the other hand, in case of the open canal system, it is not easy to determine the fee because measurement of water volume by measuring devices, which is like a water gauge, should be installed at all irrigated farms.



- c) **Production-basis:** Water service fee charges on the production level of the irrigated farm. This is an indirect method of estimating the volume of irrigation water because the higher production attributes to sufficient water use in the



scheme. Collecting information of produce is essential in this method otherwise it is not easy to determine Water service fee.

Training Session

Introductory Questions

“What is your O&M collection method?”

“Do you have problems on the collection and what?”

Practical

The financial sub-committee or the IWUO committee discuss the method of Water service fee determination. The most suitable method determined by the committee shall be sent to the general assembly for approval.

In the general assembly, the IWUO members should discuss and make a final decision on the method in accordance with detailed explanation by the financial sub-committee or the IWUO committee.

Example:

- Marshland farmer: Cooperative will deduct water fee and deposit in IWUO account
- Hillside farmer: where there is cooperative in hillside the same can be applied, however Water User Team/Zonal Committee/Scheme Management Committee must create a system of fee collection with the help of local leaders
- Other water users (car wash, brick maker, etc.): Leaders of other water users shall be responsible in collecting water fee.

2.4.2.3 Mobilization of O&M fund

Basic Knowledge for the Facilitator

In order for a scheme to successfully implement its functions, every IWUO needs to access some finances or income as O&M fund.

As already mentioned, O&M fund should be covered by IWUO members in principle. However, in some cases IWUO members cannot afford to burden all the cost of O&M activities depending on magnitude of damages of the facilities.

The district irrigation scheme is not a one-man show by IWUO. Collaboration among stakeholders is highly required. District as well as RAB has a multi-disciplinary composition of the staff to enable IWUO to address O&M fund shortfall. A business plan is a one of the strategy to mobilize external funds.

Training Session

Introductory Questions

“What funds may support your O&M costs?”

“Have you accessed external funds so far?”

Lecture

The facilitator explains the mobilization of O&M funds which possibly can assist the IWUO based on his/her experiences.

Practical

Theme [Fund sources and methods of mobilization in the irrigation scheme]

Group discussion: the facilitator prepares a flip chart and makes a table below, then asks the participants about fund sources.

Example)

Fund sources	Methods of mobilization
Water service fee	<ul style="list-style-type: none">- Water service fee collection by the Cooperative or block leaders (WUT/ZC/SMC)- Sending of a bill of Water service fee to members before the season- Claiming of payment during the general meeting- Penalty to be applied for defaulters
Membership fee of IWUO	<ul style="list-style-type: none">- Collection from all the water users of the scheme
Fishery	<ul style="list-style-type: none">- Where there is reservoir fish farming shall be another source of fund for IWUO
Other source	<ul style="list-style-type: none">- Interest from bank and other

After listing up items of the fund sources, the facilitator forms participant groups of 4-5 members to discuss mobilization methods of selected fund sources by the group. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

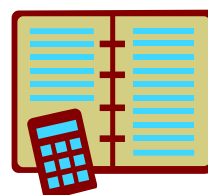
Plenary discussion: each group presents the results of the discussion. Then, the facilitator summarizes the results. The facilitator makes comments on each method based on his/her knowledge and experience whether it is feasible or not.

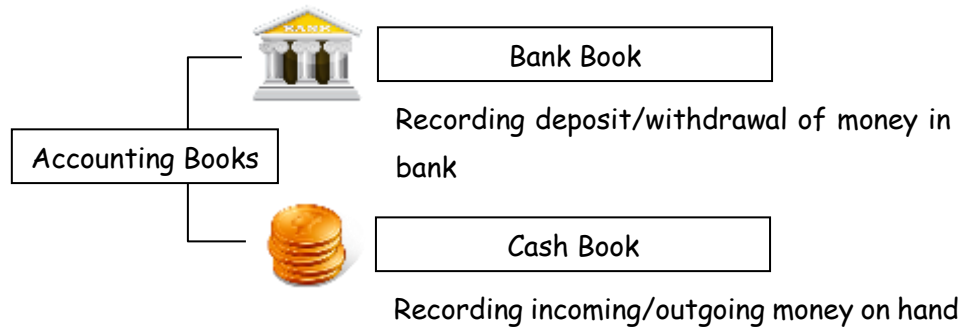
2.4.2.4 Preparation of accounting books (revenue and expenditure)

Basic Knowledge for the Facilitator

The sustainable management of the irrigation scheme requires fair and proper accounting of funds. Accounting books can assist to show proper accounting to IWUO members and other relevant stakeholders.

The accounting book consists of two volumes, i.e. Bankbook and Cashbook.





The Bankbook shows the money flow of bank account, which reflects actual deposit and withdrawal of money in the bank account. While the Cash book reflects incoming and outgoing of money on hand in the IWUO's office.

These two accounting books are closely linked each other in line with money flow generated by IWUO's activities. The money withdrawn from the bank account shall be recorded in the Bankbook as withdrawal then recorded in the Cashbook as the deposit of the same amount. The money collected from members or other sources shall be recorded as deposit in the Cashbook or in the Bankbook in accordance with the mode of payment (cash or funds transfer).

Bank statement should be checked to adjust the balance of the bankbook because banks claim the account fee and deposit interests.

All the incoming and outgoing money should be properly recorded by the accountant and checked by the IWUO committee. These data shall be utilized for the financial report during the general assembly. The following tables show examples of Bank book and Cash book.

Bank book

M	D	description	Evid. No.	Paid	Received	Balance	Signature	
							Acc.	Chair.

Cash book

M	D	description	Evid. No.	Paid	Received	Balance	Signature	
							Acc.	Chair.

Training Session

Introductory Questions

“Have you ever checked incoming and outgoing of money in IWUO’s office?”

“How do you check incoming and outgoing of money in IWUO’s office?”

Lecture

The facilitator explains necessity of accounting books for the financial management of IWUO.

Exercise

See “Annex: Exercise on record of Bank book and Cash book”.

Action Plan

The treasurers (finance sub-committee) shall prepare a Bank book and a Cash book and submit to the IWUO committee for approval in the general meeting.

2.4.2.5 Budget planning

Basic knowledge for the facilitator

The financial sub-committee has a responsibility for management of the IWUO’s budget such as Water service fee collection, payment of O&M, labour, etc.

Budget planning is a quantified process of monetary flows to estimate the cost of inputs in accordance with outputs and revenues.

Budget planning should be done before the funds are utilized, in other words, at the beginning of the IWUO’s financial year/season. It is recommended that the budget plan be prepared on the seasonal bases.

In order to make a budget plan, cropping, operation and maintenance plans should be formulated to estimate income and expenses. Also the IWUO should carefully consider the expected demand for its services and the resources required to meet the demand.

Advantages through creating the budget plan are;

- to enable IWUO members to know what is going on.
- to enable IWUO members to control scheme resources.
- to provide IWUO with a communication tool, especially as far as prioritization is concerned.
- to enable IWUO members to prepare expenditure at all times.
- to enable IWUO members to save and avoid unnecessary expenses.

Typical revenue and expenditure items are listed below:

Typical Revenue Items	Typical Expenditure Items
<ul style="list-style-type: none"> • Water service fee collected from the members (farmers and other water users) • Membership fee • Fund from fishery • Support from outside funds • Interest from bank 	<ul style="list-style-type: none"> • Water right cost • Office equipment • Office consumable goods • Allowance • O&M cost (maintenance & repair, labor, energy) • Meeting cost • Training cost • Reserved fund

The budget plan shall be drafted by the financial sub-committee and submitted to the IWUO committee for approval, in succession, the proposed budget plan shall be discussed in the general assembly to be authorized.

Training Session

Lecture

The facilitator explains the budget plan emphasizing that proper management of the irrigation scheme is similar to proper management of the family budget. For example, if you want to buy new shoes, you have to save money for them.

Practical

The Budget should reflect the IWUO's planned activities, related costs and expected results. The following items shall be taken into consideration for budget plan:

- a) Current and past performance, as well as that of other IWUOs can contribute to the budgeting process
- b) Consideration needs to be given to uncontrollable external changes that could dramatically affect the operations and its results i.e. rising fuel costs, changing markets.
- c) Good communications within and without the IWUO are essential to developing both good plans and good budgets.
- d) The higher the quality of information from members to suppliers, the more realistic budget plan will be.

The following tables show examples for the budget plan

Revenue Period: From Month/Year _____ To Month/Year _____

Description	Quantity	Unit	Unit Rate (RwF)	Amount (RwF)
Water fees (marshland)				
Water fee (Hillside)				
Bank Interest				
Others				
Subtotal				
Total				

Expenditure Period: From Month/Year _____ To Month/Year _____

Description	Quantity	Unit	Unit Rate (RwF)	Amount (RwF)
Water use permit fee				
Materials				
Salary for operators				
Sub total				
Labour				
Energy (Electricity)				
Sub total				
Utility cost for office				
Sub total				
Allowance				
Others				
Sub total				
Total				

Action Plan

The finance sub-committee shall prepare a draft of the budget plan and submit to the IWUO committee for approval in the general meeting.

2.4.3 Establishment of the Water service fee management mechanism

2.4.3.1 Preparation of Water service fee collection agreement sheet

Basic Knowledge for the Facilitator

The Water service fee is indispensable to proper operation and maintenance of the irrigation scheme. But incentive of payment by the IWUO members is not so high. This results in deterioration of facilities.

IWUO members who are the beneficiaries of the irrigation scheme have responsibility for

O&M of irrigation systems after being handed over from the government.

In order to improve the payment rate of Water service fee, an agreement form of each member should be prepared prior to provision of the irrigation service.

It is recommended that the agreement form be prepared by IWUO committee and registered in the IWUO office.



In general, contents of the agreement should cover date, name of member, name of block, irrigated area, amount of Water service fee and signature as well as a sentence of pledge of payment.

Training Session

Introductory Questions

“Do you have an agreement of Water service fee payment as IWUO members?”

“Do you think the agreement is necessary for management of the irrigation scheme?”

Lecture

The facilitator explains the necessity of such agreement and discusses with the participants what kind of agreement is effective in the Practice session.

Practical

The facilitator lists up the necessary items for the agreement on a flip chart and discuss with the participants to determine the format of agreement sheet. An example is shown in **Box-1**.

Action Plan

The finance sub-committee shall prepare forms of the Water service fee payment agreement and submit to the IWUO committee for approval in the general meeting.

Box-1**WATER FEE PAYMENT AGREEMENT (for individual farmer)**

THIS AGREEMENT, made on Date, Month, Year Between The IWUO committee, (hereinafter called “IWUO”) Address,

and

Name of IWUO’s member (hereinafter called “Member”)

ID number

I (Member) sincerely agree to pay the water fee as directed by the IWUO committee according to the statement below.

Name of Member	Name of WUT	Irrigated area	Amount of fee	Date of payment

If I (Member) shall fail to pay the fee by the agreed date, I (Member) shall receive any penalties imposed by IWUO in accordance with the constitution.

Name of member: _____ Signature:_____

Note: The performance agreement between Cooperative and IWUO can also be taken as water payment agreement between the two.

2.4.3.2 Preparation of water fee bill and receipt sheets**Basic Knowledge for the Facilitator**

To remind the IWUO member to pay water fee and to prove the payment, a bill and a receipt should be prepared. The accountant has to keep a copy of the receipt in the IWUO committee office recording a receipt book.

Training Session**Practical**

The facilitator draws the samples of bill (see **Box-2**) and receipt (see **Box-3**) on a flip chart then facilitator asks the participants to determine the formats.

Box-2

ABC Irrigator Organization Date: _____

Bill of water fee

Name of payer: _____

Amount of fee: _____

Payment period (date, month, year): by _____

This payment shall be made to the Accountant of the IO committee.

By Accountant, _____

Box-3

ABC Irrigator Organization

Receipt of O&M fee

Date _____

Name of payer: _____

Amount of fee: _____

I (accountant) surely received O&M fee.

Accountant name: _____ Signature: _____

Action Plan

The finance sub-committee shall prepare forms of the bill and the receipt and submit to the IWUO committee for approval in the general meeting.

2.4.3.3 Preparation of expense order sheet

Basic Knowledge for the Facilitator

After the approval of expense to maintain the irrigation facilities, IWUO committee instructs the accountant to disburse the money. An expense order sheet should be prepared for transparent process of money handling. It is recommended that the signer of the sheet be Chairperson with co-signer of the district irrigation staff.

Box-4

ABC Irrigator Organization

Date:

Order of Expenditure

I order the amount of _____
as an expenditure for being _____

Chairperson: _____ Sign: _____

The form that has been used by the IWUO for expense order to be approved by District is also an important part of expense order process by IWUO.

Training Session

Practical

The facilitator draws a sample of order sheet on a flip chart (see **Box-4**). The facilitator asks the participants to determine the format of the order of expenditure sheet.

The financial sub-committee shall prepare the form and submit it to the IWUO committee for approval.

Action Plan

The finance sub-committee shall prepare a form of the Order of Expenditure and submit to the IWUO committee to be approved in the general meeting.

2.4.3.4 Establishment of Water service fee flow mechanism

Basic Knowledge for the Facilitator

The water fee collection and expenditure mechanism is a basis of the financial management of the IWUO for sustainability of the irrigation scheme over many years.

Flow of water fee consists of inflow (income) and outflow (expenditure) like household. Typical inflow is water fee collection whereas typical outflow is payment of O&M cost.

The flow should be transparent and accountable to all members in order to establish members' creditability to the scheme.

Training Session

Introductory Questions

“Do you know the flow of water fee management in your scheme?”

Lecture

The facilitator explains the Water service fee flow mechanism with materials such as a receipt and a bank book or actual procedure according to his/her experiences.

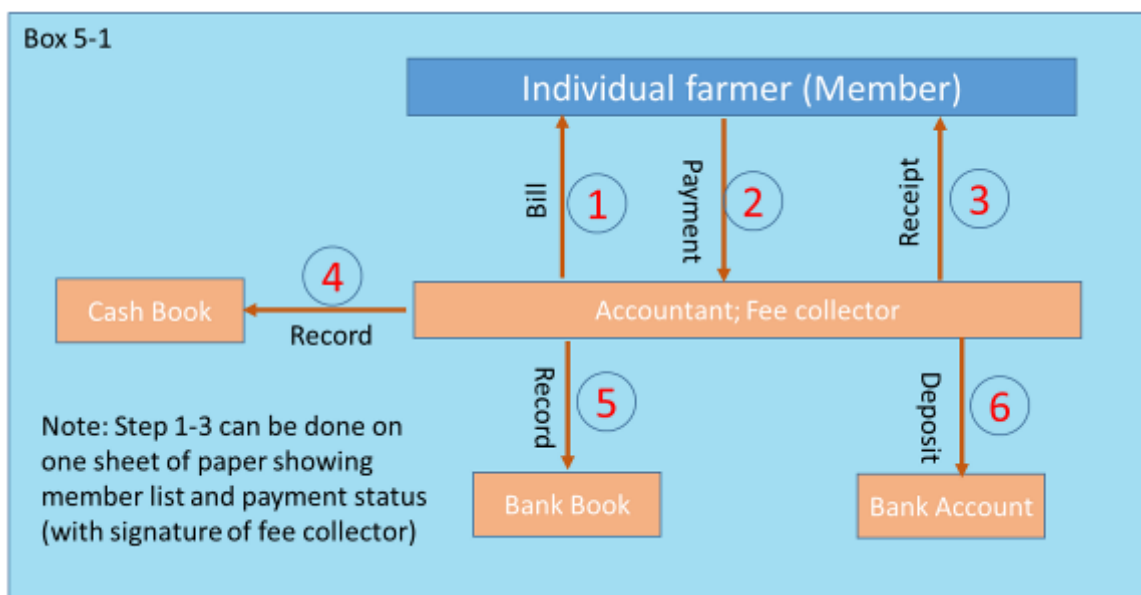
Practical

The facilitator asks the participants about the actual Water service fee collection and expenditure process in the scheme using the examples shown in **Box-5** and **Box-6**.

Then let them discuss what are different from the examples and what should be revised for proper implementation of Water service fee management at their scheme.

The discussion should be in a stepwise manner like from the beginning to the ending of the flow process e.g. from issuing the bill by IWUO management to depositing collected money in the bank account by the treasurer in case of Water service fee collection.

Box-5-1 (for individual farmer) and **Box 5-2** (for cooperative) shows Water service fee collection procedure and **Box-6** shows O&M expenditure procedure.

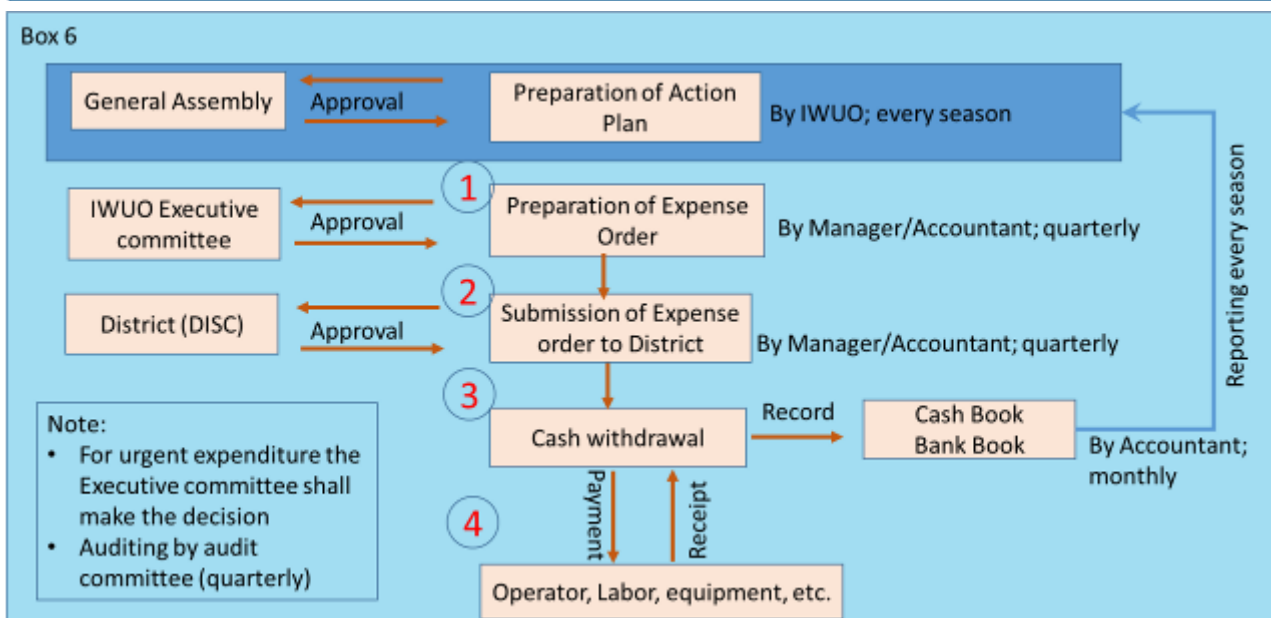
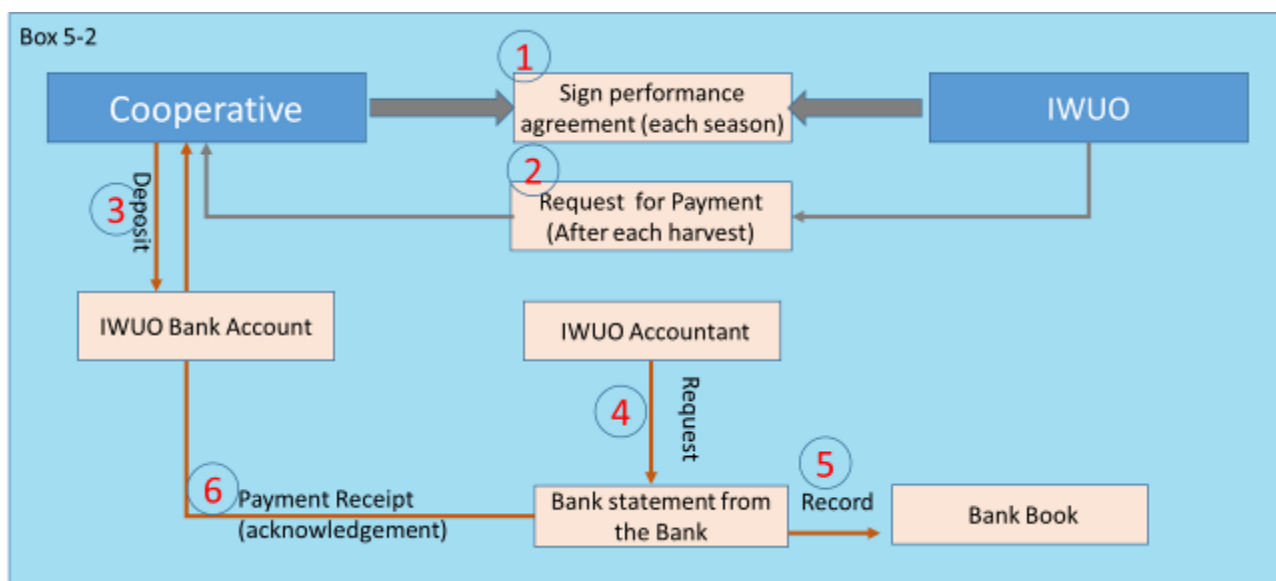


Note

In some irrigation schemes, the following effective and efficient practice is carried out.

“A member pays Water service fee to the IWUO’s bank account individually and then brings the bank slip to the IWUO office to verify the payment. The accountant records in a ledger after receiving the bank slip then issues a receipt to the member.”





2.4.3.5 Auditing system

Basic Knowledge for the Facilitator

At present, IWUOs consist of a Chairperson, a vice chairperson, a secretary, a treasurer, several members of the committee and other members as mentioned earlier. Since no auditor is assigned in general, the IWUO has no auditing system in its accounting operation. This is one of the IWUO's problems. To solve this, it is proposed to establish an auditing system.



Definition of auditing

This is the very important examination or review of financial aspects of IWUO such as financial reports, documents, records, procedures and controls to judge whether they

conform to the prescribed criteria, policies and systems and procedures of the IWUO or not.

Benefits of auditing

- The IWUO members are assured of proper use of the IWUO's resources.
- On the basis of audited accounts, the IWUO may apply for a loan.
- Suppliers gain confidence with the IWUO when a good report is given.
- On the basis of the audit report, the IWUO members can formulate future policies and business objectively.

Internal auditing and external auditing

An internal audit is an independent activity to review IWUO's bookkeeping and other operations. This auditor is usually assigned from within the IWUO management, but must not be the one charged with keeping the IWUO's books of accounts.

An external audit is an examination done by a person from outside the IWUO management, usually a hired accounting professional. He/she examines the fairness, consistency and conformity of IWUO records, reports and financial statements with existing policies, systems and procedures and financial management principles.

The objective of auditing is to assist the officials, leaders and members of the IWUO with objective analysis, appraisals and recommendations. Where management is no longer adequate, the auditor recommends necessary adjustments, revisions and improvements.

Procedure in auditing

An auditor adapts the following general approach to his/her work:

- a) Obtaining the general background information about the IWUO. This is such details as to what the IWUO functions are.
- b) Obtaining all the books and information necessary for examination. These are mainly the accounting records that are maintained through the accounting process.
- c) The auditor does vouching and verification.

Note

Vouching: Derived from the "voucher" which is any document that supports a transaction. The Auditor checks the vouchers to establish the following matters.

- That it was issued for a business transaction.
- That it relates to the period under review.
- That the transaction was fully authorized by IWUO management.
- That it was completely recorded in the books of account.

Example of vouchers are; cash sales/receipts, invoices, credit notes, electricity bills, telephone bills, deposit slips, bank statements, etc.

Verification: this is the checking of Assets and Liabilities.

Who Should Be Audited?

All Limited Companies must be audited at the end of every financial period by an external auditor. Banks are also treated like companies and are also required to be audited at the end of each year.

However, other entities, such as IWUOs, are not compelled by law to have their books audited by an external auditor. But due to the many advantages that arise from audited accounts, it is necessary to have their books audited.

Audit report

Once the auditor is through with the auditing work, he/she communicates with the IWUO management in the form of an audit report. If satisfied that the recording of transactions was proper and that the income statement and the balance sheet present a true and fair view of the financial position of the IWUO, he/she gives a report.

It is therefore necessary that the auditor gets maximum co-operation from the IWUO management so that he/she carries out his/her audit work successfully and gives a good report.

The Audit report should include the following chapters as a bare minimum:

- Detailed audit report for cash
- Detailed audit report for receivables
- Physical inventory
- Detailed audit report for furniture and fixtures

Reports serve the following purposes:

- Communication of information
- Influence decision making
- Monitor performance
- Comply with legal requirements
- Document work done

Training Session

Lecture

The facilitator explains the roles and objectives of the external and internal auditing, especially importance of the internal auditing for IWUO members. The facilitator recommends an election of the internal auditor among IWUO members to establish transparency and accountability of the financial management.

Action Plan

The finance sub-committee shall prepare an election schedule of the internal auditor and submit to the IWUO committee to be implemented in the general meeting.

2.4.4 Exercise on record of Bank book and Cash book

The facilitator prepares samples of the Bank book and the Cash book described below on flip

charts to record simple money flows. Then the facilitator explains the money flow in April 2012 as an example to the participants.

The participants (Financial sub-committee members or IWUO committee members) fill the two accounting books guided by the facilitator based on the money flow explained.

Question)

The money flow in April 2012 is as follows:

Initial balance of the bank account is Tsh. 700,000 and the cash book is Tsh. 20,000 as of 31st of March.

- On 1st April, the accountant withdrew Tsh. 500,000 from the bank account. Thus the withdrawn money should be recorded in the Cash book.
- Ten (10) Notebooks of Tsh. 10,000 were purchased on 3rd of April.
- Ten (10) cement bags of Tsh. 150,000 were purchased on 7th of April.
- Allowance of the operator Tsh. 50,000 was paid on 10th of April.
- Water service fee of Tsh. 200,000 was collected on 15th of April.
- Tsh. 500,000 was deposited in the bank account on 30th of April.
- Interest of deposit of Tsh. 500 was transferred by the bank on 30th of April.

Bank book

M	D	description	Evid. No.	Paid	Received	Balance	Signature	
							Acc.	Chair.
3	31					700,000		
4	1	Withdrawal	1	500,000		200,000		

Cash book

M	D	description	Evid. No.	Paid	Received	Balance	Signature	
							Acc.	Chair.
3	31					20,000		
4	1	Withdrawal	1		500,000	520,000		

Answer)

Bank book

M	D	description	Evid.	Paid	Received	Balance	Signature
---	---	-------------	-------	------	----------	---------	-----------

			No.				Acc.	Chair.
3	31					700,000		
4	1	Withdrawal	B1	500,000		200,000		
4	30	Deposit	B2		500,000	700,000		
4	30	Interest	B3		500	700,500		

Cash book

M	D	description	Evid. No.	Paid	Received	Balance	Signature	
							Acc.	Chair.
3	31					20,000		
4	1	Withdrawal	C1		500,000	520,000		
4	3	Notebooks (10)	C2	10,000		510,000		
4	7	Cements (10)	C3	150,000		360,000		
4	10	Allowance (op)	C4	50,000		310,000		
4	15	Water service fee	C5		200,000	510,000		
4	30	Deposit	C6	500,000		10,000		

CHAPTER 3: PARTICIPATORY MONITORING AND EVALUATION OF IWUO

3.1 Objectives

The objective of this training is to capacitate stakeholders on what to monitor in OMM of irrigation scheme and how to evaluate the activities of IWUO. At the end of this session, the participants expected to understand the monitoring and Evaluation (PM&E) of IWUO activities and be able to establish PM&E systems in participatory manner.

3.2 Target of the Training

This training manual should focus mainly those stakeholders that are responsible for the sustainable management of irrigation scheme in the country. These are; DISC, SISC, IWUO, Cooperative. RAB and MINAGRI should take the lead in implementing the training of this module.

3.3 Expected Output of the training

- Preparation of Monitoring Forms
- Utilization of M&E mechanism

3.4 Topics of the Training

3.4.1 Roles and functions of PM&E

Introduction (Basic knowledge to the Facilitator)

Since the introduction of Ministerial Order for the management of irrigation scheme, the implementation of its decree has focused only on the formation and registration of IWUO. There is no clear procedure set especially for M&E of IWUO activities.

However, Monitoring and Evaluation (M&E) are essential activities in the irrigation schemes because every irrigation scheme should consistently progress toward the proper direction to achieve their expected results in the implementation of IWUO activities (OMM). M&E needs reliable and relevant information on regular bases but it is not easy to continuously carryout to obtain the required data.

Generally, **MONITORING** is the continuous and routine data collection that takes place during a certain activities (e.g. project implementation). In other word, it is periodic review at every level of the implementation of IWUO activities, (e.g. O&M), to ensure that inputs deliveries, required activities and maintaining the facilities are proceeding according to plans on specified indicators.

EVALUATION is an activity done at specific time (mid and end of an activity) to establish whether the activities has met the desired objectives. It is a process for determining

systematically and objectively the relevance, effectiveness, efficiency, impact and sustainability of activities to the objectives. Evaluation should be carried out during implementation and at completion of O&M activities and enabling incorporation of lessons learned into decision making in the irrigation scheme

Here, the concept of “*Water users must be the main implementers of its management*” that leads to the introduction of “*Participation of farmers to the irrigation scheme management (O&M activity)*”, (to conduct more efficient and effective O&M), that is called Participatory Monitoring and Evaluation (PM&E).

Moreover, without farmers’ participation, M&E systems may persist to fulfil accountability requirement of the government side rather than farmers’ benefits.

The implementation of PM&E leads the stakeholders;

- To understand the items that are needed to monitor and evaluate in their scheme
- To develop their capacity on OMM
- To understand better management of the scheme
- To encourage their ownership of the scheme
- To create trust among the stakeholders
- To enhance sustainability of the scheme, and
- To unify the members as a family in the scheme

It should note that PM&E needs eyes of the third party to undertake fairly and transparently. Therefore, the District staffs (DISC) or Sector staffs should lead PM&E in participation with the IWUO and Cooperatives leaderships.

● The training Session

The facilitator should start the session by asking an introductory question such as

- “What is the major activities of IWUO?”
- “Do you think it is important to monitor IWUO activities?”
- “What should we monitor in IWUO activities?”
- “Do you want to participate in M&E activities of IWUO?”
- “Who should do what in M&E of IWUO?”

Lecture by Facilitator

.

Practical

Theme [What kind of monitoring and evaluation is needed in OMM?]

Group discussion: the facilitator forms participant groups of 4-5 members. The groups

discuss and list up items to be monitored and evaluated among the IWUO activities. Then, the facilitator leads them to summarize the results of the discussion on a large sheet of paper.

Example)

Monitoring and evaluation IWUO activities by Group A
<ul style="list-style-type: none"> - Operation plan is followed or not. - Condition of irrigation facilities - The amount of water in the dam - Status of water distribution (availability of water in the downstream canal) - Water service fee collection rate (Expected vs collected)
Monitoring and evaluation IWUO activities by Group B
<ul style="list-style-type: none"> - Action plan and its implementation - Documentation in the office (Filing system (receipt, MM, in-out letters. WUL, Maps etc.) - Financial management (Cash book, Bank book), budget usage - Excess water losses from the irrigation system (uncontrolled water flow into drain from plots) - Facilitator can add his own idea (items)

Plenary discussion: each group presents the results of the discussion for the plenary discussion. Then, the facilitator summarizes the results.

3.4.2 Establishment of PM&E systems

1) Items of PM&E

Introduction (Basic knowledge for the Facilitator)

The main items of PM&E should be related to achievement of the objectives in IWUO day-to-day activities. In other words, the irrigation scheme can be able to proceed towards the proper direction through implementation of PM&E.

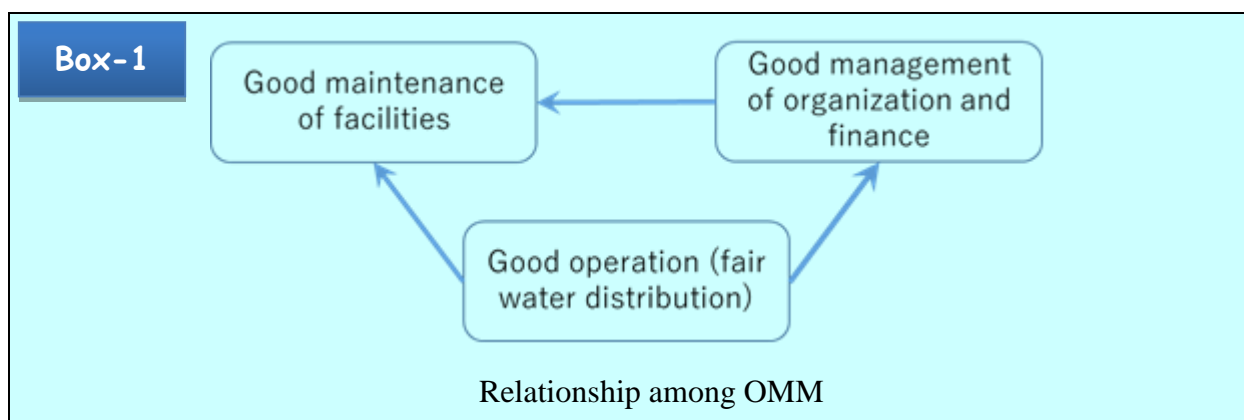
As explained before IWUO activities covers the operation Maintenance of Management of the irrigation scheme.

Related to the **Operation:** Most of farmers are interested in the timing (when will they get water), flow rate (amount of water) and duration of irrigation applications (for how long) once they have been involved in the irrigation scheme. Therefore, items of PM&E should be covering to ensure farmers' interest as well. For example, timing of facility operation or flow rate of canals should be monitored, and in addition, whether water reaches downstream of the scheme should be monitored to check the fair distribution of the water resource.

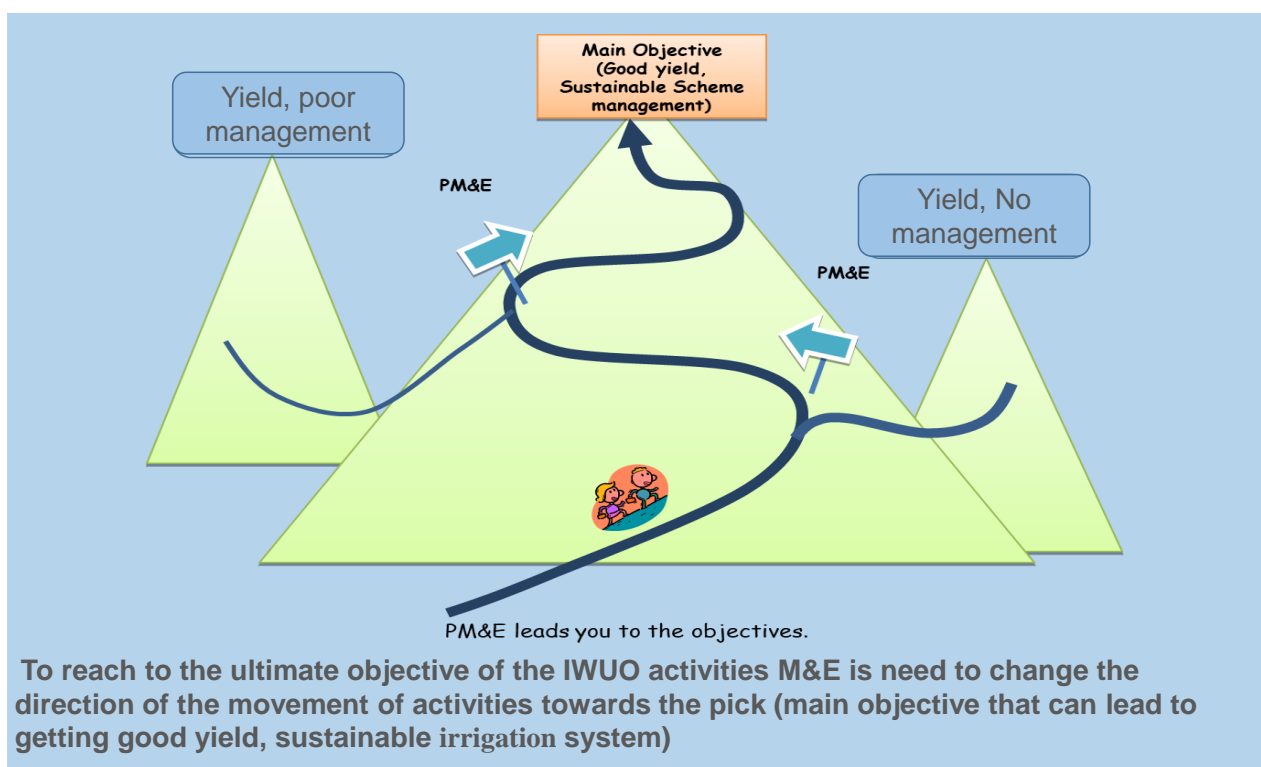
Related the **Maintenance** part: The maintenance plan was attained, whether the canals are clean, drainage are well maintained, no excess dredging, obstruction of flow in the canal, flood free, erosion free, etc.

Related to the **Management**: Monitoring and evaluation of human resources, usage of water fee collected and financial allocation should be considered for the management of the irrigation scheme. (e.g., how many farmers participated in cleaning the main canal, how many percent of members have paid Water service fee, for what purpose the water fee collected is spent, are there any illegal taking of water from main canal etc.). The presence of conflict management mechanism, clear filing system, data management, project document, maps, O&M manual.

Box-1 explains relationship between Operation, Maintenance and Management (OMM) of an irrigation scheme. It shows that Operation is the most important activities among the three components of OMM since securing yield is the direct and eventual concern of farmers in irrigation.



Box-2 explains that PM&E signboards guide climbers to reach the peak of the mountain along meandering climbing paths in order to avoid taking wrong routes.



Practical

The facilitator forms three (3) participant groups and assigns the task of creating operation, maintenance and financial records to each group. The groups discuss and formulate each record on a large sheet of paper referring to sample plan.

The facilitator leads the groups to present the results of the discussion for the plenary discussion. Then, the facilitator summarizes the results.

The participant shall prepare the forms of records referring to the attached sample record.

2) Methods of PM&E

Introduction (Basic knowledge for Facilitator)

1) Method of monitoring Operation

The main aim of monitoring the operation of the irrigation scheme is to find the gates are opened on time, the irrigation calendar are respected according to the plan, the exact amount of water is flowing in the main canal, secondary canal etc. It also helps check whether there is no unnecessary water losses from turnouts, canals etc. (refer to forms 1, 2 and 7)

2) Method of monitoring maintenance

The purpose of the monitoring of maintenance is to find whether the planned maintenance is

carried out as planned or not.

It is recommended that the persons who are NOT in charge of managing maintenance activities be responsible for monitoring of maintenance. This is because he/she are NOT in charge of managing maintenance can check the maintenance activities fairly.

The Executive committee or O&M team shall decide the method and the interval of monitoring. Furthermore, in case some problems are observed by members, he/she shall report the problems to the Executive Committee or DISC.

A typical process for monitoring is shown below:

- Identify clearly what is going to be monitored and evaluated
- Decide indicators used in monitoring and evaluation activities and who, when and how these indicators will be collected and compiled
- Comparison of maintenance records with maintenance plan
- Analysis, detection of problems and identification of reasons
- Reporting (**Form-7**)

Indicators do not always need to be quantifiable, qualitative indicators are as useful as quantitative one.

Evaluation can be undertaken at regular interval or at critical times. In the case of irrigation scheme, it seems to undertake an evaluation at the end of year or cropping season before starting the new season. It is recommended that evaluation be undertaken by the District staffs to avoid unfavourable bias view by the IWUO members. In order to establish the PM&E systems, the IWUO should be involved in all process. (refer to Form 3, 4 and 7)

3) Method of monitoring management

The main purpose of monitoring the management of the scheme (IWUO) is to confirm fair distribution of water is achieved to both upstream and downstream beneficiaries of the scheme, to determine the available water before every season starts and to check the collected fund is used according to the plan.. In addition, the usage of human resources (community work), the collection rate of water fee, transparent usage of fund according to the action plan, financial record, the preparation of financial statement, auditing of IWUO, which will avoid mismanagement of the available fund, human resource and the available water resources.

Practice

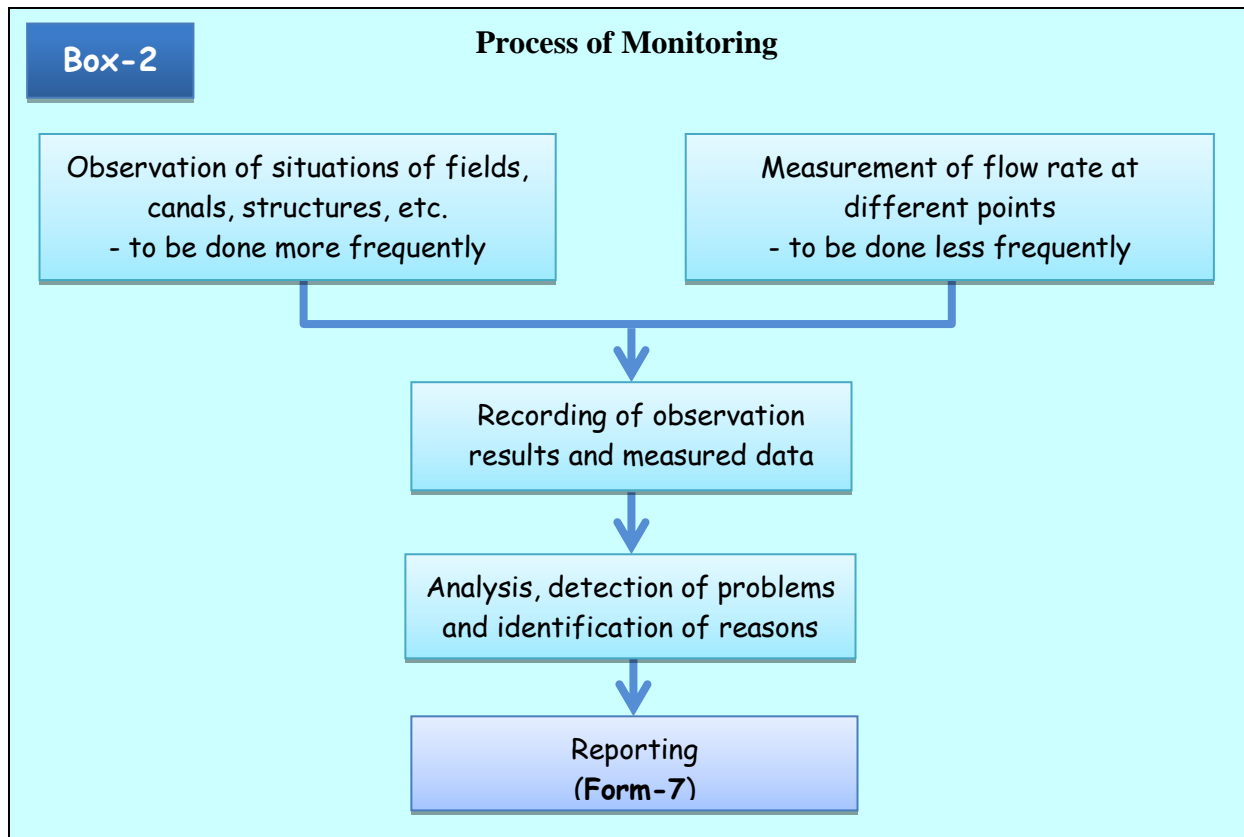
In fact, during the irrigation period, some irrigation blocks or even some farmers in the same block sometimes take more irrigation water than the required/agreed in the plan, and some irrigation blocks or some farmers sometimes receive less irrigation water than the required.

To minimise such situations, the periodical assessment (PM&E) of water distribution is needed.

The O&M sub-committee shall be responsible for monitoring of operation and shall decide the method and the interval of monitoring.

Furthermore, in case some problems are observed from the monitoring activities, the

persons in charge shall report the problems to the committee, using the reporting format **Form-7**. A typical process of monitoring is shown in **Box-2**.



Note: Using the Form 1-7 conduct the exercise (by grouping the participant) and make presentation of the finding of each monitoring (Operation, Maintenance and Management)

3.4.3 Implementation of PM&E

1) Utilization of PM&E tools

Introduction (Basic knowledge for the Facilitator)

The operation record, the monitoring record and the financial record are commonly used for PM&E. The assigned operator is in charge of record keeping. Samples of record forms are shown in the attached forms but IWUO can modify them to be more convenient ones for implementation.

To monitor operation of the irrigation facilities, some devices are needed (eg. flow rate measurement device). Normally the flow rate can be estimated by openness of the gates or water level of the flow. Therefore, the correlation between discharge and those values should be established.

Practice

The facilitator explains the PM&E tools and shows the samples of operation record, maintenance record and management record in form-4, 5 and 6.

Eg. The manager, accountant or irrigator shall prepare forms (1-7) of M&E and submit to the IWUO committee for approval by DISC.

DISC shall also participate in the PM&E activities together with IWUO and Cooperatives

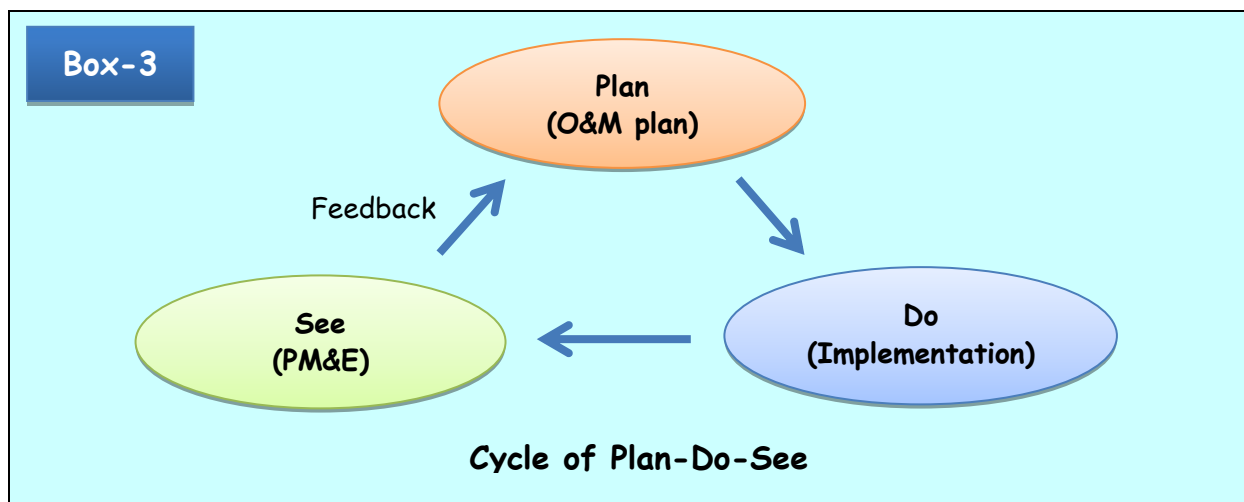
2) Feedback of results of PM&E

Introduction (Basic Knowledge)

It is very popular that a cycle of Plan-Do-See is useful in any project. The irrigation scheme also needs this cycle for effective monitoring and evaluation. “Plan”, “Do” and “See” can be expressed planning of O&M, implementation and monitoring respectively in the irrigation scheme (see **Box-3**).

The feedback corresponds the arrow between “See” and “Plan” in **Box-3** to be essential to planning stage.

In the irrigation scheme, the results of PM&E may assist IWUO when the O&M plan needs modifications to improve. Also, IWUO members are expected to be able to develop their capacity for the management of the scheme through the feedback.



Practice

- “Do you know the cycle of Plan-Do-See?”
- The facilitator explains meaning and effectiveness of the cycle of Plan-Do-See in the irrigation scheme with some examples e.g. maintenance plan.
- Determination of what kind of, when, by who and how the feedback has to be done should be discussed among IWUO members, particularly in the O&M sub-committee.

The facilitator draws the table below and discuss with the participants.

Example of Feedback systems

What	When	Who	How	Feedback to
Maintenance of facilities	At the end of every month	O&M sub-committee	Checking the maintenance records	Maintenance plan
Operation of facilities	At the end of every month	O&M sub-committee	Checking the operation records	Operation plan
Water service fee collection	At the end of season	Accountant	Checking the O&M collection book	Constitution (By-law)
Maintenance cost	At the end of every month	Accountant	Checking the expenditure record	Constitution (By-law)

For example, in case of activity of maintenance of facilities, the operator monitors the irrigation facilities using the maintenance record book and the Zonal Committee check the record at the end of every month. If they find improper maintenance, they feed back to the maintenance plan through executive committee or IWUO manager to improve maintenance activities.

Note:

The Cooperative, IWUO in collaboration with Manager, accountant, agronomist shall prepare simple feedback system (for operation, maintenance and management), discuss among stakeholders (DISC, SISC) before approval in the general assembly or DISC meeting.

Table 1: Sample example for Responsibility of stakeholders on M&E of Irrigation Scheme

Stakeholders (who)	What to monitor and evaluate	How to monitor	When	Feedback to
RAB	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Water use efficiency ✓ Implementation of Action plan ✓ Budget used ratio (Admin/O&M) ✓ Status of Reserve fund (trust fund), if any 	Using Forms 1-7	Once per season (year)	RAB headquarter
DISC (District)	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Action plan implementation ✓ Budget used ratio (Admin/O&M) ✓ Status of Reserve fund (trust fund), if any ✓ Auditing of IWUO ✓ Filing system of documents ✓ Status of water distribution ✓ Amount of available water for the season (where there is dam) ✓ Routine maintenance and cleanliness irrigation structures 	Using Forms 1-7	Once per season	District
SISC (Sector)	<ul style="list-style-type: none"> ✓ Water fee collection rate ✓ Action plan implementation ✓ Status of water distribution ✓ Status of conflict resolution ✓ Routine maintenance and cleanliness irrigation structures 	Using Forms 1-7	Once per season	Sector and District
Cooperative leaderships	<ul style="list-style-type: none"> ✓ Water distribution issue ✓ Routine maintenance and cleanliness irrigation structures (canal, drainage etc.) ✓ Damage on irrigation facilities ✓ On-time implementation of agricultural calendar (land preparation, transplanting, fertilizer application, weeding, harvesting etc.) 	Using Forms 1-7	Once per season	IWUO and District
IWUO Manager	<ul style="list-style-type: none"> ✓ Daily activity of operators, irrigators etc. ✓ Water distribution ✓ Filing system of documents ✓ Financial management 	Using Forms 1-7	Everyday	DISC
Irrigator / Operator	<ul style="list-style-type: none"> ✓ Operation of gates, valve, pump etc. ✓ Implementation of irrigation rotation ✓ Reporting illegal use of water by farmers ✓ Checking excess loss of water into the drain from the each irrigation plot 	Using Forms 1-7	Everyday	IWUO
WUT leader	<ul style="list-style-type: none"> ✓ Cleaning of main canal and secondary canal among the team ✓ Water distribution among the turnout ✓ Checking excess loss of water into the drain from the each irrigation plot 	Using Forms 1-7	Once a week	ZC
Zonal	<ul style="list-style-type: none"> ✓ Cleaning of main canal and secondary 	Using	Once a	SMC

Committee	canal among the Zone ✓Water distribution among the Zone ✓Conflict resolution within the Zone ✓Maintenance of irrigation facilities ✓Implementation of irrigation rotation ✓Reporting illegal use of water by farmers	Forms 1-7	week	
SMC	✓Cleaning of main canal and secondary canal within the scheme ✓Water distribution within the scheme ✓Implementation of irrigation rotation ✓Reporting illegal use of water by farmers ✓Conflict resolution within the scheme ✓Maintenance of irrigation facilities	Using Forms 1-7	Once a week	IWUO
IWUO Executive committee	✓Discussion with Cooperatives on irrigation calendar, action plan etc. ✓Held general assembly together with Cooperative (alternatively) ✓Annual/Seasonal reporting of IWUO activities to DISC ✓Signing of Performance Agreement ✓Overall activities of IWUO (Manager, Operators, Zonal leader, WUT, SMC)	Using Forms 1-7	Once a month	DISC
IWUO Audit committee	✓Conduct internal auditing of IWUO ✓Prepare audit report annually	Using Forms 1-7	Once every season	IWUO executive committee
IWUO Conf. Resolution committee	✓Resolve conflict among the beneficiaries ✓Prepare annual report of the committee	Using Forms 1-7	Once every season	IWUO executive committee

Form 1 Basic Operation Plan

1) Division of irrigation area into several irrigation units (WUT)

The irrigation area will be divided into the following blocks. This will be a basis for water distribution planning.

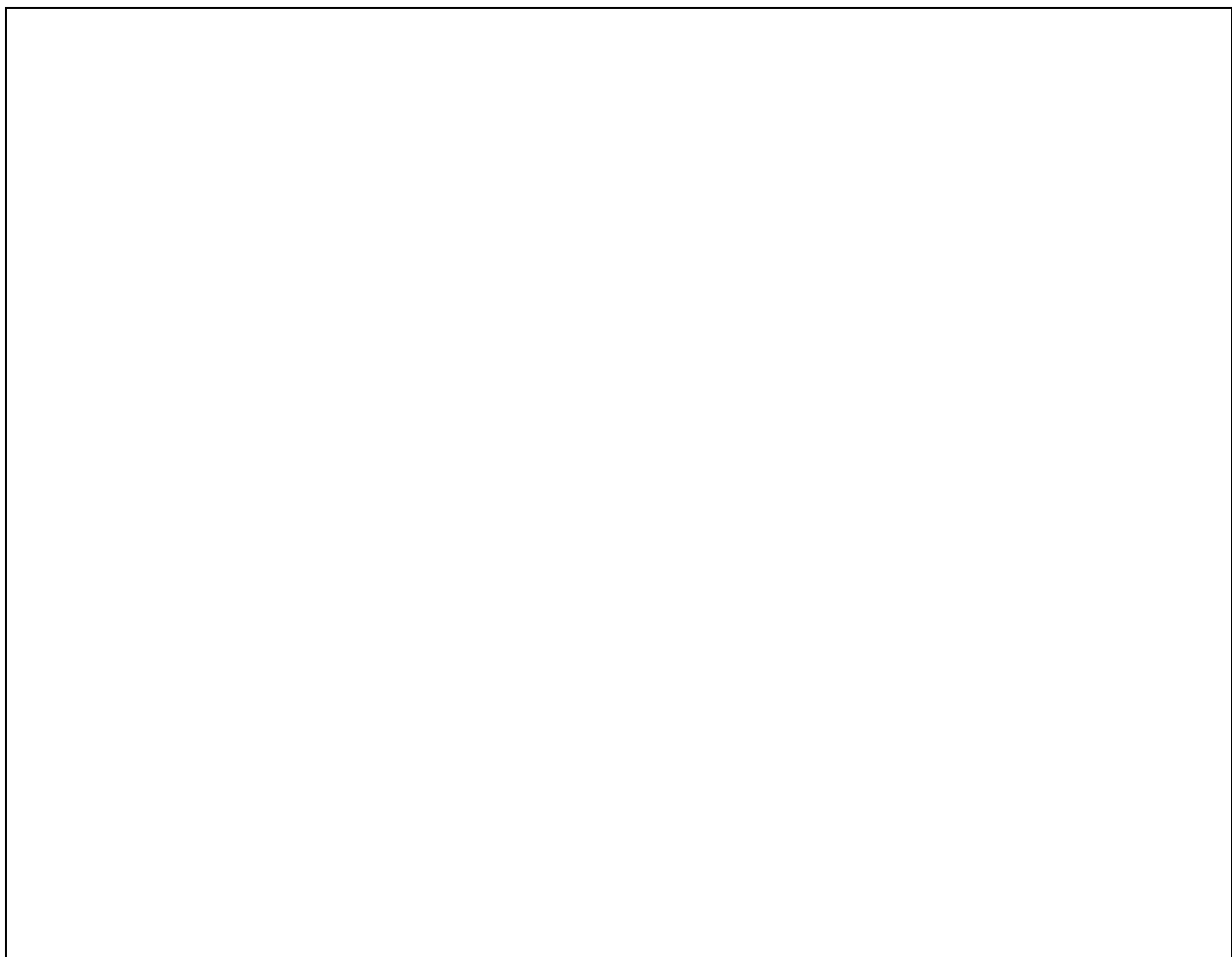
※ Method of water distribution shall be decided, firstly (between Rotation or Continuous flow)

Area of irrigation blocks (WUT)

Name of WUT	Area (ha)	Remarks
E.g. WUT-1	3.4	Upstream, Irrigated on MWF per week
E.g. WUT-8	5.2	Downstream, Irrigated on TTS per week

MWF = Monday, Wednesday, Friday; TTS= Tuesday, Thursday, Saturday

Sketch the whole irrigation area divided into WUT



NOTE: Major structures, such as main canal, secondary canal, weir, turnouts shall be drawn on this sketch

2) Basic method of operation

Location / WUT	Turnout / measuring facility	Responsible person (in charge of operation)	Method of operation
WUT 1	BLT1-3	SWD /WUT leader / Irrigator	Rotation (measuring discharge)*
WUT 3	BLT8-10	SWD / WUT leader / Irrigator	Rotation (measuring discharge)*
All IU	All turnout (Secondary canal)	SWD	Continuous (attain fair water distribution along the secondary canal)
Downstream and at the periphery of the scheme	Downstream and periphery plots	Operator/ irrigator	Continuous or rotation
All weir	Left/right main canal	>>	>>

Note: * Note: * If possible, discharge shall be measured before and after each turnout to determine the amount of water diverted at each WUT or turnout

If discharge measurement is difficult, it is necessary to check whether water reached downstream beneficiaries, plots located at the periphery of the scheme (marshland),

where often water problem is common

Recorded by _____

Date	Activities	Observation
August 3 2021	Check the gate is open to design level	Too much water is released, it needs to be adjusted
Sept 8 2021	Check main canal	At turnout #5 the main canal is blocked by farmer _____, must be punished
Sept 8 2021	Check main canal	Water doesn't reach downstream due to obstruction at upstream

Note: The operation record shall be kept (filled) by WUT leader, Irrigator and /or operators
 The content of work, place of work etc. should be described in the column "Activities"
 The situation of the fields, canals, gates, drainage and other facilities should be described in the column "Observation"

Form 3: Basic Maintenance Plan

- 1) Routine Maintenance and periodic maintenance – basic plan of activities for each facilities of the irrigation scheme

Irrigation facilities	Activities	Frequency	Responsible person (implemented by)	Indicator
Dam and reservoirs	Removal of waterweeds			Waterweeds removed
	Removal of foreign materials			
	Lubrication / oiling of valve			
Weirs and gates	Gates handle breakage			
Turnout	3 turnouts not working			3 turnouts rehabilitated
Main canal	Rehabilitation of 150m long canal			150m canal rehabilitated
Drainage canal	Cleaning of 3km drainage canal	Once a year		3km canal cleaned
Farm roads				
Flood dikes				
Bunds in the fields				
Canal crossing structure	Erosion from hillside			

- 2) Special maintenance

Measures in the case of damage by unforeseen disasters (flood, heavy rainfall, theft, earthquake (what we shall do in case the irrigation facilities are damaged by unforeseen disasters

Plan of preventive actions- what we shall do to prevent or alleviate damage by unforeseen disasters

Maintenance record

Recorded by _____

[illegible]

Form 5: Basic Management Plan

Date	Activity	Observation
11/02/1999	Checking water management/distribution	
17/08/2012	Amount of water in the dam	
	Financial management	
	Water fee collection	
	Filing system at office	
	Financial record	
	Letter correspondence system	

4 Financial record

Recorded by _____

i) Record of water fee collection Period: Until July 2022

Name of Cooperative	Total area of irrigation (ha)	Amount requested		Amount received	
		Date	Amount (RwF)	Date	Amount (RwF)
CoCuRiBu	48	8/7/2022	960,000	21/7/2022	720,000
CoCuRiGa	66	12/7/2022	1,320,000	29/7/2022	1,220,000
Hillside farmer (A separate list is required)	15	5/7/2022	30,000	30/7/2022	12,000
Mining company	-		340,000		340,000
Car wash			25,000		0
Brick making					
Total					2,292,000

ii) Record of revenue and expenditure Period: Until July 2022

Date	Description	Revenue	Expenditure	Balance
1/7/2022	Balance from last month			1,500,000
21/7/2022	Water fee from CoCuRiBu	720,000		2,220,000
29/7/2022	Water fee from CoCuRiGa	1,220,000		3,440,000
31/7/2022	Salary of operators		270,000	3,170,000
17/8/2022	Rehabilitation of drainage canal		177,000	2,930,000

5 Financial statement

Date: _____

Recorded by: _____

i) Balance in Bank Account Period: Until July 2022

Description	Name of Bank	Balance in account
A/c No. 1234567	KBC (O&M fund)	5,230,000
A/c No. 5678910	BK (Reserve fund)	1,500,000
A/c No. 9876543	SACCO (O&M fund)	650,000
Total		7,330,000

ii) Revenue

Period (Season A): From Month / Year To Month / Year

Description	Expected amount (RwF)	Actual amount (RwF)
Water fee from marshland	12,000,000	8,000,000
Mining	350,000	350,000
Water fee from Hillside	1,230,000	560,000
Other		
Total		8,910,000

iii) Expenditure Period:

Period (Season A): From Month / Year To Month / Year

Description	Planned amount (RwF)	Actual amount (RwF)
Salary of operators	810,000	810,000
Rehabilitation of drainage canal (main canal)	3,000,000	1,800,000
Utility cost for office	150,000	95,000
Meeting allowance		
Transport fee		
Communication fee		
Total		2,705,000

6 Water management

Date	Description	Observation	Advice (comment)
	Amount of water in the scheme (dam) at each season		
	Fair water distribution (downstream and periphery of the scheme)		
	Water saving mechanism (reducing losses from the field)		
	Illegal use of water and facilities (application of punishment)		
	Collaboration with cooperative in water management		

7 Office Administration

Date	Description	Observation	Advice (comment)
	Filing system (letter, receipt, minutes of meeting)		
	Content of Minutes of meeting		
	Data organization (scheme)		

	map, project document, O&M manual)		
	Financial documents (Receipt, bankbook, cashbook, audit report etc.)		
	Asset database		
	Update of water user lists		
	Performance agreement		
	Evaluation of human resource (Community participation)		
	Action plan, performed activities, budget used		

To _____ (IWUO, DISC, SISC etc)

Date _____

Prepared by _____

Description of problem

E.g.1 Loss of water at Left Canal turnout number 3 caused by damage or illegal breakage of main canal

E.g.2 Flooding of the plot from the drainage canal at _____ point

E.g.3 Sedimentation inside main canal from turnout No 12 to 15 on right main canal caused by flood from hillside

Proposed measures, solution and action

E.g. 1

Rehabilitation of damaged part is necessary, this is an emergency and need quick action. There should be punishment on the illegal action

E.g. 2

Rehabilitation of drainage canal and it needs quick action

E.g. 3

Removal of sedimentation by hiring casual labourer, community work can't handle the cleaning work as it is only once a week and the issue need quick action

CHAPTER 4: OFFICE MANAGMENT (Document Filling)

4.1 General

4.1. Target Trainee

Leadership of the scheme and Field collaborators/managers of IWUOs in the schemes

4.2. Methodology

Lecture and practices/ learning by doing

4.3. Time allocation

Lecture: three (3) hours in each model site

Practical: 3 days in each model site (managers and facilitator will conduct filing trial in each office accordingly)

4.4. Materials

For practise: Computer machine, paper clip, blinder clip, staples, stapler, file folder, post it pad, liquid glue, marker pens, collection fluid, scissors, hole punch, pencil, pencil sharpener, adhesive tape, filing cabinet, steel cabinet, date stamp, register, filing shelves, box files etc.

For theory: training module, manila paper

4.5. Outputs

- Understanding a whole process of filing
- Office organization and filing

4.2 Objectives

General: At the end of this session, the participants are expected to understand importance of documents filing in the office and be able to plan, prepare and put the documents in a well-organised manner.

Specific: The participant (field collaborator and accountant of IWUO) will practice filing and prepare their office in a well-organized manner. Photo below shows the sample of bad and good filing of documents in an office



Bad filing office



Good filing office

4.3 Target of the training

Leadership of the scheme and Field collaborators/managers of IWUOs in the schemes

4.4 Methodology

Lecture and practices/ learning by doing

4.5 Time allocation

Lecture: three (3) hours in each model site

Practical: 3 days in each model site (managers and facilitator will conduct filing trial in each office accordingly)

4.6 Materials

For practise: Computer machine, paper clip, blinder clip, staples, stapler, file folder, post it pad, liquid glue, marker pens, collection fluid, scissors, hole punch, pencil, pencil sharpener, adhesive tape, filing cabinet, steel cabinet, date stamp, register, filing shelves, box files etc.

For theory: training module, manila paper

4.7 Outputs

Understanding a whole process of filing

Office organization and filing

4.8 The Content of the training

4.8.1 What is an Office

1) Definition

An office is a center point of organization; the office is the brain of a whole organization. The office performs a clerical function such as information collection, recording analyzing, distribution

of information and executive function such as planning, policies formulation, organization, decision making etc.

2) Office administration

Maintains office services by organizing office operations and procedures preparing payroll, controlling correspondence, designing filing systems, reviewing and approving supply requisitions, and assigning and monitoring clerical functions

3) Qualification of an Office administrator (example)

- Office administrator is responsible for coordinating office of organization/entity or companywide tasks agendas, and data-bases. You supervise other members of the administrative team, handle communications, and support bookkeeping by maintaining detailed records.
- An office administrator resume/profile should highlight his/her managerial experience, familiarity with administrative work, and ability to remain organized.

4.8.2 What is Filing

1) Definition:

Filing means keeping documents in a safe place and being able to find them easily and quickly. Documents that are cared for will not easily tear, get lost or dirty. A filling system is the central record-keeping system for an organization. It helps to organized systematically, efficiently and transparently.

2) Importance of filing

- Filing is very important to store and preserve office records and documents. It is needed for the protection of record, to provide reference, to settle disputes, to increase working efficiency, to build image etc.
- It helps to be organized, systematic, efficient and transparent. It also helps all people who should be able to access information to do so easily.
-

3) Filing Methods

The Followings Are Five Methods of Filing:

1. Filing by Subject/ category
2. Filing in Alphabetical order
3. Filing by Numbers/Numerical order
4. Filing by Places/ Geographical order
5. Filing by Dates/ Chronological order

4) Why should organization have a good filing system?

- Filing means keeping documents in a safe place and being able to find them easily and quickly. Documents that are cared for will not easily tear, get loss or dirty.
- A filing system is a central record-keeping system for an organization. It helps to organize systematically, efficiently and transparently. It also helps all people who should be able to

access information to do so easily.

- It is always pleasure when someone looks for something and is able to find it without difficulties.

5) What do we file?

We file documents that are sent to us by other people or organizations. We also file records of all our organizational activities. These can be letters, memos, reports, financial records, policy documents etc.

6) When do we file?

This depends on how busy your office is. In very busy organizations, filing is done at least every day and usually first thing in the morning. In a small or less busy office you could file once or twice a week.

7) Filing Categories

- To make filing system more useful, we can group files into categories. A category is a group/collection of things that belong together.
- When we file by categories, we try to file in a logical way; we put files together because they belong together, we don't put them together just because they start with the same letter.

8) Benefits of Good Filing

The Followings Are the Most Common Benefits of a Good Filing:

i. Better control

Document control and management in general are aided by effective filing systems.

ii. Efficiency

Staffs at all levels can easily locate and use records properly without any undue delay when a good filing system has been implemented. This leads to many micro savings in time, which collectively leads to increased efficiency in operation

iii. Protection

Put simply, an effective filing system protects documents from possible loss or damage. In physical terms this means folders for separation and adequate filing cabinet infrastructure. Digitally, this means backed up storage that is adequate in size for the files in question.

iv. Quick reference

Simplistic and strategic filing arrangement assist the organization to refer to the relevant documents much faster. Clients and customers don't relish long waits while you wade through complex folder structures to find the required information

v. Planning

The business policy can be framed and planning of the project can be done by referring past records by the management, hence, the documents provide a basis for future.

vi. Compliance

Appropriate filing fulfills the obligations under the international standards as well as legislatively. These obligations include keeping documents according to business as well as income tax, later confirmation of events etc.

vii. Evidence

In the case of dispute, effective document filing may serve as evidence before a court of law or tribunal. Timely retrieval may be vital in such circumstances.

viii. Reduced stress in the workplace

Effective filing systems have a positive impact on staff at all levels in particular, office and administration staff. Frustration from finding information can be avoided by simple and commonly understood filing structures.

9) Filing by Chronological Order

(This Model was selected to be used by IWUO office)

Filing by chronological order

in chronological filing, files and folders of documents are arranged in order of their date, day, and time. This sequence can be according to their date of receipt, or date and time of their creation with the most recent date in front of or on top of the previous items.

Advantages of chronological classification of files

The chronological classification has the following advantages:

- When dates are known, it is very easily to find out
- It is good for overall classification (i.e if the correspondences are maintained for many years)
- Chronological classification of filing is very simple to operate

Disadvantages of chronological classification of files

The disadvantages of chronological classification are discussed below:

- Chronological filing is not useful for large scale units
- It is very difficult to locate the documents if the date is not known
- Incoming letters might be separated from outgoing letters

10) Practice for filing

The trainees will learn how to make reference list by excel sheet

1) Outgoing letter

List of the letter issued by the IWUO Abahizi ba Rwamagana

No	Ref.No.	Date	Description	Destinations	Remarks
1	N0/RW/AB/2021/03/0007	March 16,2021	Request for support of fish fingerlings	RAB	Sent by e-mail
2	No/RW/AB/2022/07/0001	July 20 2022	Request for payment of water fee	Cooperative A	Given by hand
3	XXXXXX	XXX	Job Announcement	Public	Hiring of irrigator
4	ZZZZ	ZZZ	Call for consultancy or external auditing	Public	Hiring a company

2) *Eg. Incoming letter*

Letter sent to ABCD IWUO, EFGH Irrigation Scheme

No	Sender (from)	Date	Ref. No.	Subject
1	ABCD Cooperative	March 12 2021	YYYYYYYY	Claim on water distribution
2	Mr. XYZ (hillside farmer)	June 23 2021	XXXXXXXX	Application to be a member of IWUO
3	RAB	January 2 2022	ZZZZZZ	Invitation for workshop

3) *Financial record and financial statement*

(i) ***Financial records***

A good way of receipts keeping

Keeping receipts is a very important key factor of financial records. However, some paper size of receipts are smaller and can be lost easily.

In case the receipts are on small size, it is better to attach a couple of them on A4 paper size by using an adhesive tape and give them numbers, then it will be easy to keep them for a long period of time without being lost.

Sample of receipts attached to recycled A4 paper



Record of water fee collection

Sample:

Recorded by _____

Period: Until July 2022

Name of Cooperative	Total area of irrigation (ha)	Amount requested		Amount received	
		Date	Amount (RwF)	Date	Amount (RwF)
CoCuRiBu	48	8/7/2022	960,000	21/7/2022	720,000
CoCuRiGa	66	12/7/2022	1,320,000	29/7/2022	1,220,000
Hillside farmer (A separate list is required)	15	5/7/2022	30,000	30/7/2022	12,000
Mining company	-		340,000		340,000
Car wash			25,000		0
Brick making					
Total					2,292,000

Record of revenue and expenditures**Sample:**

Record of revenue and expenditure

Period: Until July 2022

Date	Description	Revenue	Expenditure	Balance
1/7/2022	Balance from last month			1,500,000
21/7/2022	Water fee from CoCuRiBu	720,000		2,220,000
29/7/2022	Water fee from CoCuRiGa	1,220,000		3,440,000
31/7/2022	Salary of operators		270,000	3,170,000
17/8/2022	Rehabilitation of drainage canal		177,000	2,930,000

(ii) Financial statement**Balance in bank account****Sample:**

Date: _____

Recorded by: _____

Balance in Bank Account

Period: Until Month/Year

Description	Name of Bank	Balance in account
A/c No. 1234567	KBC (O&M fund)	5,230,000
A/c No. 5678910	BK (Reserve fund)	1,500,000
A/c No. 9876543	SACCO (O&M fund)	650,000
Total		7,330,000

RevenuePeriod (Season A): From Month / YearTo Month / Year

Description	Expected amount (RwF)	Actual amount (RwF)
Water fee from marshland	12,000,000	8,000,000
Mining	350,000	350,000
Water fee from Hillside	1,230,000	560,000
Other		
Total		8,910,000

Expenditure period

Period (Season A): From Month / Year To Month / Year

Description	Planned amount (RwF)	Actual amount (RwF)
Salary of operators	810,000	810,000
Rehabilitation of drainage canal (main canal)	3,000,000	1,800,000
Utility cost for office	150,000	95,000
Meeting allowance		
Transport fee		
Communication fee		
Total		2,705,000

Aneex-1: A Sample of Internal Regulation

(Reference: Internal rules and regulation of Cyaruhogo Model Site)

Sample content of Internal Regulation

Preamble	
2. Explanation of the Irrigation Scheme	
3. Organizational Structure of IWUO	
4. Roles and Responsibility of Each Stakeholder	
A. General Rules of an overall IWUO	
B. Composition and Responsibilities of an overall IWUO	
C. Executive Committee.....	
D. Audit Committee	
E. Dispute Resolution Committee.....	
F. Responsibility of member of an Irrigation Unit	
G. Responsibility of Seasonal Water Distributer	
H. Responsibility of WUT Leader	
I. Responsibility of Zonal Committee.....	
J. Responsibility of SMC	
K. Responsibility of an Operator.....	
L. Responsibility of IWUO	
M. Responsibility of Sector / District	
5. Internal Regulations of IWUO	
Organization Structure of IWUO.....	
Map of the Irrigation Scheme.....	

Annex-2: Sample Operation, Maintenance and Management Manual

OPERATION MAINTENANCE MANUAL

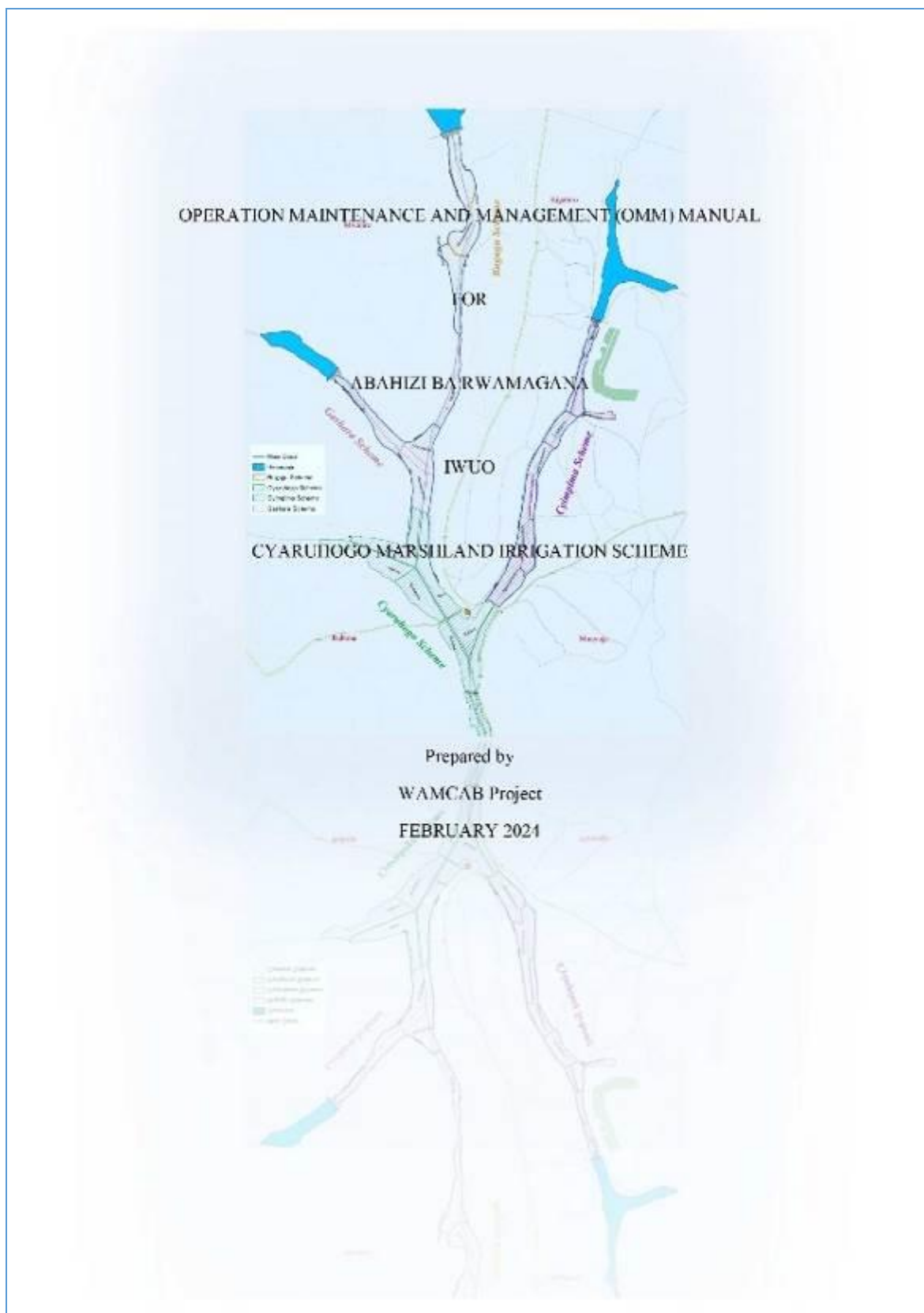


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1. INTRODUCTION

1.1 Objective of this manual

This manual was formulated as a reference material for the TF members and District staffs, under the Project for Capacity Development and Water Management Project (hereafter termed as “WAMCAB”), and presents that the basic matters and process of planning, implementation and monitoring of the operation and maintenance activities of the water related infrastructures managed by IWUO and the District

This manual is part of the IWUO Strengthening Training Manual prepared by WAMCAB project. The manual is prepared as a sample for the District staffs (TF members) to adopt it to other irrigation scheme in the District.

1.2 Definition and Function of Irrigation Facilities and Organization Structure

The following terminologies are defined to fit the meaning of each term to the particular irrigation facilities or to certain organizational units unless otherwise stated differently.

Table 1. Definition of terminologies for the scheme

No.	Terminology	Appropriate definition
1	Headwork	The main facility in irrigation system that supply water to the irrigation system, it can cover the Dam, Pump Station and/or the Diversion Weir
2	Reservoir Dam	The embankment constructed of compacted soil to store water.
3	Spillway	A structure that helps convey excess water from the dam without affecting dam body.
4	Valve house	A house constructed below the dam body where valves are installed to control the flow of water from the reservoir. It is connected to the reservoir by a steel pipe installed under the dam body.
5	Main Canal:	The main canal in the marshland is a canal that emerge from each weir and run along the left and right side of the marshland. It is an irrigation canal that conveys water from its source to the field
6	Secondary canal	Secondary canal is a canal that emerge from main canal and run parallel or perpendicular to the main canal. It convey water from main canal to tertiary or to the field.
7	Tertiary canal	Tertiary canals are small field canals within each plots
8	Diversion Weir	A headwork facility that raise the water level in a stream or main drain and divert water from the stream to the main canal
9	Turnout	A facility on the main canal or secondary canal that divide /divert water to secondary/tertiary canal
10	Gate (Sluice gate)	An opening set on diversion weir to divert water from river and supply to the main canal
11	Stop log	A hydraulic engineering control element that are used in raising or adjust the water level in a river, canal, or reservoir. It can be a wooden block of different size that will be used at each turnout to help control the flow of water inside the main and secondary canal.
12	Abutment	Part of side wall of the diversion weir that support the bank of river (as in river training facility)
13	Apron	Part of hydraulic structure set upstream and downstream of the structure to protect it from erosion, such as weir, drop, culvert, turnout
14	Drop structure	Drop is a hydraulic structures used to reduce water velocity to non-erosive rates by reducing and stabilizing the grade of the canal, drain, watercourse or gully floor

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15	Drainage canal	Manmade canal or natural stream that carries excess water from the field to downstream of the scheme.
16	Road crossing canal	A culvert structure under a road that convey water for irrigation
17	Marshland	It is the land between hills (valley land) below the dam body that is characterized as wetland and assigned by the government to be used to grow crops, especially rice.
18	Hillside	Any agricultural field outside of the marshland, as defined above
19	Water User List (WUL):	A periodically updated list of all water users inside a defined irrigation scheme. These include crop producers, fish farming, car wash, brick making etc.
20	Irrigation Map:	A digitized map consists of irrigation network, facilities in the scheme and list of landowner that should be updated periodically;
21	Pumping water	The action of setting any kind of pump in the canal or reservoir to pump water for irrigating hillside farm or other purposes.
22	Irrigation Unit (IU):	A group of farmers who irrigates their land from a particular turnout point on the main/secondary canal of the irrigation scheme.
23	Water User Team (WUT):	Water User Team are group of farmers organized along a few number of turnout or weir (in case of Cyaruhogo) for management purpose and they will be responsible for water distribution among each turnout.
24	Zonal Committee (ZC):	Zonal Committees are organized along the left or right main canal where they will be responsible for water distribution along the main canal (left or right separately)
25	Scheme Managment Committee (SMC):	The Scheme Management Committee are the second higher-level organization of IWUO. Their responsibilities relate to water management and conflict resolution within each scheme. In Rwamagana there will be four SMC for each scheme (Cyimpima, Bugugu, Gashara and Cyaruhogo)
26	Overall IWUO:	The IWUO formed at higher level of the structure whose members elected considering equal representation from each scheme (Bugugu, Cyimpima, Cyaruhogo & Gashara)
27	Seasonal Water Distributor (SWD)	Seasonal Water Distributor shall be assigned at each IU/WUT to take the responsibility of water distribution at WUT level focusing on secondary and tertiary canal every season. Mostly they are effective when working on incentive basis.
28	Support Staff:	These are technical staffs hired by IWUO to support the day-to-day activities of the organization. It includes operator, irrigator, manager, accountant (depending on the capacity of the IWUO)
29	Cooperative:	The cooperative is a profit oriented business organization that will engage mainly in production and selling of the rice utilizing facilities in the scheme.
30	Farmers Group	Farmers Group is a group organized under the cooperative whose member involve in agricultural activity (land preparation, transplanting, harvesting etc.)
31	Performance Agreemnet	It is an agreement made every season by and between IWUO and Cooperative for production of rice by the cooperative and provision of water by IWUO and collection of water fee for the service given.

2. ORGANIZATIONAL STRUCTURE

2.1 General background

According to the Ministerial Order of Rwanda each irrigation scheme is expected to establish a cooperative that focus on production (business) and an IWUO, whose responsibility is merely the management of the irrigation scheme. As proposed by WAMCAB project, for proper management of the scheme the beneficiaries of the scheme were organized into different layer of structure according to the irrigation facilities. The lowest level being the Irrigation Unit (IU) that is set at turnout level, followed by Water Users Team (WUT) and Zonal Committee (ZC) and so on.

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For proper understanding of the IWUO structure one must understand the layout of the irrigation system, hence the following section devotes to the brief explanation of the scheme layout.

2.2 Layout of Cyaruhogo Irrigation Scheme

2.2.1 General Information

The Cyaruhogo Irrigation Scheme is consisting of four interconnected marshlands commonly known as Cyaruhogo Marshland. This marshland is divided into four cooperatives namely Bugugu, Cyimpima, Gashara and Cyaruhogo. The main source of water is the three reservoir dams constructed at Bugugu, Cyimpima and Gashara sites. Cyaruhogo site gets water from the existing stream, springs and considered as an indirect beneficiary of the three reservoir dams.

2.2.2 The Irrigation Scheme Layout

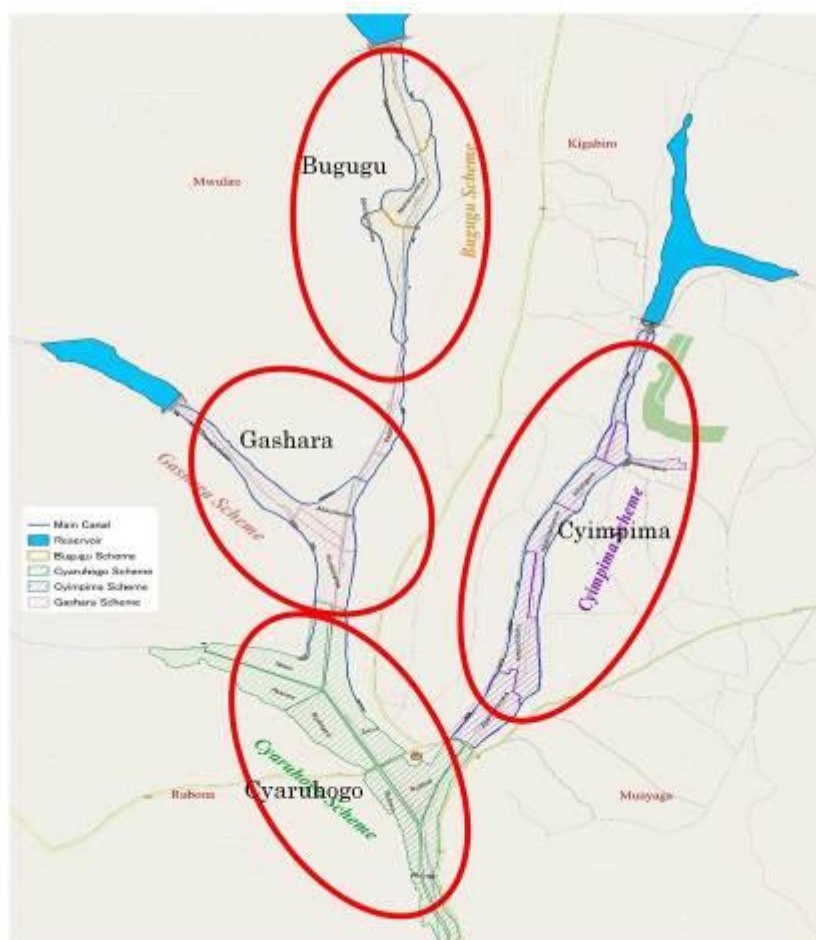


Figure 1: Layout of Cyaruhogo Irrigation Scheme

Initially, the Chinese Government developed the marshland in around 1980's. JICA has rehabilitated the irrigation facilities in the year between 2018 and 2020. The content of the rehabilitation include raising the height of the embankment and construction of new dam at the three sites (Gashara, Bugugu and Cyimpima) and setting up of lined canal on left and right sides of the marshland. In addition, the facilities at Cyaruhogo site is rehabilitated by the District through Grassroots fund from Japanese Embassy. The summary of the intervention and the facilities installed in the scheme are summarized below.

Table 2: The Irrigation Facilities in Cyaruhogo Irrigation Scheme

Name of site	Dam Height (m)	Reservoir capacity, m3	Main canal, km	Turnouts	Command area
Bugugu	12	451,000	7.71	32	48
Cyimpima	11	553,000	8.82	38	56
Gashara	13	478,000	6.96	34	66
Cyaruhogo	0	5 weir	9.45*	94	130

*Note: * earth canal*

The three reservoir dams are equipped with valve house constructed at downstream of the embankment where the water flow is controlled in the main canal. The main canals runs on the left and right side of the marshland. Turnouts are set on the main canal at average distance around 200m apart, from which secondary canal and tertiary canals are constructed by the community from where the beneficiaries irrigated their field.

2.3 Organizational Structure and its Function

I. Establishment of the IWUO

The lower level of the IWUO is set according to the irrigation facilities as follow.

- One turnout is set to serve a group of the farmer that is considered as one **Irrigation Unit (IU)**. A total of (32 + 38 + 34 + 94) irrigation units is set. Each IU shall choose SWD who is responsible for water distribution from each secondary canal
- Water Users Team (WUT) shall be organized according to the existing group and the number of IU (manageable size) for the left and right side of the scheme separately so that management of irrigation water can be conducted smoothly.
- Accordingly, 10 WUT (6 on the left canal and 4 on the right canal) will be created. (See map below). Each WUT will elect a leader who will be responsible in fair distribution of water among the turnout within its WUT and routine maintenance of canals. The member of each turnout shall assign a seasonal water distribution who will be responsible for fair water distribution among the secondary canal of each turnout.
- Zonal committee shall be set according to each main canal (left and right main canal). The committee shall be responsible for water distribution of main canal and trained to maintain infrastructures (concrete and masonry made structures).

- SMC consists of 3 members shall be set for Gashara scheme. It will be responsible for conflict resolution at scheme level and planning of O&M of the scheme.
- Three members shall be elected to be part of the overall IWUO committee members.
- For Cyaruhogo site, WUT is set according to the existing farmers group.

Table 3: WUT set at Bugugu site

Main canal	WUT Code	Turnout Code (IU)	Irrigation Zone
Left main canal	WUT-BL1	BLT-1; BLT-2; BLT-3	Zone A
Left main canal	WUT-BL2	BLT-4; BLT-5; BLT-6; BLT-7	Zone A
Left main canal	WUT-BL3	BLT-8; BLT-9;	Zone B
Left main canal	WUT-BL4	BLT-10; BLT-11; BLT-12	Zone B
Left main canal	WUT-BL5	BLT-13; BLT-14; BLT-15	Zone B
Left main canal	WUT-BL6	BLT-16; BLT-17	Zone B
Right main canal	WUT-BR1	BRT-1; BRT-2	Zone A
Right main canal	WUT-BR2	BRT-3; BRT-4; BRT-5	Zone A
Right main canal	WUT-BR3	BRT-6; BRT-7; BRT-8	Zone A
Right main canal	WUT-BR4	BRT-9; BRT-10; BRT-11	Zone B
Right main canal	WUT-BR5	BRT-12; BRT-13; BRT-14; BRT-15	Zone B

Table 4: WUT set at Cyimpima site

Main Canal	WUT Code	Turnout Number (IU)	Irrigation Zone
Left main canal	WUT-CL1	CLT-1; CL-2; CLT-3; CLT-4; CLT-5; CLT-6	Zone A
Left main canal	WUT-CL2	CLT-7; CLT-8; CLT-9	Zone A
Left main canal	WUT-CL3	CLT-10; CLT-11; CLT-12; CLT-13	Zone B
Left main canal	WUT-CL4	CLT-14; CLT-15; CLT-16	Zone B
Left main canal	WUT-CL5	CLT-17; CLT-18; CLT-19	Zone B
Right main canal	WUT-CR1	CRT-1; CRT-2; CRT-3; CRT-4; CRT-5; CRT-6	Zone A
Right main canal	WUT-CR2	CRT-7; CRT-8; CRT-9	Zone A
Right main canal	WUT-CR3	CRT-10; CRT-11; CRT-12; CRT-13	Zone B
Right main canal	WUT-CR4	CRT-14; CRT-15; CRT-16	Zone B
Right main canal	WUT-CR5	CRT-17; CRT-18; CRT-19	Zone B

Table 5: WUT at Gashara site

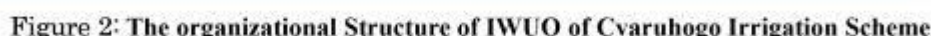
Main Canal	Name of WUT	Turnout Code	Irrigation Zone
Left Main Canal	WUT-GL1	GLT-1; GLT-2; GLT-3; GLT-4	Zone A
Left Main Canal	WUT-GL2	GLT-5; GLT-6	Zone A
Left Main Canal	WUT-GL3	GLT-7; GLT-8	Zone A

Left Main Canal	WUT-GL4	GLT-9; GLT-10;	Zone A
Left Main Canal	WUT-GL5	GLT-11; GLT-12; GLT-13	Zone B
Left Main Canal	WUT-GL6	GLT-14; GLT-15	Zone B
Right Main Canal	WUT-GR1	GRT-1; GRT-2; GRT-3; GRT-4; GRT-5	Zone A
Right Main Canal	WUT-GR2	GRT-6; GRT-7	Zone A
Right Main Canal	WUT-GR3	GRT-8; GRT-9	Zone B
Right Main Canal	WUT-GR4	GRT-10; GRT-11	Zone B

Table 6: WUT set at Cyaruhogo site

Weir	Main Canal	Name of group	Name of WUT
Weir No 1	Left main canal	Akarwa	WUT-Akarwa1
Weir No. 1	Right main canal	Akarwa	WUT-Akarwa2
GRMC	Right main canal (Gashara)	Nawe	WUT-Nawe
Existing weir	Left main canal	Sovu	WUT-Sovu
Weir No 2	Right main canal	Nyakagezi	WUT_Nyakagezi
Weir No 2	Right main canal	Nkungu	WUT_Nkungu1
Weir No 2	Left main canal	Nkungu	WUT_Nkungu2
Weir No 3	Right main canal	Rubindi	WUT_Rubindi1
Weir No 3	Left main canal	Rubindi	WUT_Rubindi2
Weir No 4	Right main canal	Rubona	WUT_Rubona1
Weir No 4	Left main canal	Rubona	WUT_Rubona2

The overall IWUO is formed by combining the four cooperatives as one big organization. The elected leaders of overall IWUO are set to represent members from each cooperative considering gender issue. In addition, during the General Assembly meeting of IWUO, a procurement committee was found necessary to be established as the organization need approval from the committee for purchase of equipment and service that require a budget of more than 50,000RwF. The final structure of the IWUO is presented in the following figure.



The rules and regulation of the scheme has been prepared and approved. The bylaw document should be considered as part of this O&MM manual. For the detail of the approved internal regulation please refer to Annex 3. The internal regulation of IWUO shall be updated during every general assembly meeting as required.

Performance agreement shall be made by and between the four cooperatives and IWUO at the beginning of every season. The size of area to be irrigated depending on the amount of water available in the scheme during each season and the responsibility of both entity shall be clarified in the agreement. The District shall sign the performance agreement as a witness.

The District has allowed the IWUO to use a facility that was left to the District by JICA project used during the rehabilitation of the scheme. The building has two offices, a meeting place, a store and a house used by guardsman. WAMCAB support in installing solar power that provides electricity for the office. IWUO is planning to install electricity from national grid to smooth the office activities, as the solar power is not dependable source during cloudy day, morning and evening time.

Regular meeting must be conducted among each committee. The General Assembly of IWUO and Cooperative is conducted in the beginning of each Season. The cost of this meeting shall be shared between IWUO and Cooperative, alternately. In addition to the explanation of Action Plan, the

reporting of financial statement of IWUO must be done during the general assembly as part of transparency and accountability

During DISC meeting, the President of IWUO should make a presentation on the activity of IWUO and problem faced in their activity

Executive committee meeting shall be made once in three month to discuss the issue pertaining in the operation and maintenance of the scheme and IWUO activities.

3. Irrigation Plan and Operation

3.1 General

As explained before Cyaruhogo Irrigation Scheme is consists of four cooperative. The schemes has many irrigation facilities that must be understood by the beneficiaries, operators and IWUO so that proper operation of the facilities are achieved and their life span be increase


3.2 Procedure of Irrigation Operation




3.2.1 The Major Infrastructures




Before one talk about the operation of an irrigation structure, it is necessary to know the types of facilities in the scheme. The following table summarize the major irrigation infrastructure of Cyaruhogo Irrigation Scheme that must be understood by beneficiaries and IWUO for proper operation and maintenance of the facilities.

Table 7: Types of irrigation structures set in the scheme


(1) Major facilities


Type of infrastructure	Name and description
	Dam: the structure that plays a role in storing water necessary for irrigation. It helps maintain a steady supply of water to paddy fields from the river even during the times of low river flow.

	<p>Valve house: is a structure housing valves that helps release water from the dam.</p> <p>Irrigation canal: the canal that convey water from the source to the irrigation system</p> <p>Emergency canal: the canal that convey water from the dam to the drainage system during emergency flow.</p>
	<p>Inside valve house there are 2 sets of three valves.</p> <p>Irrigation valve (left side): The control valves that regulate the flow of water into the irrigation system.</p> <p>Emergency valve (Right side): the valve that operates only during high flood water in the dam and during emptying the dam is required to clean it</p> <p>Environmental protection valve (middle one): the valve that feeds water (base flow) into the natural stream as keeping the environment of living things inside the stream</p>
	<p>Diversion Weir: It helps raise the water in the river using stop log and divert water to the main canal.</p>

	<p>Spillway: it serves to remove excess water smoothly from the reservoir without affecting the dam</p>
	<p>Water level gauge: The upstream of dam is provided with step that indicate the level of water which helps to know the volume of water inside the reservoir using an H-V curve</p> <p>H-V curve: In order to calculate the amount of water in the reservoir we must have a function to convert between volume and elevation. This function is defined as Volume-Elevation Curve (H-V curve)</p>
	<p>Measuring water level: The water level in the dam should be measured on a daily basis to determine the amount of water used for the irrigation and the daily flow of water into the reservoir</p>

(2) Irrigation Canals

	<p>Main Canal: It conveys water from the main source (diversion, valve house) to the irrigation system through turnouts</p> <p>Turnout: it helps divert water from main canal to secondary canal. Usually it has an opening or a gate and stop-log that helps divert water from the main canal to the secondary canal</p>
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	<p>Secondary canal: It conveys water from main canal to the field. It can be perpendicular or parallel to the main canal</p>
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(3) Other structures

	<p>Chute structure: an inclined channel through which water is conveyed smoothly and it reduce and stabilizing the slope of the canal.</p>
	<p>Drop structure: it is an irrigation structure set on the canal to reduces water velocity to non-erosive rates by reducing and stabilizing the slope of the canal</p>
	<p>Road crossing canal (culvert): This is a water way which conveys water under the road. Often it is made of concrete culvert</p>

3.2.2 Regular Operation under Normal Condition

(1) Headwork (Dam, valve house)

Before the beginning of any season, IWUO should know the volume of water available in each reservoir (H-V curve must be understood by IWUO).

Irrigation valves should be opened only when irrigation is needed, otherwise, it should be kept closed in the nighttime, rainy day and harvesting season.

Emergency valve opens only when unexpected flood occurs in the catchment area that might destroy spillway or other structures

Base flow valve is often kept open all the time to keep the environment for micro-organisms in the natural stream (main drain).

Sample H-V curves for Cyimpima dam is presented below. Say for example, when the water level is at 1354.49masl the available volume of water is around 128,306m³ (See H-V curve and table below)

For complete data, please see Annex 2.

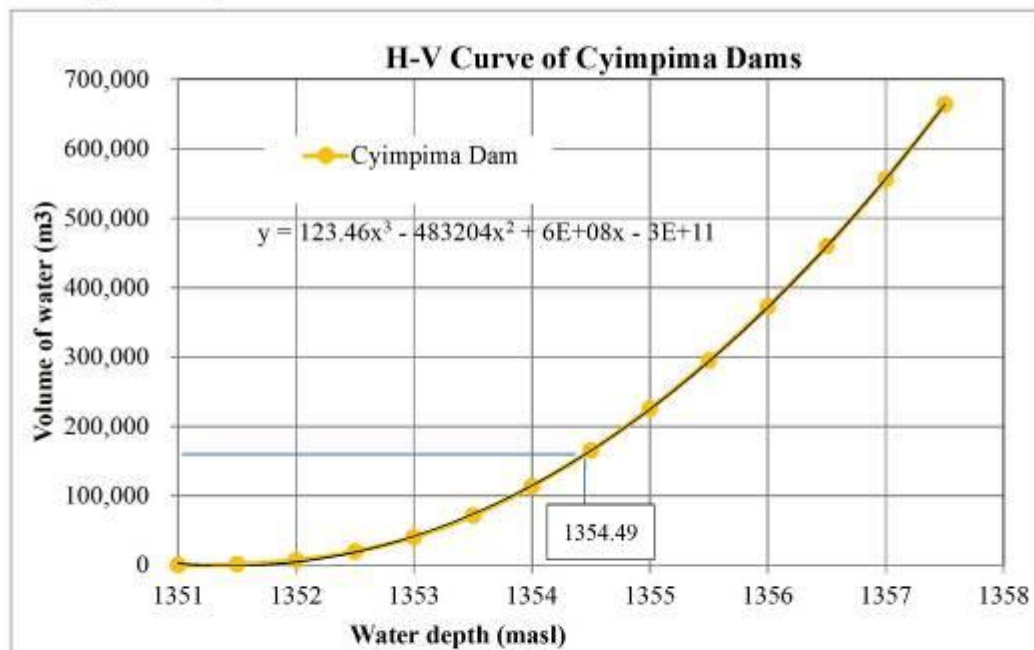


Figure 3: Sample H-V curve

**Available Volume of Water for Irrigation in the dam related to the water level
(at Cyimpima Dam)**

Elevation	0	1	2	3	4	5	6	7	8	9
1354.50	0.00	1,102	2,208	3,317	4,431	5,549	6,670	7,796	8,926	10,059
1354.60	11,197	12,319	13,484	14,634	15,788	16,945	18,107	19,272	20,442	21,615
1354.70	22,793	23,974	25,159	26,349	27,542	28,740	29,941	31,146	32,356	33,569
1354.80	34,786	36,008	37,233	38,462	39,695	40,932	42,174	43,418	44,668	45,921
1354.90	47,178	48,439	49,704	50,972	52,243	53,522	54,803	56,088	57,377	58,669
1355.00	59,966	61,267	62,571	63,879	65,192	66,508	67,828	69,153	70,481	71,812
1355.10	73,149	74,489	75,833	77,181	78,533	79,888	81,248	82,612	83,979	85,350
1355.20	86,726	88,103	89,489	90,876	92,266	93,662	95,060	96,463	97,870	99,280
1355.30	100,695	102,113	103,535	104,961	106,392	107,825	109,263	110,705	112,150	113,600
1355.40	115,053	116,519	117,972	119,436	120,904	122,377	123,854	125,334	126,818	128,306

Table 8: Sample data for the volume of water vs. depth of water in the dam

(2) Main canal and other structures

Irrigation water should be conveyed to the command area through the main canal, distributed through turnouts, secondary canal and tertiary canals. The water inside the main canal should be operated by irrigators and the water distribution among the beneficiaries shall be conducted by WUT or Seasonal Water Distributors.

3.2.3 Operation under Emergency Condition

Emergency condition occurs when there is heavy flood in the scheme or during dry season when the volume of water in the reservoir is extremely reduced.

During heavy flood, emergency valves should be opened to release excess water from the dam.

During dry season, where the volume of water is extremely low, the area to irrigate should be reduced and water distribution should be conducted seriously for fair distribution of the available water.

3.3 Irrigation Plan

3.3.1 General

An irrigation system will ensure your plot and plants are watered correctly at the optimal times, leaving you time to get other important tasks handled. You don't have to stress about whether you've watered too much or too little either, or if you've watered too much too fast, losing water due to runoff.

Irrigation scheduling is the decision of when and how much water to apply to a field. Its purpose is to maximize irrigation efficiencies by applying the exact amount of water needed to replenish the soil

moisture to the desired level. Irrigation scheduling saves water.

The important components of irrigation scheduling include: Rainfall amount. Potential evapotranspiration amount and Field capacity soil water content

3.3.2 Preparation of Irrigation Schedule

For direct sowing varieties, irrigation should be done at the interval of 7-8 days. It is necessary to fill the water in paddy field up to 4-5 cm after 2-3 week of transplanting because it increases nutrient availability and weed outbreak reduces in the land

3.3.3 Attaining Fair Water Distribution

Generally, long and narrow shaped irrigation network is common in Rwanda due to the nature of landscape. Most of the field closer to the headwork have easy access to the available while lack of water is common in the downstream part of the command area. This condition necessitate applying rotation between upstream and downstream and the introduction of SWD.

3.3.4 Irrigation rotation

The proper application of irrigation rotation between upstream and downstream is one of the important operation that must be applied in the scheme.

Table showing the

Zone A = Monday, Wednesday and Friday

Zone B = Tuesday, Thursday and Saturday

Sunday is a free irrigation day or focused on area that doesn't get enough irrigation

4. MAINTENANCE OF IRRIGATION FACILITIES

4.1 General

4.1.1 Main Functions

Everybody knows that some degree of maintenance is usually necessary, but problem arise and differences of opinion occur when further questions raised such as

- Why and when is maintenance needed?
- Who is responsible for it?
- How is it to be done and by whom
- How are the cost covered

4.1.2 Type of Maintenance

In surface irrigation system such as basin irrigation, furrow irrigation and border irrigation the main structures that needs maintenance are the irrigation canals, drainage canals, intake gates, side wall, abutment and apron of weir, drop structure, access roads, turnouts etc. The type of maintenance are cleaning of canals and drains, rehabilitation of broken structures (masonry or concrete structures), backfilling and correction of eroded structure. Compacting side bunds of the plot to avoid lateral flow from is one of the routine maintenance of basin irrigation. Maintenance of the main water source (diversion weirs, main canal) after every rainy season should be given high priority in maintenance of the irrigation system.

4.2 Inspection

Generally, for the content and method of inspection of irrigation structures please refer to O&M manual of Module prepared by WAMCAB project

4.2.1 Routine Inspection

(1) The irrigation infrastructure

Before the beginning of each season, an inspection shall be made for proper functionality of the hydraulic structure such as weir, main canal. Turnouts, gates, culverts.

Prior to the release of water into the main canal an inspection shall be made on the main canal to see if there is any obstacle, deposition of sediment, the functionality of turnouts, drop structures and breakage of canal bank by some farmer for illegal water taking

(2) Drainage canals

The inspection of the main drainage canal should be made after every rainy season by IWUO (in charge of infrastructure, manager or president). A clear plan should be set to rehabilitate damaged part of the drainage canal.

4.2.2 Damage Inspection

(1) Cause of Damages

In this irrigation scheme there is often damage from huge flood from the catchment area of the scheme after every rainy season. The damage occurs mainly on weir, main drain and main canals.

Sometimes the encroachment of animal into the main canal (which is not allowed) might also cause the damage on main canal and other infrastructures

In addition, the level of damage is also recorded during inspection including the responsible organ for rehabilitation

(2) Inspection and Action

Inspection should be made on the extent of the damage from the flood and the necessary rehabilitation plan and action to be done should be confirmed. The need for mobilization of community and necessary budget for rehabilitation of the damage should be prepared for immediate action.

4.3 Maintenance Activities

(1) The headwork (Dam, Diversion Weir)

Where there is erosion on part of the dam, it should be maintained immediately before it gets worst. The diversion weir set in the scheme (especially, Cyaruhogo site) might damage by flood during rainy season. These weirs shall be maintained after every season. The main contents of the repair shall be the removal of sediments and other structure from the weir, the rehabilitation of erosion at aprons, (abutments) of upstream and downstream of the weir. In addition, some concrete work, mortar work etc. shall be applied where the structure is damaged due to the impact of big stones transported by flood water.

(2) Canals and Related Structures

Main canals should always be free from any obstacle, grasses, stones etc. before the beginning of each season. Canals and structures on main canals such as turnouts, drop structures etc. will be damaged during flood period and/or after irrigation. Erosion, siltation, scouring of structure and overtopping or breakage of the main canal are common damages that needs maintenance in the irrigation system.

(3) Drainage system

In the scheme, the main stream is served as the main drainage canal. As there is many intermediate weir on this canal, the maintenance of drainage canal should be given the focus of the activities of the beneficiaries.

It should be rehabilitated by the community participation, for easy work, or by the trained farmers repair team on the basis of monetary payment every once in a year after flood period.

(4) Farm roads

After every rainy season, farm roads, rural road and other important roads are damaged due to the occurrence of erosion or siltation from the hillside area. These roads should be rehabilitated immediately before it gets serious if left for longer time. Dou-no technology can be used in the rehabilitation of farm roads and footpath within the scheme.

As the road is serving different stakeholders, both IWUO and Cooperatives are responsible to the maintenance of road including the milling company and union when big maintenance is needed.

4.4 Method of Maintenance

Generally for method of maintenance of irrigation structures please refer to O&M manual of Module prepared by WAMCAB project

4.4.1 Canal Cleaning

(1) Weeding

The existence of grass and other obstacle inside the canal reduce the discharge in the canal. Removal of weeds or any kind of plant from the main canal (canal bottom and side slopes) should be done at an agreed frequency within one production season. The major cleaning should be done once per each season. The cleaning shall be done mainly by community participation. Each IU or WUT members should be responsible for the cleaning of the canal that serves their plots.

(2) Desilting

Sediment removal from the main canal and other structures must be done after each rainy season or after each production season (i.e., twice a year).

4.4.2 Protection Works

(1) Backfilling around structures

Due to huge rainfall in the scheme, there is progressive erosion in around irrigation structure such as the apron and sidewalls of turnouts, drop structures and main canals. Backfilling should be done using selected soil that should be properly compacted.

(2) Rubble packing

After every rainy season< different extent of damage is expected specially downstream of weir or drop structure where hydraulic energy of water result in breakage or erosion of apron or downstream of it. Such area, better be rehabilitated using soling. Soling (Rubble packing) is the process of hand packing rubble stones one adjacent to another, to provide a stable waterway downstream of apron on weir or drop structures.

(3) Do-Nou Technology

Rural road, farm roads and other necessary road that are helpful to the community should be maintained properly. One of the simplest and long-lasting repair method id Do-nou technology that can be made with locally available materials, such as soil rope and sandbag. It is generally the filling of soil in sandbags and repairing potholes and other damaged part of the road.

The method of do-nou technology is explained in detail on Road Repair Manual of Out-put 3

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of WAMCAB project.

4.4.3 Minor Repair to Structures

(1) Cement mortar

Minor repairs are always aimed at maintaining the performance of a structure; during minor repairs, small scale defects of finishing layers and fillings, as well as minor damages of the facilities are eliminated. Minor repairs are carried out with a frequency that ensures the effective operation of the structure from the moment when construction is completed till the next major repairs.

Cement mortar can effectively be used for small-scale defects or cracks on structure that might be caused by the collusion of stone carried by flooding of stream or main canal.

(2) Concrete or Masonry

If the cracks or damage on a structure is larger there is a need to repair with masonry or concrete work. Proper plan and remedial design should be prepared, cost estimated and approved by the IWUO executive committee.

4.4.4 Earth Filling

(1) Stripping of top soil

Before rehabilitation of earthwork by filling of earth material, the top soil should first be stripped to remove unwanted material that will reduce the compaction of the filled soil.

(2) Heightening and widening of canal bank and farm road

As time goes by, infrastructures depreciates and loss its original shape due to many reasons such as erosion or human act. The shape of canals changed, width of farm roads reduced. These situation necessitate increasing the height or widening of canals and farm roads. Proper care must be applied to achieve the original shape of these structures and maintenance guidance prepared by WAMCAB should be adhered to, such as Do-nou technology.

4.4.5 Maintenance of Valve

Out of all the six valves installed in the valve house, the operating valve is the main valve that will be operating on a daily basis, hence vulnerable/susceptible to damage quickly due to mismanagement. This valve sometimes result in breakage due to too much torque applied during opening and closing of the valve, as happened at Cyimpima in 2022.

The method of fixing/repairing the broken valve is explained in Annex 1 from the experience of Cyimpima valve.

The cause of breakage was the application of excessive torque/force during closing of the valve by a drunk operator.

5. BUDGET, WATER FEE AND OTHER ACCOUNTING PROCEDURE

5.1 Budget of the Scheme

Action plan should be prepared annually and presented to the GA for approval. Similarly, seasonal budget of the scheme must be prepared and approved by the General Assembly of IWUO

The source of fund for IWUO is mainly the water fee collected from the beneficiaries of the scheme.

5.2 Water Fee Collection

Often it is common to hear from the farmer that “water is God given natural resource, then why we need to pay for it?” First, one must understand the meaning and purpose of water service fee that must be paid by the beneficiaries. Every beneficiaries of the water in the irrigation system should be registered as member of IWUO and each member of IWUO should pay water service fee.

Those beneficiaries under cooperatives, the water fee should be deducted from their product after harvest. This will be done under the Performance Agreement signed between the two. Whereas, if there are other beneficiaries, like hillside vegetable producers, they have to pay water fee as one of the input for farming. Payment is better be paid before planting and irrigating the crops so that it will avoid mistrust between the farmers and IWUO. A farmer who failed to contribute for water service fee should be removed from Cooperative membership or stopped from using water from the scheme.

IWUO and local leaders including the District should involve in enforcing the rules and regulation of IWUO.

5.3 Bank Account

IWUO should open bank account for the purpose of fund management. As directed by M.O. the IWUO should open two bank account, such as O&M Fund and Reserve Fund. The water fee collected from the beneficiaries should be deposited in the two bank account in the ratio agreed in the Rules and Regulation of IWUO. Presently 75% of the collected water fee should be deposited in one account as O&M Fund and the remaining 25% should be deposited as Reserve Fund.

5.4 Accounting Book and Cash Receipt Systems

5.4.1 Accounting Book

Accounting Books are all books and records that are or can be made available to the independent auditors for the purpose of auditing the financial statements and expressing an opinion thereon. The account book covers ledger account, bankbook and cashbook. The account should be supported with evidence such as receipts, payment bills, minutes of meeting, expense order etc. The accountant or the manager of IWUO must be responsible for arranging and managing the accounting books of

IWUO. He or She should present it to the audit committee or any external auditor as per required. District staffs will also have access to the accounting book when required. Financial statement should be prepared before every season and present to the general assembly so as to create accountability and transparency of the budget.

5.4.2 Cash Receipt Systems

A cash receipt is a printed acknowledgement of the amount of cash received during a transaction involving the transfer of cash or cash equivalent. The original copy of the cash receipt is given to the customer, while the other copy is kept by the seller for accounting purposes.

IWUO should prepare its own cash receipt for the purpose of cash transaction. The accountant shall prepare the receipt for payment, checked by the manager and approved by the President.

In the collection of water fee from cooperative the cash receipt system must follow the following simple procedure.

Step 1: Cooperative and IWUO must sign a performance agreement at each season and it should indicate the responsibility of each entity. The agreement must include but not limited to the size of irrigated land, the expected amount of water feet, terms of payment, transfer date and account number of IWUO etc.

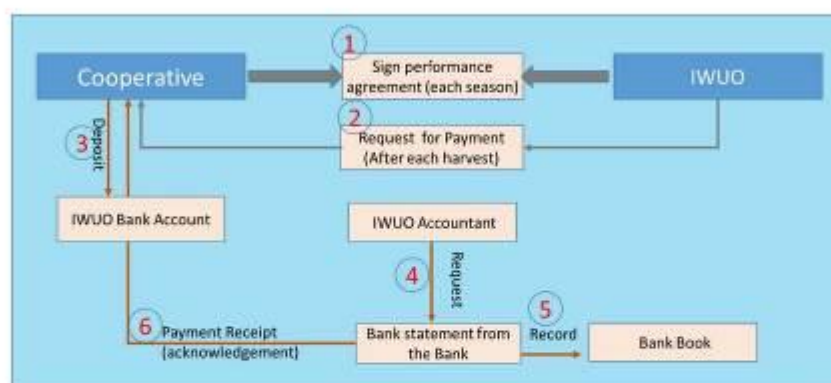
Step 2: Once the period of payment (often after harvest) approaches, IWUO should made a request of payment (as a reminder) to the Cooperative

Step 3: The cooperative shall deposit the amount agreed to IWUO bank account at the agreed time.

Step 4: IWUO accountant or the manager request bank-statement from the bank

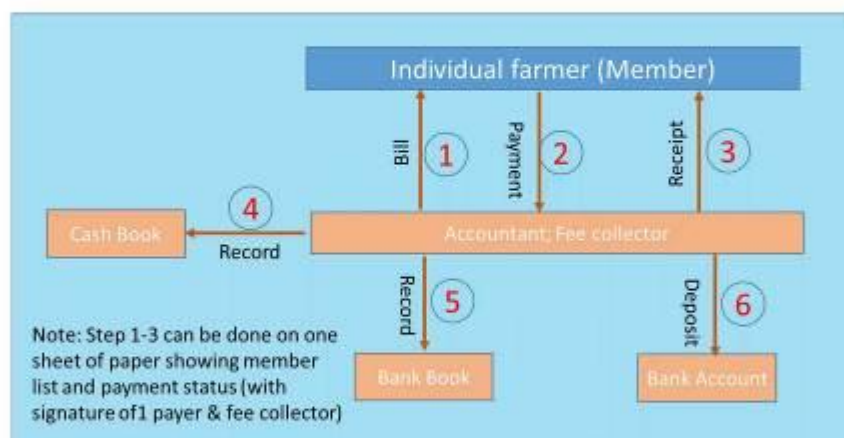
Step 5: Once the amount deposited is confirmed from the bank statement, IWUO accountant or manager shall record this transaction on bankbook

Step 6: IWUO shall give payment receipt (acknowledgment) of the deposited cash to the Cooperative.



In the collection of income from other source, such as sell of sand or hillside farming, a properly prepared format approved by executive committee shall be used. The format must include name and signature of farmer who pays the bill and the person who receive the bill. The bill will be checked by the Manager and the President, frequently. The following figure shows the process that shall be

applied when collecting cash from individual members or other source (punishment, milling, hillside farmer, cattle owner, etc.



Payment sheet is used for collecting money

Receipt is given

Recorded in special book for water fee

Deposited in the bank

Record in bank book

5.4.3 Purchasing Procedure

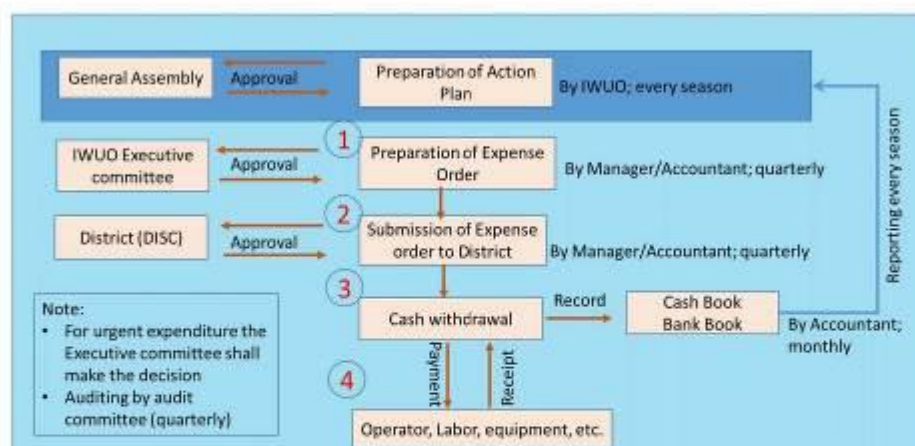
After the approval of expense order by District to maintain the irrigation facilities or purchase necessary material, IWUO committee instructs the accountant to disburse the money. An expense order sheet should be prepared for transparent process of money handling. It is recommended that the signer of the sheet be Chairperson that should be approved by the District.

If the cost of the expense is more than e.g. RwF. 20,000, the IWUO committee must have an action plan that is approved during the general assembly. If the expense is required for urgent unplanned purpose an urgent meeting shall be done by the overall committee for approval of the expense before submitted to the District for expense order.

In some irrigation schemes, the following effective and efficient practice is carried out

“A member pays O&M fee to the IWUO’s bank account individually and then brings the bank slip to the IWUO office to verify the payment. The treasurer records in a ledger after receiving the bank slip then issues a receipt to the member.”

Generally, for IWUO to use the budget it has to go through the following process.



The above figure shows the process for the use of expense under IWUO. Initially the general assembly must approve the action plan of the IWUO every season. Once the action plan is approved by the general assembly:

- Step 1: IWUO Manager or accountant prepare expense order, monthly. It should include salary, payment for rehabilitation or maintenance of facilities in the coming month. The expense order must be approved by executive committee and signed by the president to be submitted to District.
- Step 2: The prepared expense order must be submitted to the District (DISC) for approval.
- Step 3: Once the expense order is approved by the District, IWUO will withdraw money from the bank. Procurement committee shall approve if the budget to be used by IWUO exceeds more than 500,000RwF. After each payment made the accountant must record the amount withdrawn in the cashbook and bankbook. The payment of salary will done through bank transfer
- Step 4: Payment shall be made to the required purpose (labor, material, etc.), receipt shall be received and recorded in the Cashbook, and balance of everyday expense must be recorded in the book. Accountant must prepare a monthly financial report for the purpose of auditing and to be presented to the general assembly every season.

The following is the sample format to be used in the preparation of financial statement. One can modify this format as required.

(i) **Balance in bank account**

Date: _____

Recorded by: _____

Balance in Bank Account

Period: Until Month/Year

Description	Name of Bank	Balance in account
A/c No. 1234567	KBC (O&M fund)	5,230,000
A/c No. 5678910	BK (Reserve fund)	1,500,000
A/c No. 9876543	SACCO (O&M fund)	650,000
Total		7,330,000

(ii) **Revenue**

Period (Season A): From Month / Year To Month / Year

Description	Expected amount (RwF)	Actual amount (RwF)
Water fee from marshland	12,000,000	8,000,000
Mining	350,000	350,000
Water fee from Hillside	1,230,000	560,000
Other		
Total		8,910,000

(iii) **Expenditure**

Period (Season A): From Month / Year To Month / Year

Description	Planned amount (RwF)	Actual amount (RwF)
Salary of operators	810,000	810,000
Rehabilitation of drainage canal (main canal)	3,000,000	1,800,000
Utility cost for office	150,000	95,000
Meeting allowance		
Transport fee		
Communication fee		
Inspection of facilities		
Total		2,705,000

Annex 1: How to repair a broken irrigation valve

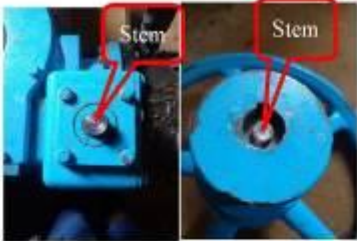




This simple guidance is prepared for irrigation scheme constructed by JICA such as Ngoma-22 and Cyaruhogo Scheme, where the type of irrigation valves are similar.



1. General view of valve house at Cyaruhogo Scheme



2. The main characteristics of a broken irrigation valve and its repair procedure

	<ul style="list-style-type: none"> ✓ Irrigation Valve before broken ✓ Butter fly type ✓ Easy to operate, can be operated with very little energy ✓ If excessive energy applied, the stem will break
	<ul style="list-style-type: none"> ✓ A broken irrigation valve (Cyimpima, 2021). ✓ The stem that connect the handle to the valve is broken due to poor operation by a drunken operator ✓ Half part of the stem remain inside the handle and the other half remain with the valve ✓ These two parts of the broken stems should be welded properly

	<ul style="list-style-type: none"> ✓ Broken stem on the main body of the valve and inside the detached operating handle
	<p>Disassembling the handle (parts of the handle)</p> <ol style="list-style-type: none"> 1. The stem 2. The body 3. Operating wheel 4. Bolt-nut the fix the stem to the wheel
	<ul style="list-style-type: none"> ✓ The stem can be removed by releasing the side bolt that holds it with stem holder ✓ When it is difficult, it can be removed by welding the stem part with small iron-bar on which force is applied using a hammer
	<ul style="list-style-type: none"> ✓ Part of the broken stem (the key) removed from its body
	<ul style="list-style-type: none"> ✓ Welding the two stem ✓ It will be better if good welding system is adopted to create good bond between the broken parts

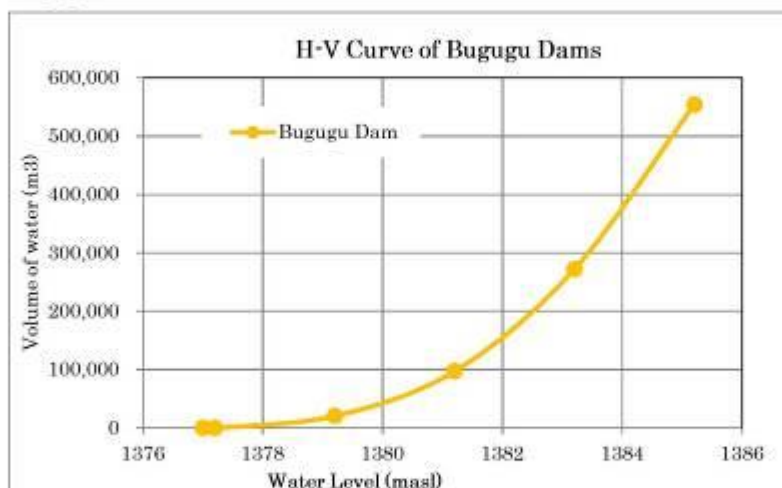
	<ul style="list-style-type: none"> ✓ Welded stem Care must be given to uprightness of the stem during welding ✓ Once adjusted, the body and handle can be fixed back
	<ul style="list-style-type: none"> ✓ Reassembling the body and handle back to the main valve

3. Point to be taken into account

- During welding of the stem, make sure the stem is upright so that it avoid jerking of the operating handle during operation
- After welding, the stem should be made clean before reassembling the body and handle part
- Clear advice and guidance should be given to each operator on how to operate the irrigation valve (no too much torque)
- No operator is allowed to enter into the valve house if he got drunk
- The operator who disobey the directive given by IWUO shall be responsible to cover the cost of the repair.

Annex 2: H-V curves for Cyimpima, Gashara and Bugugu Dam at Cyaruhogo Irrigation Scheme

1) H-V data for Bugugu Dam

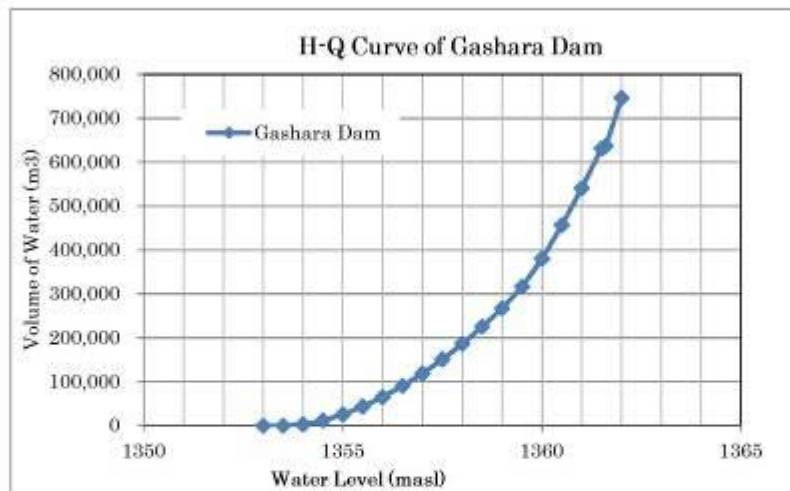


Available Volume of Water for Irrigation in the dam related to the water level
(at Bugugu Dam)

Elevation	0	1	2	3	4	5	6	7	8	9
1379.80	0	732	1,465	2,395	2,940	3,639	4,432	5,184	5,935	6,639
1379.90	7,466	8,205	8,867	9,732	10,499	11,269	12,042	12,817	13,585	14,176
1380.00	15,180	15,946	16,733	17,527	18,321	19,118	19,918	20,720	21,523	22,333
1380.10	23,144	23,957	24,773	25,592	26,413	27,237	28,064	28,894	29,726	30,561
1380.20	31,789	32,240	33,082	33,929	34,779	35,629	36,484	37,340	38,200	39,061
1380.30	39,928	40,793	41,666	42,540	43,416	44,294	45,176	46,060	46,948	47,837
1380.40	48,730	49,625	50,523	51,424	52,328	53,234	54,143	55,056	55,970	56,887
1380.50	57,809	58,710	59,616	60,531	61,516	62,499	63,485	64,476	65,468	66,213
1380.60	67,141	68,111	69,085	70,021	70,960	71,942	72,906	73,873	74,843	75,816
1380.70	76,791	77,769	78,751	79,734	80,721	81,710	82,701	83,697	84,695	85,696
1380.80	86,689	87,705	88,714	89,725	90,740	91,756	92,776	93,799	94,824	95,851
1380.90	96,884	97,912	98,954	99,982	101,015	102,066	103,128	104,178	105,231	106,287
1381.00	107,146	108,008	108,873	110,159	111,409	112,681	113,757	114,815	115,916	117,000
1381.10	118,086	119,175	120,267	121,362	122,469	123,568	124,663	125,769	126,877	127,989
1381.20	129,103	130,229	131,319	132,462	133,587	134,715	135,845	136,979	138,113	139,254
1381.30	140,196	141,341	142,688	143,838	144,991	146,147	147,305	148,466	149,630	150,796
1381.40	151,066	151,138	154,313	155,490	156,678	157,854	159,040	160,228	161,419	162,613
1381.50	163,819	165,019	166,212	167,417	168,623	169,833	171,045	172,264	173,482	174,704
1381.60	175,929	177,155	178,385	179,617	180,853	182,090	183,310	184,574	185,829	187,068
1381.70	189,320	189,514	190,810	192,090	193,182	194,617	195,825	197,119	198,428	199,704
1381.80	200,982	202,265	203,547	204,853	206,125	207,415	208,709	210,006	211,308	212,609
1381.90	213,914	215,222	216,533	217,846	219,162	220,481	221,802	223,126	224,452	225,792
1382.00	227,114	228,448	229,786	231,126	232,468	233,813	235,161	236,512	237,865	239,221
1382.10	240,579	241,841	243,104	244,671	246,029	247,411	248,795	250,162	251,542	252,924
1382.20	254,108	255,696	257,086	258,478	259,873	261,271	262,671	264,074	265,480	266,888
1382.30	268,299	269,712	271,128	272,546	273,967	275,390	276,817	278,246	279,677	281,111
1382.40	282,547	284,986	286,428	288,872	289,318	289,767	291,319	292,873	294,120	295,506
1382.50	297,051	298,516	299,982	301,452	302,924	304,398	305,876	307,355	308,837	310,321
1382.60	311,808	313,298	314,789	316,284	317,781	319,280	320,782	322,286	323,793	325,302
1382.70	326,814	328,328	329,843	331,363	332,888	334,410	335,936	337,465	338,997	340,531
1382.80	342,067	343,605	345,147	346,689	348,236	349,784	351,335	352,888	354,444	356,001
1382.90	357,362	359,125	360,689	362,257	363,827	365,399	366,973	368,551	370,130	371,711
1383.00	373,295	374,882	376,471	378,062	379,655	381,251	382,849	384,449	386,052	387,657
1383.10	389,264	390,873	392,485	394,099	395,716	397,335	398,956	400,579	402,205	403,833
1383.20	405,463	407,096	408,739	410,387	412,038	413,685	415,291	416,937	418,586	420,235
1383.30	423,888	425,543	427,209	428,869	430,521	432,185	433,850	435,518	437,189	438,861
1383.40	439,536	440,212	441,891	443,572	445,255	446,941	448,628	450,318	452,010	453,704
1383.50	455,409	457,098	458,798	460,504	462,205	463,912	465,620	467,332	469,044	470,759
1383.60	472,478	474,195	475,918	477,640	479,163	481,092	482,821	484,551	486,286	488,022
1383.70	489,759	491,499	493,240	494,984	496,739	498,477	500,227	501,978	503,731	505,487
1383.80	507,244	509,004	510,765	512,528	514,293	516,061	517,830	519,601	521,374	523,149
1383.90	524,923	526,704	528,485	530,267	532,051	533,836	535,620	537,416	539,208	541,001
1384.00	542,797	544,594	546,393	548,195	549,998	551,802	553,609	555,417	557,227	559,039

Figure 4: H-V curve and data for Bugugu dam

2) H-V data for Gashara Dam

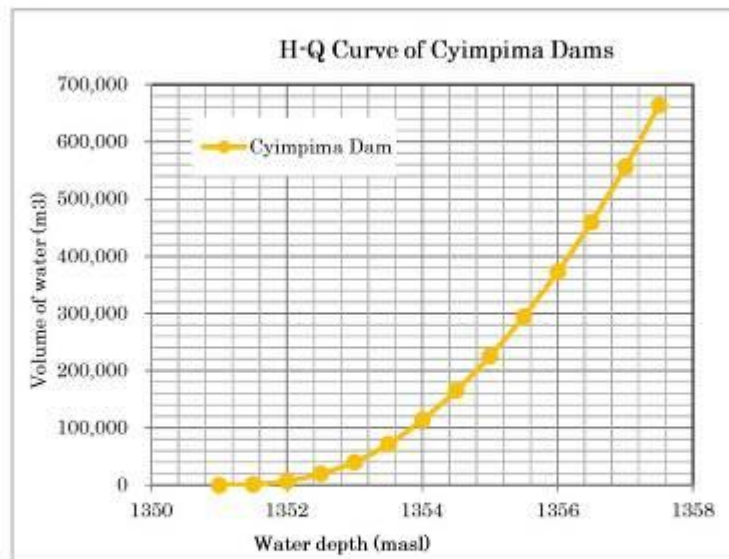


Available Volume of Water for Irrigation in the dam related to the water level
(at Gashara Dam)

Elevation	0	1	2	3	4	5	6	7	8	9
1357.60	8	660	1,321	1,984	2,648	3,312	3,975	4,638	5,302	5,965
1357.60	6,667	7,542	8,419	8,897	9,375	10,008	10,744	11,479	12,115	12,804
1357.70	11,494	14,136	16,878	18,555	19,272	19,970	17,671	18,372	19,076	19,782
1357.80	20,489	21,197	21,899	22,621	23,321	24,051	24,768	25,489	26,209	26,972
1357.90	27,657	28,384	29,112	29,842	30,574	31,308	32,043	32,781	33,521	34,261
1358.00	35,005	35,730	36,456	37,185	37,906	38,628	39,351	40,079	40,817	41,577
1358.10	42,159	42,901	43,645	44,387	45,107	45,828	46,549	47,271	47,992	48,716
1358.20	50,768	51,672	52,437	53,235	53,975	54,767	55,561	56,357	57,156	57,986
1358.30	58,788	59,601	60,408	61,228	62,042	62,849	63,658	64,461	65,268	66,074
1358.40	66,258	67,164	67,992	68,822	69,634	70,449	71,256	72,065	72,868	73,670
1358.50	74,096	75,544	76,385	77,547	78,102	78,859	79,619	80,381	81,145	81,912
1358.60	81,281	84,132	85,828	86,902	88,700	89,481	90,544	91,410	92,289	93,209
1358.70	92,102	92,999	93,893	94,786	95,698	96,609	97,512	98,422	99,336	100,251
1358.80	107,149	107,888	108,611	109,318	110,057	110,797	111,531	112,267	113,006	113,748
1358.90	118,492	119,439	120,388	121,340	122,295	123,252	124,211	125,176	126,142	127,118
1359.00	128,091	129,056	129,912	130,817	131,749	132,679	133,607	134,536	135,467	136,399
1359.10	139,948	140,880	141,811	142,764	143,719	144,668	145,619	146,571	147,524	148,478
1359.20	149,103	150,134	151,169	152,207	153,247	154,292	155,339	156,389	157,442	158,498
1359.30	159,174	160,238	161,305	162,374	163,436	164,501	165,568	166,631	167,697	168,761
1359.40	169,124	170,219	171,311	172,407	173,501	174,598	175,691	176,786	177,881	178,978
1359.50	172,411	173,543	174,674	175,808	176,945	178,087	179,232	180,379	181,521	182,666
1359.60	181,844	182,996	184,172	185,340	186,513	187,689	188,869	190,045	191,229	192,478
1359.70	195,821	196,821	197,822	198,827	199,835	200,848	201,864	202,884	203,904	204,924
1359.80	207,761	209,000	210,239	211,482	212,728	213,978	215,232	216,489	217,751	219,017
1359.90	220,294	221,568	222,847	224,119	225,399	226,681	227,966	229,251	230,536	231,821
1360.00	234,260	235,512	236,760	238,012	239,278	240,548	241,822	243,098	244,378	245,658
1360.10	246,320	247,674	249,024	250,378	251,685	253,017	254,351	255,684	257,019	258,358
1360.20	260,182	261,659	263,062	264,469	265,881	267,290	268,717	270,141	271,570	273,004
1360.30	274,442	275,885	277,332	278,784	280,249	281,701	283,167	284,637	286,112	287,592
1360.40	288,076	289,555	291,038	292,527	294,021	295,518	297,019	298,524	300,031	301,544
1360.50	304,180	305,717	307,259	308,809	310,357	311,914	313,478	315,041	316,603	318,169
1360.60	319,771	321,358	322,950	324,541	326,147	327,754	329,366	330,981	332,595	334,214
1360.70	335,884	337,584	339,147	340,795	342,449	344,107	345,772	347,441	349,116	350,797
1360.80	352,482	354,173	355,869	357,571	359,279	360,991	362,710	364,433	366,162	367,897
1360.90	369,619	371,354	373,089	374,832	376,585	378,345	380,109	381,877	383,650	385,424
1361.00	387,171	389,153	391,062	392,977	394,896	396,821	398,754	400,692	402,636	404,585
1361.10	405,449	407,382	409,309	411,242	413,172	415,107	417,039	418,977	420,920	422,868
1361.20	424,328	426,448	428,576	430,710	432,851	434,998	437,151	439,311	441,476	443,648
1361.30	444,929	446,971	449,002	451,039	453,085	455,131	457,189	459,253	461,321	463,394
1361.40	465,462	467,510	469,558	471,612	473,672	475,738	477,811	479,891	481,976	484,068
1361.50	486,151	488,258	490,365	492,478	494,591	496,709	498,831	500,959	503,091	505,224
1361.60	506,478	508,603	510,724	512,842	514,965	517,091	519,221	521,357	523,491	525,633
1361.70	528,381	530,536	532,699	534,869	537,044	539,221	541,402	543,587	545,771	547,961
1361.80	551,462	553,786	556,126	558,470	560,827	563,179	565,545	567,919	570,299	572,688
1361.90	575,094	577,488	579,899	582,318	584,745	587,179	589,621	592,072	594,530	596,995
1362.00	599,464	601,949	604,479	606,916	609,441	611,972	614,474	617,005	619,540	622,081

Figure 5: H-V curve and data for Gashara dam

3) H-V data for Cyimpima Dam



Available Volume of Water for Irrigation in the dam related to the water level
(at Cyimpima Dam)

Elevation	0	1	2	3	4	5	6	7	8	9
1354.50	0.00	1,103	2,309	3,517	4,731	5,949	7,170	8,396	9,626	10,859
1354.60	11,197	12,319	13,454	14,604	15,758	16,905	18,107	19,272	20,442	21,613
1354.70	22,793	23,914	25,038	26,169	27,302	28,440	29,581	30,748	31,908	33,100
1354.80	34,796	35,908	37,023	38,142	39,265	40,392	41,524	42,670	43,818	44,971
1354.90	47,178	48,289	49,404	50,522	51,643	52,767	53,894	55,024	56,155	57,277
1355.00	59,966	61,077	62,192	63,310	64,432	65,556	66,682	67,810	68,941	70,073
1355.10	71,449	72,560	73,675	74,793	75,913	77,036	78,161	79,288	80,417	81,547
1355.20	83,726	84,837	85,952	87,069	88,188	89,309	90,432	91,556	92,681	93,808
1355.30	100,603	101,714	102,829	103,946	105,064	106,183	107,303	108,424	109,546	110,669
1355.40	115,053	116,164	117,279	118,396	119,514	120,633	121,753	122,874	123,996	125,118
1355.50	129,797	130,908	132,023	133,139	134,256	135,374	136,492	137,611	138,730	139,849
1355.60	144,936	146,047	147,162	148,279	149,396	150,514	151,632	152,751	153,870	154,989
1355.70	160,435	161,546	162,661	163,777	164,893	166,010	167,127	168,244	169,361	170,478
1355.80	176,128	177,239	178,354	179,469	180,584	181,699	182,814	183,929	185,044	186,159
1355.90	192,517	193,628	194,743	195,858	196,973	198,088	199,203	200,318	201,433	202,548
1356.00	209,202	210,313	211,428	212,543	213,658	214,773	215,888	216,999	218,114	219,229
1356.10	226,191	227,302	228,417	229,532	230,647	231,762	232,877	233,992	235,107	236,222
1356.20	243,536	244,647	245,762	246,877	247,992	249,107	250,222	251,337	252,452	253,567
1356.30	261,235	262,346	263,461	264,576	265,691	266,806	267,921	269,036	270,151	271,266
1356.40	279,779	280,890	282,005	283,120	284,235	285,350	286,465	287,580	288,695	289,810
1356.50	297,668	298,779	299,894	301,009	302,124	303,239	304,354	305,469	306,584	307,699
1356.60	316,382	317,493	318,608	319,723	320,838	321,953	323,068	324,183	325,298	326,413
1356.70	335,437	336,548	337,663	338,778	339,893	341,008	342,123	343,238	344,353	345,468
1356.80	354,792	355,903	357,018	358,133	359,248	360,363	361,478	362,593	363,708	364,823
1356.90	374,467	375,578	376,693	377,808	378,923	380,038	381,153	382,268	383,383	384,498
1357.00	394,466	395,577	396,692	397,807	398,922	400,037	401,152	402,267	403,382	404,497
1357.10	414,722	415,833	416,948	418,063	419,178	420,293	421,408	422,523	423,638	424,753
1357.20	435,262	436,373	437,488	438,603	439,718	440,833	441,948	443,063	444,178	445,293
1357.30	456,136	457,247	458,362	459,477	460,592	461,707	462,822	463,937	465,052	466,167
1357.40	477,227	478,338	479,453	480,568	481,683	482,798	483,913	485,028	486,143	487,258
1357.50	498,592	499,703	500,818	501,933	503,048	504,163	505,278	506,393	507,508	508,623

Figure 6: H-V curve and data for Cyimpima dam

Annex 3: Internal Rules and Regulation of Abahizi Ba Rwamagana

The Project for Water Management and Capacity Building in Rwanda, WAMCAB

Internal Regulations
for
Abahizi ba Rwamagana
(Irrigation Water Users Organization, IWUO)

Octobre 2020

Rwamagana



*Water Management and Capacity Building Project
(WAMCAB)*



Training Manual

for

Operation and Maintenance of Irrigation Infrastructures

February 2025

Prepared under WAMCAB in collaboration with RAB

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Abbreviation

BoQ	Bill of Quantity
EC	Executive Committee
FC	Field Collaborator
FRT	Farmers' Repair Team
Frw	Rwandan Franc
GEP	Google Earth Pro
GPS	Global Positioning System
IMTA	Irrigation Management Transfer Agreement
IWUO	Irrigation Water Users Organization
JICA	Japan International Cooperation Agency
O&M	Operation and Maintenance
PM&E	Participatory Monitoring and Evaluation
PIM	Participatory Irrigation Management
WAMCAB	Water Management and Capacity Building
RAB	Animal Resources Development Board
RSSP	Rwanda Rural Sector Support Project
Rwf.	Rwandan Franc
SMAP	Strategic Management and Accountability Plan
SMC	Scheme Management Committee
ZC	Zonal Committee
GNSS	Global Navigation Satellite Systems

Chapter 1 Introduction

The Project for Water Management and Capacity Building (WAMCAB) has been implemented from March 2019 to February 2025 through the support from the Japan International Cooperation Agency (JICA). The main objective of the project was capacitating the stakeholders related to the management of irrigation scheme, such as Irrigation Water Users Organization (IWUO), so that they could achieve the sustainable management of irrigation schemes in Rwanda. The implementation of the project was conducted in collaboration with the staffs of Rwanda Agriculture and Animal Resources Development Board (RAB).

In this project, different training modules, management model and IMTA manual were prepared that will be applied to capacitate the stakeholders related to sustainable management of irrigation scheme in Rwanda.

According to the Ministerial Order of Rwanda No. 001/11.30 of 23/11/2011, IWUO is expected to perform as a non-governmental organization in the management of the irrigation scheme it operates. The management capacity of the beneficiaries need to be improved in different aspect of IWUO management. This manual is prepared to improve the management capacity of the beneficiaries of irrigation scheme in Rwanda. The manual is organized into twelve chapter.

The manual explains the importance of Participatory Irrigation Management (Chapter 2) and the IWUO's implementation structure (Chapter 3) for sustainable irrigation scheme management.

In the first part of the manual, the importance of preventive and early-stage repair work (Chapter 4) is explained to motivate people to perform proper operation and maintenance on a regular basis. It explains how to manage facilities (Chapter 5) and how to map (Chapter 6) and inspect (Chapter 7) them for this purpose. It also explains specific techniques for facility repair and civil works (Chapter 9), as well as techniques for repairing farm roads using sandbags (Chapter 10) by IWUO itself, and routine O&M activities (Chapter 12). It explains how to prepare Bills of Quantities (Chapter 8) and O&M plans (Chapter 11) related to these activities.

All the training manual are prepared under WAMCAB project in collaboration with RAB. The manuals are expected to be used in capacitating IWUO in the country and must be given to the target trainees on routine basis as elected leaders are substituted every three years. The District and RAB should take the responsibility of the routine training

Chapter 2 Importance of PIM

Content Type	Concept and Theory		
Objectives	In this chapter, an overview of Participatory Irrigation Management (PIM), which is still not well known in Rwanda, is provided, and why PIM is important for sustainable irrigation scheme management, its benefits and expected outcomes are explained.		
Outcomes	It is expected that the understanding of the content of this chapter will foster a sense of ownership of irrigation scheme (facilities) and encourage farmers to take a more active role in the operation and maintenance of the irrigation facilities in their schemes.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

2.1 Introduction

2.1.1 Introductory questions

Have you heard about participatory water management before? Participatory Irrigation Management, PIM, is an important concept in the sustainable operation, maintenance and management of irrigation scheme. Dialog below is the conversation between Farmers about example of ownership.

Farmer A: Can I borrow a pen?

Farmer B: What happened to the one they gave us at the beginning of the workshop?

Farmer A: I've lost it already.

Farmer B: Why do you lose it so easily when you were given it?

Farmer A: It's hard to manage it well when I think I'll get it again soon.

Farmer B: That's because of a lack of ownership. You didn't pay for it yourself, so you don't recognize it as your own. I think it's because they think that it's no problem to lose it because they'll get it again soon, or they can borrow it from someone else.

Farmer A: You could be right... If I buy my own tools or mobile phone, I will repair it and use it even if it is broken....

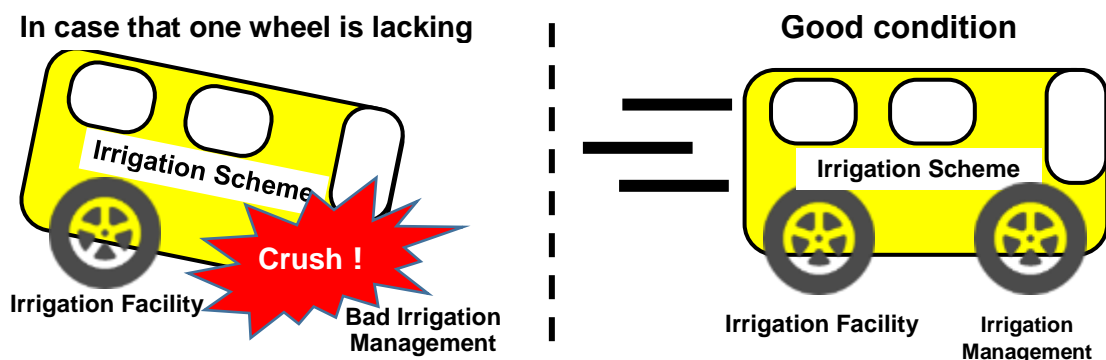
The same can be said for the maintenance of irrigation scheme. Because the government or donors have constructed or developed the facilities on their own, mostly the beneficiaries were not participated in the planning and implementation stage leading to that they are not aware that they own these facilities, so farmers do not think that they need to maintain the facilities because they think that the government or donors will repair the facilities if repair is needed.

In general, the ministry of agriculture through RAB establish IWUO capacitate it and sign an Irrigation Management Transfer Agreement (IMTA). However, most of the beneficiaries lack proper capacity for O&M of the scheme and don't have enough finance or management capacity to maintain the IWUO as an organization. Most of the IWUO also think that they don't need to manage the irrigation facilities because they were developed by the government and donors without the proper participation and involvement of the beneficiaries. Some beneficiaries think that the government budget should be used to maintain and manage the facilities in the irrigation scheme?

2.2 What is Participatory Irrigation Management (PIM)?

Participatory Irrigation Management (PIM) means that all stakeholders, such as beneficiaries, local leaders and central government, should participate and especially farmers' participation for the activities and discussions about irrigation management is important. More precisely, PIM is an approach of irrigation development and management with the participation of all stakeholders, especially farmers”.

In regard to irrigation system, irrigation facility and irrigation management are like the two wheels of a vehicle, so irrigation system cannot function well if even one of them is lacking.



Both wheels, Irrigation Facilities and Irrigation Management, are required for proper management of the Irrigation system. And stakeholders means not only main water user, farmers, but also other water users and government from central to sector level are also included. So not only farmers but also those other stakeholders are expected to participate irrigation management actively.

2.3 Key to the success of Participatory Irrigation Management (PIM)

The requirement for successful Participatory Irrigation Management is “Active participation of farmers in the management of irrigation scheme”. It can be said that the two pre-requirements for satisfying this condition are:

- (1) fair water distribution and
- (2) Ensuring the stable profitability of irrigated agriculture.

Since "Vitalization IWUO's activities" is the foundation of the success of Participatory Irrigation Management, it is also important to strengthen capacity for organizational management and system for water fee collection.

It is most important to foster a sense of ownership, with irrigation schemes being managed by IWUO. In addition, there are two essential aspect for sustainable scheme management.

- (1) A sense of participation and cooperative management by all water users. And
- (2) an understanding of the need and importance of equitable water distribution and water fee.

For more information on commercial agriculture, please refer to the SMAP and WAMCAB Output 5 manuals for more details, if necessary.

In order to collect sufficient water fees, it is essential that farmers receive a stable and adequate profit from their agricultural production. In this context, proper irrigated agriculture practices are important, as it has the potential to reduce damage caused by drought, allow cultivation at times when rain-fed agriculture is not possible, and improve the quality of products.

2.4 Expected outcomes of PIM

By the participation of stakeholders and water users (farmers) in Irrigation Management, it is expected to produce outcomes as follows.

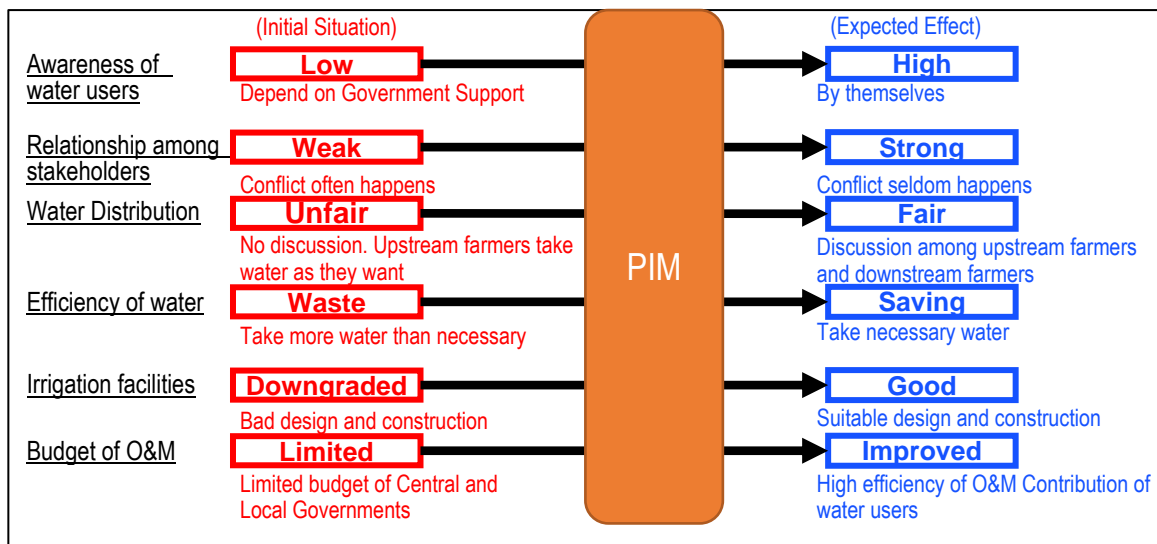


Figure: Expected changes in stakeholders as a result of the introduction of PIM.

2.4.1 Awareness of water users:

Awareness of water users is inadequate and farmers are depending on Support from Government in general. Farmers doesn't have any idea that they are the main actor to maintain irrigation schemes. But through PIM, farmers' awareness become high. They will participate actively for the planning and carry out the necessary activities themselves.

2.4.2 Relationship among stakeholders:

Weak relationships among water users causes conflicts in water use and other aspects like cops value chain management. However, as PIMs become more common, relationships are developed through participation in activities, and problems are less likely to occur, and when conflicts occur, they are resolved through discussion and the application of rules in IWUO.

2.4.3 Water Distribution:

The upstream and downstream farmers will be consulted by the IWUO through the PIM to ensure fair water distribution and its efficient use in the scheme .

2.4.4 Irrigation facilities:

Ideally, farmers should be involved from the planning stage when new irrigation scheme are developed or existing schemes are rehabilitated, and their opinions should be taken into account to foster their ownership of the project and irrigation scheme. However, even in already developed scheme, PIM can be achieved by explaining the importance of PIM and the benefits of irrigated agriculture to them, promoting their understanding and gradually encouraging their participation and understanding of the importance of irrigation facilities and their involvement in IWUO activities.

The essence of PIM is not only to involve stakeholders from the operation and maintenance stage, but also to involve them in discussions from the planning stage of the project and to formulate plans that take into account their opinions and requests. This is expected to lead to farmers recognising that their necessary facilities have been developed, rather than that they have been developed by the government or donors without their involvement, and to take a more proactive role in facility operation and maintainance after the facilities have been developed.

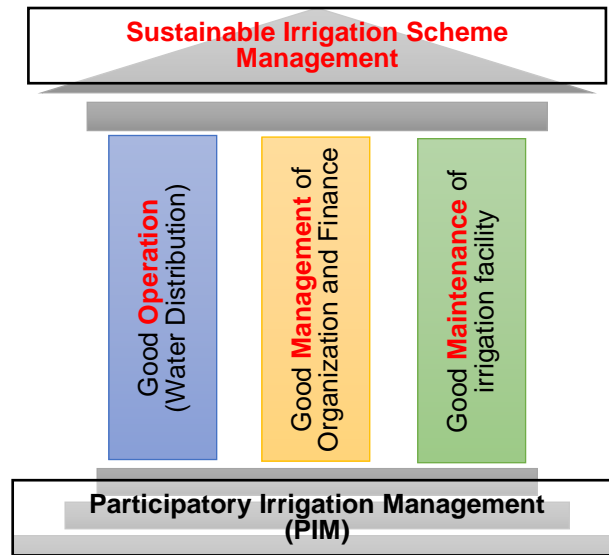
2.4.5 Budget of Operation and Maintenance (O&M):

With the proper collection of water fees, IWUO will have the necessary budget to proper operate and maintenance for irrigation facilities as defined in the Irrigation, Management Agreement. Farmers will also actively participate in the O&M activities conducted by the IWUO and as a result, the overall activities of the IWUO will be carried out smoothly and effectively.

2.5 Key to the sustainable irrigation scheme management

PIM is the foundation for IWUO's activities, and key to realize the sustainable irrigation scheme management are OMM.

- Good Operation (water distribution)= Fair Water Distribution
- Good Management of Organization and Finance of the IWUO
- Good Maintenance of irrigation facility
-



2.6 Conclusion:

Ideally, farmers should be involved from the planning stage when new irrigation schemes are to be developed or existing schemes are to be rehabilitated, and their opinions should be taken into account to foster their ownership of the project and irrigation scheme. But even in already developed scheme, PIM can be achieved by explaining the importance of PIM and the benefits of irrigated agriculture to them, promoting their understanding and gradually encouraging their participation and understanding of the importance of irrigation facilities and their involvement in IWUO activities.

Chapter 3 Implementation structure of O&M and water management

Content Type	Concept and Theory		
Objectives	It is practically impossible for the manager or representative of an IWUO to be solely responsible for the day-to-day O&M and water management of an irrigation scheme. Therefore, it is more realistic and efficient to establish sub-committees under the IWUO to manage at each level such as for each scheme, irrigation zone, irrigation block and diversion facility. The positions required to manage the IWUO are also indicated, and these should be used as a guide to consider hiring the necessary staff.		
Outcomes	This chapter presents a case study conducted through the WAMCAB and shows the roles of those responsible person at each level. These case studies can be referred in other schemes as well.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

3.1 Introduction

A sub-committee of the Executive Committee (EC) in charge of O&M and water management is proposed by WAMCAB and the O&M team which is responsible for planning and managing the implementation of O&M and water management. And the Farmers' Repair Team (FRT) for implementation of technical repair work in each irrigation zone or block in the WAMCAB.

3.2 Roles and Responsibility of O&M Team

O&M team has roles and responsibility to conduct planning and supervising the implementation and monitoring of activities related to the maintenance of irrigation facilities and water distribution within the irrigation scheme. For example, O&M team lead to conduct facility inspection. As a practical example, the O&M team plans the implementation of a facility inspection, mobilizes FRT members, conducts the inspection and compiles the results. The O&M team is then responsible for reporting on the condition of the facility to the EC and recommending plans and budgetary measures for any necessary repair activities.

In the case of IWUOs consisting of more than one irrigation scheme, the member of O&M team is composed by the in charge of Infrastructure and members of the Scheme Management Committee (SMC). If the IWUO consists of a single irrigation scheme, O&M team is composed by member of SMC and members of the Zonal Committee (ZC).

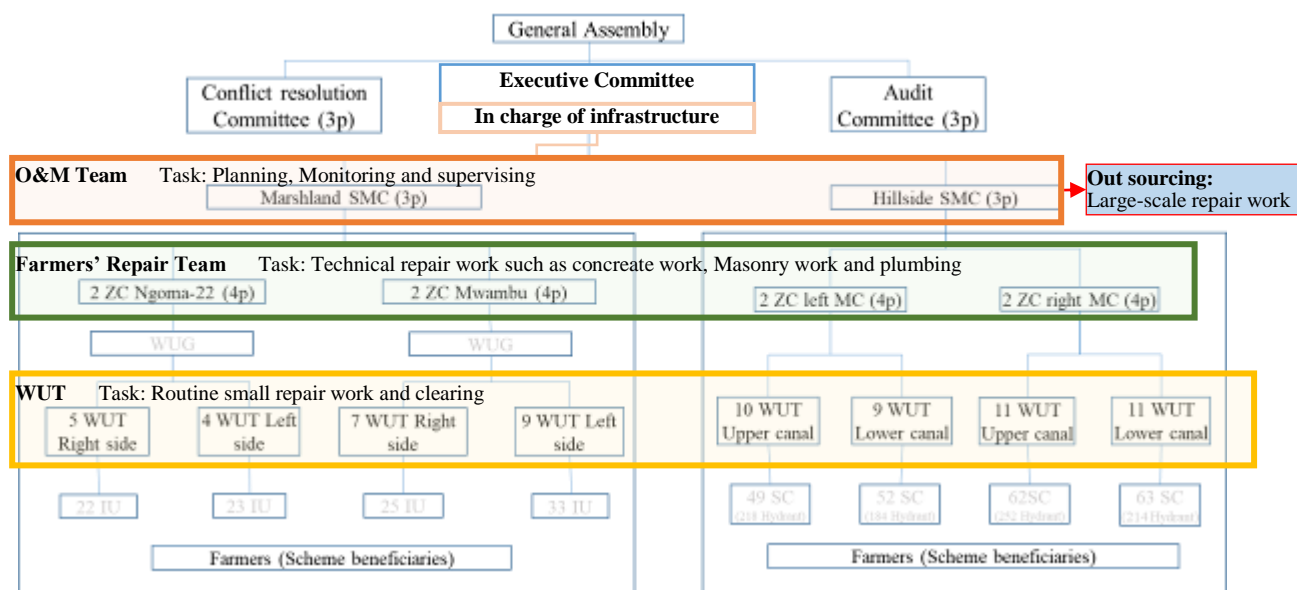
3.3 Roles and Responsibility of Farmers' Repair Team (FRT)

FRT has responsibility to conduct field practice for technical work such as concrete work, masonry work and plumbing which was planned and organized by O&M team. FRT also conduct inspection on the condition of irrigation facilities in their schemes or irrigation zone together with O&M team. They are ordinary farmers, but through the content of this manual and practical training, they will learn basic civil works and other skills, which will enable them to conduct simple repairs and construct small-scale facilities.

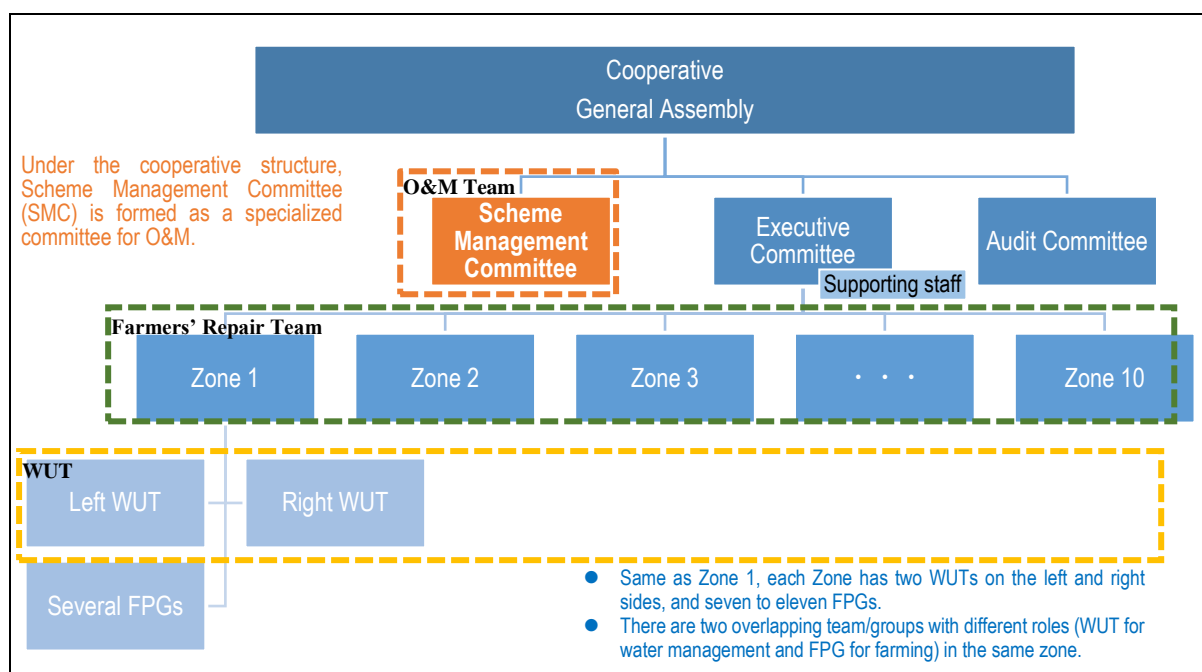
As a result, the IWUO's budget can be used more efficiently, as there is no need to outsource outside engineers and contractors.

3.4 Typical IWUO organisational chart and composition of O&M teams and FRTs

The figure below shows the organisational chart of a typical IWUO and the composition of the O&M team and FRT. This is the case of an IWUO consisting of several irrigation schemes that share in the same water source.



In cases where irrigation scheme is small and human resources are limited, instead of establishing an IWUO independently of the cooperative, an SMC may be established under the cooperative and be responsible for the management of the irrigated scheme. The organisational chart and the composition of the O&M team and FRTs in such cases are shown in the diagram below.



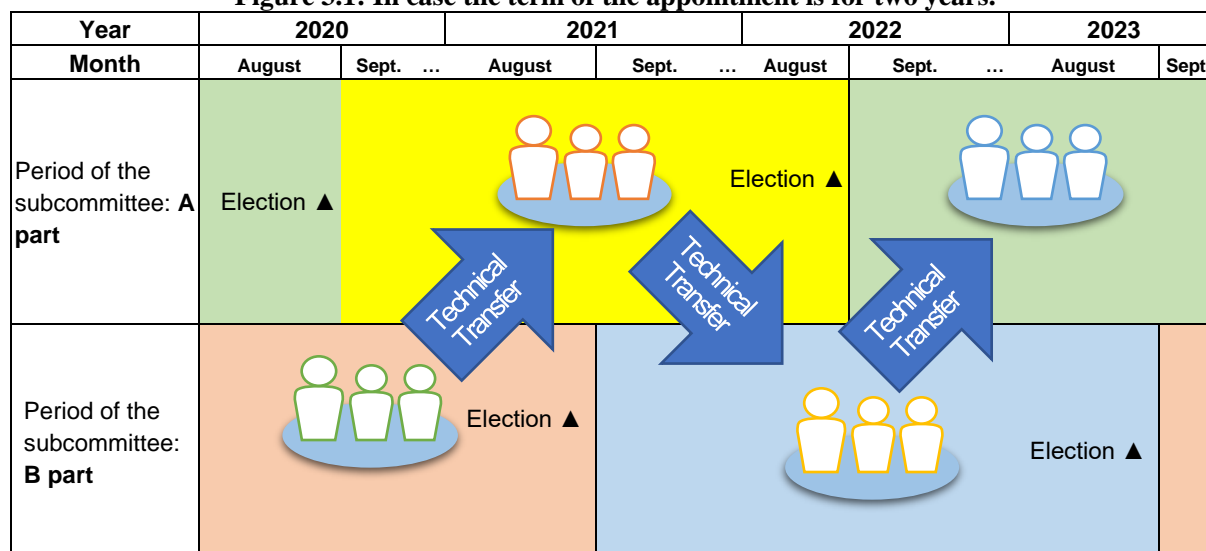
3.5 How to ensure the transfer of skills

Members of O&M teams and FRTs are ,generally, term-limited positions; training is provided to strengthen IWUOs and the capacity of personnel engaged in these positions is enhanced, but they are replaced by other elected persons at the expiry of their term of appointment. If all personnel are replaced at once, the continuity of information and skills is lost and the need to train personnel from scratch again arises. If this is done repeatedly, training will always be needed.

Therefore, the following are examples of ideas on how to transfer skills between members. Election of the members of each sub-committee should be renewed every half of the term. By staggering the terms of office, when a new member is elected, the other half of the members will lead each activity, thereby strengthening the capacity of the new member. To give a practical example, the idea is that if the term of appointment is

two years, half of the members are elected every year; if it is three years, elections are held every one-and-a-half years, with half of the members elected each time. It is also advisable to arrange for a handover period for the replacement of the person in charge, so that the former member can hand over skills and information to the successor so that they can smoothly carry out their duties. Specifically, it is assumed that the former and the successor will carry out maintenance and management work together, explaining the work and confirming key points on site, as well as how to fill in existing forms and how to store the filled-in information.

Figure 3.1: In case the term of the appointment is for two years.



Of course, re-election of competent leaders is beneficial to IWUOs and is a strong option unless prohibited by the IWUO's internal rules. In the WAMCAB model site, some IWUO has the idea to establish an umbrella organization like a Union, similar to the Cooperative, where qualified IWUO leaders will be hired by that organization as advisors to support newly elected IWUO leaders. (However, this has not yet been realized.)

It is also useful for the existing responsible persons to periodically go back to the basics and reconfirm their roles and responsibilities. It is also recommended that the IWUO manager take the lead in conducting the following lecture for new and old members whenever a new member joins the O&M and Farmer repair team.

- Organizational structure of IWUO
- IWUO responsibilities/Obligations
- responsibilities of each organ (O&M and Farmers' Repair Team responsibilities, as well as WUT Leaders)
- Information transfer within IWUO

3.6 Schedule of the activity

An example of annual activity schedule is given below for IWUOs' activities. Especially for newly established IWUOs, it is necessary to establish their own schedule with reference to these.

F: First, M: Middle, L: Last

		September	October	November	December	January	February	March	April	May	June	July	August
	Explanation of the items	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L
		Short rainy			Short dry			Long rainy			Long dry		
Cultivation Season													
	Season A: Paddy												
	Season B: Paddy												
	Season C: (If necessary)												
Farming activity													
	Inputs procurement												
	Seed distribution												
	Fertilizer distribution(DAP UREA)												
	Land preparation												
	Planting /DAP application												
	Watering												
	First weeding / earthing up and mounting												
	Top dressing UREA												
	Chemical application												
	Second weeding												
	Second fertilizer application												
	Harvesting and drying												
	Collecting produce, drying and selling												
	Preparing nursery beds												
	Sowing vegetable in nursery beds												
	Land preparation												
	Transplanting												
	Weeding												
	Pest management												
	Harvesting and take produce to the market												
Irrigation activity													
	Irrigation period												
	Facility inspection												
	Repair work (not miner)												
	Canal cleaning												
	O&M plan formulation (Review)												
	Water distribution plan formulation (Review)												
	Monitoring implementation of O&N plan												
	Monitoring implementation of Water distribution plan												
	Irrigation calendar preparation / update												
WUO activity													
	General assembly												
	Audit												
	Executive committee meeting												
	Election (Once a three year)												
	Filing financial documents												
	Preparation / updating water users list												
	Meeting organized at zonal level												
	Attending SISC meeting (Technical meeting)												
	Attending DISC meeting												
	Preparation and signing the performance agreement between WUO&Cooperative												
	Updating internal regulation & Rules												
		F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L	F M L
		September	October	November	December	January	February	March	April	May	June	July	August

Figure 3.2: Sample schedule in marshland irrigation scheme

Chapter 4 Importance of Preventive and Early-Stage Repair Works

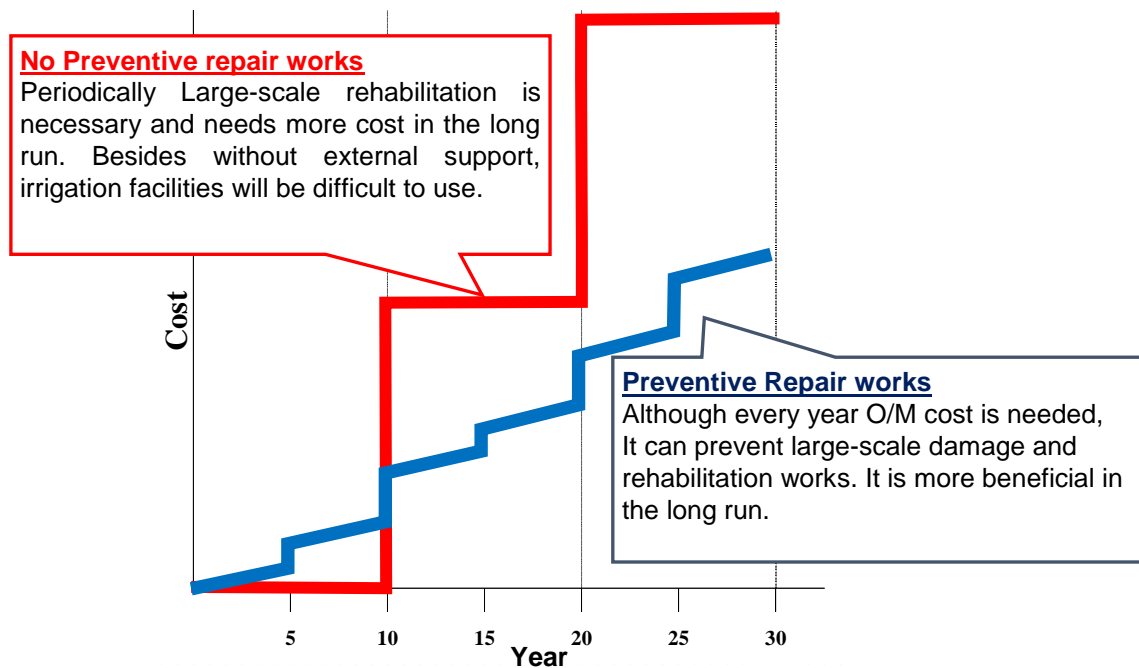
Content Type	Concept, Theory and Explanation of practical activities.		
Objectives	This chapter explains the importance of implementing daily and periodic facility inspections of irrigation facilities, the importance of early action, and the effectiveness of such inspections.		
Outcomes	It also provides general examples of daily and periodic O&M work and the role of each organisation. These are used to help each IWUO to consider the activities to be undertaken in their own scheme for O&M activity.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

4.1 Introduction

Purpose of this chapter is to make farmers aware of the importance of maintenance of facilities in irrigation scheme. It will give an opportunity to learn about the importance of preventive and early-stage maintenance, the role of IWUO and the government, daily inspections and simple repairs to major rehabilitation works.

4.2 Why do we need to maintain irrigation scheme

Let's think about why it's needed to maintain irrigation scheme. Let's start with an example that might be familiar with. It is said that early detection and treatment of diseases is important. This can be achieved by visiting the hospital before the symptoms become severe, having regular check-ups, receiving advice from the doctor and receiving the necessary treatment. However, if the disease is detected too late, it may progress without the patient realizing it, and one day the patient may suddenly experience symptoms that interfere with daily life, require a long period of treatment or major surgery. Or in the worst scenario, the disease can leave serious sequelae that make it impossible to live as before, or even lead to death. The same applies to the various facilities that exist in irrigation scheme. By regularly checking the condition of the facilities and detecting any damage at an early stage, it is possible to identify the cause of the damage and take measures to prevent it from spreading, or if the damage is small enough, simple repairs can be done to reduce the damage and keep the facilities functioning. However, if no action is taken and the damage is left unrepaired, facilities that were previously usable will suddenly break down and lose their function one day. For example, what happens if an irrigation canal, turnouts and gate suddenly stop functioning during the growing season? The crop that has been growing well may dry up and not be able to be harvested. In addition, if you are unable to close the intake gates during a flood, sediment can flow into the main canal or fill the diversion works with sediment, eventually making the facility unusable. In general, if preventive repairs are not carried out, major rehabilitation will be required on a regular basis, which will be costly in the long term. In addition, these major rehabilitations cannot be carried out by the IWUO itself, and without external support, such as from the government, it will be difficult to use the irrigation facilities. On the other hand, when preventive repairs are carried out, instead of requiring annual O/M costs, major damage is prevented from occurring and consequently less major rehabilitation is required. Over the long term, the cost is less than if no preventive repairs were carried out. Just like human health care, preventive and early-stage treatment of irrigation facilities is crucial.



4.3 Daily O&M activity

So far, you have understood the importance of daily preventive and early-stage repairs. Now let's take a look at what can be actually done about daily O&M.

4.3.1 Individual farmer

First of all, when you go to your plots, take a closer look at your fields to see if they have collapsed or are leaking. Are there any holes in the levee caused by wild animals, or have the levee collapsed due to human traffic? These can cause leaks and water loss, so take measures to close the holes or reinforce the levee with filling soil. You should also check the condition of the canals that supply water to your plots. Weeds can block the flow of water, reducing efficiency, increasing irrigation time and causing overflow. If the canal is facing a hillside, there may be an inflow of sediment after rainfall. The accumulation of sediment in the canal can cause a similar loss of function. If weeding is carried out before the weeds become overgrown, the labor load is relatively low. If the inflow of sediment is also small, it can be removed with a simple operation. It is impossible for several person in charge of facility to check all the facilities in an irrigation scheme every day, but each farmer can look around his or her own plot, which will result in the early detection of problems in the whole scheme. If you find anything unusual around your plot, reporting it to leader of you irrigation unit or zone leader.

4.3.2 Community Work:

However, large scale soil run-offs caused by heavy rainfall, such as at the beginning of the rainy season, or weeding of long sections of canal, cannot be carried out by individual farmers. In such cases, it is useful to organise and implement community work at the zonal level or entire IWUO level. It is also important to remove the root cause of the problem, rather than just the symptomatic solution. For example, although it is important to remove sediment from canals, it is also necessary to take measures to prevent sediment from entering the canals to begin with. This can be done by identifying the points where sediment comes into the canal, such as wadis, and installing cut drains and soak pit to reduce the amount of sediment flowing into the canal. Or, If the land is cultivated to the edge of a canal, it is useful to create a certain buffer zone of appropriate distance between the canal and the cultivated land. Erosion damage can also occur around concrete structures, such as turnouts, due to high discharge in canals and surface run-off by heavy rain. If the damage is small, it may be possible to backfill the eroded part of structure or reinforcing with sandbags. There is also a great deal of value in working together to remove weeds, as overgrown areas can become habitats for insect pests. In some irrigation scheme, large scale community work for clearing and weeding of canals is part of the preparatory work before cultivation season.

4.4 Seasonal or annual O&M activity

Some O&M activities are required to be conducted before starting or after the end of the cropping season, and other O&M activities are required to be conducted once a year. As main canals are used for irrigation water supply at all times throughout the cropping season, it is impossible to conduct major repairs, rehabilitation or new construction work that would require a longer period of stopping the irrigation water supply. Medium- and large-scale repairs and cleaning should therefore be carried out before or after the season.

Furthermore, even if cleaning of canals is carried out in many schemes, it is seldom that drainage canals are properly maintained. While many beneficiaries tend to pay attention to the condition of the irrigation canals to ensure that water reaches their plots, farmers need to be convinced that proper maintenance of the drainage canals is equally important to ensure that excess water is drained and flushed away quickly in the time of flooding. Regular maintenance, including individual and community work, is described in more detail in Chapter 12.

Rust prevention and greasing of valves and metallic gates are less frequent tasks than other cleaning tasks and, depending on the condition of the facility, maintenance work is generally carried out about once a year. Other maintenance tasks, such as cleaning and maintenance of the inside of irrigation pumps and building repairs of IWUO offices, should also be conducted on an annual basis with regular monitoring of the condition of the facilities.

4.5 Roles of IWUO

Heavy rains and floods can damage concrete structures and make farm roads muddy, making it impossible to transport harvests. These can be difficult to repair through community work by ordinary farmers. In the model scheme of WAMCAB, “O&M team” and “Farmers' Repair Team” have been established within the IWUO to take responsibility for the maintenance of the facilities, and to lead the work to carry out simple repair works that require a certain level of technical skill. The teams are responsible for repairing damaged, old and leaking concrete canals, repairing collapsed canal walls, and rehabilitate and building new turnout. In the past, the IWUO outsourced these simple civil works to local contractors to carry out the repair work, but by using the human resources within the IWUO, it is now possible to reduce the cost by 1/3.

4.5.1 Necessity of facility inspection:

While it is important for IWUO to be able to respond to sudden damage to the irrigation facility within the scheme, repairs of a certain scale need to be planned and carried out based on the condition and priority of those facility. At the end of the cropping season, the O&M and Farmers' Repair Teams conduct a status survey of the irrigation facility within the scheme to determine the condition and level of damage to key irrigation facilities, and to prioritise and formulate repair work plan in order to allocate the limited budget available. It is necessary to carry out these works during the limited dry season, as work cannot be carried out when it rains, especially for carrying out civil works. A plan will be developed to determine which facilities will be repaired, when and how much will be spent on them.

4.6 Government roles

Local government such as District, Sector, cell and village level, they are involved in the management of IWUOs through DISC meetings, SISC meetings and support for the setting up of community work. They will also be involved in supervising the activities implemented by IWUOs to confirm that the necessary activities are being carried out, e.g. for the approval of Expense Orders. They will be expected to monitor the status of irrigation facilities through these opportunities and provide technical advice as appropriate.

In the event of disaster-level rainfall or flooding, there may be damage on a scale that the IWUO cannot handle. In such cases, the IWUO may submit a report on the situation to the district or RAB station, and they may be able to provide technical and financial assistance. However, due to limited government budgets, it is not always possible to respond timely and flexibly.

The IWUO has also established a reserve fund for future major repairs, so that in the event of serious damage to the facilities, the IWUO will be able to carry out these repairs on its own, without having to rely on the government.

This is a way of preparing for the possibilities of the future, just as we save for our children's education.

Chapter 5 Facility inventory and coding

Content Type	Explanation of practical activities		
Objectives	<p>This chapter explains the preparatory work for conducting facility inspections, including the identification of facilities that IWUOs are responsible for O&M and the coding of facilities to enable them to be identified without miscommunication in the field.</p> <p>Basically, the activities described in this chapter do not need to be carried out every year and are intended to be carried out only once, immediately after the scheme is developed, but it is expected that the content will be reviewed at times of wear and tear of the coded information and at times of replacement of IWUO members.</p>		
Outcomes	Understand facility coding and prepare the foundation for facility management.		
Lecturers:	RAB and District staff and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

5.1 Introduction

There is a need to clarify which facilities IWUOs are responsible for operation and maintenance of irrigation schemes. Depending on the irrigation scheme, Cooperative may be responsible for managing dry yards and farm roads in the scheme, while the District or other governmental body may be responsible for maintaining public roads and bridges. In other cases, the RAB may be responsible for the operation of pumping stations, and it is important to clarify the IWUO's demarcation of responsibility.

Therefore, the first step in managing irrigation facilities by IWUO, it is required to identify the facilities to be managed by IWUO itself. To do this, facility inventory in the scheme needs to be carried out.

Facility coding is a means of managing facilities with the aim of avoiding confusion or mistaken of target facilities and thereby making management easier and smoother. It is used to ensure that the people concerned on the ground properly recognise the target facilities. The purpose is similar to writing the owner's name on their belongings or signboards of shops.

This work should be done at the time of scheme development by the organisation that led the project, but in many schemes this information is not kept. Therefore it is required to be implemented by IWUOs with the support and guidance of technical personnel from the relevant organisations (such as RAB and District) at the time the IWUO is established or at the time when its activities are resumed.

5.2 Instructions for Facility inventory

To begin, the type and number of facilities within the irrigation scheme should be identified. Some schemes were developed under government or donor projects, and if planning documents are available at that time, these should be used as a starting point to list the facilities located within the scheme.

Information on the location, size and record of water source, history of facility repair and type of facility (water intake facilities, main and branch canals, diversion facilities, drainage facilities and others) are collected for each facility and compiled into a list. Following is a sample list for the reference.

Example: List of Scheme major facilities

District	* * * * *			Date ; / /	
Scheme	* * * * *				
Facility Name	Structure / type	Description	Constructed Year	Rehabilitated Year	Remark
Head work	Dam??? Valve House Reinforced Concrete/ River	W=10.0m, H=3.0m 5 main gates 1 intake gate	1987	2009	
No1. Main canal	Concrete canal	L= 1000m Rectangular section W=0.5, H=0.5m 2002 rehabilitated with RSSP fund	1987	2002	
No2. Main canal	Stone masonry	L= 1000m Rectangular section W=0.5, H=0.5m 2002 rehabilitated with RSSP fund	1987	2002	
No1. Secondary canal	Earth canal	L= 500m Trapezoid section Bottom W=0.4, H=0.4m	1987		
No2. Secondary canal	Earth canal	L= 800m Trapezoid section Bottom W=0.4, H=0.4m	1987		

5.3 Purpose of the coding facility

It is expected that coding of these facilities will be done during irrigation scheme development, but if not, it should be planned by the IWUO O&M team and implemented with the FRT. In addition, as these coding deteriorate over time, the information becomes unreadable. Therefore, they need to be maintained and re-written at the end of the irrigation period or during off-farm periods by the collaboration of O&M team and FRT.

5.4 Instructions for Coding

Coding can refer to the task of directly writing the administrative code to the facility, but it is also intended to define the code for facilities that are difficult to write directly on the facility, as it is also intended as an abbreviation for when the facility name is written on reports and survey forms.

Facilities that could be covered for coding are listed below, but depending on the actual situation of the scheme and the managing entity, it may be necessary to consider the facilities to be covered as appropriate.

Facilities that are expected to be coded directly on the facility	Facilities intended to be defined as an abbreviation
<input type="checkbox"/> Valves <input type="checkbox"/> Pumps <input type="checkbox"/> Diversion box <input type="checkbox"/> Regulating tank <input type="checkbox"/> Weir (Traditional, Developed) <input type="checkbox"/> Gate <input type="checkbox"/> Drop <input type="checkbox"/> Turnout <input type="checkbox"/> Hydrant <input type="checkbox"/> Drainage box	<input type="checkbox"/> Dam <input type="checkbox"/> Irrigation canals (Main, secondary, tertiary and on-farm) <input type="checkbox"/> Drainage canals <input type="checkbox"/> Farm Road

It is preferable to give each facility a unique name to identify it for administrative purposes. Each facility will be assigned an abbreviation and number for the feature that describes the facility and its location.

Detailed example of coding facilities :

Facility name	Abbreviation (Example)
<u>Right side Main Canal</u> :	RMC
<u>Left side Secondary Canal No. 4</u> :	L-SC4
<u>Secondary Canal No.3 on Lowe Right side canal</u> :	LR-SC3
<u>Right side Main Canal Turnout No.5</u> :	RMC-T5
<u>Traditional Weir No.1</u> :	TW1
<u>Developed Weir No. 2</u> :	DW2

For these coding works, weatherproof (or waterproof) paints, brushes and metal brushes are required, and dust and soils on the surface should be removed with a metal brush before painting to ensure a long life of the paintwork and to prevent any confusion when checking the condition of the facility on site.



Chapter 6 Preparation of scheme map and Water Users' List

Content Type	Theory and practice		
Objectives	This chapter explains the necessity and importance of irrigation scheme map and water user list, which are essential for O&M of facility within irrigation scheme by IWUO, and explains how to prepare them.		
Outcomes	Understand the procedures and specific methods for preparing maps of irrigation schemes and water user lists.		
Lecturers:	RAB and District staff	Trainees:	Leaders of IWUO and FC (IWUO manager)

6.1 Introduction

It is important to prepare a map of the entire irrigation scheme in order to have an idea of the current status of the scheme and system of water distribution. For schemes that have been developed through government, donor or other projects, it is likely that maps have been prepared at the planning stage, so these should be available. If map and other information are already lost, it can be prepared using Google Earth and other GIS software. IWUO offices, water intake facility and turnouts can be recorded as point data, while canals and roads can be drawn as line data.

This information can then be printed out so that the layout of facilities throughout the scheme can be seen at a glance.

Following is the sample image of irrigation scheme map which shows Irrigation canals, drainage, road, weir and turnout. Also it's included the area of each WUT.

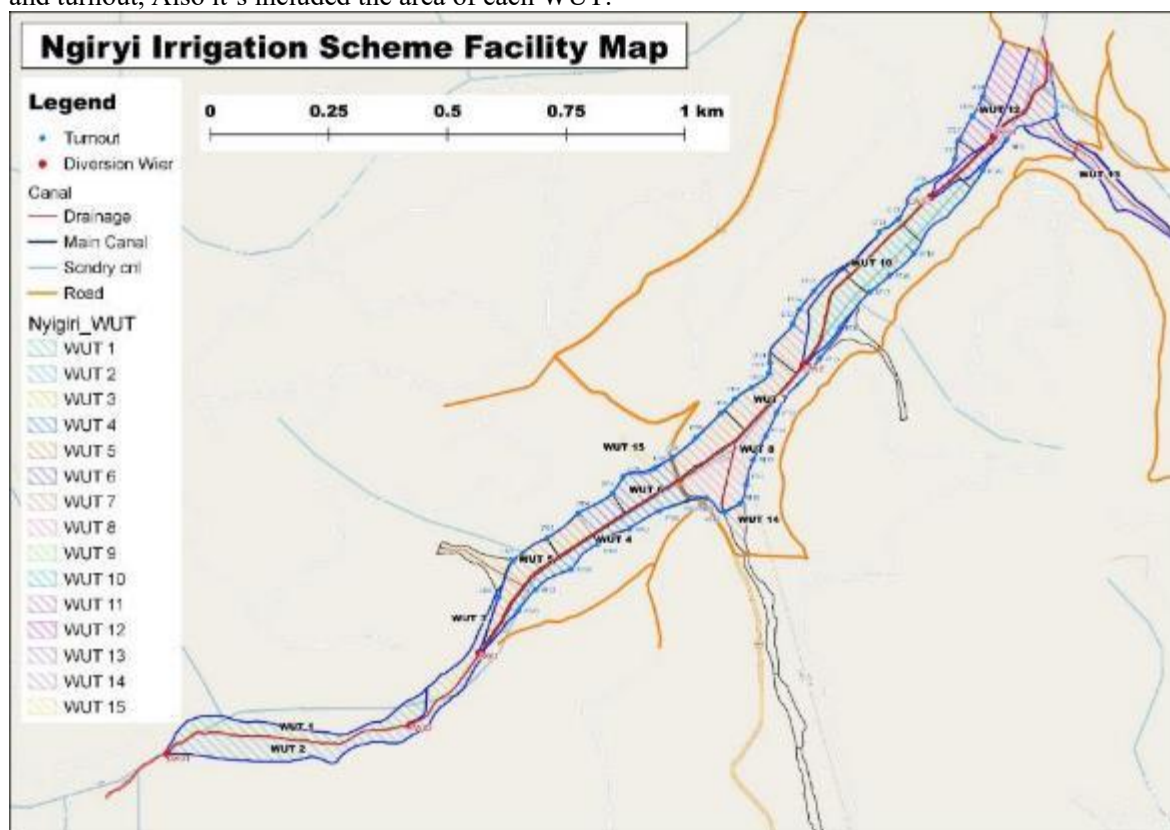


Figure: Sample image of Irrigation Scheme Map

6.2 Basic information of Irrigation scheme map and Water users list

6.2.1 Irrigation scheme Map:

One of the important database required for good management of irrigation scheme (also indicated in the Ministerial Order). Normally, irrigation maps are part of the output of the design document of the irrigation scheme, but most of the scheme in the country lacks such basic database, hence need to be prepared anew.

The map should include...

- **The exact layout of the scheme** (position of dam, canal layout, drainage layout, road network etc.)
- Position of **weir** (including properly developed one and locally made), **turnout**, and **other water source** such as **springs, farm ponds, etc.**
- Each facility (weir, turnout) shall be given an ID number

6.2.2 Water users list:

The list of all people who are using same water source including the people who use water in other activities not only for agriculture purposes (Livestock, industry or mining, for example).

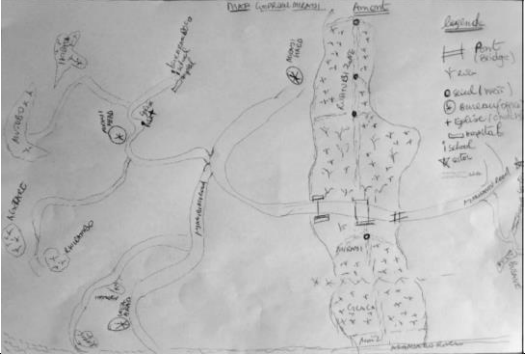

The water users list should include...

- Name of the landowners (land users)
- A plot ID corresponding to the landowners (land users),
- the weir or turnout from which the land gets its water,
- Area irrigated by each weir, turnout and other water source.
- Type of water use or cultivated crop

It would be expected to be updated every season or annually, since some of the cultivated area may differ season by season.

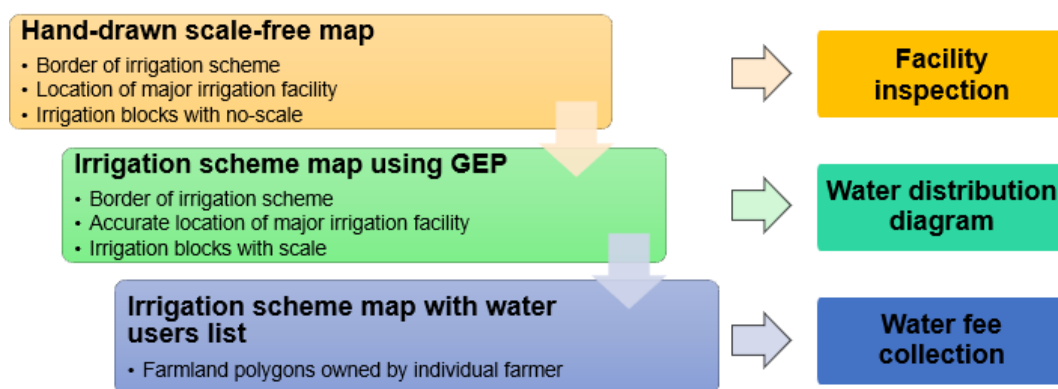
6.2.3 Type of Irrigation scheme map:

It is important to start by developing hand-drawn maps with no-scale, such as in the early stages of IWUO establishment that shows the location of major facilities and irrigation blocks.

	
Hand-drawn scale-free map	Maps with accurate coordinates and scales based on survey results



6.3 Role of maps along the phases:

Each map has a specific role to play, and it is important to prepare them where you can start first.



6.3.1 How to prepare those maps:

- Traditionally, facility planning maps have been prepared based on the ground survey or aerial photogrammetry survey, **but it is difficult and costly for IWUOs to carry out these surveys by themselves.**
- On the other hand, satellite imagery has recently become high-resolution and available free of charge, and it is now possible to use it to determine the status of existing facilities, even for small-scale irrigation schemes.
- However, satellite image itself can only be read or utilized by a few knowledgeable people, and these satellite images do not always show the latest status, so maps need to be prepared based on both satellite images and current conditions.
- Not only satellite imagery, but also GIS software is becoming complimentary, and all of the software used in this training can be used for free. The features of each are as follows.

Name	Feature
Google Earth Pro (GEP) 	Limited functions, but easy to use for beginners. It is easier to display and create data than to analyse geographical information.
QGIS 	Many analysis functions are available, but require a certain level of knowledge to use.

6.4 How to prepare Irrigation scheme map by Google Earth Pro (GEP)

General flow of the preparation of Irrigation scheme map by Google Earth Pro is shown as follows.

STEP1: *Before going to the field

Trace the boundaries and facilities of the target scheme using GEP in advance and identify the facilities that need to be checked during the field works (In consultation with relevant stakeholders, identify facilities to be included on the Irrigation scheme map).

STEP2: Confirm the **location of the facilities on site using GPS.**

(It may be efficient **to focus on facilities that could not be identified on the satellite imagery**).

STEP3: Based on the results of the field survey, finalize the Draft map using GEP.

STEP4: Confirm the Draft map with IWUO representatives and finalize.



Tips - Before start the practise: basic operation with the mouse for Google Earth Pro

Action	Mouse operation
To look in any direction	“Left-click” and “hold”. Then, drag the cursor until you see the view you want.
To return to the default view:	Click the map and press “r”.
Zoom in & out	Use the scroll wheel on your mouse.
Tilt to view hills & mountains	Move the mouse back and forth while pressing the scroll wheel. (Press “Shift” + “Left-click”. Then, drag in any direction.)
Point the view North	Click the map and press “n”.

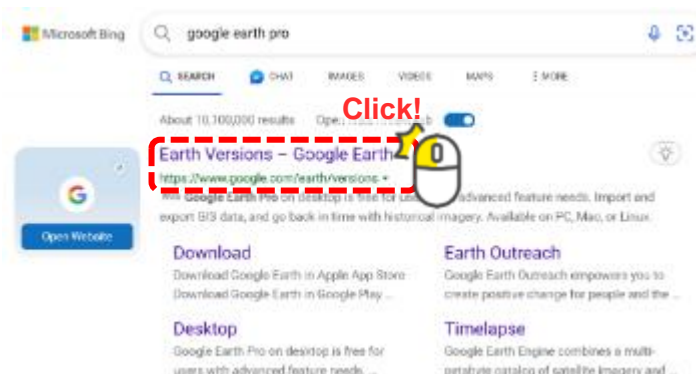
6.5 STEP1: before going to the field work

(1) Install Google Earth Pro:

- Google Earth is a computer program that renders a 3D representation of Earth based primarily on satellite imagery. **It is free software provided by Google Inc.** It allows users **to view satellite images of the world.**
- There are desktop, smartphone and browser applications for the system.
- It can **draw lines and polygons** and **measure their length and area using desktop version app..**

How to get it?

- Visit Google Earth website <https://www.google.com/earth/versions/>
- or Search “Google Earth Pro” on any Search engine (e.g, Google, Being and Yahoo!)



- Once you have accessed the Google Earth Pro website, click on the icons on the page in the following order. (Note that the design of the website changes from time to time.)



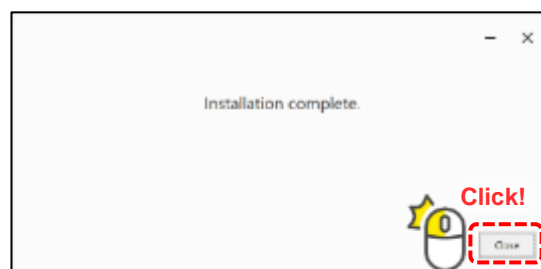
The installer will be downloaded.

Alternatively, it is usually saved in the 'Downloads' folder in your PC.

- When the installer is launched, the following screen appears and the installation proceeds while the necessary information is downloaded from the internet. Therefore, internet connection is essential for installation.

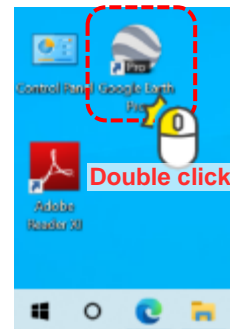
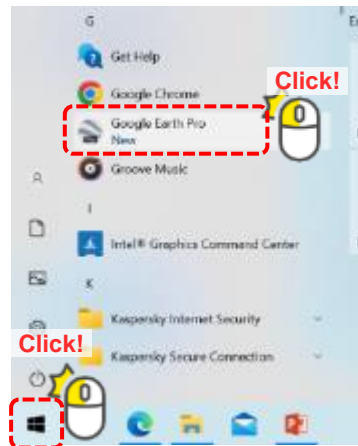


- Installation is complete, by clicking “Close”.



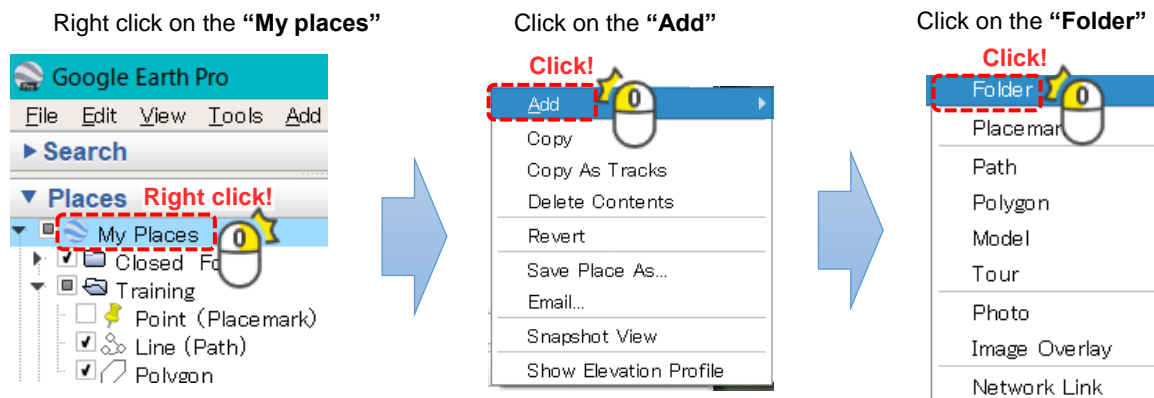
(2)Launch “Google Earth Pro”

Launch the software by selecting Google Earth Pro from the menu that appears by clicking the [Start (or Windows)] button, or by double-clicking the Google Earth Pro shortcut on the desktop.



(3)Preparation of the folder (Organizing the layers)

- Prepare the folder for the target scheme on the side menu. Create folders for each facility under the folder with the name of the irrigation scheme prepared.

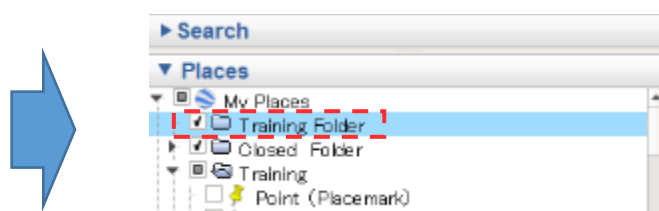


New window will come out.

Name the folder "Training Folder"



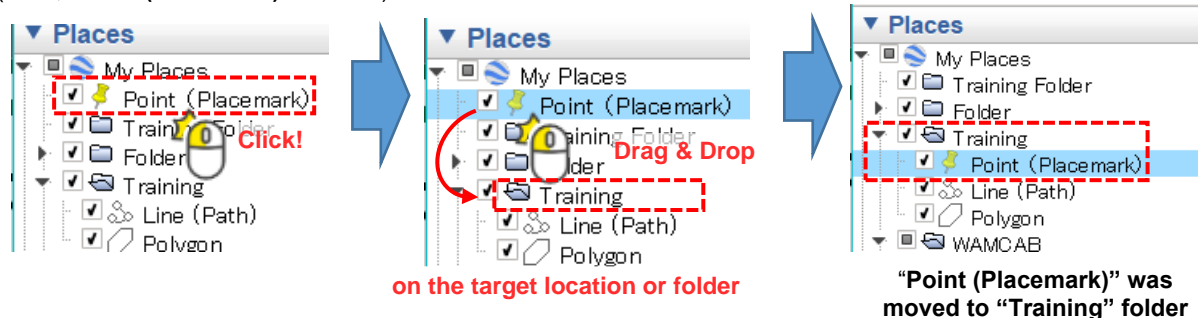
"Training Folder" will be created under the "My places"



How to move and organise folders and layers

Right click on the “**Target layer**”
(Here, “**Point (Placemark)**” is used.)

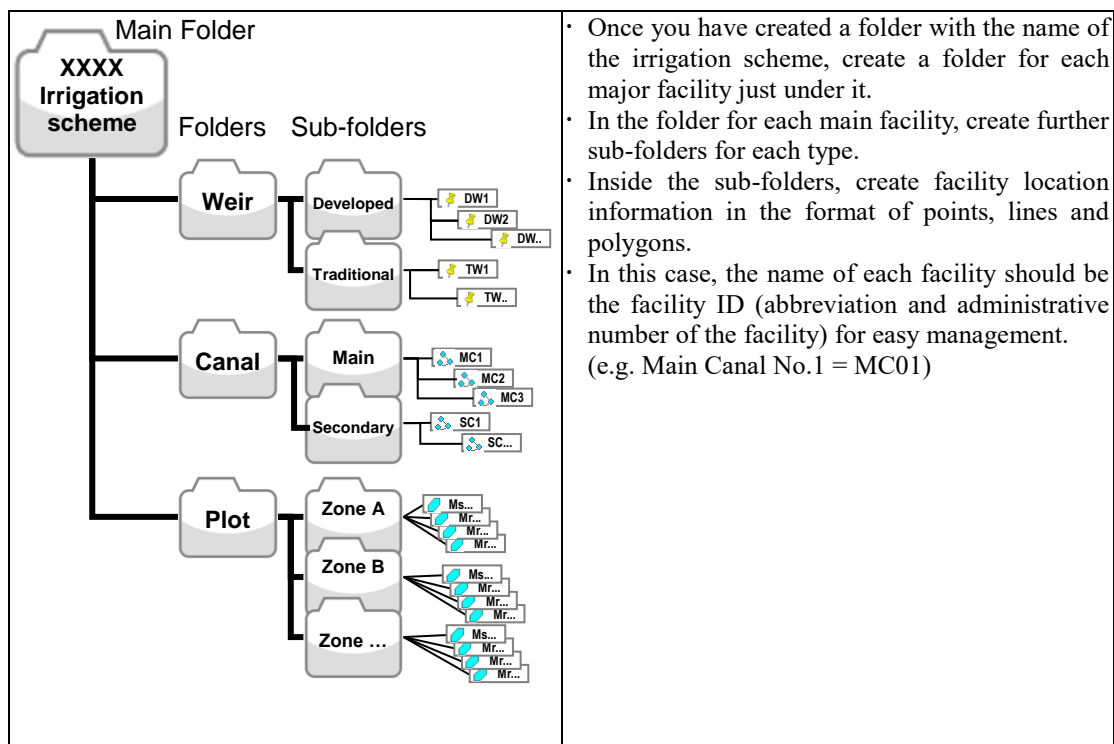
Drag and drop the “**Target layer**” with the mouse to the target location.



TIPS: Function to organize the layers in “Places”

<p>Click!</p> <p><input checked="" type="checkbox"/> : Visible <input type="checkbox"/> : Not Visible</p> <p>Click!</p>	<p>※ By switching the tick of the box in front of each folder or layer name, it is possible to show or hide them.</p>
<p>Folder <u>CLOSED</u></p> <p>Folder <u>OPENED</u></p> <p>↑ Now, “<u>Untitled Placemark</u>” is visible</p>	<p>※ The view of the folder changes each time when this triangle icon is clicked.</p>

6.5.2 How to manage information at each facility using folders.


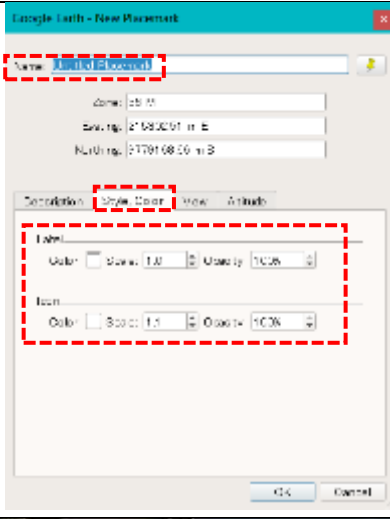

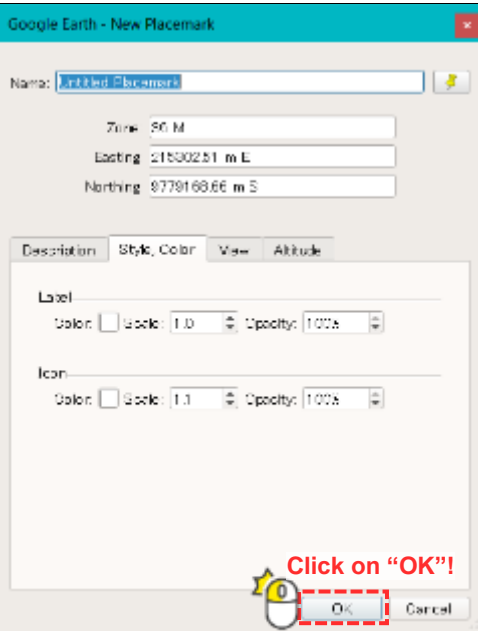


(1) Place the type of feature and facility in the scheme


Following table shows the general facility which needed to be mapped on the site map. As it is difficult to cover all facilities due to time and resource constraints, the prioritisation of facilities for each scheme should be considered and mapped on the site map based on the priority.

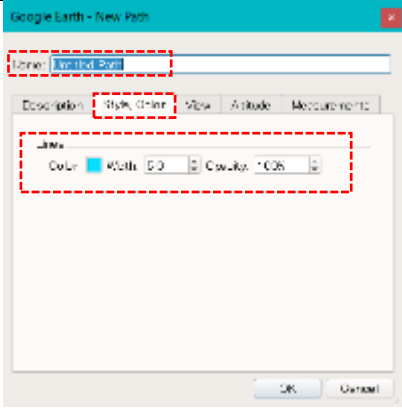
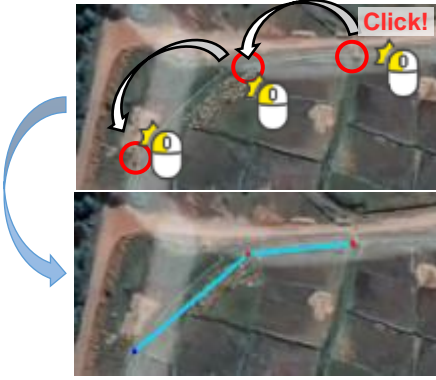
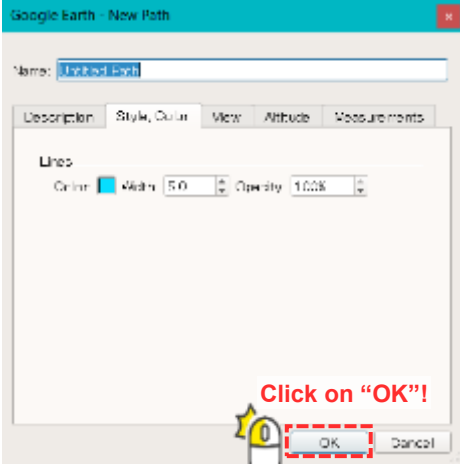
Type of feature	Icon on Google Earth Pro	Target facilities in the scheme (Example)	Image of the facility
Point (Placemark)		<ul style="list-style-type: none"> • Dam, Diversion Weir, Pump house, Spring, Reservoir, • Turnout, Gate, Division box, valve, Hydrant, Wash out (Flashing gate) • Bridged, Culvert, Office, other buildings • Sedimentation basin • Water harvesting structure • Rice processing facility • Drying floor • Market centre, workshop (Garage), Bore hole 	
Polygon		<ul style="list-style-type: none"> • Command area, Irrigation block, Production grouped, • Individual farmers' plot, Public land, • Watershed • Demonstration plot, Residential area • Utilized /Unutilized area, Developed/Undeveloped area, Planed area, Proposed area • Water Pan, Fish ponds 	
Line (Path)		<ul style="list-style-type: none"> • River, stream, channel • Irrigation canal (Main, secondary and tertiary), Pipe line, Aqueduct • Drainage canal (Main, secondary and tertiary), • Farm road 	

1)How to add a new Point and change the Placemark


	<ol style="list-style-type: none"> 1. Click on the “Add Placemark” icon
	<ol style="list-style-type: none"> 2. New window come up 3. Input name 4. Click “Style, Colour” tab 5. ※You can change colour and size of label and Icon
	<ol style="list-style-type: none"> 6. Adjust the point location to the appropriate location by Drag & Drop the Placemark icon
	<ol style="list-style-type: none"> 7. Click “OK” to save.

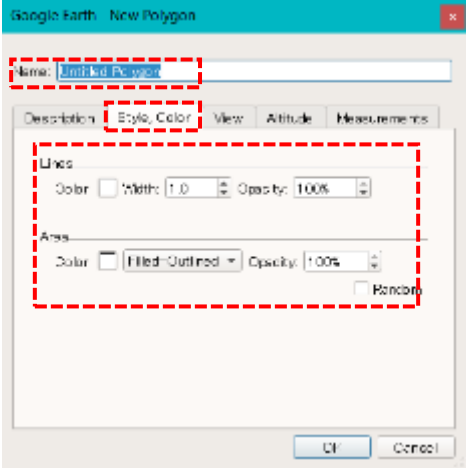
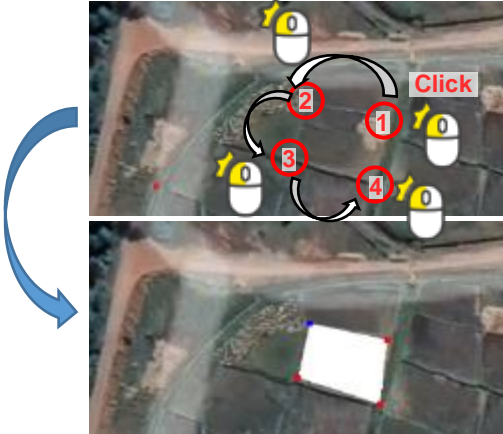

2)How to draw a new Line and changing the style of Path

	<ol style="list-style-type: none"> 1. Click on the “Add Path”
---	--

	<ol style="list-style-type: none"> 2. New window come up 3. Input name 4. Click “Style, Colour” tab <p>※You can change colour and transparency of lines.</p>
	<ol style="list-style-type: none"> 5. Click along the breakpoints to draw a line
	<ol style="list-style-type: none"> 6. Click “OK” to save.

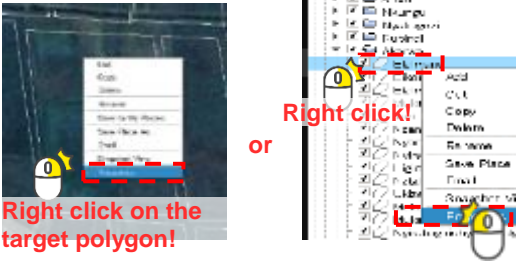

3)How to draw new polygon change the style

	<ol style="list-style-type: none"> 1. Click on the “Add Polygon”
---	---

	<ol style="list-style-type: none"> 2. New window come up 3. Input name 4. Click “Style, Colour” tab ※ You can change colour and width of outlines and area of Polygon
	<ol style="list-style-type: none"> 5. Click along the corner of the boundary of target area to draw polygon
	<ol style="list-style-type: none"> 6. Click “OK” to save.

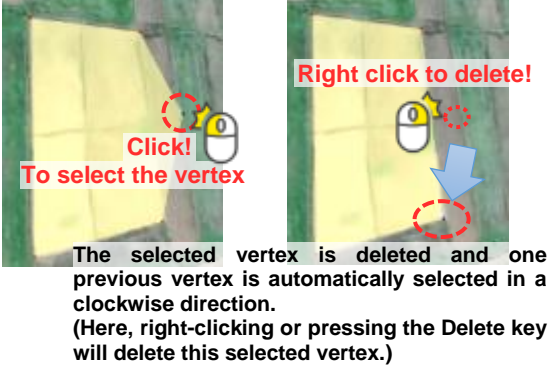
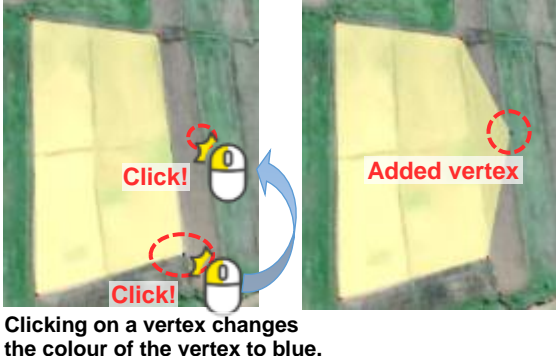
2.4.9 How to modify polygon and polyline after each feature has been prepared

To edit a prepared feature, right-click on the layer of the target feature and click on “Properties” in the menu that appears.

	<ol style="list-style-type: none"> 1. Open Properties window for modifying feature.
	<ol style="list-style-type: none"> 2. Click "OK" to save the modification

When the window is open, it is possible to move, add and delete vertices of polygons and polylines; for Placemarks, it is possible to adjust their position. Clicking on a vertex changes the colour of the vertex from red to blue. Detailed operation are shown as follow.

➤ Delete: right-click or press Delete key.

	<p>Delete vertex:</p> <ol style="list-style-type: none"> 3. Clicking on a vertex with the mouse changes the colour of the vertex from red to blue. 4. Right-click or press Delete key to delete selected vertex. 5. When deleting vertices continuously, right-click or hit the Delete key repeatedly for smooth deletion.
	<p>Delete vertex:</p> <ol style="list-style-type: none"> 6. Clicking on a vertex with the mouse changes the colour of the vertex from red to blue. 7. Right-click or press Delete key to delete selected vertex. 8. When deleting vertices continuously, right-click or hit the Delete key repeatedly for smooth deletion.

- Add: by clicking on a vertex, the next vertex after the blue vertex can be added.

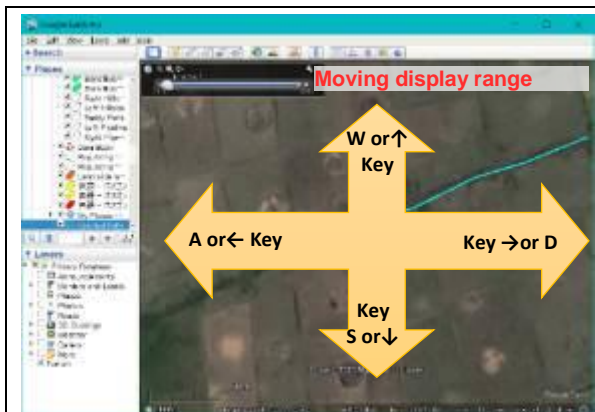
	<p>Add vertex to polyline:</p> <ol style="list-style-type: none"> 1. Polylines contain information on beginning and end points. When the property is displayed, the endpoint is selected and the vertices are shown in blue. 2. The polyline can be extended by clicking on it. (A vertex is added further ahead of the current endpoint.)
	<p>Add vertex to polyline:</p> <ol style="list-style-type: none"> 1. Polylines contain information on beginning and end points. When the property is displayed, the endpoint is selected and the vertices are shown in blue. 2. The polyline can be extended by clicking on it. (A vertex is added further ahead of the current endpoint.) 3. The polyline can be extended by clicking on it. (A vertex is added further ahead of the current endpoint.)

- Adjust: by dragging a vertex, the position of the vertex can be adjusted.

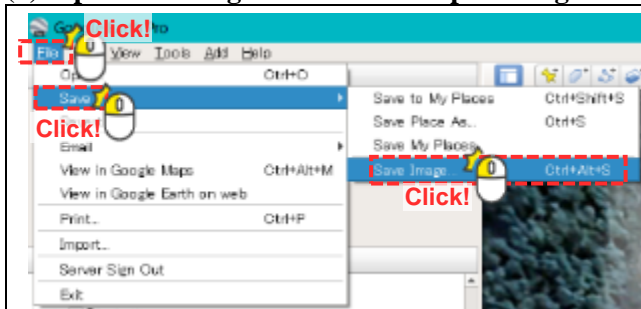
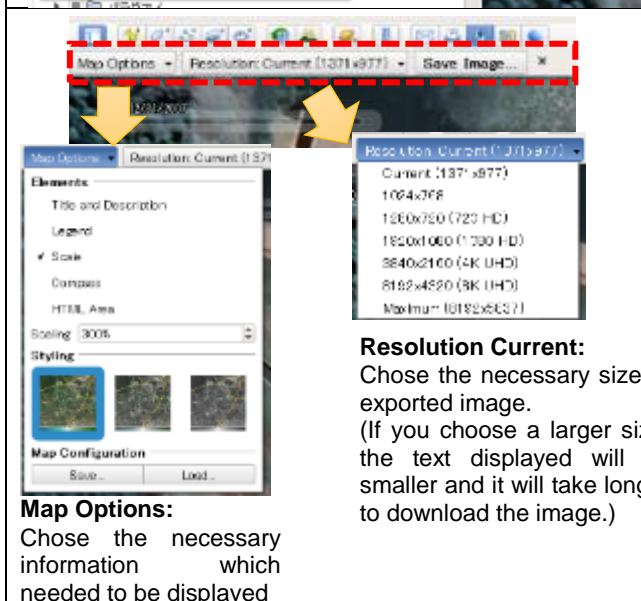
	<p>Adjust vertex:</p> <ol style="list-style-type: none"> 4. by dragging a vertex, the position of the vertex can be adjusted.
--	---

6.5.3 How to shift the display range when drawing a feature to the end of the screen.

	<ol style="list-style-type: none"> 1. When the property window is open and vertices are being added or deleted,
--	--

	<p>2. The Arrow keys or AWS D keys on the keyboard can be used to move the display range. (Note: This does not work when the property window is active).</p>
---	--

(1) Export the Irrigation scheme map as image

	<p>1. Click “File”, “Save”, then click “Save Image”</p>
 <p>Map Options: Chose the necessary information which needed to be displayed</p> <p>Resolution Current: Chose the necessary size of exported image. (If you choose a larger size, the text displayed will be smaller and it will take longer to download the image.)</p>	<p>2. New menu bar will come out</p> <p>3. When you have completed the settings, click “Save Images” and specify where you want to save the images.</p>

6.6 STEP2: Confirm the location of the facilities on site using GPS.

2.5.1 Basic information on GPS

Global Positioning System (GPS):

- It is originally owned by the United States.

- It is one of the global navigation satellite systems (**GNSS**) that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

Types of GNSS operated by various countries:

- GPS (USA)
- Galileo(EU)
- GLONASS (Russia)
- QZSS (Japan)



Fundamental information on GPS (GNSS):

- GPS is a system that uses radio signals received from **at least four satellites** to locate the position of the device.
- Receiving signals from more satellites improves accuracy of position.
- Accuracy is therefore reduced in areas surrounded by buildings in city centers and, such as valley bottoms and deep forests where the sky is covered.
- **The accuracy of a handy GPS or smartphone is maximum about 3m (5 to 3m in general),** however, a GPS from professional surveyor can provide measurements with an accuracy of about 2 cm.

6.6.1 Introduction of handy GPS:

The Garmin ETREX series, which is the most common handheld GPS, will be used for this explanation.



1	Zoom keys
2	Back key
3	Thumb Stick
4	Menu key
5	Power and backlight key
6	Mini-USB port (under weather cap)
7	Battery cover
8	Battery cover locking ring
9	Mounting spine

(Source: https://www8.garmin.com/manuals/webhelp/eTrex22x-32x/EN-US/eTrex_22x_32x_OM_EN-US.pdf)

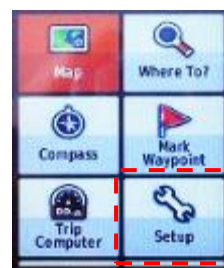
6.6.2 Function of GPS:

GPS has a various functions, but only the functions used for the Mapping system are described below.

- **Recording the Tracks:** Automatically records the path that the GPS device has travelled based on specified conditions.
- **Waypoint:** Record positional information for any given point. The locations are automatically numbered, but can also be given a short name.

6.6.3 Initial setup for Handy GPS

It shows which settings need to be changed just after the purchase of the GPS or when the settings have been initialised. Before the field work, please confirm the main items in the “Setup” menu which are listed as follows.

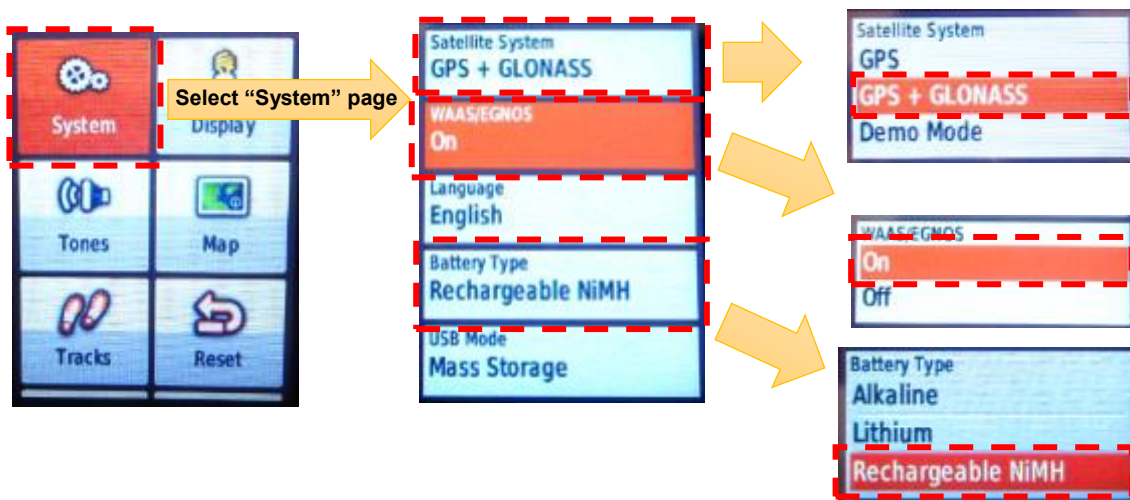


1. System setting
2. Track setting
3. Unit setting

All settings start from going to the “Setup” page first.

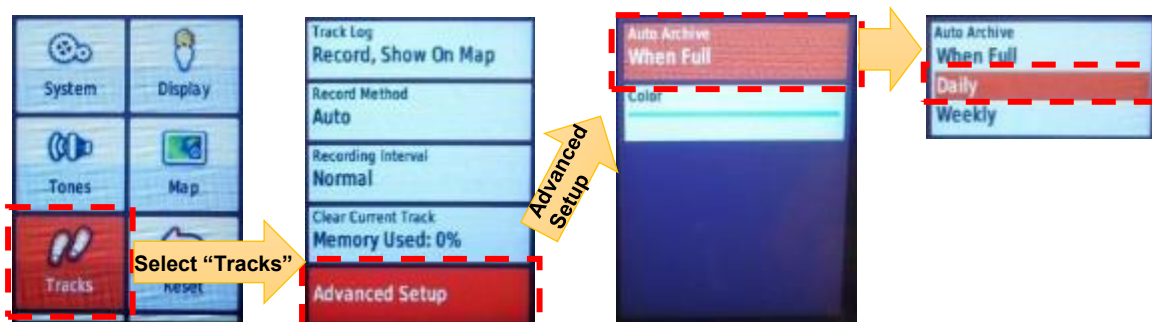
1. System setting

“Satellite System”, “WAAS/EGNOS” and “Battery Type” setting needed to be changed from the default setting. Setting for “Satellite System” and “WAAS/EGNOS”, these changes of settings enable more precise coordinates to be obtained. If you are using rechargeable batteries, select “Rechargeable NiMH” in “Battery Type” setting. If this setting is not selected appropriately, the remaining battery level will not be displayed properly. (Check this setting if the remaining battery power is displayed only a little after replacing the battery with a freshly charged.)



2. Track Setting

Change the “Auto Archive” setting from “When full” to “Daily”. This setting change allows the Track logs to be stored in the “Archive” folder on a daily basis. (Only today's Tracks are possible in the “Current” folder.)



3. Unit setting

The units of coordinates displayed on the GPS device can be switched. Those settings are related to only the displayed unit and it not effect to the collected coordination. When you change the settings the display coordination is automatically converted as selected.

Datum and Spheroid for coordinates displayed on the GPS device can be selected. It does not affect positioning accuracy so there is no need to change it from WGS 84. (If the printed map at hand uses a different definition, change the setting when comparing coordinates in the field).



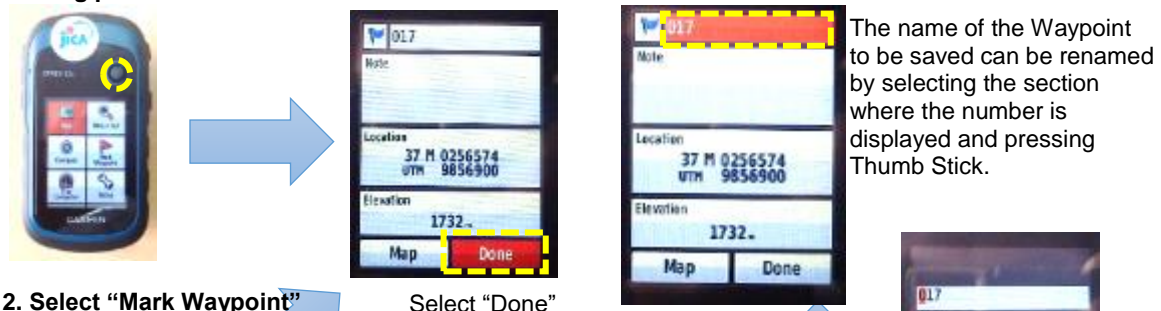
6.7 Basic operation of Handy GPS

Following shows the basic operation of handy GPS during the field work.

6.7.1 How to save the Waypoints

There are two approach to save the waypoints.

1. Long press Thumb Stick



2. Select "Mark Waypoint"



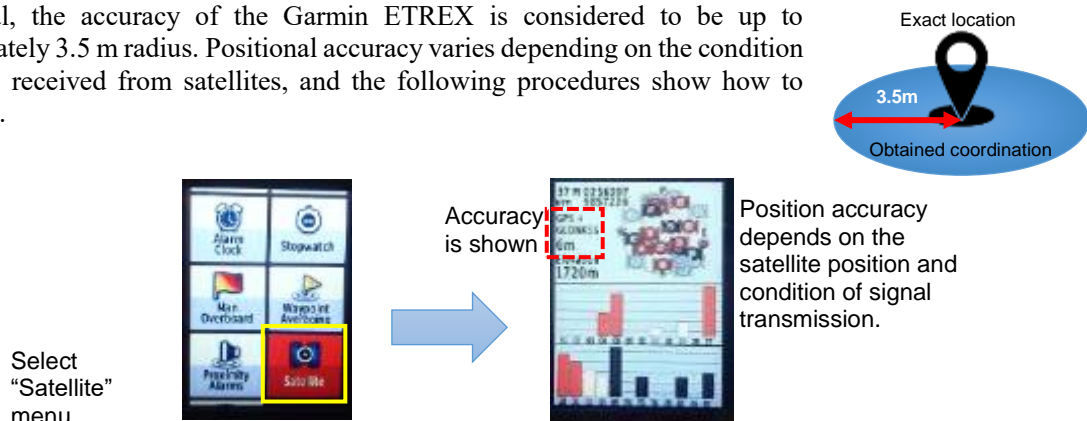
6.7.2 Check the Waypoints on GPS

Saved waypoints can be displayed on a map by selecting "Map" on main menu.



6.7.3 How to confirm the accuracy of GPS

In general, the accuracy of the Garmin ETREX is considered to be up to approximately 3.5 m radius. Positional accuracy varies depending on the condition of signals received from satellites, and the following procedures show how to confirm it.



6.8 FAQ

6.8.1 Waypoints and Tracks do not appear on the map when the MAP page is selected.

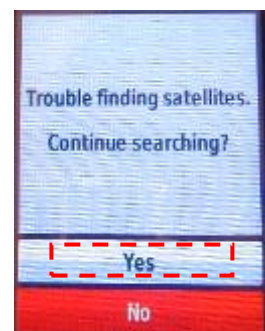


Answer: Using the Zoom key, zooming in makes Waypoints and Tracks appear on the screen.



6.8.2 The position of the Map page does not change when the device is moved, the device is not receiving the signal properly.

Answer: The device may have selected Demo Mode when it was indoors where it could not receive signals and the screen on the right was displayed. If you select "Yes" when this screen appears, your device will be in "Demo Mode". You need to change the settings as described below.





How to get necessary data for Irrigation scheme map:

- For the facility for point data, record its location using Waypoint.(e.g. Mark waypoint on the turnout)
- For facility for lines and polygons, record Waypoints at the start, middle and end points and record track data.(e.g. working along the canal, working along the border of IU)
- **Waypoint No. and Detailed information** will be recorded on the **data sheet for fieldwork.**

Page No: _____ The Project for Rehabilitation of Irrigation Facilities in Rwamagana Soft Component

Name of Cooperative: _____

Cooperative Group Name: _____

No	GPS No	Direction	User Name	Filed type	Comment

How to get necessary data for water users list:

- GPS data recorded at each starting of block can be linked to all plot in left and right side of the point and also land owner, cultivated crop etc.
- Locations for irrigation facilities can be linked to collected waypoint, Irrigation Unit (IU), Water Users Team(WUT), zone, scheme etc.
- **Waypoint No. and Detailed information** will be recorded on the **data sheet for field work.**

Preparation of water users list

Name of IWUO:.....

Name of zone:.....

Name of WUT:.....

#	GPS point No	Turn out (side)	Name of Land user	Name of land owner	Crop grown	Field Type	Comment

Name of Data collector: _____

Name of Irrigation scheme: _____

Name of Zone/Block: _____

#	GPS Waypoint No.	Name of Facility	Detailed information	Comment

6.9 STEP3: Based on the results of the field survey, finalize the Draft Site map using Google Earth Pro.

6.9.1 Data transfer from GPS to PC

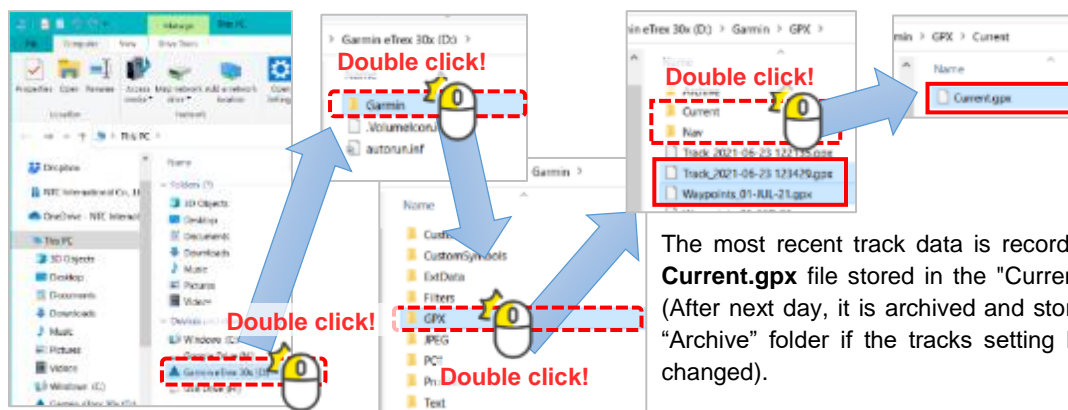
After the field work, collected data need to be stored in the PC and confirm the data. Following shows how to access the data in the GPS device and store it to the PC.

Connect the GPS to the PC using the bundled USB cable. It may take a few minutes for the PC to detect the GPS device. (It takes longer for the first time, as it is detected after the drivers have been installed automatically.)

The USB cable should be used the one bundled with the device. However, if it is lost or not with you, you need to carefully select an alternative USB cable to use, as some USB cables can only supply power and others support data transfer. (If a cable that can only supply power is connected, the GPS device will boot but the PC will not recognise the device.)

GPS data collected in the field is stored inside the GPS as a GPX file. Once the PC has recognised the connected GPS device, follow the steps below to access the target folder.

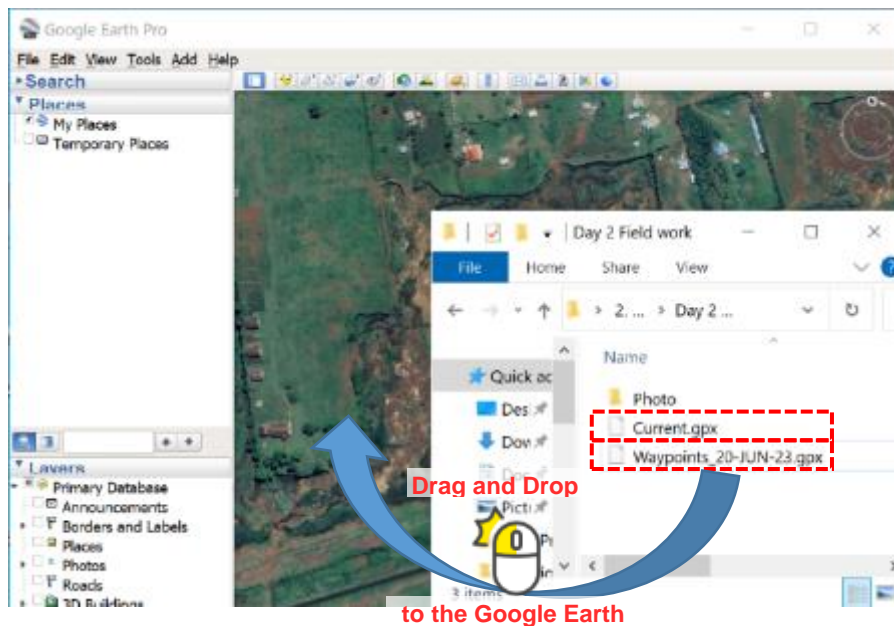
- Waypoints: "PC" → "Garmin ETREX 20X" → "Garmin" → "GPX"
- Tracks: "PC" → "Garmin ETREX 20X" → "Garmin" → "GPX" → "Current" or "Archive"



Copy Track (e.g. *2023-06-14 11:52:03 Day.gpx*) and Waypoint (e.g. *Waypoints_14-JUN-23.gpx*) file to your PC.

6.9.2 Open the GPX file copied to your own PC and check its contents.

To importing the data from GPX files which collected by GPS device, Drag and drop GPX files into Google Earth Pro.



The window shown below appear. Then, Click OK with default settings. (If you don't find the window below, Click on the Google Earth Pro Window)



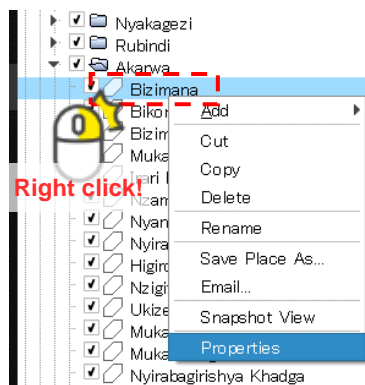
The data is stored under "Temporary Places".



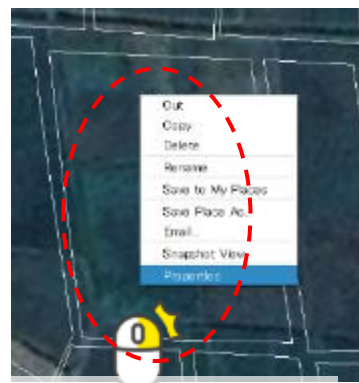
6.9.3 How to correct existing data using Google Earth Pro

Finalize Site map based on Track and Waypoint data collected by GPS with the datasheet. Add facilities that have been identified based on field information and correct information that was previously prepared and incorrect on the Google Earth Pro.

There are two ways to open the properties of a target displayed on a layer or by right-clicking on the target feature on the map. While the properties are open, you can relocate point (Placemark) and edit polygon and polyline, such as moving, adding and deleting. After editing, click "OK" in the properties window to save the edits.



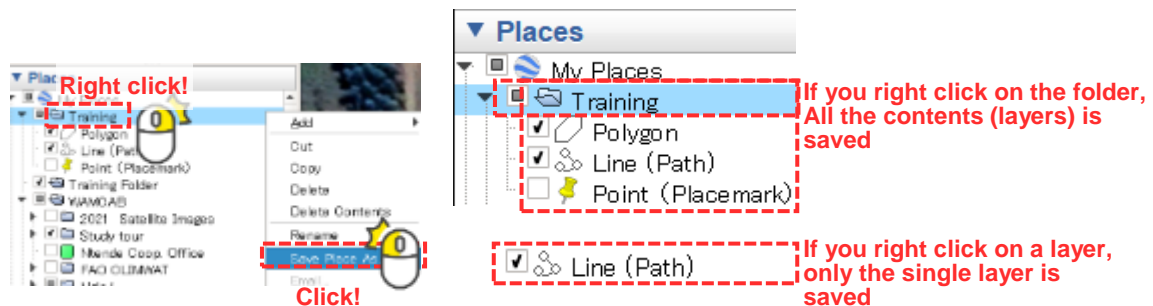
Or



Right click on the target feature!

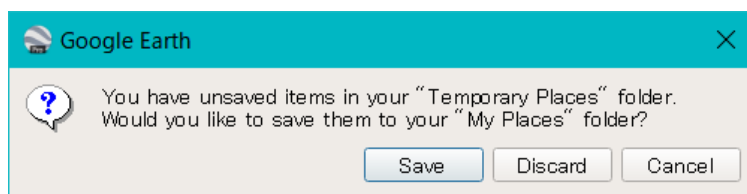
6.9.4 Save prepared Point, Line and Polygon to KMZ file

KML and KMZ file format is native data format for Google Earth Pro. Right click on the target folder or layer which you want to save, then Click “Save Place as”. Chose the folder where you want to save the data in the PC. Then, KMZ file is saved.



6.9.5 Don't leave important data in the temporary folder

When you close the Google Earth Pro, it may ask you following message.



Your effort will be gone!



It mean there is some data inside of “Temporary Places”. Please make sure there is no important data in it. If there is, please move those data under the “My Places”. Data under My Places save automatically when you close Google Earth Pro.

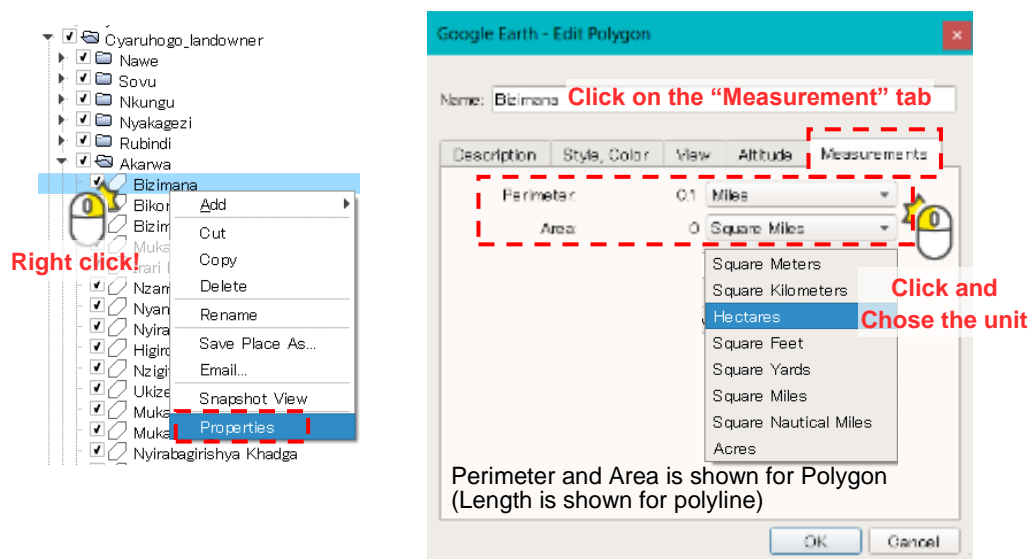
Since original GPX files for Tracks and Waypoints or any other data from KMZ files are already stored in the PC, It is not necessary to save those data under “My Places”. But please make sure that there is no other data such as the data for Site map or any other prepared data under “Temporary Places”. If there is, please move those necessary data to “My Places” by Drag & Drop.

6.10 STEP4: Confirm the Draft map with IWUO representatives and finalize.

Corrections are made on the GEP based on the GPS data, and the completed data is printed out as an image and distributed to IWUO and the relevant parties.

6.11 How to prepare calculate the area for each water user using Google Earth Pro

After creating polygons, the area can be confirmed by displaying the properties of the polygon. When properties window opened, go to “Measurement” tab. The “Perimeter” and “Area” is shown for Polygon and “Length” is shown for polyline. The unit can be converted as you like.



Chapter 7 Facility inspection

Content Type	Explanation of practical activities		
Objectives	<p>This chapter explains the necessity and methods of facility inspections related to the regular O&M of facilities carried out by IWUOs, as well as providing sample survey items and survey forms for reference.</p> <p>The objective is to enable IWUO to select the necessary survey items according to the facilities in their respective scheme and to carry out facility inspections by themselves.</p> <p>The collection of this information is also an important activity that provides the foundation for the formulation of an O&M plan.</p>		
Outcomes	Understand the importance of facility inspections and enable IWUO members to perform it by themselves.		
Lecturers:	RAB and District Staff (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

7.1 Introduction

The systematic maintenance of irrigation facilities requires regular confirmation of the facilities condition. Depending on the condition of the facilities, it becomes possible to improve day-to-day maintenance and prepare action plans and budgets for required repairs during the non-irrigation season.

7.2 Classification of the facility condition

The condition of the facility is classified into levels 1-4, and the results are used to formulate a maintenance and management plan.

- **Level 1:** There is no damage and it's working properly.
- **Level 2:** There is minor damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)
- **Level 3:** Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)
- **Level 4:** There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Examples of each level of classification are given below, although they vary depending on the IWUO's technical and financial capacity.

	
Level 2: Although some sediment has accumulated in the canal, it still functions for water conveyance,	Level 2: Sediment has carried away and accumulated as a result of flooding caused by heavy

so consider utilising regular community work opportunities to clean it out.	rainfall. Although this does not affect water intake at this point, it is necessary to remove sediment from around the weir when the water level drops or after harvesting.
	
Level 3: Part of the masonry is damaged and there is a concern that erosion will occur over time to the backside of the canal and so on, so immediate countermeasure work needs to be carried out.	
	
Level 3: Sediment accumulation and lack of masonry sections are occurring and need to be addressed quickly before the next flood. If another flood occurs in this condition, there is a risk of accumulated sediment entering the field through the canal and severely damaged areas of masonry.	Level 4 : Flooding has washed away facilities around the weir. This needs to be addressed by large-scale civil works, which cannot be handled by the financial and technical capacity of the IWUO in general, so government support is needed.

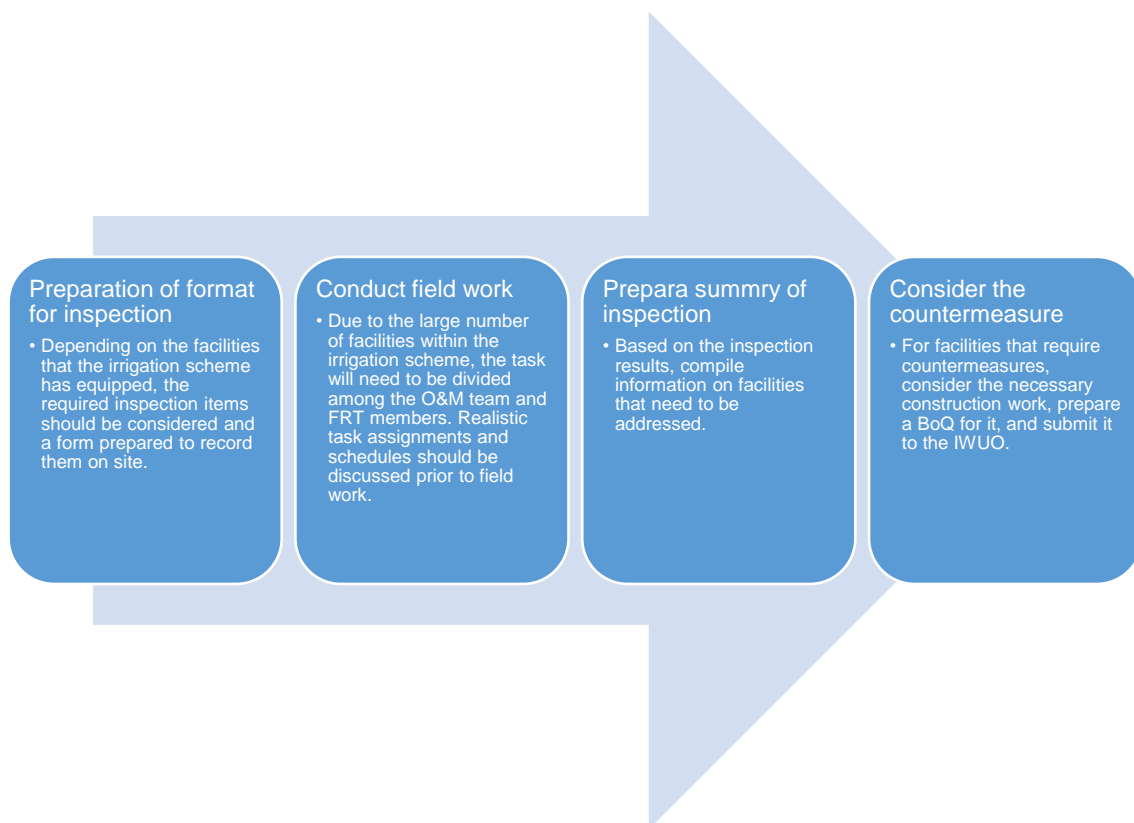
With regard to this level classification, Level 2 defines facility issues that can be addressed by facility users within the daily maintenance of the facility, such as sediment and weed overgrowth.

Level 3 refers to minor cracks in concrete structures, cracks in earthen channels and rust on gates. This is damage that could lead to progressive damage if left untreated.

Level 4 refers to damage that cannot be resolved by IWUO alone, such as major damage to weirs and other structures due to flooding, or failure of p

7.3 Flow of the facility inspection

Following diagram showing the flow of the facility inspection.



7.4 Using format for inspection

For IWUO members, it is not easy to understand what to check during the field work for checking the facility condition. Therefore, it is advisable to prepare a checklist for each facility in the beginning, listing the points that need to be confirmed. After a few experiences and an understanding of what to check, simpler check lists can be utilized. Followings are the sample of the format for facility inspection for various scheme and facilities.

Generally, these formats consist of two types: a format for recording the condition of each facility in the field, and a format for compiling and summarising those results. As described, after having experienced several facility inspections and understanding the points to be confirmed, it is possible to use the summary format from the beginning to conduct the facility inspections in the field.

7.4.1 Sample format for facility inspection: Main Earth canal and turnouts

Inspection sheet for Main canal and Turnout in Nigari

General information			
Date of inspection :		Name of Inspector :	
Target Main canal :			
Condition of Main Open Earth Canal			
Target section			
Weeds are growing on the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
The original shape of the canal is maintained.	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity
Sediment inside the main canal	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment (It may not cause overflow)	<input type="checkbox"/> Heavy sediment (It may cause overflow)

Illegal water intake	<input type="checkbox"/> No	<input type="checkbox"/> Some part of canal are cut	<input type="checkbox"/> Many part of canal are cut
Any issues or challenges			
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Condition of Turnout			
Name of structure			
Structure is broken	<input type="checkbox"/> There is no crack	<input type="checkbox"/> Small cracks (There is no big leakage)	<input type="checkbox"/> Big cracks (There is big leakage and not functional)
Turnout is blocked or choked by sediment	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment but it's working	<input type="checkbox"/> Heavy sediment and flow is obstructed
Around turnout is eroded	<input type="checkbox"/> No erosion damage	<input type="checkbox"/> Small erosion damage (Turnout is sustained.)	<input type="checkbox"/> Heavy erosion damage (countermeasure required)
Diverted destination (just after turnout)	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment but it's working	<input type="checkbox"/> Heavy sediment and flow is obstructed
Any issues or challenges			
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

7.4.2 Summary format for facility inspection: Main Earth canal and turnouts

Summary sheet for result of Inspection of main earth canal and turnouts in Nigari

Name of responsible person:

Date of Inspection:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the condition classified as level 1).

Level 2: There is minor damage or degradation but it working properly. (No need any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation that can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it cannot be managed by IWUO. (Need some assistance from outside)

Condition of Main Open Earth Canal	Section			
	Weeds			
	shape of canal			
	Sediment			
	Illegal intake			
	Issues or challenges			
	Grading			
Proposal for required action by IWUO				
Condition of Turnout	Name of turnout			
	Broken Structure			
	Sediment			
	Erosion			
	Diverted destination			
	Issues or challenges			
	Grading			
Proposal for required action by IWUO				

7.4.3 Sample format for facility inspection: Main drain and developed weir

Inspection sheet for Main drain and Developed weir in Nigari

General information			
Date of inspection :		Name of Inspector :	
Target Main canal :			
Condition of Main Drainage canal			
Target section			
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
The original shape of the canal is maintained.	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity
Sediment condition inside the canal	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment (It may not cause overflow)	<input type="checkbox"/> Heavy sediment (It may cause overflow)
Traces of overflows	<input type="checkbox"/> No	<input type="checkbox"/> Small part seems overflowed	<input type="checkbox"/> Many part seems overflowed
Any issues or challenges			
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

Condition of Developed Weir			
Name of structure			
Operational condition of the gates	<input type="checkbox"/> Gates are operational	<input type="checkbox"/> The gates can be opened and closed, although there are some problems.	<input type="checkbox"/> The gates can be no longer be opened or closed. (Not operational)
Stop logs' availability	<input type="checkbox"/> All the stop logs for weir is available	<input type="checkbox"/> Some of the stop logs are missing (but weir is functional)	<input type="checkbox"/> most of the stop logs are not available (weir)
Stop logs' operationality	<input type="checkbox"/> Stop logs are operational	<input type="checkbox"/> Some stop logs are not removable.	<input type="checkbox"/> Most stop logs are not removable.
Sediment condition	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment but it's working	<input type="checkbox"/> Heavy sediment and flow is obstructed
Condition of upstream of weir (Side wall and apron)	<input type="checkbox"/> No cracks, depletion and erosion	<input type="checkbox"/> Small cracks, depletion or erosion but still stable	<input type="checkbox"/> Big cracks, depletion or erosion and no longer stable
Condition of downstream of weir (Side wall and apron)	<input type="checkbox"/> No cracks, depletion and erosion	<input type="checkbox"/> Small cracks, depletion or erosion but still stable	<input type="checkbox"/> Big cracks, depletion or erosion and no longer stable
Any issues or challenges			
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

7.4.4 Summary format for facility inspection: Main drain and developed weir

Summary sheet for result of Inspection of main drain and developed weir in Nigari

Name of responsible person:

Date of Inspection:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the condition classified as level 1).

Level 2: There is minor damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Condition of Main Drainage canal	Section			
	Weeds			
	Shape of canal			
	Sediment			
	Traces of overflows			
	Issues or challenges			
	Grading			
	Required action by IWUO			
Condition of Developed Weir	Name of weir			
	Condition of the gates			
	Stop log availability			
	Stop log operationally			
	Sediment			
	Upstream of weir condition			
	downstream of weir condition			
	Issues or challenges			
	Grading			
	Required action by IWUO			

7.4.5 Sample format for facility inspection: Main Pipeline Canal and Drainage Canal

Inspection Sheet for Main Pipeline Canal and Drainage Canal in Ngoma22 hillside

Date of inspection :		Name of Inspector :	
Target Main canal :			
Condition of Main open canal			
Target section			
Availability of Sluice Gates	<input type="checkbox"/> Existing	<input type="checkbox"/> Stolen	<input type="checkbox"/> Damaged (Not working)
Availability of Air valve	<input type="checkbox"/> Existing	<input type="checkbox"/> Stolen	<input type="checkbox"/> Damaged (Not working)
Flushing condition	<input type="checkbox"/> Flushed properly	<input type="checkbox"/> Flushed with small discharge	<input type="checkbox"/> Not flushed well
Any issues or challenges			
Grading of the facility condition		Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4	

7.4.6 Summary format for facility inspection: Main Pipeline Canal and Drainage Canal

Summary sheet for result of Inspection for Main canal and drainage

Name of responsible person:

Date of Inspection:

Name of Main Canal:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the condition classified as level 1).

Level 2: There is minor damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Section		B.P. to SC1	SC1-2	SC2-3
Condition of Main open canal	Availability of Sluice Gates			
	Availability of Air valve			
	Flushing condition			
	Grading			
	Proposal for required action by IWUO			

7.4.7 Sample format for facility inspection: Secondary Pipeline Canal in hillside

Inspection sheet for Secondary Pipeline in Ngoma22 hillside

General information

Date of inspection :	Name of Inspector :
Target Main canal :	
Name of Secondary Canal:	

Condition of Diversion facility

Condition of Protection facility(concrete and HDPE cover) for valve	<input type="checkbox"/> Existing	<input type="checkbox"/> Not Existing	<input type="checkbox"/> Damaged
Condition of air vent for the pipeline	<input type="checkbox"/> Existing	<input type="checkbox"/> Not Existing	<input type="checkbox"/> Damaged
Accessibility to valve	<input type="checkbox"/> Accessible	<input type="checkbox"/> Accessible but there are some obstacles	<input type="checkbox"/> Not Accessible, there are many obstacles
Operationality of valve	<input type="checkbox"/> Working properly	<input type="checkbox"/> No	
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

Condition of Secondary Pipeline Canal

Exposure condition of pipeline	<input type="checkbox"/> Not exposed	<input type="checkbox"/> Slightly exposed	<input type="checkbox"/> Partially exposed or more
Any damage on the secondary pipeline or leakage from the pipe	<input type="checkbox"/> No damage and exposed part	<input type="checkbox"/> Damaged	<input type="checkbox"/> Leakage from pipe
The HDPE valve or and cap is existing.	<input type="checkbox"/> HDPE valve exist	<input type="checkbox"/> End cap exist	<input type="checkbox"/> It was stolen or broken
The pipeline is flashed from the end valve properly?	<input type="checkbox"/> The pipeline is flashed successfully	<input type="checkbox"/> Somehow well flushed	<input type="checkbox"/> Not flushed
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

Condition of Hydrant

Number of Hydrant on secondary pipeline		
Hydrant exist or not.	Existing	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Existing but damaged	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Not exist	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
Tap can be connected to Hydrant or not?	Well connected	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Can't be connected	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
Water can be supplied from Hydrant	Water comes out well	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Water doesn't come out	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
The condition of the Hydrant	Working with High Pressure	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Working with Low Pressure	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
	Not working	Hydrant No. <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4, <input type="checkbox"/> 5, <input type="checkbox"/> 6, <input type="checkbox"/> 7, <input type="checkbox"/> 8, <input type="checkbox"/> 9
Comprehensive evaluation of facility condition		Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4

7.4.8 Summary format for facility inspection: Main Pipeline Canal and Drainage Canal

Summary sheet for result of Inspection for Secondary Pipeline Canal in hillside

Name of responsible person:

Date of Inspection:

Name of Main Canal:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the condition classified as level 1).

Level 2: There is minor damage or degradation but it working properly. (No need any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Condition of Diversion facility	Secondary Canal	SC1	SC2	SC3
	Protection facility			
	Air vent			
	Accessibility to valve			
	Operationality of valve			
	Proposal for required action by IWUO			
Condition of Secondary Canal	Exposed pipeline			
	Damage or leakage			
	End cap and valve			
	Flashing of pipeline			
	Proposal for required action by IWUO			
Condition of Hydrant	Number			
	Not existing			
	Tap connection			
	Water availability			
	Functionality			
	Proposal for required action by IWUO			
Comprehensive evaluation of facility condition				

7.5 Consideration of counter measure classified Level 3

The following are countermeasures for damage categorised as Level 3.

Changes in canal shape due to sedimentation, erosion or excavation of earth canals are expected to be addressed by community work, such as removing sediment or filling and compacting eroded areas with reference to the conventional canal shape.

Cracks on concrete canals can be repaired by filling with mortar and reshaping the surface. If part of the structure is damaged, it should be repaired using a structure with conventional structure. (e.g. If the existing structure is made of concrete, it should be repaired using concrete; if it is masonry, it should be repaired using masonry.) If the cause of the damage can be identified, the necessary measures should be considered for a permanent solution. (e.g. road drainage flows into irrigation canals, damage to facilities due to livestock invasion, damage to farm roads and the canals due to overloaded trucks passing through the scheme, etc.).

For erosion and excavation around canals due to flooding, etc., backfilling by appropriate compaction and protection of surface areas with the use of sandbags can also be effective. (For sandbags, as they deteriorate due to ultraviolet radiation, it is necessary to cover the surface layer with soil, as appropriate.)

7.6 Sample training schedule for facility coding and facility inspection

The following is a schedule of the training conducted by the Project. When implementing the training, the contents should be reviewed and implemented with reference to the below schedule.

Schedule for Facility inspection training for extension site								
Date	Contents of the training		Venue	Presenter	Participant			
	AM	PM			Model site	Main Extension site	Sub Extension site	Service provider

Day 1	Lecture style training (1) Importance of Facility inspection (2) What is facility cording and Its importance (3) How to conduct Facility inspection (4) What is facility coding (5) How to prepare data sheet for inspection (6) Explanation of the irrigation facility using scheme map (7) Good practice in the Model site		Model site	TF member, FC and IWUO in charge of Infrastructure and O&M team from Model site	FC, IWUO president and in charge of Infrastructure	Scheme manager, O&M team and IWUO President	Scheme manager and IWUO President and in charge of Infrastructure	HoReCo or Yara Yara staff who is the person in charge of the extension scheme
Day 2	Field visit to a model site (8) Practice for facility inspection in the model site	(9) Desktop classification of facility condition using Site map	Model site	FC, TF member and N/S	Ditto	Ditto	Ditto	Ditto
Day 3	Field work in the Extension site (10) Practice for facility inspection in the extension site Lecture style training	Group discussion (11) Types of maintenance work and responsible persons (12) Discussion for prioritize the facility for repair work	Main Extension site	FC, TF member and N/S	Ditto	Ditto	Ditto	Ditto
※Evaluation will be conducted at the beginning and ending of the training								

7.7 Reference data sheet which was prepared for WAMCAB model sites

Some sample data sheet for facility inspection attached as follows. It can be referred when the data sheet needed to be prepared for other irrigation scheme.

Inspection Sheet for Main Concrete Canal and Drainage Canal in Cyaruhogo Model site

Date of inspection :		Name of Inspector :							
Scheme Name									
Target Main canal :									
Condition of Main concrete canal									
Target section									
Staff gauge for water level at the headwork	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged
Crack on the canal	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage
Sediment and weed inside canal	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
Depression of the canal or gap at the joint part	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Condition of Drainage facilities									
Target section									
Sediment in the drainage canal	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
The original shape of the drainage can	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity
Condition of stone masonry crossing drainage canal	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Condition of Main concrete canal									
Target section									
Staff gauge	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged	<input type="checkbox"/> Not existing	<input type="checkbox"/> Existing but not cleaned	<input type="checkbox"/> Damaged
Crack on the canal	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage	<input type="checkbox"/> Not existing	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Big cracks and much leakage
Sediment and weed inside canal	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed	<input type="checkbox"/> No sediment and weed	<input type="checkbox"/> Some sediment and weed	<input type="checkbox"/> Heavy sediment and weed
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
Extension joint condition	<input type="checkbox"/> No gap	<input type="checkbox"/> Gap with minor likage	<input type="checkbox"/> Gap with serous leakagelikage	<input type="checkbox"/> No gap	<input type="checkbox"/> Gap with minor likage	<input type="checkbox"/> Gap with serous leakagelikage	<input type="checkbox"/> No gap	<input type="checkbox"/> Gap with minor likage	<input type="checkbox"/> Gap with serous leakagelikage
Depression of the canal or gap at the joint part	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow	<input type="checkbox"/> No depression and gap	<input type="checkbox"/> Small depression or gap but no leakage	<input type="checkbox"/> Big depression or gap with leakage or overflow
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Condition of Drainage facilities									
Target section									
Sediment in the drainage canal	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)	<input type="checkbox"/> No sediment and water can flow smoothly	<input type="checkbox"/> Some sediment makes shape of drain unclear but water can flow (No overflow)	<input type="checkbox"/> Heavy sediment makes shape of drain unclear and water can't flow (Overflow)
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
The original shape of the drainage can	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity
Condition of stone masonry crossing drainage canal	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure	<input type="checkbox"/> No cracks on wall	<input type="checkbox"/> Small cracks (No leakage)	<input type="checkbox"/> Serious cracks or settlement of the structure
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

Level 1: There is no damage and it's working properly.

Level 2: There is minor damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Summary sheet fo restult of Inspection of Main Concrete Canal and Drainage Canal in Cyaruhogo Model site

Name of responsible person:

Date of Inspection:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the conditon clasified as level 1).

Level 2: There is miner damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Condition of Main concrete canal	Section									
	Staff gauge									
	Crack									
	Sediment and weed									
	Weeds along the canal									
	Depression or gap									
	lissues or challenges									
	Grading									
	Required action by IWUO									
Condition of Drainage	Section									
	Sediment									
	Weeds									
	Shape									
	Masonry condition									
	lissues or challenges									
	Grading									
	Required action by IWUO									

Inspection sheet for turnout and Secondary canal in Cyaruhogo Model site

General information									
Date of inspection :									
Scheme Name									
Target Main canal :									
Name of turnout or Secondary Canal:									
Condition of turnout facility									
Condition of concrete stop logs /metallic gate	<input type="checkbox"/> Existing	<input type="checkbox"/> Not Existing	<input type="checkbox"/> Damaged	<input type="checkbox"/> Existing	<input type="checkbox"/> Not Existing	<input type="checkbox"/> Damaged	<input type="checkbox"/> Existing	<input type="checkbox"/> Not Existing	<input type="checkbox"/> Damaged
Condition of metallic gate	<input type="checkbox"/> Good	<input type="checkbox"/> Rast	<input type="checkbox"/> Damaged	<input type="checkbox"/> Good	<input type="checkbox"/> Rast	<input type="checkbox"/> Damaged	<input type="checkbox"/> Good	<input type="checkbox"/> Rast	<input type="checkbox"/> Damaged
Operationality of the stop log	<input type="checkbox"/> Stop log is operational	<input type="checkbox"/> Some stop log is not removable.	<input type="checkbox"/> Most stop logs are not removable.	<input type="checkbox"/> Stop log is operational	<input type="checkbox"/> Some stop log is not removable.	<input type="checkbox"/> Most stop logs are not removable.	<input type="checkbox"/> Stop log is operational	<input type="checkbox"/> Some stop log is not removable.	<input type="checkbox"/> Most stop logs are not removable.
Operationality of the mettalic gate	<input type="checkbox"/> Gates is operational	<input type="checkbox"/> The gate can be opened and closed, although there are some problems.	<input type="checkbox"/> The gate can be no longer be opened or closed. (Not operational)	<input type="checkbox"/> Gates is operational	<input type="checkbox"/> The gate can be opened and closed, although there are some problems.	<input type="checkbox"/> The gate can be no longer be opened or closed. (Not operational)	<input type="checkbox"/> Gates is operational	<input type="checkbox"/> The gate can be opened and closed, although there are some problems.	<input type="checkbox"/> The gate can be no longer be opened or closed. (Not operational)
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Condition of Secondary Canal									
Sediment inside the canal	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment (It may not cause overflow)	<input type="checkbox"/> Heavy sediment (It may cause overflow)	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment (It may not cause overflow)	<input type="checkbox"/> Heavy sediment (It may cause overflow)	<input type="checkbox"/> No sediment	<input type="checkbox"/> Some sediment (It may not cause overflow)	<input type="checkbox"/> Heavy sediment (It may cause overflow)
Any damage on the secondary or leakage from the embankment?	<input type="checkbox"/> No damage and exposed part	<input type="checkbox"/> Damaged	<input type="checkbox"/> Leakage from the embankment	<input type="checkbox"/> No damage and exposed part	<input type="checkbox"/> Damaged	<input type="checkbox"/> Leakage from the embankment	<input type="checkbox"/> No damage and exposed part	<input type="checkbox"/> Damaged	<input type="checkbox"/> Leakage from the embankment
The original shape of the canal is maintained.	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity	<input type="checkbox"/> It's maintained.	<input type="checkbox"/> Expanding due to erosion and farmers' activity a little	<input type="checkbox"/> Heavily expanding due to erosion and farmers' activity
Weeds are growing along the canal	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)	<input type="checkbox"/> No weed	<input type="checkbox"/> Few weeds (It may not cause overflow)	<input type="checkbox"/> Heavy weeds (It may cause overflow)
Any issues or challenges									
Grading of the facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		
Comprehensive evaluation of facility condition	Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4			Level <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3, <input type="checkbox"/> 4		

Level 1: There is no damage and it's working properly.

Level 2: There is miner damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Summary sheet fo restult of Inspection of turnout and Secondary canal in Cyaruhogo Model site

Name of responsible person:

Date of Inspection:

For the condition of each facility, classify the following items into levels 2 to 4 and fill in. (Leave blank if the conditon clasified as level 1).

Level 2: There is miner damage or degradation but it working properly. (No need to any urgent repair work by IWUO but continuous monitoring by IWUO and minor clearing is required by farmers.)

Level 3: Performance of the facility is poor due to the damage or degradation which can be handled by IWUO. (Repair work or community work is needed by IWUO)

Level 4: There is serious damage and it can't be managed by IWUO. (Need some assistance from outside)

Condition of turnout facility	Name of turnout									
	Presence or absence									
	Condition									
	Stop log Operability									
	Gate Operability									
	Issues or challenges									
	Grading									
	Proposal for required action by IWUO									
Condition of Secondary Canal	Section									
	Sediment									
	Canal Embankment?									
	Shape of canal									
	Weeds									
	Issues or challenges									
	Grading									
	Proposal for required action by IWUO									

Chapter 8 Preparation of Bill of Quantity (BoQ)

Content Type	Explanation of practical activities		
Objectives	This chapter explains how to calculate the project costs that IWUO need to allocate in their budgets at the planning stage, such as for repair work on irrigation facilities or when upgrading simple temporal structure to permanent one. Understanding the contents will help IWUO to use the water use fees collected by beneficiaries in an appropriate and systematic way.		
Outcomes	By understanding the contents of this chapter, users will be able to learn the structure and calculation procedures of the BoQ, and will be able to prepare the BoQ and calculate required budget from BoQ on their own IWUO.		
Lecturers:	RAB and District staff	Trainees:	IWUO managers and Leaders of IWUO

8.1 Introduction

IWUOs can only utilise the funds from collected water fees for various activities after preparing an Expense order, submitting it to the DISC and getting approval. It is relatively easy to estimate the cost of electricity and labour, but for the rehabilitation of facilities, the project cost is expensive and it is difficult to estimate it based on the calculation of the required quantities of materials if knowledge for cost estimation is not available.

In addition, if these quantities of materials can't be properly determined, problems may occur such as over- or under-purchase of materials and exceeding the budget.

The allocation of budget without evidence raises questions about the appropriateness or validity of the plan, When planning the construction of new facilities or rehabilitation of existing facilities in the Action Plan,

Unnecessarily over budgeting hinders appropriation of other necessary projects, and under budgeting may result in a budget shortage at the time of implementation, and the construction work may not be completed. This chapter is intended to enable RAB and District staff and IWUO manager to understand this content and work with IWUO members to prepare BoQ.

8.2 What is BoQ

BoQ, Bill of Quantity, is detailed list of materials, components, and labour required to complete a construction project. It provides a detailed breakdown of all the items that are required to build a structure, including their description, quantity, unit of measure. It also shows the exact cost of the project by multiplying the quantity of each item by the unit cost.

Following is sample of professional BoQ for the donor project.

Table 1: Sample of professional BoQ

3. Water Storage Facility Development Component

	Description	Unit	Quantity	Unit Price (Rwf)	Amount (Rwf)
3.1	WATER STORAGE FACILITY (FLOOD CONTROL RESERVOIR) (Size 200m X 100m X 2m)				

Clear site & Strip top soil, 150mm depth	m ²	W 112m x L 212m=	23,744	500	11,872,000
Excavate soft material and place on Embankment, Haulage not exceeding 1km	m ³	L 200m x W100m x H2.3m – A (2m x 3m / 2)m ² x L (100m + 200m) x 2=	44,200	2,500	110,500,000
Haul stockpiled soft material from drains and place in Embankment, haulage not exceeding 1km	m ³	44,200m ³ - 1,842m ³ =	42,358	500	21,179,000
Spread earthfill material to recommended layers, Form canal embankment, including compaction to the required specified MDD 95% and trim to the appropriate canal profile & shape	m ³	A (1+5) 1/2m ² x L (103.5m + 203.5m) x 2=	1,842	2,250	4,144,500
Total cost of proposed Water Storage Facility (Flood Control Reservoir) (Size 200m X 100m X 2m)					147,695,500
Round					148,000,000
TOTAL OF WATER STORAGE FACILITY DEVELOPMENT COMPONENT					148,000,000

***IWUO is not required to prepare something with such precision.**

“Quantity” represents the amount of the target Item. “Unit” is the numerical unit of “Quantity”. Metres and kilometres are commonly used for length, and Kg and Ton for weight. “Unit Price” is the price or cost per Unit. Note that this amount varies depending on the timing and region. The quantity required is determined from the volume of the facility based on the size and structure of the facility adjusted to the site conditions. Therefore, construction quantities for the same facility will vary depending on the conditions. Each cost is calculated by multiplying the quantity by the unit cost and the sum of each item is the total cost.

8.3 Type of the bill

8.3.1 Bill of Materials

Material costing is estimated from the material quantity and their unit cost. For example, the Cement quantity is 4 bags for the project and its rate per bag is 15,000 Rwf. So, its estimated cost will be,

$$= 4 \text{ bags} \times 15,000 \text{Rwf} = 60,000 \text{ Rwf.}$$

8.3.2 Bill of Labour

Labor costing is estimated from labor quantity and their per-day rate. For example, if 5 laborers are required to complete any work in 2 days on-site and they are per day wages are 4,000 Rwf, then the cost of labor will be,

$$= 5 \times 4,000 \text{Rwf} \times 2 \text{ days} = 40,000 \text{ Rwf.}$$

While there are some ways of estimating construction quantities that are required for large-scale, detailed design and estimation such as for donor projects, the training content will focus on simple civil works to be carried out by IWUO. Therefore, estimation of labor cost, earthworks and other works are not included in the scope of this training, **as they are to be covered or carried out by community work.**

Table 2: Sample BoQ for community work

Cost Breakdown of weir rehab				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck	8	65,000	520,000
Sand	truck	4	40,000	160,000

Gravel	truck	1	80,000	80,000
Cement	bags	40	13,000	520,000
Timber	piece	30	4,500	135,000
Nails	piece	8	2,000	16,000
Sand Bags	piece	400	400	160,000
Total				1,591,000

8.4 How to calculate the volume of the material?

8.4.1 Bill of Materials

How to calculate the quantity of the material? The first step is to calculate the area of the standard cross-section, and then multiplying it by the length (depth) makes it possible to calculate the volume.



Figure 8.1: What materials does the structure consist of?

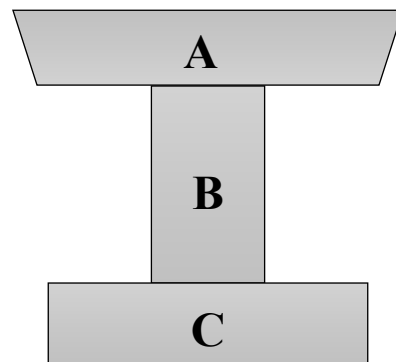
(1) Example of calculation of the calculation of the cross section of the facility

If the structure is complicated, divide it into small squares or triangles and add them together to find the total area of cross-section. By multiplying the length or depth, volume of the structure can be obtained.

As it is difficult to calculate the cross section all at once, the area is divided into parts as shown on the right.

- Area of part A: area of trapezoid
- Area of part B: area of rectangle
- Area of part C: area of rectangle

Total area of A+B+C = cross-sectional area of structure

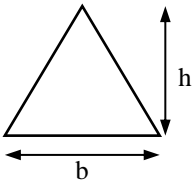
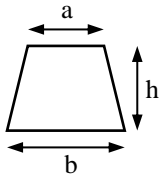
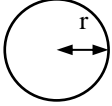


By multiplying the length or depth, volume of the structure can be obtained.

8.4.2 For your reference: Formulas for Area Calculation

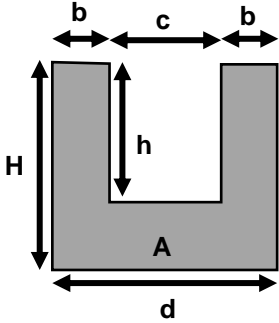
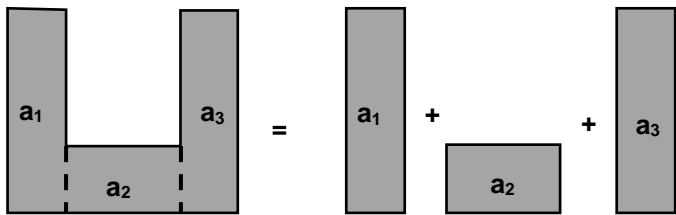
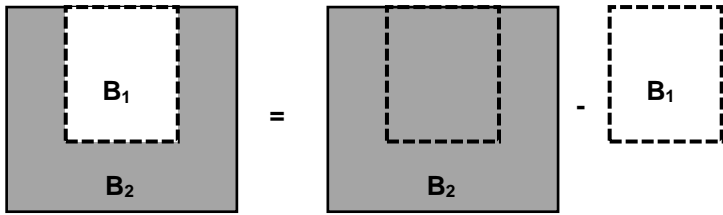
The following is a general area calculation method for various shape.

Rectangle Area = $w \times h$ ✓ w = width ✓ h = height		Parallelogram Area = $b \times h$ ✓ b = base ✓ h = vertical height	
--	--	--	--

Triangle Area = $0.5 \times b \times h$ ✓ b = base ✓ h = vertical height		Trapezoid Area = $(a+b) \times 0.5 \times h$ ✓ a = top base ✓ b = base ✓ h = vertical height	
Circle Area = $3.14 \times r \times r$ ✓ r = radius			

8.4.3 Area Calculation Tips

The following is a calculation method for the cross-sectional area, using a concrete canal cross-section as an example. As there are several approaches and methods of calculation, two calculation methods are shown here. It is better to adapt the method that one considers easier to the calculation in practice.

For determining the area (A) in the figure below,	
Pattern A: Complex shapes break down the surface into several forms.	
	$a_1 = H \times b$ $a_2 = (H-h) \times (d-c)$ $a_3 = H \times b$ Then, $a_1 + a_2 + a_3 = A$
Pattern B: Subtract the area of the area of the extra portion from the total area.	
	$B_1 = H \times A$ $B_2 = h \times c$

	Then, $B_1 - B_2 = A$
--	-----------------------

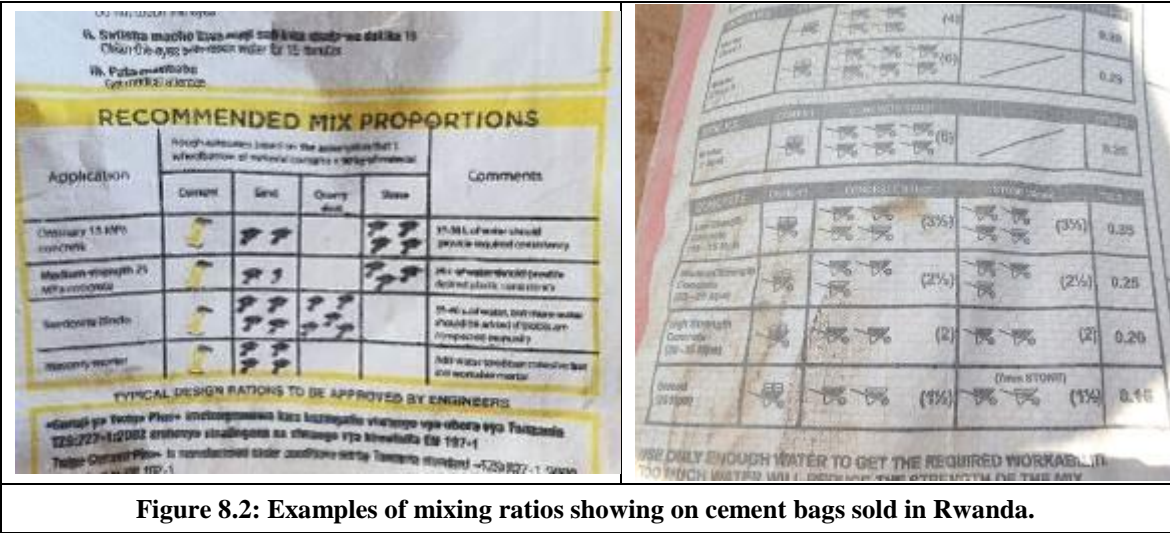
8.5 Bill of Materials

Up to this section, the explanation so far has enabled you to determine the volume of the target facility.

From this section, you will learn how to calculate the volume of required materials to construct the target facility. As shown in the following picture, general commercial concrete provides the necessary mixing ratio for each purpose on the bag.

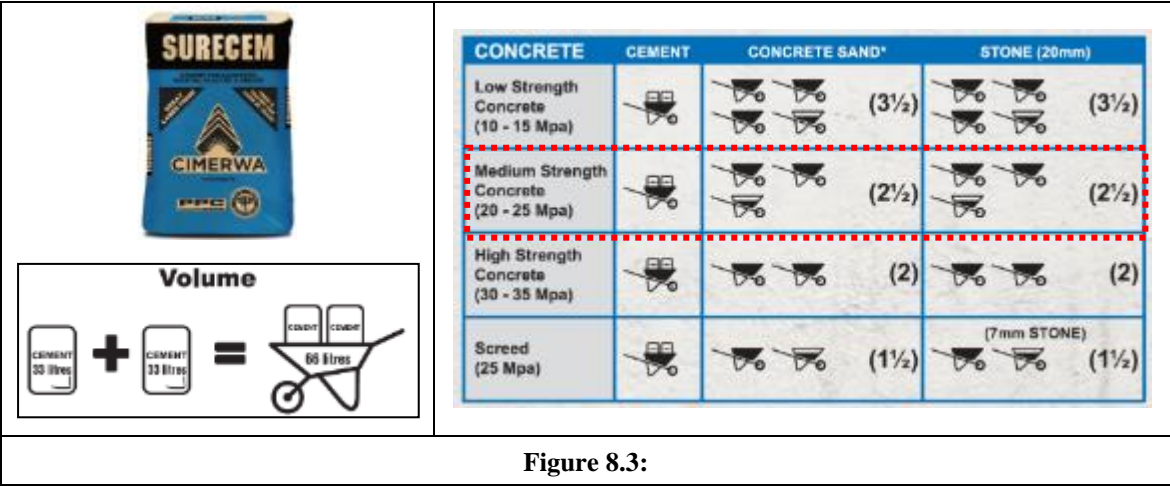
8.5.1 Materials required for concrete work

In the example below, two cement bags represent the volume of one wheelbarrow. (Note that different manufacturers use different expression or conversion.)



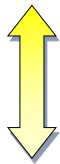

If Medium Strength Concrete is required, the ratio should be 1 : 2.5 : 2.5.

It means Cement 1 wheelbarrow (=2 bags) : Sand 2 and half wheelbarrow : Gravel 2 and half wheelbarrow



General mixing ratio of 1m³ concrete, recommended mixing ratio is Cement 1: Sand 2: Gravel 4 or Cement 1: Sand 3: Gravel 6 in volumetric basis.

Table 3: The mix ratio of concrete commonly used and the amount of cement, sand and gravel required when 1 m³ of concrete is needed.

	Volumetric Mixing ratio				Cement		Sand	Gravel	
	Cement	Sand	Gravel		kg	Bag (1bag=50kg)	(m ³)	(m ³)	
Strong  Weak	1	1	2		600	12	0.390	0.780	
	1	1.5	3		440	8.8	0.425	0.850	
	1	2	4		345	6.9	0.445	0.890	
	1	2.5	5		285	5.7	0.460	0.915	
	1	3	5		270	5.4	0.520	0.865	recommended
	1	3	6		240	4.8	0.465	0.935	
	1	4	8		190	3.7	0.480	0.960	

※Mix about 30 to 45liter of water per cement bag (50kg) apart from the above materials.

For concrete, the required volume of each material can be obtained by multiplying determined volume of the target facility by the ratio of sand, cement, and crushed stone.

Based on the mixing rate given in the table above, the quantities of cement, sand, gravel and water required to make a 1 m³ concrete structure are as follows.

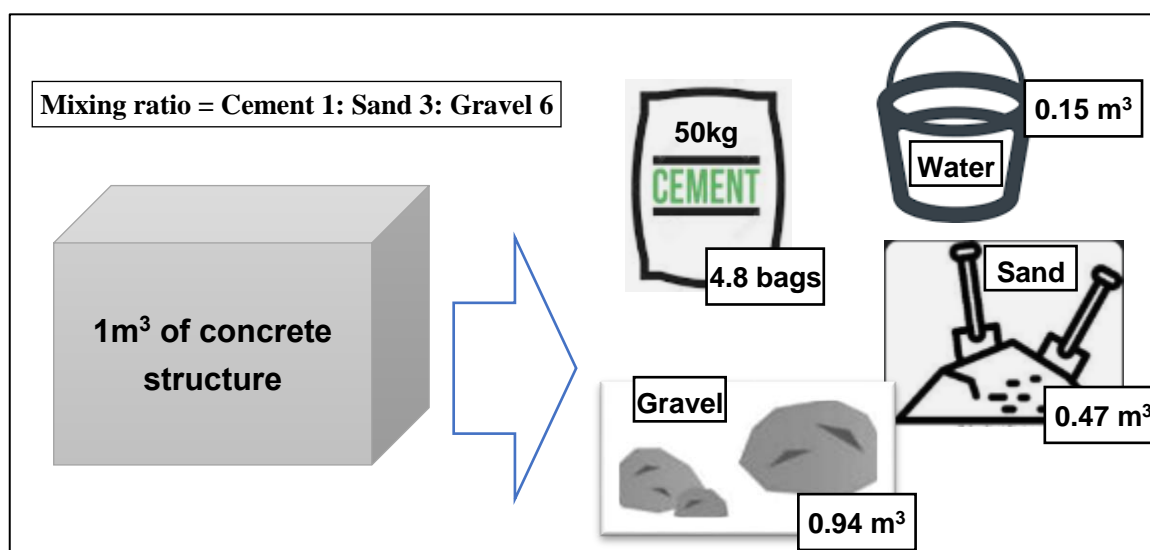


Figure 8.4: Required material to prepare 1m³ of concrete structure

Because sand fills the spaces between the gravels and cement and water fill the spaces between other materials, the total volume of material required is greater than 1m³.

8.5.2 Materials required for masonry work

For Masonry structure, following is how to estimate the required material. (As wet masonry is often used for repair and construction by IWUO, the description will focus on wet masonry.)

- 1.3 times the volume of **stone** is required relative to the volume of the structure needed.

- **0.4** times the volume of **mortar** is needed for the volume of structure needed..
- In addition, the mortar used for masonry is generally in the ratio of 1:3 or **1:4 cement to sand**. (Please refer the instruction on the cement bag which you will use)
- Water cement weight ratio of mortar is usually 50%. (25 liter of water for 1 cement bag of 50kg)

Based on the above conditions, the volumes of cement, stone, sand and water required to make a 1 m³ wet masonry structure are as follows.

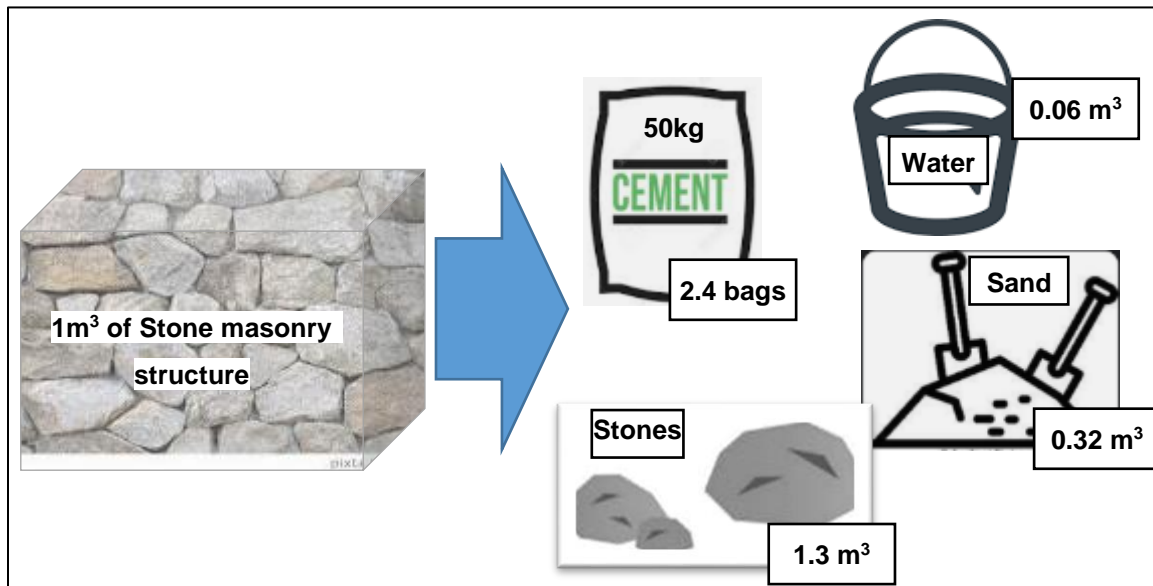


Figure 8.5: Required material to prepare 1m³ of wet masonry structure

8.5.3 Unit conversion to order the material

One bag of cement is approximately 50 kg, which equates to 0.035 m³ per bag in terms of volume. For most civil construction materials, the order unit is based on **one truck**. The capacity of one truck is 5 m³. it's better to add 25% especially for stone and between 5% to 10% for sand and gravels.



※ The capacity of trucks varies by region or its availability, so please confirm at the time of order.

8.5.4 Tips

- ✓ You can't buy 0.5 cement bags. Any fractions of the calculated quantity must be rounded up and adjusted to the smallest unit in the order. (1 bag for cement bags).
- ✓ Gravel and sand quantities must also be rounded up when converted to per-truck quantities. After construction, these excess materials can be used at another construction work, so make an effort to store them properly and avoid wasting them.
- ✓ If the materials are delivered by truck and need to be transported to the construction site from the road, the cost of transportation should also be accounted for. Depending on the scheme, some beneficiaries may cooperate without charge as community work to transport it, so please consider asking for such cooperation after discussion among the parties

8.6 How can we calculate the project cost?

After obtaining the required quantity of construction materials, multiply it by the unit cost obtained from material supplier. Inquire the local supplier about the unit cost of the materials to be used for the construction and multiply this by the quantity obtained from the calculation. For materials, obtain the costs including transport costs to the site. For materials, it is important to obtain the unit price including transport costs to the site.

The following is a reference format for the calculations. First, the unit price of each material is obtained and filled in. Then, the "Quantity" of each material multiplied by the "Unit Cost" is filled in the "Cost" column. The sum of the "Cost" of each material obtained is then filled in in the "Total" column.

Table 4: Sample format for calculation of project cost

Cost Breakdown of weir rehab				
Item	Unit	Quantity	Unit price (Frw)	Cost (Frw)
Stone	truck	8		
Sand	truck	4		
Gravel	truck	1		
Cement	bags	40		
Sand Bags	piece	400		
Total				

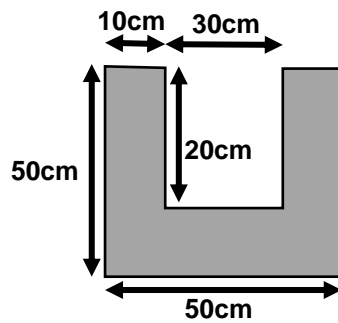
8.7 Exercises

The following are Exercises to check understanding of what has been explained up to this point.

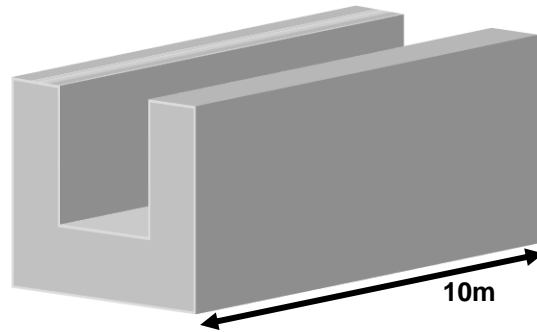
8.7.1 Exercise 1: Calculation of the volume of the structure

Exercise for calculation of the required material for concrete structure:

- Calculate the cross-section of the structure below.
- Calculate the volume of the structure below.



Target cross section



Target structure for calculation of the volume

8.7.2 Exercise 2: Calculation of the required material for concrete structure:

- Calculate required volume of each material (Quantity) of the structure which was obtained in Exercise 1 and fill the table below.
- Mixing ration to be applied is Cement 1: Sand 3: Gravel 6.

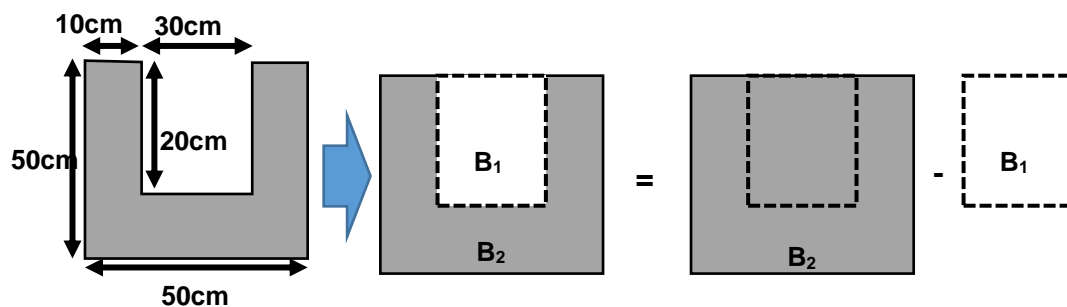
Cost Breakdown of Concrete canal construction				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck			
Sand	truck			
Gravel	truck			
Cement	bags			
Total				

8.7.3 Answers and explanation of calculation methods for Exercise 1&2

Calculation of the volume of the structure: The units used in the calculation should be meters to avoid errors hereafter. (Not calculate in centimetre)

Calculation of the cross section: $B_1 = 0.5\text{m} \times 0.5\text{m} = 0.25\text{m}^2$, $B_2 = 0.2\text{m} \times 0.3\text{m} = 0.06\text{m}^2$

Then, $B_1 - B_2 = 0.25\text{m}^2 - 0.06\text{m}^2 = \underline{0.19\text{m}^2}$



Calculation of the volume: Volume = Area \times Length = $0.19\text{m}^2 \times 10\text{m} = \underline{1.9\text{m}^3}$

Required volume of Concreate is 1.9m^3

Calculation of the volume of the material: Required volume of Concrete is 1.9m^3 as obtained above.

Mixing ration Cement 1: Sand 3: Gravel 6 (below is the information from Table 3)

Table 5: Table General mixing ratio of 1m^3 concrete						
Volumetric Mixing ratio			Cement		Sand	Gravel
Cement	Sand	Gravel	kg	Bag (1bag=50kg)	(m^3)	(m^3)
1	3	6	240	4.8	0.465	0.935

- Cement $4.8 \text{ bags} \times 1.9 \text{ m}^3 = 9.12 \text{ bags} \div 10 \text{ bags} = 1 \text{ bag}$
- Sand $0.465 \text{ m}^3 \times 1.9 \text{ m}^3 = 0.884 \text{ m}^3$
 $= 0.884 \text{ m}^3 \times 1.1 \text{ (10\% Extra)} \div 5 \text{ (capacity of track)} = 0.19 \text{ Track} \div 1 \text{ Track}$
- Gravel $0.935 \text{ m}^3 \times 1.9 \text{ m}^3 = 1.777 \text{ m}^3$
 $= 1.777 \text{ m}^3 \times 1.1 \text{ (10\% Extra)} \div 5 \text{ (capacity of track)} = 0.13 \text{ Track} \div 1 \text{ Track}$

8.7.4 Exercise 3: Calculation of the construction cost

Based on the results of Exercises 1 & 2, the quantities required were obtained.

If the unit costs of the materials were met as per the table below as a result of the interviews, calculate the Total cost required for this project.

Cost Breakdown of Concrete canal construction				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck	0	50,000	
Sand	truck	1	50,000	
Gravel	truck	1	50,000	
Cement	bags	10	12,000	
Total				

8.7.5 Answers and explanation of calculation methods for Exercise 3

Just Multiply quantity and unit price. Then sum up all the cost to obtain the Total cost for this project.

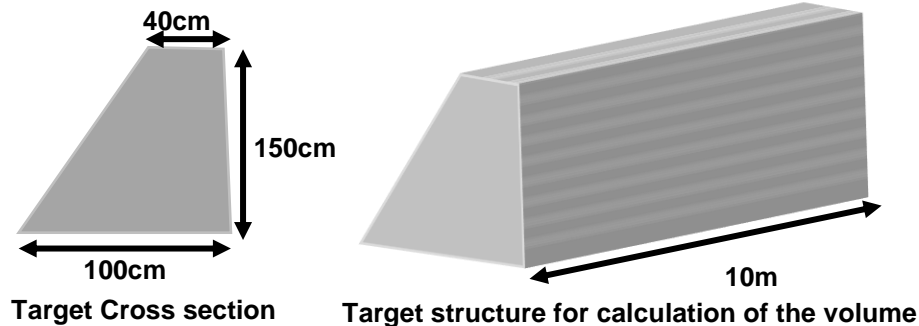
Cost Breakdown of Concrete canal construction				
Item	Unit	Quantity	Unit price (Frw)	cost (Frw)
Stone	truck	0	50,000	0
Sand	truck	1	50,000	50,000
Gravel	truck	1	50,000	50,000
Cement	bags	10	12,000	120,000
Total				220,000

In addition to those cost above, the cost of wood for formwork, strings, nails and other construction tools, casual labor, etc., should be accounted for. Contingency budget of 10% is also recommended to account for price fluctuations and other factors.

8.7.6 Exercise 4: Calculation of the volume of the structure

Exercise for calculation of the required material for stone masonry structure:

- Calculate the cross-section of the structure below.
- Calculate the volume of the structure below.



8.7.7 Exercise 5: for calculation of the required material for stone masonry structure:

Calculate required volume of each material of the structure obtained in Exercise 4.

Condition: Mortar Mixing ration, Cement 1: Sand 4

Cost Breakdown of stone masonry construction				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck			
Sand	truck			
Gravel	truck			
Cement	bags			
Total				

8.7.8 Answers and explanation of calculation methods for Exercise 4 & 5

Calculation of the cross-section of the structure: Trapezoid Area = $(a+b) \times 0.5 \times h$
 $= (0.4m+1.0m) \times 0.5 \times 1.5m = \underline{1.05m^2}$

Calculation of the volume of the structure: Volume = $1.05m^2 \times 10m = \underline{10.5m^3}$

Calculation of the volume of the material:

Volume of stone masonry structure = **10.5m³** which was obtained in Exercise 4.

1.3 times the volume of **stone** is required relative to the volume of the structure needed.

So, volume of **stones** = Volume of structure $\times 1.3 = 10.5m^3 \times 1.3 = \underline{13.7 m^3}$

Required stones is $13.7 m^3 \times 1.1$ (10% Extra) $\div 5$ (capacity of truck) = 3.01 Track \approx **3 Trucks**

(Normally fractions should be rounded up, but in this case the fractions were so small and therefore rounded down.)

0.4 times the volume of **mortar** is needed for the volume of masonry required.

Volume of **mortar** = Volume of structure $\times 0.4 = 10.5m^3 \times 0.4 = \underline{4.2 m^3}$

Calculate volume of cement and sand from the volume of required mortar.

Mortar Mixing ration, Cement 1: Sand 4 (1+4 = 5)

Mortar $4.2 \text{ m}^3 \div 5 = 0.84 \text{ m}^3$

Cement $1 \times 0.84 \text{ m}^3$: Sand $4 \times 0.84 \text{ m}^3$

= Cement = 0.84 m^3 : Sand = 3.36 m^3

Required material for mortar are Cement 0.84 m^3 and Sand 3.36 m^3

Convert the required quantities into units for ordering.

❑ Cement $0.84 \text{ m}^3 = 0.84 \div 0.03 = 6.33 \approx 28 \text{ bags}$ (1 bag $\approx 30 \text{ liter} = 0.03 \text{ m}^3$)

❑ Sand 3.36 m^3 : 3.36×1.1 (10% Extra) $\div 5$ (capacity of track) = $0.739 \text{ Track} \approx 1 \text{ Track}$

8.7.9 Exercise 6: Calculation of the construction cost

Based on the results of Exercises 4 & 5, the quantities required were obtained.

If the unit costs of the materials were obtained as a result of the interviews, calculate the Total cost required for this project.

Cost Breakdown of stone masonry construction				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck	3	50,000	
Sand	truck	1	50,000	
Gravel	truck	0	50,000	
Cement	bags	28	12,000	
Total				

8.7.10 Answers and explanation of calculation methods for Exercise 6

Just Multiply quantity and unit price. Then sum up all the cost to obtain the Total cost for this project.

Cost Breakdown of stone masonry construction				
Item	Unit	Quantity	Unit price (Frw)	Total cost (Frw)
Stone	truck	3	50,000	150,000
Sand	truck	1	50,000	50,000
Gravel	truck	0	50,000	0
Cement	bags	28	12,000	336,000
Total				536,000

8.8 Conclusion

The results of the calculations will be used as reference to formulate IWUO's O&M Plan (Action Plan). Since the calculations included assumptions, this is not an exact required amount of materials or project cost. It is important to review the plan and find the best calculation method through practice.

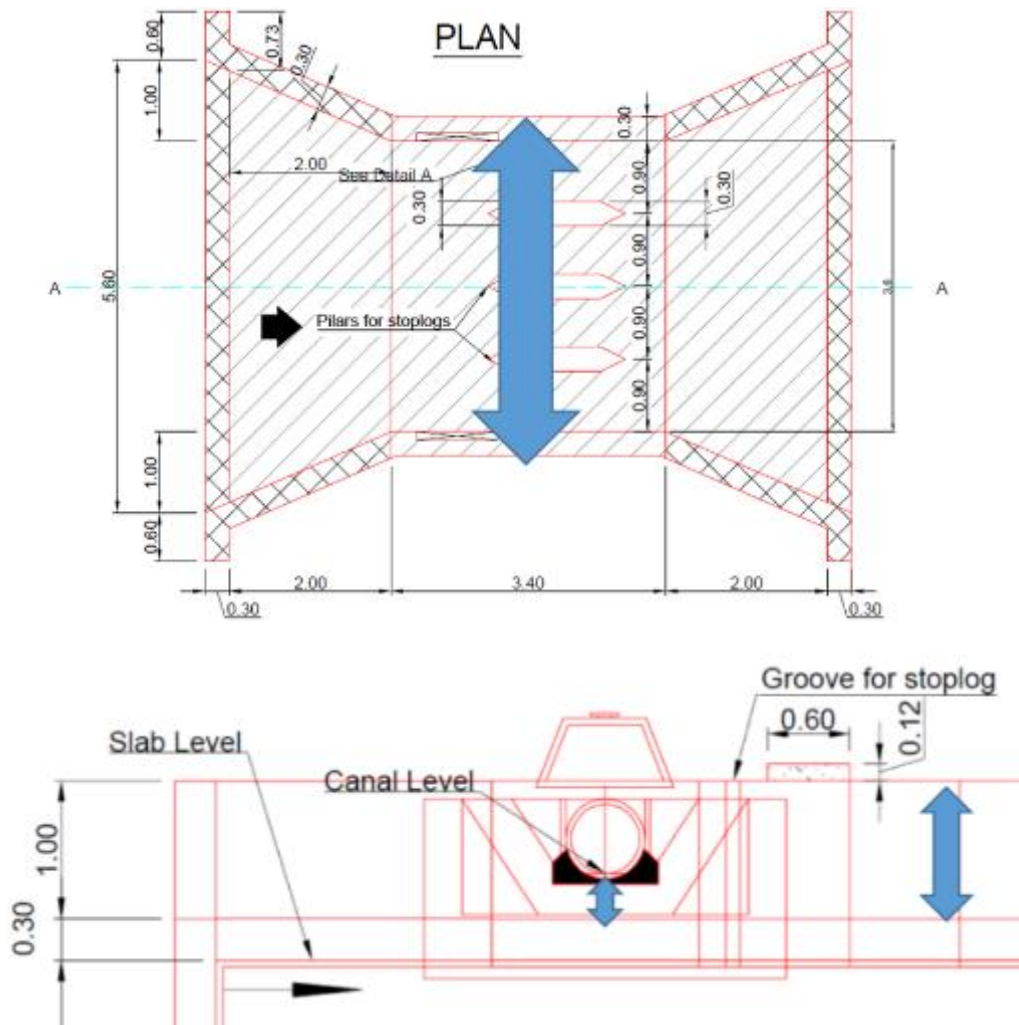
8.9 Modification of drawings and preparation of BoQ based on survey results.

In case of weir, following parameter is needed to modified based on the actual condition.

- Width of weir: Determined on the basis of the width of the embankments on both banks and the river.

- Height of side wall: The existing embankment height is applied in case of rehabilitation or upgrading.
- Height of intake: The height of the intake is determined based on the elevation of the canal to which the water is to be supplied.

Bottom height of intake = Height of destination + Distance \times Gradient (1/1000)



Chapter 9 Civil work for repairing irrigation facility by IWUO

Content Type	Theory and practice		
Objectives	This chapter introduces the simple civil works techniques required by the IWUO to carry out small-scale repair works and new construction of structures within the irrigation scheme. It is targeted to provide an understanding of the procedures and key points at each step of the process.		
Outcomes	It is expected that understanding the content of this chapter will improve the technical skills of the O&M team and FRT members, enabling them to make simple facility repairs and new construction/upgrades facility on their own.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, O&M team and FRT

9.1 Introduction

This text provides procedures and methodology for civil work, which IWUO members can refer to when they repair or rehabilitate their own facilities. Also, it can be possible to construct some facility by using knowledge gained through this activity after some practical experience.

9.2 General Information

9.2.1 Concrete

Concrete is a construction material composed of cement, fine aggregates (sand) and coarse aggregates mixed with water which hardens with time. Portland cement is the commonly used type of cement for production of concrete. Concrete technology deals with study of properties of concrete and its practical applications.

Reinforced concrete, concrete in which steel is embedded in such a manner that the two materials act together in resisting forces. The reinforcing steel -rods, bars, or meshes- absorbs the tensile, shear, and sometimes the compressive stresses in a concrete structure. Plain concrete does not easily withstand tensile and shear stresses caused by wind, earthquakes, vibrations, and other forces and are therefore unsuitable in most structural applications. In reinforced concrete, the tensile strength of steel and the compressive strength of concrete work together to allow the member to sustain these stresses over considerable spans.

In a construction work by IWUO, concrete is used for the construction of aqueduct, slabs and other load bearing elements.

9.2.2 General Flow of civil work

The general flow of civil work and repair work is described below.

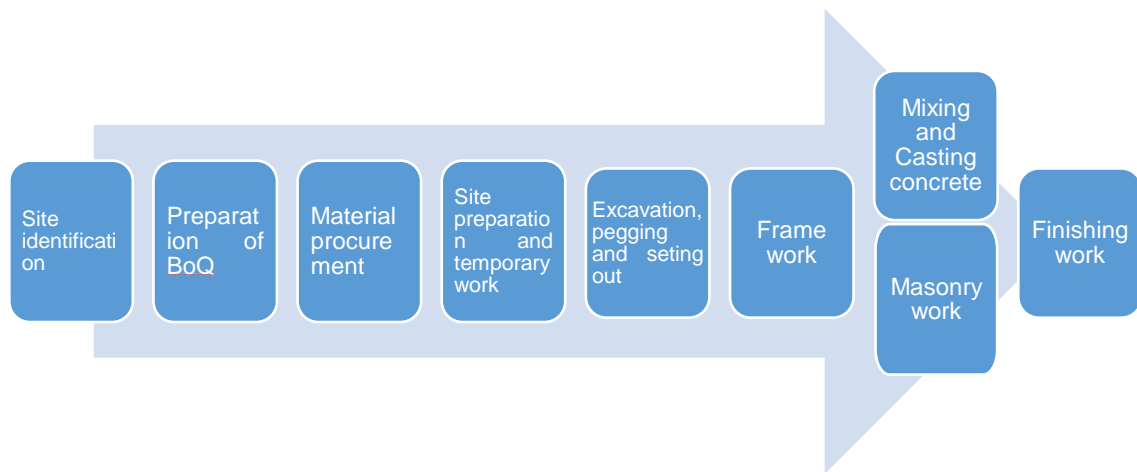


Figure 9.1: General Flow of civil work

Details of each step are described below.

1. Site identification
 - Identify the target structure which has the problem.
 - Target facilities will be selected based on the results of facility inspections conducted on a periodic basis.
2. Preparation of BoQ
 - Determine the quantity of materials needed and calculate the cost of the work based on the market price at that time.
3. Material procurement
 - Procure necessary materials such as sand, gravel, cement, etc. and transport them to the site.
4. Site preparation and temporary work
 - To make it easier for materials to be brought into the site, paths and simple bridges should be established, and if groundwater is seeping out, pumps should be used to drain it.
 - If a canal is needed to be closed, a detour route of the canal should be provided or water supply to the canal should be stopped. Otherwise, the site will be affected by the supplied water by the canal.
 - Also, sand bags can be utilized for temporally and partially closing the canal.
5. Excavation
 - Excavate to the extent necessary for the work in order to establish the foundations for the structure.
6. Formwork
 - Formwork is provided to achieve the desired shape when concrete is cast. Also, since concrete is soft immediately after casting, the formwork is intended to maintain the shape of the concrete.
7. Construction work
 - A) Mixing and Casting concrete
 - Sand, gravel, cement, and water are mixed in the specified proportions and cast into the formwork.
 - After concrete is cast, maintain appropriate humidity to ensure that it shows sufficient strength and durability for curing the concrete.
 - B) Wet Masonry work

- When building up stones or bricks, mortar or concrete is applied to attach them together.
It is less expensive than concrete work.

8. Finishing work

- After the casting and curing of concrete, the surface of the structure is levelled with a trowel and mortar or other materials to ensure a good surface finishing.

9.2.3 Types of Concrete

There are many types of concrete in construction, but there are two types commonly used:

(1) Plain or ordinary concrete

Plain concrete will have no reinforcement in it. The main constituents are the cement, aggregates, and water.

These types of concrete are mainly used in the construction of pavements and the buildings, especially in the area where there is less demand of high tensile strength.

(2) Reinforced concrete

The reinforced cement concrete is defined as the concrete to which reinforcement is introduced to bear the tensile strength. Plain concrete is weak in tension and good in compression. Hence the placement of reinforcement will take up the responsibility of bearing the tensile stresses. The steel reinforcement used in the concrete can be in the form of rods, bars or in the form of meshes.

Although stronger than plain concrete, it is more expensive and is therefore not often used in IWUO repair work. Concrete slabs are used as simple bridges in some of irrigation scheme, and reinforced concrete technology is used when these become deteriorated or damaged and require repair.

9.2.4 Stone Masonry

Stone masonry is a type of building masonry construction that uses stones and mortar. This construction technique is used for building foundations, floors, retaining walls, walls and columns. The stones used for masonry construction are natural rocks. These natural rocks are cut and dressed into proper shape in order to use it in masonry construction. Stones are one of the most durable and strong building materials.

(1) Materials Used for Stone Masonry

The materials used for stone masonry are Stones and Mortar.

1) Stones

The stones used for masonry construction must be hard, tough and free from cracks, sand holes, and cavities. The selection of stone for particular work depends on the availability of the stone and the importance of the structure. The common stones used for masonry construction are limestone, sandstone, granite, marble, laterite, etc.

2) Mortar

The binding material used for masonry construction is the mortar. Cement, sand and water form the mix for masonry mortar.

(2) Classification of Stone Masonry

The two main classifications of Stone Masonry are Wet Masonry and Dry Masonry.

1) Dry Masonry

Dry masonry is built using only stones. The stones are stacked without using mortar, and the stones are stacked while empirically considering the stresses to resist the back earth pressure. Since mortar is not used, it is less expensive than wet masonry, but it's not as strong as wet masonry. In places where it is exposed to water, such as canal walls, it is necessary to consider the risk of erosion on the back side of the wall surface.

2) Wet Masonry

Wet Masonry is a method of stacking stones or bricks by applying mortar or concrete and bonding them together. Because they are stabilized by bonded materials, Wet masonry are structurally more stable than dry masonry and can be stacked up to a height of approximately 5 meters.

Therefore, this manual focuses on wet masonry.

9.3 Materials and Tools Used

9.3.1 Necessary tools and equipment for civil work

The following describes the tools and equipment required for civil works. These are needed not only for mixing and casting cement, but also for site preparation to curing after casting.

Wheel barrow

The capacity of a typical wheelbarrow, which is widely distributed in Rwanda, is about 55 litres.

Wheelbarrows are utilised not only for transporting materials, but also for measuring the volume of sand, gravel and other materials for concrete mixing.









Shovel

Shovels are used for mixing materials such as cement and aggregates when preparing concrete and mortar, as well as for casting after mixing.


The use of a hoe is also recommended for mixing concrete materials, as it is easier to handle.






<p>Trowel</p> <p>Used for levelling the surface of concrete or mortar after casting and for filling mortar between stones for masonry work.</p>	
<p>Containers, buckets.</p> <p>Containers can be used for measuring volumes when mixing materials in cases when small quantities of mortar or concrete are required, e.g. during small civil engineering works.</p> <p>They can also be used for transporting concrete or mortar to the site when mixing and casting is carried out some distance away from the construction site.</p>	
<p>Watering can</p> <p>Watering can be used to add water to concrete and mortar when mixing.</p> <p>It is also utilised when curing concrete after it has been casted.</p>	
<p>Saw</p> <p>Saws are used to cut pegs to the required length and to cut timber for formwork. They can also be used to cut PVC pipes for weep holes or other materials to the required length or shape.</p>	
<p>Hammer and nails</p> <p>Hammer and nails are used to establish formwork and to set up a level reference by driving nails onto stakes and tying a string to the nails.</p>	
<p>Sledge hammer.</p> <p>A hammer weighing approximately 1 kg is used during masonry to shape the stone into the right shape and size.</p> <p>In addition, it can also be used for driving in pegs.</p>	

<p>Timber</p> <p>Timber is used for formwork and pegs. It is important that the surface of the wooden boards is as flat as possible and that those used for pegs are straight. Inexpensive materials are generally used, as they do not directly affect the strength of the completed structure or facility.</p>	
<p>Panga.</p> <p>Panga is used for site clearance and excavation of hard layers before construction. It is also useful in making pegs on site, in adjusting the size of the formwork and in cutting the strings.</p>	
<p>Spirit level</p> <p>Spirit levels are used to check whether pegs, formwork, strings, etc. are installed vertically and horizontally. They are also used to check that structures, such as canal beds and walls, are vertical and horizontal.</p>	
<p>String (levelling string)</p> <p>String is used to indicate the area of concrete casting, reference level lines and target heights for masonry works.</p>	

9.3.2 Materials required for civil works.

<p>Cement bag</p> <p>Cement is required for making concrete and mortar. After purchase, cement should be stored in a dry and cool place in a warehouse until use and it is not exposed to rain. Cement bags should be on slatted boards, pallets, etc., not be stored directly on the floor, as they are affected by moisture from the ground. It is not suitable for long-term storage as it absorbs atmospheric moisture and then it gets solidified and degraded once it has been opened.</p>	
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<p>Each manufacturer has different cement bag products with different strengths and different mixing ratios for different applications. So, read the instructions on the package carefully before purchase and use it that fits the purpose.</p> <p>Note that dust is harmful and it is advisable to wear a mask when using the product.</p>	
<p>Sand (fine aggregate).</p> <p>Sand that has been sedimented and scooped from the river bottom is often used. Not using silt or clay soil as fine aggregate.</p> <p>Strictly speaking, this is defined as having a particle size of 5 mm or less. Care should be taken and checked when mixing to ensure that there is no contamination of organic matter such as weeds and other plant roots, stems and leaves.</p> <p>If there is a large amount of organic contaminants, a fine wire mesh can be used as a sieve to remove these impurities.</p> <p>Depending on the season, cover on-site storage with a sheet to prevent contamination and rain.</p>	
<p>Gravel (coarse aggregate).</p> <p>Often crushed stone is used at site level. Strictly speaking, the maximum size is 25 mm to 5 mm. In the case of coarse aggregate for reinforced concrete, care should be taken not to use aggregates with too large a grain size, as they are difficult to fill in between the reinforcement bars.</p> <p>For plain concrete, the maximum dimension should not exceed 40 mm and 1/4 of the minimum dimension of the member.</p>	
<p>Stone (for masonry)</p> <p>Common sizes are around 15-30 cm, and lime stones and sandstones are commonly used.</p>	




9.4 Site identification

In principle, based on the results of facility inspections, repair work should be carried out from the high prioritised facilities. The repair work of these high priority facilities is also included in the IWUO's Action plan with the necessary costs incorporated into the IWUO's annual budget plan.

Besides the above procedures, emergency rehabilitation of important facilities can also be implemented in the event of flooding or other sudden damage, or implemented based on a request from IWUO member

or cooperatives.

Once a target facility has been selected, the dimensions (Length, width and depth) of the section to be repaired are recorded, together with a sketch of the part to be repaired. This is in order to estimate the required materials and costs based on the latest information when the actual repair is carried out. (Since in some cases the damage may progress and the original budget may not be sufficient).

		
<p>Check not only the location of the target facility, but also whether there are any problems with the transport of materials and the need for temporary works.</p>	<p>The size of the cross section and the length of the target section to be repaired should be recorded.</p>	
<p>Figure 9.2: Points of site identification</p>		

9.5 Preparation of BoQ

A Concrete structure may consist of beams, slabs, columns and foundations etc. based on type of structure. The volume of concrete required for concrete structure can be calculated by summing up the volumes of each structural member or each part of members.

The volume of concrete=length * width * height

Example=10m * 5m * 0.1m = 5m³


Details are given in the Chapter 8.

9.6 Material procurement

Procure the materials required for the repair work based on the quantities estimated when the BoQ is prepared. In this case, instead of ordering the material such as sands and stones everything at once, the order is divided into smaller portions for use in one or two days, and the actual quantity to be ordered is adjusted as the work progresses. Depending on the construction site, it might require community work or the hiring of casual labours to transport the materials, if there is some distance between the material unloading point and the actual repair site.

Ensure that the quality of the materials purchased, such as sand and stone, is acceptable. For example,

- Size of the sand grains (no clay or silt mixed in).
- No organic matter, such as plant roots or leaves, is mixed in.
- The size of the stones for masonry is not extremely large.




	
Aggregates and sands are generally ordered by the unit of a truck.	If access to the construction site is poor, materials must be transported by manpower.
Figure 9.3: Points of material procurement	

9.7 Site preparation and temporary work

Appropriate preparatory activities should be carried out to facilitate smooth civil work at the site.

When repairing a canal, the supply of water to the canal needs to be stopped as it is difficult to work when the repair section is wet. In the dry season, this will not affect farming activities, but if water needs to be supplied downstream, it is necessary to divert the canal or take other measures to supply water downstream.



When constructing weirs on small river or repairing the intake gates of weirs, it is necessary to partially or fully close off the canal or river with sandbags, as it is not possible to cast concrete or install gates if they are affected by water flow. In such cases, where it is not possible to artificially stop the water supply, it is necessary to divert the water by setting up temporary canals.

		
When repairing a canal, partition the canal with sandbags to prevent water from entering the working area.	When working inside a canal, excavate a temporary canal and supply water downstream while the work proceeds.	In cases where groundwater comes out during excavation, a pump is used to drain the water and make it ready for work.
Figure 9.4: Examples of some temporary works		



9.8 Excavation, Pegging and Setting out

Excavation work is required when formwork is set up or foundations are built with concrete when facilities are rehabilitated with concrete. As these tasks are not technically difficult, community work is sometimes used to reduce construction costs. Involving beneficiaries in this approach is also helpful to encourage ownership of the facility to be rehabilitated.

When community work is carried out, appropriate guidance is required and the borders and depths of excavation should be indicated by using stakes and strings to ensure that the work is carried out without over- or under-excavation.

	
Excavation works for the construction of canal section	Cleaning and removing of mud on site
<p align="center">Figure 9.5: Example of temporary work</p>	

After excavation, pegs are driven to mark the area where the facility is to be built. Tie the pegs together with string to indicate the reference height of the facility to be constructed. At this point, make sure that the string is horizontal.

	
Checking that the string is horizontal.	Pegs should be installed when marking the four corners or centre lines of the construction area.

9.9 Setting Formwork

Formwork has two roles: to finish the concrete into a specific shape and to support the weight of the concrete after casting.



Pegs and string are used to indicate the area and height of concrete and masonry to be established, and these are used as guides.



In the case of reinforced concrete, the formwork is placed around the iron bars after they have been in place.

Figure 9.6: Examples of formwork

9.10 Mixing and Casting concrete

Mixing concrete is simply defined as the complete blending of the materials which are required for the production of homogeneous.

9.10.1 Mixing ratio of cement

In the mixing of concrete, there are the ratios to be respected:

As shown in the following picture, general commercial concrete provides the necessary mixing ratio for each purpose on the bag.

RECOMMENDED MIX PROPORTIONS					
Application	Cement	Sand	Gravel	Stone	Comments
Ordinary 15 MPa concrete	1	2	3	4	15-18% of water should provide required consistency
Medium strength 25 MPa concrete	1	1.5	2.5	3.5	15-18% of water should provide required consistency
Ready mix concrete	1	1.5	2.5	3.5	15-18% of water should provide required consistency
Ready mix concrete	1	1.5	2.5	3.5	15-18% of water should provide required consistency
TYPICAL DESIGN RATIOS TO BE APPROVED BY ENGINEERS					
General purpose concrete - recommended mix proportions for concrete strength up to 25 MPa					
Tabelle Concrete Plus - is recommended under conditions for concrete strength up to 25 MPa					

Concrete	Cement	Sand	Gravel	Stone	Water
Concrete (15-20 MPa)	1	2	3	4	0.25
Concrete (20-25 MPa)	1	1.5	2.5	3.5	0.25
Concrete (25-30 MPa)	1	1.5	2.5	3.5	0.25
Concrete (30-35 MPa)	1	1.5	2.5	3.5	0.25
Concrete (35-40 MPa)	1	1.5	2.5	3.5	0.25
Concrete (40-45 MPa)	1	1.5	2.5	3.5	0.25
Concrete (45-50 MPa)	1	1.5	2.5	3.5	0.25
Concrete (50-55 MPa)	1	1.5	2.5	3.5	0.25
Concrete (55-60 MPa)	1	1.5	2.5	3.5	0.25
Concrete (60-65 MPa)	1	1.5	2.5	3.5	0.25
Concrete (65-70 MPa)	1	1.5	2.5	3.5	0.25
Concrete (70-75 MPa)	1	1.5	2.5	3.5	0.25
Concrete (75-80 MPa)	1	1.5	2.5	3.5	0.25
Concrete (80-85 MPa)	1	1.5	2.5	3.5	0.25
Concrete (85-90 MPa)	1	1.5	2.5	3.5	0.25
Concrete (90-95 MPa)	1	1.5	2.5	3.5	0.25
Concrete (95-100 MPa)	1	1.5	2.5	3.5	0.25

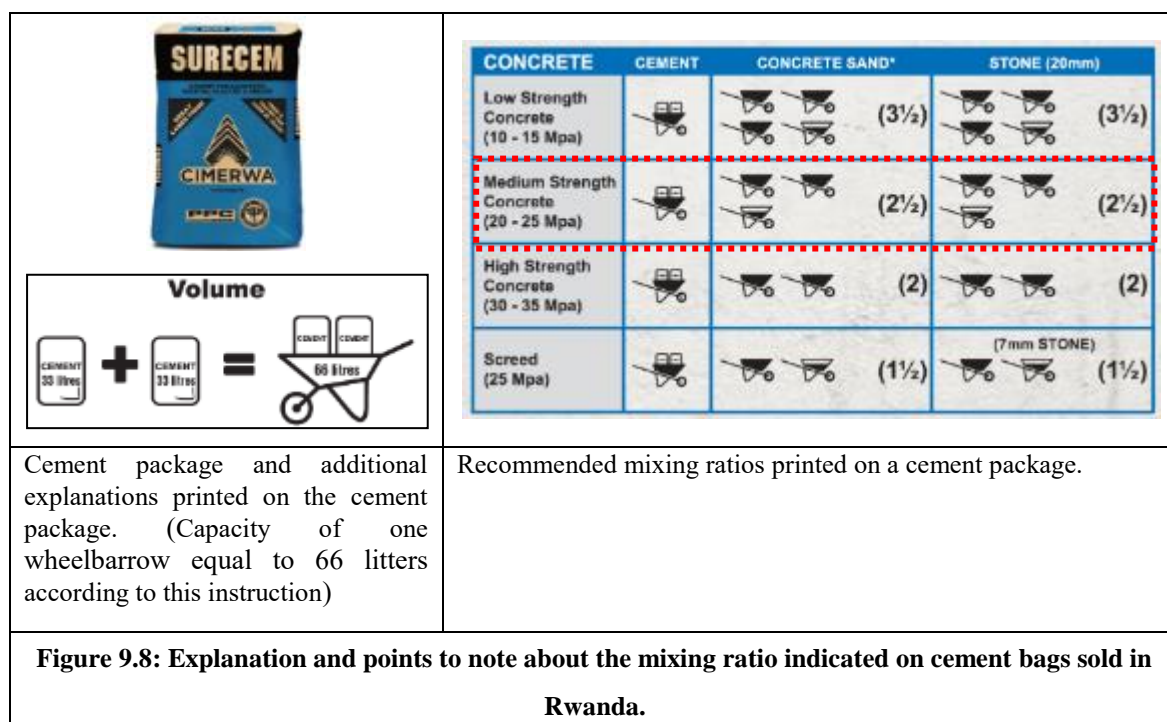
Figure 9.7: Examples of mixing ratios showing on cement bags sold in Rwanda.

In the example in Figure 9.8, two cement bags represent the volume of one wheelbarrow.

(Note that different manufacturers use different expression or conversion.)



If Medium Strength Concrete is required, the ratio should be 1: 2.5 : 2.5.

It means Cement 1 wheelbarrow (=2 bags) : Sand 2 and half wheelbarrow : Gravel 2 and half wheelbarrow.



The following are common cement mixing ratios. Reference should be made, when the description of the cement package is unclear or not understandable for the users.

Table 6: The mix ratio of concrete commonly used and the amount of cement, sand and gravel required when 1 m³ of concrete is needed.

Volumetric Mixing ratio						Cement	Sand	Gravel		
		Cement	Sand	Gravel		kg	Bag (1bag=50kg)	(m³)	(m³)	
Strong 		1	1	2		600	12	0.390	0.780	
		1	1.5	3		440	8.8	0.425	0.850	
		1	2	4		345	6.9	0.445	0.890	recommended
		1	2.5	5		285	5.7	0.460	0.915	
		1	3	5		270	5.4	0.520	0.865	
		1	3	6		240	4.8	0.465	0.935	recommended
		1	4	8		190	3.7	0.480	0.960	
Weak										

Mix about 30 to 45liter of water per cement bag (50kg) apart from the above materials.

9.10.2 How to prepare Concrete (Key points and notes)

(1)Before mixing cement,

Organic contamination causes structures to weaken, so ensure that the area to be constructed is pre-cleaned and that clearance is secured where the cement is to be mixed (about 3 m × 3m). Also, remove organic matter and other impurities from the aggregate to be mixed in advance.

(2)Mixing concrete

When preparing concrete, it is common practice to mix cement, sand and gravel all at once. However,

this is not recommended as it is time-consuming, labour-intensive and often inadequate in mixing uniformly.

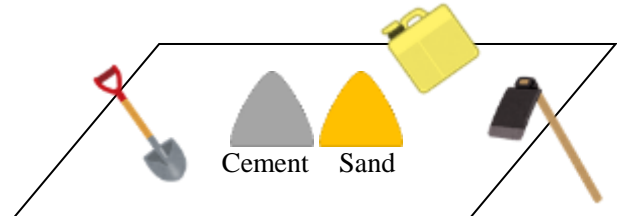
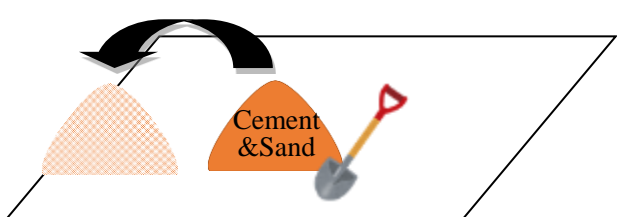
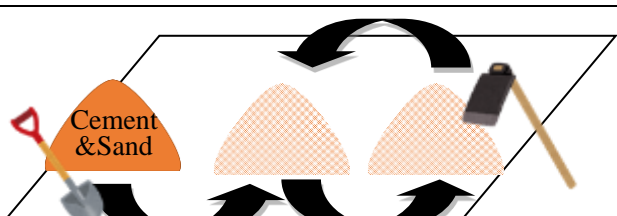
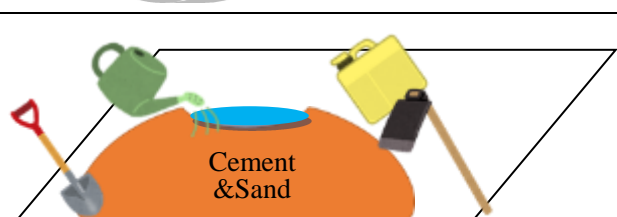

In the recommended method, sand and cement are first mixed with water and kneaded. Then, the gravel is mixed and the water content is adjusted afterwards.



Clean water should be used when mixing the cement. It is preferable to use spring water or other clear water to the extent possible, rather than from canals or drains. (If the site is inaccessible, it is not practical to transport the water from a distance, so using water from canals etc. is unavoidable.)

(3) Recommended Mixing procedure

The following methods are therefore recommended in this manual.

The amount of water to be used when using a 50 kg cement bag is 25lit to 30lit (It's almost equal to one Jerrycan of water). When mixing concrete, first add 1/4 of the water to the sand to wet it, then add the cement and mix well. Then add 3/4 of the water and mix. After adding the gravel, add the water remaining to check the condition.

<p>1. Prepare the amount of sand required for one bag of cement. When mixing concrete, first add 1/4 of required water to the sand to wet it, then mix it with cement using a shovel or hoe as well, and make a mount.</p>	
<p>2. When the cement and sand have been mixed to a certain extent, make another mount next to the first one, taking it down. At this point, the top and bottom of the mount should be switched, and this should be used to ensure that the materials are properly mixed.</p>	
<p>3. Repeat this process several times to mix the cement and sand well.</p>	
<p>4. Depress the top of the mount, mix water by dividing 3/4 of the required amount into several portions into it and mix well. (Mortar is complete.)</p>	
<p>5. When the cement, sand and water are generally mixed, the coarse aggregate is added at several times, mixing well each time.</p>	

6. Ensure that the coarse aggregate and mortar are well mixed and that the concrete is complete.	
7. Once mixed, transport to the site promptly for casting.	

(4)Note

1)Caution

In the case of fresh concrete that has not yet hardened, it is advisable to avoid touching fresh concrete with bare hands due to its highly alkaline nature. Similarly, if fresh concrete gets on skin or clothing, the alkaline components can cause a chemical reaction, which can lead to irritation, itching and inflammation. Fresh concrete is also sticky and can easily get on skin and clothing, so if it does get on skin or clothing, wash it off with water immediately.

It is also important that tools used for making concrete are properly washed after use using a brush or similar tool. If they are not washed properly, some of them may harden and become unusable in the worst case scenario the next time they are used.

2)Water-Cement ratio

In some cases, a problem with existing practice is that more water is added than the recommended amount when mixing cement. This is because adding more water makes it easier to mix, but this results in weakening the strength of the concrete. If the strength of the concrete is weakened, the strength of the facility to be built or repaired is also weakened, making it easier to be broken.

The ideal water-cement mix ratio is specified to prepare concrete of the required strength. Typical water-cement ratio is 50-60%. When cement density is 1.5 g/cm^3 , following is the ideal ratio of Water and Cement.

Water: cement = 0.75 : 1 by volumetric base

Water: cement = 0.5-0.6 : 1 by weight base

That means, if 50 kg of cement (= 1bag of cement) is used, 25lit to 30lit (1 full of jerrycan) of water should be mixed.

3)Approximate volume of a wheelbarrow

The capacity of wheelbarrows available in Rwanda is about 55 lit.

	
Mixing concrete at Ngoma 22 model site	Mixing concrete at Cyaruhogo model site
Figure 9.9: Pictures of wheelbarrows and practical concrete mixing scene.	

The capacity of a typical wheelbarrow in the world is 76lit~100lit, which is slightly different in size from the wheelbarrows available in Rwanda.

9.10.3 Key points when casting concrete

Once the concrete has been prepared by mixing sand, cement and water, it must be quickly transported to the site and cast. This is because cement becomes hardened over time.

When casting, the concrete should be compacted with a trowel or stick to ensure that there are no spaces in the cement or between the cement and the formwork, and to ensure that the cement is spread over the gaps between the coarse aggregate. However, be careful not to over-compact, as this will result in non-uniform distribution of the amount of sand and mortar between the top and bottom of the casting area.

	
Placement of reinforcement bars and form work at Ngiryi when constructing a turnout	Casting the concrete at Mwanbu schene when constructing a small turnout
	
It is also easier to create the planned shape of canal when masonry is applied by making a formwork of the planned cross section and assembling the side walls according to the formwork.	
Figure 9.10: Pictures of concrete casting.	



9.10.4 Curing the concrete after casting

Concrete curing is the process of keeping concrete at the temperature and humidity required for curing for a certain period of time after casting to ensure the required qualities, such as strength, durability and water sealing, and to protect it from being affected by damaging effects.

Concrete curing is therefore required to provide moisture, prevent water from dissipating, maintain an appropriate temperature and protect the concrete from damaging effects such as vibrations, impacts and loads until it has attained a strength that is capable of resisting external forces.

Practical ways to achieve this include regular watering and providing cover or other protection from sunlight and other elements. Covering the surface with towels etc. and watering from buckets or other containers at both ends can keep the surface moist for a longer period.

The length of time for curing required is determined by the atmospheric temperature. In a warm environment such as Rwanda, **five days** is a typical curing period when using ordinary cement. During the dry season, when daytime temperatures are high outside and sunlight is strong, concrete surfaces are more vulnerable to the effects of direct sunlight and rapid evaporation of surface moisture, which can lead to cracks and other problems. It is important to maintain the concrete surface by covering it well to keep it moist and to supply water by watering can at the appropriate time.

	
Curing after concrete has been cast.	The leaves of banana trees available on site are used to protect them from direct sunlight. The purpose of curing is to prevent drying out. Covering prevents drying and supplies moisture to the concrete after it is cast to promote the strength gains.
Figure 9.11: Pictures of a concrete curing process	

9.11 Finishing work for concrete work

9.11.1 Purpose of finishing works

Finishing the surface of a concrete structure to make it flat and free from its unevenness makes it look more suitable and easier to maintain.

9.11.2 Methodology

If you find small cracks on the surface of the structure or parts of the structure where the gap between the formwork and the concrete is not fully filled with concrete, you should fill them with mortar or other materials.

It is customary practice to level the surface of the concrete using a trowel or flat wooden stick (reused

pegs) and apply a surplus of cement to the surface before the concrete surface has hardened.



As mentioned previously, the formwork should be removed after a curing period of approximately five days.

9.11.3 Key points after concrete work

The site should be restored to its original condition after civil works. Specifically, if the site has been dirty due to work or temporary storage of materials, it should be cleaned and returned to the same condition as before the construction work.

It is also not advisable to leave surplus materials on site. This is because, if mounds of sand or other materials are left on site, they will be washed away during heavy rainfall and cause subsequent damage in the area surrounding the site by blocking canals or drainages.

To avoid waste of purchased materials, surplus materials should be transported and stored in an appropriate place and used for the next repair or construction work.

9.11.4 Importance of proper Backfilling and compaction after backfill

Just filling in all the backfill soil at once is very weak and can easily be affected by subsidence after rainfall or by erosion due to water flow. It is therefore advisable to backfill by about 10 cm, then compact, and repeat the same backfilling and compacting process repeatedly by about 10 cm. When applying compaction, it is better to use a shovel handle or pegs to firm the soil, rather than just stamping on it. If the soil to be backfilled is dry, adding a moderate amount of water may also be useful to ensure a firm finishing.

In addition, if the parts of the backfill that have the potential to be eroded by floodwater should be backfilled using sandbags. They will be less vulnerable to erosion than if it is simply backfilled in the event of flooding or overflowing.

Sandbags are weak to UV radiation and the surface of the sandbag should be covered by soil to avoid exposure to direct sunlight. This prevents deterioration and allows them to maintain their function over a longer period of time.

9.12 Steps in construction of wet masonry

- Step 1: To assist in your stacking, sort the stone by size; setting aside the smallest pieces to use as shims (these will help level unsteady larger stones). Prepare for this activity by stretching well and always lift using your arms and legs, not your back. Shims, or smaller stones, help level unsteady larger pieces.
- Step 2: Digging a trench in deep and as wide as your largest stone. To stabilise the stones to be placed, an additional depth of 15 cm should be excavated from the bottom of the facility to be constructed, and a stable foundation should be established with crushed stone.
- Step 3: Start with the largest stones first. Lay them flat from one end of the trench to the other. Continue to stack stones, working back and forth, one level at a time.
- Step 4: Prepare mortar in parallel with the above process. The mortar used for masonry is generally in the ratio of 1:3 or 1:4 cement to sand. (Please refer the instruction on the cement bag which you will use.) Remember to use the proper cement-to-water ratio and to use it within 30 minutes of mixing it.
- Step 5: Position stone tightly together, mixing small and large pieces. Stagger joints between stones to create more stability. The thickness of the joint should be between 2-2.5 cm and no less than 1 cm depending on the size of the stone. Fill the spaces between stones with mortar. Use a stick or trowel tip to make sure that the mortar fills even the smallest gaps.
- Step 6: In the case of retaining wall construction, crushed stone should be placed behind the wall while building the stone masonry, and soil should be added and properly compacted. It is advisable to place a filter fabric between the fill and the stone wall.
- Smaller stones are used to fill gaps and give shape to the wall.
 - Stones should not protrude from the wall and should be properly set with the mixture.
 - The walls should be cured for at least 5 to 7 days.
 - When building retaining walls in masonry, make sure that it slopes back slightly to ensure stability.

9.13 Finishing work for stone masonry work

The purpose of finishing works is the basically same as concrete structure which is explained in the previous section.

In the case of masonry work, mortar shall be used to fill the spaces between the stones on the surface (which is called pointing). These should be done properly, especially in parts that are exposed to water, such as the inside of canals. Otherwise, water flow will erode the spaces between the stones or wash away the backfill, thus reducing the strength of the facility and causing it to break down in a short period of time.

9.14 Completed structure

After these steps, the facility is completed. Repairing or constructing new facilities is not the end but the

start of O&M. It is important to maintain the functionality and proper operation of these facilities.

	
Establishment of new turnouts	
	 
Rehabilitation of part of canal	Rehabilitation of canal and turnout
Figure 9.13: Examples of facilities that have been repaired or constructed.	

Chapter 10 Farm Road Repair by IWUO

Content Type	Theory and practice		
Objectives	This chapter provides a description of a simple repair method for farm roads within irrigation schemes, and aims to improve understanding of the method and the ability to practice it.		
Outcomes	With the understanding of the contents of this chapter, the O&M team and FRT members will be able to practice repairing farm roads using sandbags by themselves.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, O&M team and FRT

10.1 Introduction

Farm roads in irrigation schemes are generally not paved. Thus, ruts gradually form due to truck traffic, particularly overloaded vehicles, passing through them for shipping harvests and delivering agricultural inputs. This is where water from rainfall accumulates, causing muddying and worsening the condition of the road when vehicles pass through it, and consequently worsening the condition of the road sufficiently to affect general vehicle traffic. As a result, this can cause negative impacts such as delays in the transport of the harvest and preparation of the cropping schedule, as appropriate.

Although cooperatives are supposed to be in charge of maintaining the farm roads within irrigation schemes, they often lack sufficient technical capacity. On the other hand, IWUO members have been involved in the maintenance of the irrigation facilities in the scheme and capacitate civil work skills, which gives them a fundamental background for learning about farm road repair. In addition, the skills learned in this farm road repair training are expected to be utilized in many other aspects of irrigation scheme maintenance besides farm road repair. Therefore, while this manual is mainly targeted at members in charge of maintenance and management in IWUOs, it is also expected to be used by staff and members of cooperatives.

This manual was developed based on technical training provided by CoreRwanda, an NGO working in Rwanda, and is a simplified version of CoreRwanda's technical package, which contains more technical content.

10.2 Preparation

10.2.1 Planning for farm road repair

The following is a list of equipment and materials required for farm road repair. The quantities listed are for 20 persons working together and the prices are reference as of 2021. Tools and other equipment that IWUO already have do not need to be purchased again. Quantity of laterite, sandbags and strings for tying sandbags need to be adjusted according to the length of the section to be covered and other factors. Most of the equipment can be used over the long term once purchased, but laterite, sandbags and strings need to be procured each time when they conduct farm road repair.

Table 7: Sample list of equipment and materials required for farm road repair

Items	Unit Price	Quantity	Budget (Rwf)
Equipment			
Compactors (Made by steel)	30,000	6	180,000
Wheelbarrows	50,000	4	200,000
Mattock	4,000	4	16,000
Hoe	3,500	8	28,000
File (sharpener for tools)	2,000	1	2,000
Watering can (about 30 litter)	8,000	4	32,000
Spades with handles	3,500	8	28,000
Panga	2,500	4	10,000
Fork jembe	4,000	4	16,000
Rake	3,000	4	12,000
Wooden handles (If its needed for above mentioned tools)	300	20	6,000
Square	3,000	1	3,000
Plastic cans (for measurement of volume of sand)	2,500	6	15,000
Tape measure	5,000	1	5,000
Self-protection equipment			
Reflectors	2,500	20	50,000
Helmet	2,500	20	50,000
Gumboots	6,000	20	120,000
Gloves	2,500	20	50,000
Dust mask	500	20	10,000
Consumables			
Measuring strings	500	5	2,500
Strings (to tie up sandbags) (50m/roll)	1,500	3	4,500
Donou bags (Sand bags)	200	800	160,000
Laterite (3.5m ³ /truck)			
Total			1,000,000

The sandbags to be used during farm road repair are not the ones generally used for transporting the harvested products, but relatively small ones of 60 cm x 45 cm in size. These sandbags are used to fill laterite and are then compacted. But if the sandbags are large, the laterite cannot be compacted in the sandbags and sufficient strength cannot be achieved. If the above sizes are not available, it is still desirable to use the smallest sandbags as possible, in which case the amount of laterite to be filled into the bag should be adjusted and the sandbags should be contained less and compacted carefully.

When large sandbags are filled with a lot of sand, each bag becomes heavy, so that the effort to carry the sandbags to the repair site becomes bigger when carried by one person, making them difficult to transport and position. Therefore, it is recommended that a certain amount of sand be filled into sandbags of a specified size.

(1)Sample pictures of the equipment



From left to right in photo:
Mattock, Fork jembe, Hoe, Spades



Plastic cans (Available containers, such as existing jerry can or reusable containers, are modifying to a volume of 20 litres.)





Photo for Rakes



Watering can with a capacity of 30 liters.

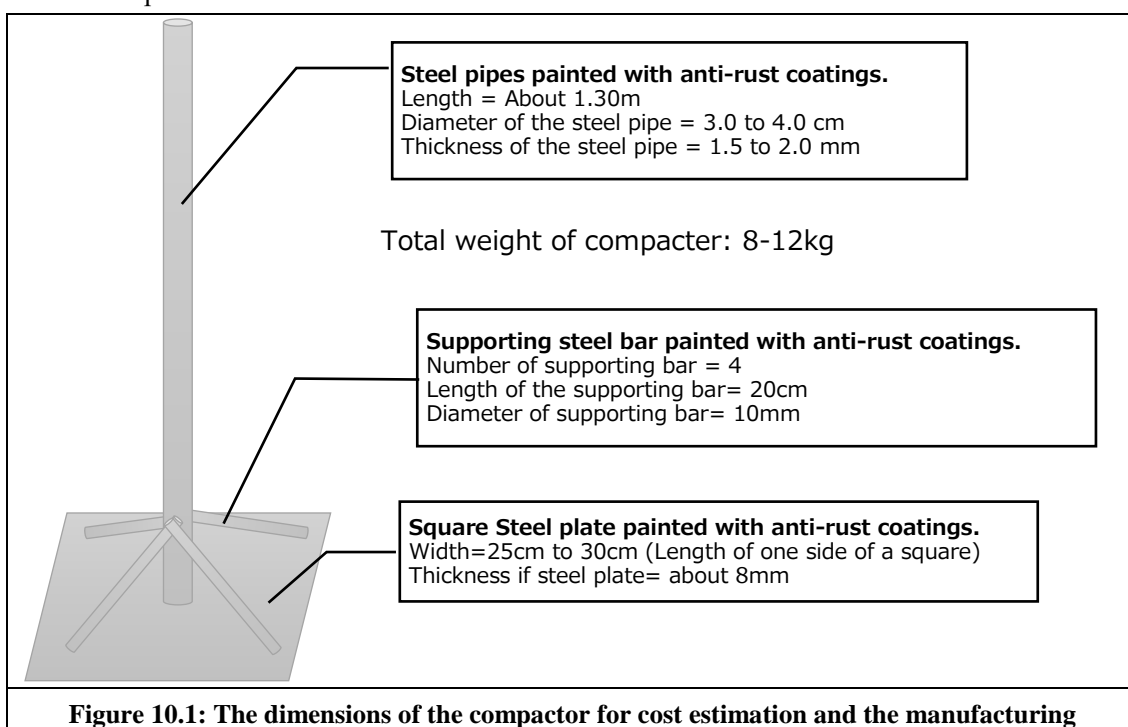


Reflectors, Gumboots , Gloves , Dust mask and Helmet for self-protection purpose should be properly equipped. Roadside operations are at risk of being exposed to traffic and therefore appropriate safety measures need to be taken.

	
<p>From left to right in photo: Strings (to tie up sandbags), Panga and other equipment. Twines should be made of plastic or other materials that are not easily degraded.</p>	<p>Sample of compactors</p>

(2) Compactor

As for compactors, they are generally not sold in shops and are therefore ordered to be manufactured in workshops in Kigali or other big cities. Figure 10.1 is reference dimensions for use in farm road repair. Prototypes will be prepared using reference dimensions, grip and strength will be examined, and if there are any inconveniences, improvements will be made as necessary, and the necessary quantities will be fabricated. It is recommended that consideration be given to ordering the compactor including some extras, as it can be applied to civil work in irrigation scheme, such as compaction of embankments, not only for farm road repair.



(3) Quality of laterite

When purchasing laterite for the first time or when it is difficult to identify laterite from other ordinary soil, it is advisable to ask District or Sector officer for assistance and refer them to a proper supplier, check

the condition of the borrow pit, or ask them to be present at the time of delivery to confirm that there are no problems and good condition.

When checking by IWUO themselves, it is also advisable to check that there is no contamination of plant roots, leaves or other organic matter when delivered to the site. If there is a problem, take appropriate action, such as refusing to receive the material or asking for an alternative material to be delivered.

10.2.2 Selection of target section

Farm roads repair with sandbags is a technique for manually repairing erosion-damaged sections caused by surface run-off, rutted areas caused by traffic of heavy vehicles and depressions where rainwater accumulates, rather than upgrading farm roads to a higher standard. Therefore, it is practical to target sections from a few metres to a maximum of 100 m in length and a 3m to 4m in width for construction work. It is also necessary to carry out countermeasure work to address the cause of the damage, as repair work alone is not likely to solve the problem, as the farm road is likely to be damaged again over time. In many cases in Rwanda, surface run-off from upstream roads and farmland often flow into the area concerned. So, Countermeasures such as conveying the drained water to an appropriate drainage ditch, clearing road drainage that is filled by sediment and installing canal-crossing drainage works could be considered.

Once the target section of farm road has been determined, its length and width should be measured and a sketch of the section that needs to be repaired should be recorded.



10.2.3 Method of estimating project costs - How to calculate the required quantity of laterite

This section explains how to calculate the amount of laterite used for farm road repair, which is required for cost estimation of farm road repair.

An example is given below for the case of damaged sections at Points A to C as shown in the figure below.

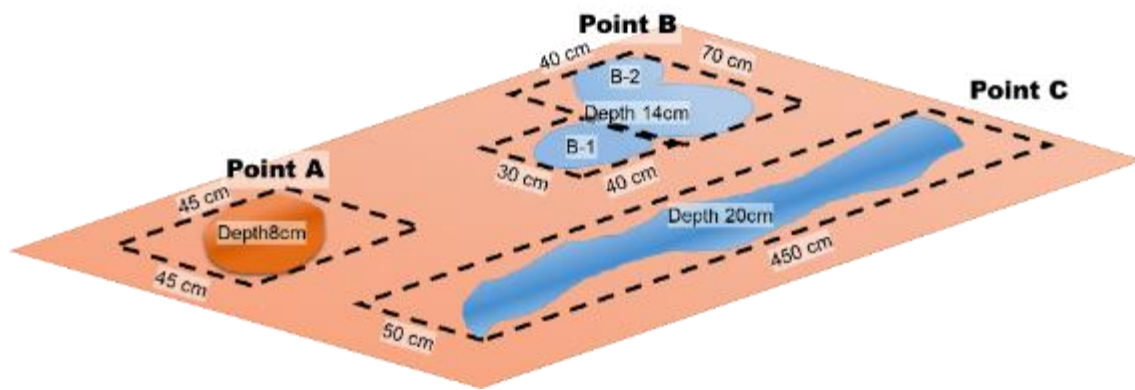


Figure 10.3: Example of target section for road repair work

After identifying the damaged sections of the farm road, the target section should be roughly modified in the form of rectangle shape and measured. In this process, the target area needs to be adjusted from the actual shape to a dimension of 40 cm x 40 cm x 10 cm. This is based on the size of the sandbags.



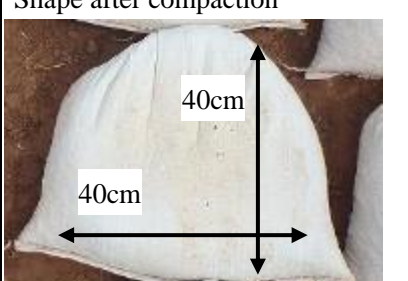
		<p>Shape after compaction</p> 
<p>Sandbag immediately after filling with laterite.</p> <p>The position for tying the sandbag is at a mid-point between the top of the soil inside and the upper edge of the bag.</p>	<p>Sandbag in place and before compaction</p>	<p>Sandbag in position after compaction. After compaction, the sandbag is hardened and its dimensions become about 40 cm x 40 cm x 10 cm.</p>

Figure 10.4: Picture of Do-nou sandbags

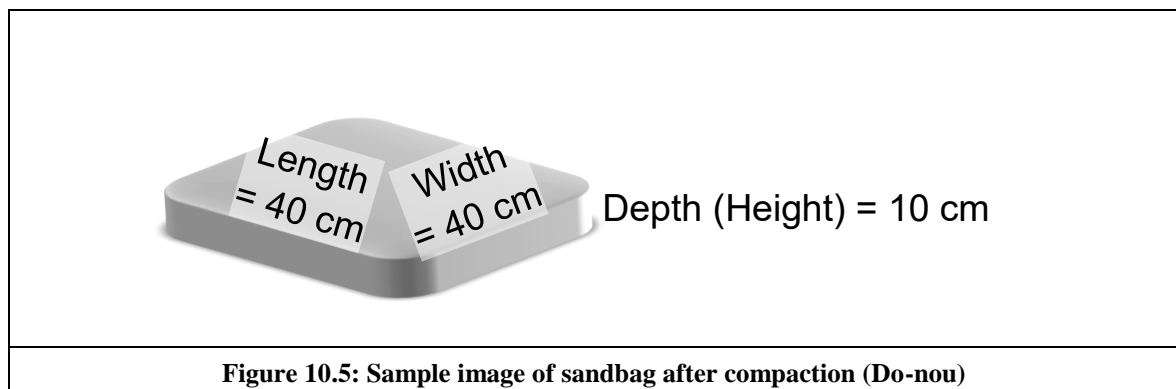
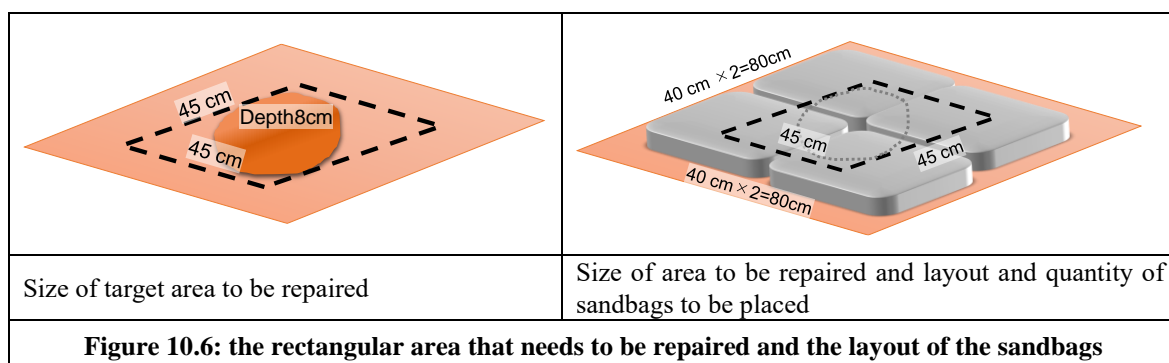


Figure 10.5: Sample image of sandbag after compaction (Do-nou)

Using Point A as a first example, the following explains how to determine the area of repair and how to calculate the number of sandbags required.

The figure below shows the rectangular area that needs to be repaired and the layout of the sandbags. The target section is 0.45 m (45 cm) x 0.45 m (45 cm) x 0.08 m (8 cm). The dimensions of a sandbag after arranging and compaction will be 0.4m x 0.4cm x 0.1m, so the quantity of sandbags required is determined based on this size.



In this case, the rectangular size width of the damaged area is 0.45 m, which is larger than the width of one sandbag (0.4 m) and smaller than the width of two bags (0.8 m), so the width of the repair target is 0.8 m. Similarly, the length of the damaged area is 0.45 m, but the length of the repair target is adjusted to 0.8 m. The depth of the eroded part is 0.08 m (8 cm) as well, which is shallower than the thickness of one sandbag (0.1 m), so only one layer of sandbags is sufficient. This means that the area to be repaired would be 0.8 m (width) x 0.8 m (length) x 0.1 m (length).

Table 8: dimension before and after adjustment of the target section

Location	Before adjustment				After Adjustment		
	Width (m)	Length (m)	Depth (m)		Width (m)	Length (m)	Depth (m)
Point A	0.45	0.45	0.08	→	0.80	0.80	0.10

The number of sandbags required for each side can be determined by dividing the length and width of the repair area by the dimensions of the sandbags (0.4 m on each side), In the case of Point A, the width is 0.8 m (Width of repair area) / 0.4 m (Width of sandbag) = 2 bags.

In the same way, the length is 0.8 m (Length of the repair area) ÷ 0.4 m (Length of the sandbag) = 2 bags. This means that the number of sandbags is 2 bags for Width, 2 bags for Length and only 1 layer, so 2 x 2 x 1 = 4 bags.

Table 9: Calculation of required sand bags for Point A

After Adjustment			No. of sandbags
Width (m)	Length (m)	Depth (m)	
0.80 ÷ 0.4 = 2 bags	0.80 ÷ 0.4 = 2 bags	0.10 ÷ 0.1 = 1 layer	2 bags × 2 bags × 1 layer = Total 4 bags

If the erosion is deep and depth of damaged section exceeds 0.1 m, the sandbags need to be layered according to the depth.

For example, if the depth is 0.16 m (16 cm), two layers are required, so the required sandbags for length and width must be multiplied by the number of layers.

For Point B, one depression is divided into two parts and the area to be repaired is defined. This allows

the area that needs to be repaired to be optimised. Careful division of the complex shape saves quantity required and improves efficiency, although the efforts required for calculation are slightly increased.

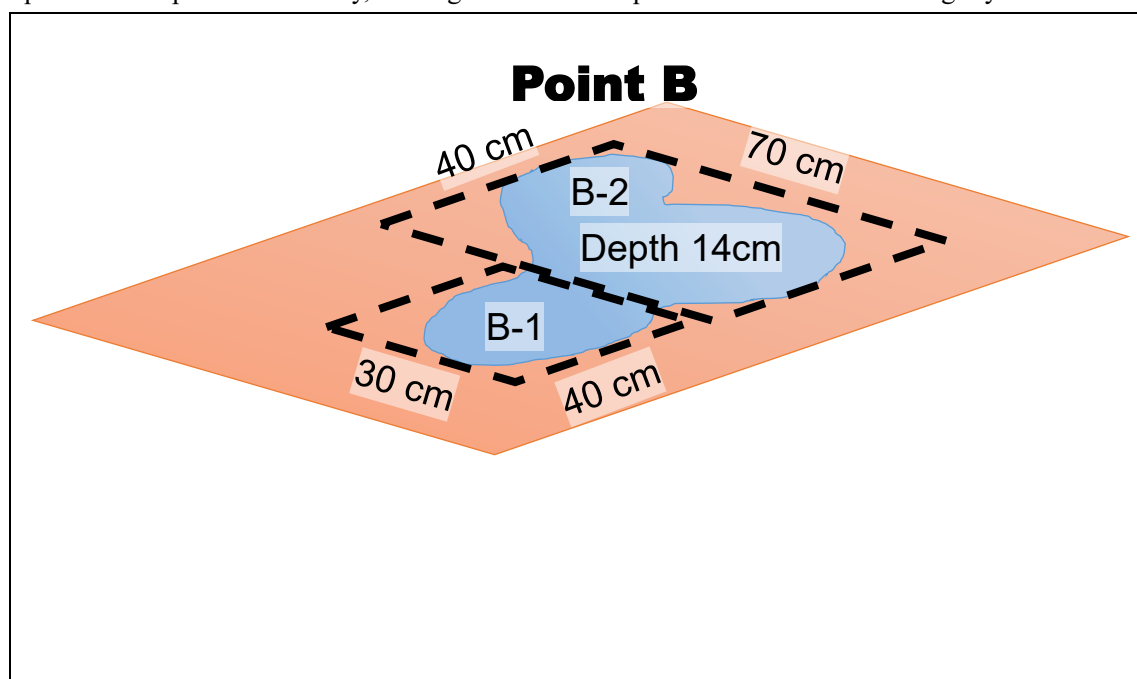


Figure 10.7: Example of how to divide the target section into several rectangles

The table below shows the results of adjusting the repaired areas of based on the size of the sandbags for Points A to C shown in the example above.

Table 10: Calculation of Total required sand bags

Point	Before adjustment				After Adjustment			No. of sandbags
	Width (m)	Length (m)	Depth (m)		Width (m)	Length (m)	Depth (m)	
Point A	0.45	0.45	0.08	→	0.80	0.80	0.10	$2 \times 2 \times 1 = 4$ bags
Point B-1	0.30	0.40	0.14		0.40	0.40	0.20	$1 \times 1 \times 2 = 2$ bags
Point B-2	0.70	0.40	0.14		0.80	0.40	0.20	$2 \times 1 \times 2 = 4$ bags
Point C	0.50	4.50	0.20		0.80	4.80	0.20	$2 \times 12 \times 2 = 48$ bags
Total required sand bags								$4+2+4+48=$ 58 bags

As described above, the quantity of sandbags required for each repaired section was determined, and it was found that a total of 58 bags of sandbags were required for the entire section of Point A to C covered in this example.

10.2.4 Calculation of the required laterite.

As one sandbag is filled with 20 litter (= 0.02 m³) of laterite, the quantity of laterite required can be determined by the number of sandbags needed for the repair times 0.02 m³.

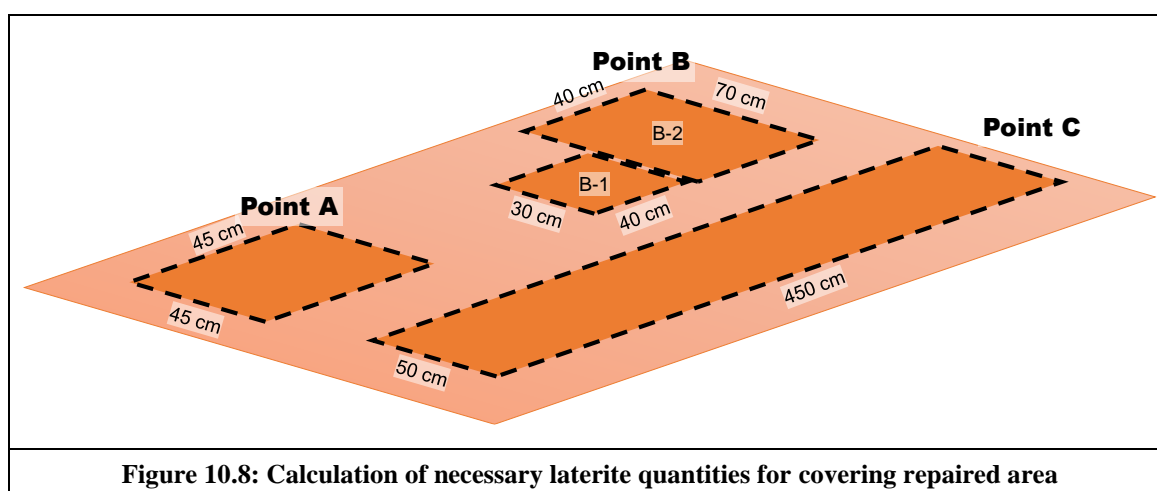
15% of the required quantity is expected to be added as spare to cover losses during the work and minor adjustments made on site.

Table 11: Calculation for Quantity of laterite to be ordered considering spare

Number of required sandbags (target section A to C)	Capacity of laterite per sandbag	Amount of laterite needed	Quantity of laterite to be ordered considering spare (15%)
58 bags	0.02m ³	1.16m ³	$1.16 \times 1.15 = 1.334\text{m}^3$

In addition to the laterite required to fill the sandbags, it is also necessary to estimate the amount of laterite required to cover and to compact surface of the sandbags to protect. This is to prevent wear and deterioration of the surface of the sandbag which is vulnerable to UV light.

The calculation method for the quantities required to cover the target section with laterite is described as follows. The calculations are based on the target area adjusted in shape to a rectangle as shown in the figure below. In the same way, 10% of the required quantity shall be added as a spare for covering and compacting the surface layer at the connection between the existing road and the repaired sections of road.



The target thickness after compaction is 10 cm, but as the volume is reduced about 80% by compaction, the thickness of the surface layer before compaction is assumed to be about 12 cm for the laterite volume calculation.

Table 12: Calculation for Total amount of laterite for covering surface of target section

Point	After Adjustment of the size for repair work			Amount of laterite
	Width (m)	Length (m)	Depth (m)	
Point A	0.80	0.80	0.12	$0.8 \times 0.8 \times 0.12 = 0.0768 \text{ m}^3$
Point B-1	0.30	0.40	0.12	$0.3 \times 0.4 \times 0.12 = 0.0144 \text{ m}^3$
Point B-2	0.80	0.40	0.12	$0.8 \times 0.4 \times 0.12 = 0.0384 \text{ m}^3$
Point C	0.80	4.80	0.12	$0.8 \times 4.8 \times 0.12 = 0.4608 \text{ m}^3$
Total amount of laterite				$= 0.5904\text{m}^3 \div \mathbf{0.60\text{m}^3}$

The sum of filling the sandbags and covering the surface layer is the amount of laterite required for farm road repair in the target section.

Table 13: Calculation of Total required amount for the project

Item	Amount of laterite
Laterite for filling sandbags	1.33 m ³
Laterite for covering sand bags	0.60 m ³
Total required amount for repair work	1.33+0.60 = 1.93m³

As shown in the table above, the amount of laterite required in this case was determined to be 1.93 m³.

In practice, it is not possible to order the amount of laterite required for farm road repairs as calculated above. Generally, the order is for a volume per truck. For smaller quantities, it may be possible to purchase per capacity per wheelbarrow (=55 lit = 0.055m³), depending on the quantity required, to be discussed with the supplier.

Below is a calculation of the quantity to be ordered in this example based on the capacity of a 3.5-tonne truck, which is a common capacity for trucks in Rwanda. The calculation is made by dividing the quantity of laterite required by the capacity of the truck to be ordered.

Table 14: Calculation for Quantity to order

Quantity of laterite required	Capacity for ordering	Quantity to order	
1.93m ³	3.5ton/tuck	$1.93 \div 3.5 = 0.55$ truck	= 1 truck

Basically, the order is made in units of trucks. So, the calculation results are rounded up fractions to obtain the number of trucks required.

In this case, there is likely to be an extra of about 45% of the quantity to be ordered. When too much laterite is left over, it is advisable to reduce losses by reconsidering the target section, e.g. by extending length to be repaired.

10.2.5 Schedule of the farm road repair

Farm road repair should preferably be implemented during the dry season, as the work is generally affected by rainfall.

At the time of the first repair work training, it is recommended that the first day of the training should be a classroom lecture session to explain the work procedures. And the field practice should start on the second day, and should be completed within a total of five days maximum. As the participants are also not used to the procedure and it is expected to take longer than usual, it is recommended that the first practical training session should be conducted for a length of about 30 m and be carried out by about 15 to 20 people.

From the second time onwards, it is advisable to determine the target length that can be completed in a number of days that is not too long for the participants, based on their experience from the first time.






The following schedule is given below as a reference when it was implemented in a WAMCAB training.

Table 15: Sample schedule for Road repair training

Date		Contents
Day 1	AM	Pre training evaluation
		Concept of the training
	PM	Basic Theory explanation about DO-NOU Technology for road repair work <ul style="list-style-type: none"> - How to measure the target section - How to tie sand bag up - How to arrange sand bags and compact
Day 2	AM	Road repair Practice using DO-NOU Technology on site
	PM	<ul style="list-style-type: none"> - How to adjust the target section to rectangle shape - How to fill sand bags
Day 3 & Day 4	AM	Actual repair work on site: Divide participants into working groups as follows.
	PM	<ul style="list-style-type: none"> - Arrangement of the target section - Filling and tying sand bags - Transport and placing the sandbags - Compaction and watering sand <p>Participants rotate through the groups to ensure that participants experience all roles and tasks.</p>
Day 5	AM	Actual repair work on site
	PM	Post training evaluation

10.3 Implementation procedures for farm road repair using Do-nou sandbags

The method of repairing farm roads using sandbags is shown with photographs of each step of the process.






<p>1. Drain or remove any water stagnant in the target section.</p>	
<p>2. Prepare the target section by chipping away the surface layer with a hoe, shovel or mattock, shaping it into a flat rectangle to the size of the sandbag.</p> <p>Remove weeds, if present.</p> <p>After the work, the size of the excavated area should be measured to ensure that it reaches the appropriate dimensions and, if necessary, it should be modified.</p>	 
<p>3. Provide adequate amounts of water using a watering can to improve the ground contact with the sandbags.</p>	
<p>4. Compaction with a compactor to strengthen the base of the excavated part.</p>	






5. Fill the sandbags with laterite which has been measured using a container and tie the bag with string.



6. Arrange the sandbags over the target area. In this process, the sandbags should be placed with the closed knot underneath the sandbags.



<p>7. Compact the positioned sandbags with a compactor. The number of compaction should be 15 to 20 times for each sandbag.</p>	
<p>8. Fill the gaps of the sandbags after compaction with laterite. Then apply water and compact 15 to 20 times for each part throughout the whole surface again.</p>	  
<p>9. If a second layer is required, place another layer of sandbags over the section to be covered and repeat the process from Step 6.</p>	

<p>10. Applying laterite to protect the surface of the sandbags. Use rakes to level the surface.</p> <p>Establish a gradient to ensure that the centre of the road is high and water flows into the drainage ditches at this time. (Check the gradient with a level.)</p>	 
<p>11. Watering and compacting the surface laterite with a compactor.</p>	 
<p>12. If necessary, excavate roadside ditches and cleaning out ditches to ensure flow paths to the drainage destination.</p>	

13. Complete!



10.4 Maintenance after repair work.

- Regularly monitor the erosion damage and deterioration of the repaired section, and repair the surface layer using laterite before the sandbags are exposed. In case the sand bag is exposed and get damaged, a new sandbag is prepared, placed and compacted in the same way as in the previous section, to the area where the sandbag was removed. The surface of the replaced sandbags is then also covered with laterite and compacted.
- Regularly check the condition of roadside ditches and carry out excavation and cleaning of ditches if necessary.
- In cooperation with the District and Sector, also consider restricting the passage of overloaded trucks causing damage to the farm road.

Chapter 11 Formulation of O&M plan

Content Type	Theory and Explanation of practical activities		
Objectives	This chapter explains the O&M plans that IWUOs formulate to systematically implement the activities required for the maintenance of their facilities. It explains the purpose of developing an O&M plan and how to do so. The objective of this chapter is to enable IWUOs to understand the content and to be able to formulate and implement their own O&M plans on a sustainable way.		
Outcomes	IWUOs will be able to develop their own O&M plans and will be able to explain the necessity of the plan and obtain approval for it at the time of General Assembly.		
Lecturers:	TF members and FC	Trainees:	IWUO managers and Leaders of IWUO

11.1 Introduction to formulation of O&M Plan

11.1.1 What is O&M plan?

O&M plan provides a schedule and cost estimation framework for the Operation and Maintenance activities required for the target period, when and by whom these activities are to be carried out, and the budget required for these activities. In many IWUOs, expenses for O&M and water management are included in the Action Plan and authorised at the time of General Assembly.

For some irrigation schemes where time has passed since the establishment of the IWUO, these expenses may be allocated on the basis of actual performance in the past. However, in the case of IWUOs that are still at the infant level, just after their establishment, it is difficult to properly allocate a necessary budget for the planned activity because of their limited experiences. In addition, it is also difficult to identify the activities that are essentially needed.

Therefore, this chapter aims to provide an explanation of what activities need to be planned and included and to understand procedure and what is required to prepare an O&M Plan.

It should be mentioned that the contents and activities described up to this chapter are assumed to be carried out all along and with the stipulated outputs prepared.

11.1.2 Importance of O&M activity

Think about the response to the following questions for each of the Operation and Maintenance activities.

Operation	Without proper operation of the irrigation facility, What will be happened?
	Without monitoring of operation and water distribution, What will be happened?
	Without monitoring of available water resources, what will be happened?
Maintenance	Without clearing of the irrigation canal and drainage, what will be happened?
	Without repair work of the damaged facility, what will be happened?

Proper operation and maintenance is essential for the sustainable management of irrigation schemes, and

planning for those activity is the foundation of it. Therefore, the formulation of an O&M Plan is an important activity.

11.1.3 What kind of O&M activities are necessary for sustainable irrigation scheme management?

So what activities should actually be planned and implemented by IWUOs? Please discuss among the stakeholders.

The following are examples of activities related to Operation and Maintenance which usually conducted by IWUO. Utilize listed activity as a reference to consider and list up what activities are needed in your own scheme.

Operation (To realize fair water distribution)	
Operation of daily irrigation facility	
	<ul style="list-style-type: none"> • Open and close of the gates, stop log installation at each weir or turnout • Patrol for illegal water abstraction and operation of the facility by water users
Monitoring the condition of water distribution and other information	
	<ul style="list-style-type: none"> • Gate operation • Monitoring water source (Rain fall and water level of the dam or river etc.)
Maintenance (To maintain the function of the facility)	
Daily maintenance work for irrigation facility	
	<ul style="list-style-type: none"> • Removing weed, check condition of levee and canals which surrounding own plot
Seasonal repair work of irrigation facility and other related facility	
	<ul style="list-style-type: none"> • Clearing of main canal, Removing sediment from drainage canal
Special (urgent) repair work of the facility	
	<ul style="list-style-type: none"> • Repair work for broken structure,

Through these considerations and discussions, it will be possible to raise awareness of the activities that IWUOs should be focusing on.

11.2 Typical Activities in Action Plan related to O&M Plan

There are three major categories in the IWUO Action plan: 1. Administration, (Salary for supporting staff, office supplies, meeting expenses), 2. Governance (leadership training, meetings), and 3. Infrastructure (maintenance).

The following list show examples of activities in each category, extracted from the Action plan prepared by IWUO in WAMCAB Model sites. Especially when preparing an O&M Plan for the first time, it is recommended to consider and prepare the activities required for your irrigation scheme with reference to the below, since it is not yet known what activities are needed.

The necessary activities organised in the previous section should be categorised into the areas of

Administration, Governance and Infrastructure, and again consider whether there are any missing activities that should be included in the O&M plan.

11.2.1 Administration in Action plan

Activity	Description
Salary of IWUO supporting staff	<ul style="list-style-type: none"> ➤ Manager ➤ Account ➤ Irrigators ➤ Operator at dam ➤ Security at office or important facility ➤ Casual labor
Transport or allowance for supporting staff	
Procurement of stationary	Papers, note book, pens, files and etc. for office management
Electricity bill	Used for the pump operation or IWUO office
Communication cost	

11.2.2 Governance in Action Plan

Category	Activity	Description
Leadership	Updating water users list	
	Preparation of water distribution plan (irrigation calendar)	For faire water distribution
	Preparation of O&M plan	For proper O&M activity
	Meeting preparing the GA	Preparation of Action Plan
	Hosting GA meeting	
	Meeting of executive committee, audit committee, conflict resolution committee and other committees	Allowance, Transport, bottle of water
	SMC Meetings, Zonal level Meeting	Periodical meeting to identify the issue or challenges
	Technical meeting	If necessary
	Incentive, Transportation and allowance to Leaders (SMC and ZC)	
Training	Training of WUTs, Zone leaders and Irrigators on proper water management	For maintaining of irrigation infrastructure, For remembering of their responsibilities
Rewording	Rewording of farmers, WUT and zone leaders for best practice of O&M activities	To motivate each leaders to perform properly

11.2.3 Infrastructure related activity (Maintenance) in Action Plan

Activity	Description
Facility inspection	Records keeping for status of infrastructure and preparation of O&M plan
Visit of infrastructure for the monitoring the activity	Confirm weather water users cleaned and perform their task properly
Controlling erosion surrounding the scheme and Protection of the buffer zone	Preventing of sedimentation, Planting the tree in dam buffer zones and creating the erosive trenches
Saving	Saving money for Repairing the facility and rehabilitating
	Simple repair of facility and its construction works anytime its needed

Activity		Description
	for reserve fund	Use it in special case or for big infrastructure in coming period, 20% will be saved as trust fund and reserved fund
Transport and allowance		for field work
Construction	Turnout	Clearly describe the facility, location, and number of units to be covered
	Canal crossing structure	For reduce the amount of sediment or water to enter the irrigation canal
	Embankment along main drainage	Preventive measure for flooding
Rehabilitation	Turnout, canal or drainage embankment, canal crossing drain and weir	Preventing continuous deterioration , Preventive measure of drain embankment collapsing
	locally made weirs	Regular maintenance is required to maintain functionality
	the IWUO office	Leak and roof repair, exterior painting, electrical equipment repair
Procurement	stop logs	Use in fair water distribution
	timber and sand bags	for repair works (damaged embankments reinforcement)
Cleaning	Main canal and main drainage	For fair and proper water distribution, Preventive measure for flooding
	Main canals on behalf of these who resist cleaning.	If it needed
	dams	Removal of hyacinth plants (floating weeds) from dams

Among these activities, focus on activities related to the maintenance of facilities and water management in the irrigation scheme, and prepare an Operation Plan for activities related to Administration and a Maintenance Plan for activities related to Infrastructure.

11.3 Component of the O&M plan

Based on the results of the facility inspection and water distribution plan, an annual maintenance and management plan is formulated in the past chapter. At this stage, the administrative costs required to manage the IWUO, the costs required for water distribution and operation of irrigation facility (Operation cost), and the costs required for cleaning and repairing the facilities (Maintenance cost) should be considered separately.

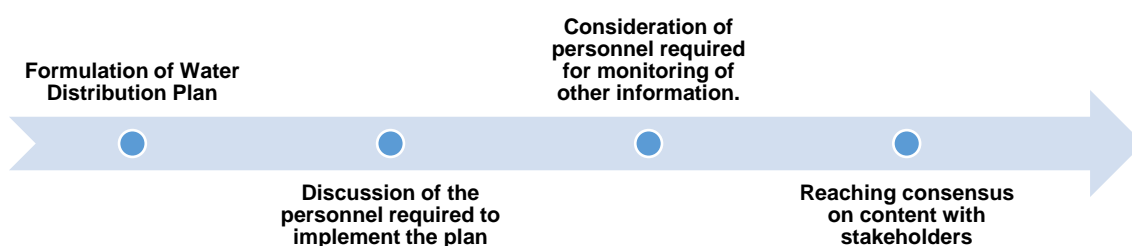
As explained in the introduction, the O&M Plan is included as a component of the Action Plan prepared by the IWUO. The following will present the steps regarding the planning of operations of irrigation facilities and maintenance such as rehabilitation, new construction, and cleaning by IWUO related to the O&M Plan portion.

O&M plan provides a **schedule** and **cost estimation framework** for the **Operation and Maintenance activities** required for the target period, **when** and **by whom** these activities are to be carried out, and **the budget required for these activities**.

11.3.1 Operation Cost

After the formulation of the water distribution plan, the costs required for its implementation and monitoring are to be covered. It includes personnel costs for gate operators of weir or from dam, Irrigators to monitor the distribution of water from main canals, and personnel to operate stop logs and diversion facilities. The costs are mainly for the irrigation period.

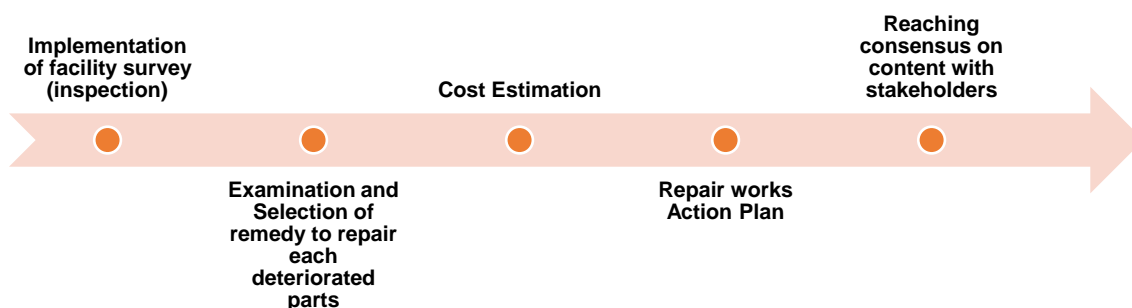
Personnel costs for permanently employed staff such as managers and accountants responsible for the overall management of IWUO activities, engineers or technicians responsible for technical support, and salaries for security guards for irrigation facilities and IWUO offices are included in this category. If dam water levels and rainfall are also monitored, those expenses for personnel should also be included. Other costs such as the purchase of office supplies and electricity are also included.



11.3.2 Maintenance Cost

Based on the results of the Facility Inspection, the parts of the facility that need to be repaired, their priority and budget should be considered. Once the target facilities are identified, the amount of materials required to repair or construct the facilities is determined and the estimated construction costs are included. If it is technically difficult to implement by FRT, consider hiring an external contractor and collect a reference quotation to confirm the required budget.

When employing external labour to carry out large-scale cleaning, repair work or construction work, the timescales and frequency should also be considered and the necessary costs should be included in the budget.



11.3.3 Maintenance plan

Once the details of the repair activities have been determined, a schedule should be prepared, considering

when these activities should be carried out. In principle, repair activities are carried out using this schedule and the maintenance budget, but in the event of damage to facilities due to unexpected heavy rainfall, etc., the EC and others must consult and flexibly reallocate the necessary budget.

For each activity, the number of activities required, the Frequency of activity, and the unit cost should be estimated. And the necessary expenses for each planned activities are accounted for over the duration of the activity. As a reference indicator, Cost for Administration +Governance is considered to be 25% of the overall activity budget (= approximately 75% expenditures related to infrastructure).

How to fill in specific formats and prepare a plan is explained in the later part of this chapter.

11.4 Conclusion

For sustainable irrigation scheme management, **Operation (To realize fair water distribution) and Maintenance (To maintain the function of the facility)** are keys.

In most IWUOs, the Action plan that is prepared includes elements of an O&M Plan. O&M plan provides a **schedule and cost estimation framework** for the **Operation and Maintenance activities** required **for the target period, when and by whom** these activities are to be carried out, and **the budget required for these activities**.

11.5 How to formulate O&M plan

In most IWUOs, the Action plan that is prepared includes elements of an O&M Plan. The objective of this section is to understand the components of an O&M Plan and the procedures for formulating it through practice.

11.5.1 Practice for filling the format of O&M plan

Using sample format for Operation Plan and Maintenance Plan which is attached on the last page of this chapter, Participants fill the format. The aim of this exercise is to learn how to fill out the forms. It is also to identify any other activities that may be needed in addition to those listed in the current plan.

11.5.2 Format for Operation plan

Operation Plan include activities and expenses related to supporting staff responsible for operation and maintenance of irrigation facilities. (Cost for Administration and Governance for the entire IWUO activities are not included in this time). It is necessary to establish a system to ensure that the water distribution plan is properly implemented when the operation plan is formulated.

The Operation Plan form is attached below. Each item shall be discussed and described.

#	Target facility	Required operation works	Responsible for operation	No. of personnel	When (Duration)	Frequency	Unit Cost (Rwf /Unit)	Total cost (Rwf)	Budget Source

The following is an example from the Operation plan prepared by the WAMCAB model site. It is to be used as a reference for the preparation of the plan.

Table 16: Example of Operation Plan

#	Target facility	Required operation works	Responsible for operation	No. of personnel	When (Duration)	Frequency	Unit Cost (Rwf /Unit)	Total cost (Rwf)	Budget Source
1	Valve from dam	Open and close at certain time	Operator	1	Throughout irrigation period (4 month ×2 seasons)	Monday to Saturday	80,000 Rwf / Month	640,000 Rwf	Water fee
2	Developed weir No.1	Installing and removing stop logs	Irrigator	1	Throughout irrigation period 4 month ×2 seasons)	Monday to Saturday	80,000 Rwf / Month	640,000 Rwf	Water fee
3	Dam site and office	Guarding important facility	Guard	2	Throughout year (12 month)	Every day	80,000 Rwf / Month	960,000 Rwf	Water fee

11.5.3 Format for maintenance plan

Maintenance Plan is the plan for maintenance activities on a daily, seasonal, and annual basis, as well as for rehabilitation or new construction of facilities requiring civil work. Based on the result of Facility inspection, necessary activity will be proposed.

For the budget of civil works activities, it is required to prepare a BoQ of required materials and equipment and to account for them from the standpoint of justification. (Preparation BoQ is explained in the other chapter.)

#	Target facility	Priority	Required repair works (Activity)	Responsible for repair work	Schedule	Frequency	Unit Cost (Rwf /Unit)	Total Cost (Rwf)	Budget Source

The Maintenance Planform is attached below. Each item shall be discussed and described.

#	Target facility	Priority	Required repair works (Activity)	Responsible for repair work	Schedule	Frequency	Unit Cost (Rwf /Unit)	Total Cost (Rwf)	Budget Source
1	2 nd Weir on MC	High	Clearing of the sediment around the weir	The farmers who are using water from this weir are responsible	At the end of season (Jan. May)	Once a season (2 times /year)	Not expected to pay any cost	0 Rwf	none
2	Main drainage	High	Clearing of the sediment and repair embankment	IWUO hire 10 casual labor for 5 days and supervise cleaning work	Before every rainy season	Once a season (2 times /year)	700,000 Rwf/season	1,400,000 Rwf	Collected water fee
3	Turnout	middle	Newly construct 10 turnouts along the Main canal	Farmer Repair Team	June.	Once a year	500,000 Rwf/unit (*BoQ is needed)	5,000,000 Rwf (*BoQ is needed)	Collected water fee

11.5.4 Conclusion

The activities planned here are taken into the part of Action Plan based on the priority and available budget.

In participatory irrigation management, it is important to apply a bottom-up approach to planning, with the important input of the beneficiaries through WUT and ZC to the IWUO.

11.6 Monitoring of Planed activity by IWUO itself

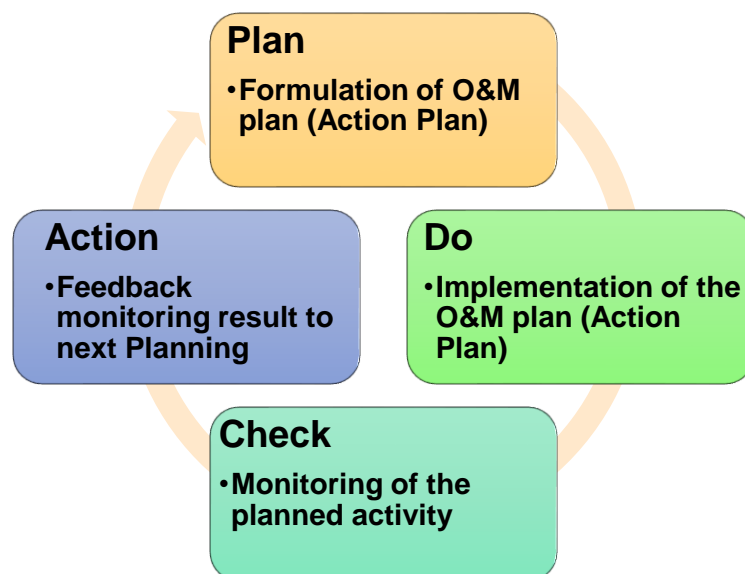
The various activities and their cost for the maintenance of the irrigation scheme were identified through above practise. It is expected that some of the activities will be covered by the IWUO budget, some will be conducted freely through community work, and some will be carried out by outsourcing or hiring labours. The implementation of these activities will be checked and monitored on a time to time basis to ensure that activities are carried out properly. This is responsibility of IWUO (O&M team) and manager

The costs of the activities will be also confirmed whether there is any difference between the planned and actual costs after the implementation of the activity. And if there is any gap, why for improving accuracy of cost estimation at the time of planning phase.

At the end of the period of Action Plan, the monitoring result of the O&M plan will be reviewed. In particular, it should be monitored whether community work has been carried out properly as planned. And if not, if it has a serious impact on the overall water distribution within the scheme, it may be necessary to consider to be implemented the activity under the IWUO budget in the next period. The same applies to activities that were planned to be carried out by other parties than IWUO.

11.6.1 PDCA cycle

The plan is not the end of the process; it must be monitored to ensure that the contents of the plan are properly implemented, and measures must be taken if necessary.



11.7 Revenue-based plan adjustments

The amount of water user fees earned is generally determined from the cultivated area. The expected revenue obtained each season is compared with the estimated expenditure for the planned activity, and if the expenditure is higher, the planned activity is required to be reviewed. The results of the Facility inspection are prioritised and some adjustments of the planned activity are made based on this prioritisation, such as postponing low-priority activities to the next season.

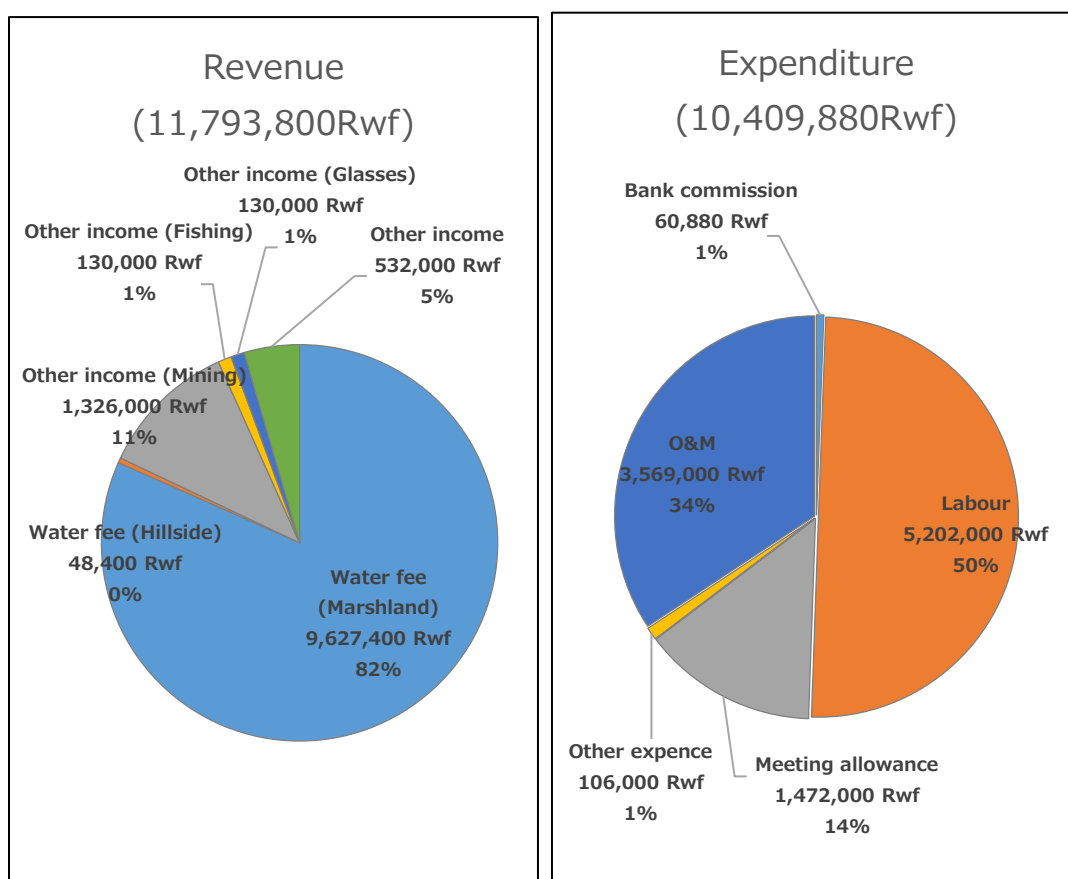
If there is any possibility to reach mature agreement with cooperatives and farmers, it could be an option to calculate the water user fees for implementation of the necessary activities based on dividing the estimated expenditure by the beneficiary area, and to consider raising the water user fees. In this case, if the difference between the current water user fee and the revised water user fee is big, it is also important to consider the option of raising the fee in step by step over several seasons and to negotiate with the relevant parties.

In addition to the water user fees collected from farmers, efforts to increase IWUO revenue are also important. For example, irrigation scheme with dam diversify their sources of income and increase their revenue through such activities as fish farming in the dam lakes, selling grass on the dam body as livestock feed, fruit tree planting for watershed protection purposes and beekeeping.

11.8 Example of breakdown of revenue and expenditure

The following is a breakdown of total revenue and expenditure for the IWUO ABAHIZI ba Rwamagana of the Cyaruhogo model sites for the 2021-2022A and 2021-2022B seasons. IWUO ABAHIZI ba

Rwamagana is rice cultivated schemes with four marshland irrigation schemes with a total area of 260 ha.



More than 80% of the revenue is from water use fees, although there is also income from water use fees from mining company (about 11%) within the scheme, fish farming and the sale of grass for livestock. As for expenditure, labour costs account for nearly half of the expenditure, while activity costs related to O&M account for 34% and allowances paid to meeting participants account for 14% of expenditure.

Sample format for the formulation of O&M Plan

Operation Plan

#	Target facility	Required operation works	Responsible for operation	No. of personnel	When (Duration)	Frequency	Unit Cost (Rwf /Unit)	Total cost (Rwf)	Budget Source
1									
2									
3									
4									
5									

Maintenance Plan

#	Target facility	Priority	Required repair works (Activity)	Responsible for repair work	Schedule	Frequency	Unit Cost (Rwf /Unit)	Total Cost (Rwf)	Budget Source
1									
2									
3									
4									
5									

Chapter 12 Regular maintenance of the irrigation facility

Content Type	Explanation of practical activities		
Objectives	This chapter explains the tasks related to O&M that are required of each stakeholder in the irrigation schemes. Although the stakeholders and conditions differ in each scheme, the objective is to understand the need for each task and to enable IWUOs to carry out the required tasks using the human resources available in each scheme.		
Outcomes	Through understanding the content of this chapter, all stakeholders, from IWUO leaders to farmers who are members, will understand the importance of daily O&M activities and will be able to implement the appropriate activities in a timely manner.		
Lecturers:	TF members and FC	Trainees:	IWUO managers and Leaders of IWUO

12.1 Introduction

Irrigation facilities have appropriate maintenance cycles depending on their target and the issues it faces. What would happen if canals were cleaned only once a year? Is it necessary to apply anti-rust coating to the metal parts every week?

Appropriate frequency of maintenance and management will optimise costs and impacts. The following are examples of the maintenance that can be assumed for each period.

12.2 Conducting regular (daily to monthly) O&M

As it is very costly to carry out all maintenance of irrigation facilities from the IWUO budget, routine activities by users themselves, or group work based on irrigation blocks or zones, can be effective. Cleaning the canals and drainages which each group uses on a periodic basis, e.g. once a month, can prevent from sediment and weeds growing in the canals. Since these works tend to increase the workload at one time as the work interval increases, it is advisable to periodically conduct these works while monitoring the conditions of the target facility.

- Removal of sediment and weeds in secondary or tertiary canals
- Removal of sediment and weeds in drainage channels

12.3 Conducting seasonal O&M

After harvest, the irrigation is no longer required, so actions such as stopping the water supply in irrigation canals and repairing canals and diversion facilities can be implemented. It is also advisable to check the condition of the canal at this time of season, as the shape of the canal will gradually change as sediment and weeds are repeatedly removed. For irrigation schemes with pipeline facilities, screen cleaning and pipeline clearing operations are also important.

Repairs and new construction of concrete structures should also be carried out during the non-irrigation season. However, the need for new construction of weirs and diversion facilities should be carefully considered. With regard to weirs, there have been some cases of water shortages downstream due to excessive water abstraction upstream, and the problem may be solved by improving upstream water use

and distribution. Diversion facilities should also be considered before construction, as in many cases problems can be solved by proper maintenance of secondary canals and thorough enforcement of water distribution rules. Those effort can save the limited budget and utilize for other activities.

Water level gauges and other indicators on dams and diversion facilities need to be cleaned before each cropping season to ensure that they are in a suitable condition for use, as any dirt on them will make it impossible to measure accurately.

12.4 Conducting annual O&M

For the annual maintenance, Following tasks need to be conducted especially for maintenance of machinery.

- ☐ Greasing gates
- ☐ Applying anti-rusting to metal parts
- ☐ Maintenance of pumps.

12.5 Emergency Protocols for Floods and Other Events

Due to climate change, unprecedented heavy rains have occurred in recent years, damaging irrigation facilities. While it is important to take preventive measures against floods, the following measures are required in the event of a disaster.

- ☐ Temporary reinforcement of overflowed areas with sandbags
- ☐ Removal of sediment and other debris by community work when floodwaters enter canals
- ☐ Emergency release of water from the dam



*Water Management and Capacity Building Project
(WAMCAB)*



Training Manual

for

Water Management

February 2025

Prepared under WAMCAB in collaboration with RAB

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Abbreviation

AWD	Alternate Wetting and Drying
CWR	Crop Water Requirements
DISC	District Steering Committee
E_a	Application Efficiency
EC	Executive Committee
E_c	Conveyance Efficiency
E_i	Irrigation Efficiency
ET_O	Reference Evapo-Transpiration
ET	Evapo-Transpiration
ET_{crop}	Crop Evapo-Transpiration
FAO	Food and Agriculture Organization
FC	Field Collaborator
FRT	Farmers' Repair Team
GA	General Assembly
GWR	Gross Water Requirement
K_c	Crop Coefficient
O&M	Operation & Maintenance
PS	Plastic Sheet
PIM	Participatory Irrigation scheme Management
PLM	Prevention of Lateral Movement
PWM	Proper Water Management
IWA	Irrigation Water Amount
IWUO	Irrigation Water Users Organization
SISC	Sector Irrigation Scheme Committees
SMC	Scheme Management Committee
TF	Task Force
WUT	Water User Team
ZC	Zonal Committee

Chapter 1 Introduction

The Project for Water Management and Capacity Building (WAMCAB) has been implemented from March 2019 to February 2025 through the support from the Japan International Cooperation Agency (JICA). The main objective of the project was capacitating the stakeholders related to the management of irrigation scheme, such as Irrigation Water Users Organization (IWUO), so that they could achieve the sustainable management of irrigation schemes in Rwanda. The implementation of the project was conducted in collaboration with the staffs of Rwanda Agriculture and Animal Resources Development Board (RAB).

In this project, different training modules, management model and IMTA manual were prepared that will be applied to capacitate the stakeholders related to sustainable management of irrigation scheme in Rwanda.

According to the Ministerial Order of Rwanda No. 001/11.30 of 23/11/2011, IWUO is expected to perform as a non-governmental organization in the management of the irrigation scheme it operates. The management capacity of the beneficiaries need to be improved in different aspect of IWUO management. This manual is prepared to improve the management capacity of the beneficiaries of irrigation scheme in Rwanda. The manual is organized into nine chapter.

The manual explains the importance of fair water distribution (Chapter 2) and the IWUO's implementation structure (Chapter 3) for achieving this goal.

It provides an introduction to the concept of irrigation water requirement (Chapter 4), software for estimating water requirement (Chapter 5), and technical explanations on the preparation of water system diagrams necessary for water distribution planning (Chapter 6).

It also introduces practical and monitoring methods for water distribution (Chapter 7) and water saving techniques at the field level (Chapter 8&9).

All the training manual are prepared under WAMCAB project in collaboration with RAB. The manuals are expected to be used in capacitating IWUO in the country and must be given to the target trainees on routine basis as elected leaders are substituted every three years. The District and RAB should take the responsibility of the routine training

Chapter 2 Importance of fair water distribution

Content Type	Concept and Theory		
Objectives	This chapter describes the importance of fair water distribution, which is one of the key elements of water management. The purpose of this chapter is to provide an overview of fair water distribution, its necessity, and understanding of the roles of stakeholders in achieving it.		
Outcomes	An understanding of the need for fair water distribution and an atmosphere promoting its implementation will be fostered throughout IWUO stakeholders. It will also form the foundation for understanding the content described in the chapters that follow.		
Lecturers:	RAB and District staff and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and farmers

2.1 Introduction

Do you think irrigation water is equitably distributed in your irrigation scheme? Do the upstream farmers use more water and the downstream farmers can use limited amount? What is fair water distribution? Some of you may be wondering why we need to distribute water fairly.

In this chapter those fundamental question will be explained, so that you can understand the importance of fair water distribution.

2.2 The importance of fair water distribution:

Let's say you visit a buffet restaurant. If you pay the same price but find that there is not enough food left because you were in the back of the line, do you feel disappointed or unfair? How would you feel if the people ahead of you in the line put more food on their plates than they could eat, and then they left the food on the plate and waste it?

Of course, the restaurant is responsible for providing enough food for the customers who are paying the same price and need to purchase and prepare more food to provide a certain amount of extra. But if there are not enough foodstuff, it's impossible to serve the food even if the restaurant wants to, and it would be better to be able to distribute the food to all the customers without wasting it.

Let's replace "customer" with "farmer" and "restaurant" with "IWUO".

The IWUO receives water fees from the farmers and is responsible for ensuring that each farmer receives a sufficient amount of water for their cultivation. However, as water resources are limited and the amount of water available generally can't be increased, it is important to avoid the wasting of water and to distribute the amount of water available effectively in order to satisfy farmers!

2.3 What is fair water distribution?

The term "fair water distribution in irrigation scheme" means distributing water 1) at the necessary time, 2) in the necessary amount and 3) in a fair manner.

Generally speaking, paddy field require more water at the time of land preparation, nursery preparation and transplanting, and early boot stage and heading stage. But if water is not delivered when it is needed, or delivered when it is not needed such as vegetative stage or at harvest period, there is no way to use it.

It would also be unacceptable for downstream farmers to be restricted from use of the water because they are located downstream and therefore have lower yields, even though they are paying the same water fee. This would reduce the willingness of downstream farmers to pay for water fee. Even if the source of water is a large river or a dam, there could be a major drought once in several years. What if the few available water resources are only distributed to a few powerful farmers or local leaders when this happens?

The problems of unfair water distribution, imbalance between upstream and downstream, etc. lead to a decline in the collection of water service fees and can be a source of internal conflict.

When water service fees are not paid, there is no sufficient budget to maintain the facilities in the irrigation scheme, operators, irrigators or security guards cannot be hired, broken facilities cannot be repaired, and as a result, the capacity and function of the facilities is reduced. Eventually, this leads to a further worsening of the water distribution and a negative spiral, which leads to increase the number of farmers who do not pay water fee.

In order to prevent such a negative perception from occurring and worsening, it is necessary to realize "fair water distribution" as a precondition for the solution of "high water service fee collection rate".

2.4 The Necessity of water service fee

Some farmers think that there is no need to pay for water service fees because they believe that crops grow on their own when it rains, so there is no need to irrigate in the first place, or that river water and rain are a gift from God and there is no need to pay for them.

However, rain fed agriculture means that yields are dependent on the amount of rainfall in season, and in the event of a severe drought, there is even a risk of crop failure.

But irrigation stabilizes production and increases yield through proper use of irrigation facilities. And particularly in hillside areas, irrigation can diversify crop varieties, cropping intensity (Growing crops in three seasons: A, B and C), improve crop quality, and increase marketing prices by shifting the cultivating season from rain fed irrigation based farming .

Irrigation facilities are also essential to distribute irrigation water to each irrigation zones (or blocks), and it obviously costs money to operate and maintain these facilities. In pumping-irrigation scheme, electricity or fuel are essential to operate the pumps, and these cost naturally high to use.

The fair water distribution within the irrigation scheme and the proper collection of water service fees are essential for realizing the sustainable operation and maintenance of the irrigation scheme, and it is important that each farmer understands importance of irrigation facility and the benefits of irrigated agriculture. So, now that you have understood the need and importance of fair water distribution, let's

look at how it can be achieved and the role of the IWUO and the main water users and farmers beneficiaries.

2.5 IWUO initiatives

There are a number of activities that IWUO should undertake to ensure fair water distribution:

2.5.1 Preparation of a water distribution plan based on a cropping calendar

Based on the cropping calendar which is a cultivation schedule showing the period from land preparation to harvest, IWUO needs to distribute water to irrigation areas. Generally, cropping calendar for irrigation scheme is prepared by cooperatives and farmers cultivate according to this calendar. The amount of irrigation water requirement for target crops varies according to the weather condition, soil type, amount of rainfall and the growing stage of the crop from time to time. In particular, high amount of irrigation water is needed at the time of land preparation for paddy and irrigation water is critically required after transplanting and flowering and fruit production periods of the crops for getting higher yield. A water distribution plan shows where, when and how much irrigation water will be required.

IWUO is responsible for formulating a water distribution plan in cooperation with the cooperative based on the crop calendar. Also, IWUO is responsible for the abstraction of water from water sources such as dams and rivers, the maintenance of irrigation facilities within the scheme, as described follows, and realize the fair water distribution according to the plan.

2.5.2 Maintaining irrigation facilities to ensure proper water distribution.

Without irrigation facilities, proper water distribution based on the water distribution plan can't be achieved. In the absence of secondary canals, tertiary canal and turnouts, water distribution cannot be carried out since water can't be delivered and distributed properly. The presence of irrigation facilities is therefore a precondition for proper water distribution.

Even if these facilities exist, if they are not properly maintained and repaired, they will not be able to sustain their function for deliver and divide irrigation water and proper distribution will not be possible.

Therefore, it is necessary to maintain these facilities using the collected water service fees from water users. In addition, some irrigation scheme of a certain scale hire scheme managers, irrigators, pump operators, gate operators, and security guards to operate their facilities, and these salaries need to be covered from collected water service fees.

The IWUO is responsible for the maintenance and operation of facilities and the water distribution in the scheme and using the water service fees properly collected paid.

2.5.3 Establishment and operation of internal rules for water distribution

Water distribution is carried out in accordance with the plan which was previously mentioned, which

requires the establishment and operation of appropriate rules for water distribution. It is very difficult to achieve water distribution according to the plan without internal rules, because in the absence of internal rules each farmer will use the water in the canal without control. For example, farmers in the irrigation scheme are required to follow the crop calendar. This is because water distribution plan is based on a cropping calendar that is representative of the entire irrigation scheme, not on the cropping schedules of individual farmers. If this cropping calendar is not followed or respected, irrigation water may not be supplied when it is needed for crops. In addition, when the crop is harvested in the entire scheme, it is possible to stop the water supply in the main canal for cleaning and repair work on the facilities. In these situations, it is not possible to take water from the source and distribute it to each plot for the convenience of individual farmers who do not follow the crop calendar. In order to avoid such situation, the IWUO needs to cooperate with the cooperative and instruct the farmers in the scheme to follow the cropping calendar accordingly.

Although, each irrigation scheme has its own water distribution system. In the case of scheme which is applying rotational irrigation method (or time sharing) for water distribution, the irrigation scheme is divided into several zones (or blocks) and irrigation water supply along the order. In this case, if water is diverted from main canal out of order, the amount of water available in the zones where it is supposed to be used will be insufficient. In addition, in the scheme which apply flow sharing method, if some zones take more irrigation water than the amount of water allowed to be taken, it will cause shortage of water in the irrigation blocks downstream. It is the responsibility of IWUO to establish these rules and to supervise the irrigation water distribution and use of water in accordance with these internal rules. The punishment of farmers who do not follow the internal rules will also be necessary to maintain order. Otherwise, no one will follow the internal rules, leading to selfish water abstraction etc. It is also important to ensure that the rules are properly noticed to the farmers and that farmers are aware of the exact dates and time of availability of irrigation water in each zone. Another effective approach is to appoint and train terminal-level leaders within the farming community to manage water use in each zone or turn out.

2.5.4 Water distribution monitoring (proof of fair water distribution)

It is essential that the organisation responsible for water distribution is fairly managed and that water management internal rules and processes are disclosed to farmers. IWUO is responsible for recording and disclosing how much water is available and how much water is distributed to irrigation scheme and irrigation zones on a daily basis. In the case of pump irrigation scheme, pump operating time and discharged from storage (regulating) tanks should be prepared and recorded as actual water distribution, and a record of actual supply in accordance with the plan should be kept. Not only measuring and recording rainfall, such as daily monitoring of river discharge and water level in dams at water source is also important in terms of understanding the amount of available water resources. It is necessary to record and disclose the results of appropriate water distribution to farmers in order to ensure transparency. The results of water distribution should be explained at the General Assembly (GA) and other occasions.

Day-to-day irrigation water management within the scheme is carried out by Irrigators, Seasonal Water

Distributors and others under the supervision of the IWUO manager. They are responsible for diverting water from the main canal to secondary or tertiary canals and monitoring water distribution among the Water Users Team units, and their activities ensure smooth water management in the scheme.

2.5.5 Transparency and accountability on use of water service fee

Water service fees are funds collected from farmers and these are disbursed for the purpose of operating IWUOs activities. In order to prove that these funds have been spent properly, it is essential to daily organize and manage expenditure-related receipts, prepare monthly financial reports, submit financial reports to the general assembly (GA) and conduct periodic audits. In addition, the process of verifying and approving expense orders at the District Steering Committee (DISC) should be properly carried out to confirm the details of the expenditure.

2.6 Farmers' obligation

Now that I have explained the activities that the IWUO needs to carry out, here is a brief overview of what each farmer needs to do for fair water distribution.

2.6.1 Water use in accordance with the internal rules and water distribution plan

In accordance with the water distribution plan developed by IWUO, the amount of water that can be taken and the date and time for irrigation are defined for each irrigation zone (or block) along the main canal. It is important to respect these internal rules in order to ensure fair water distribution between zones. It is important that each farmer has a mind to respect these internal rules and schedule and they also need to know when their irrigation zone can be irrigated, and each zone leader needs to be properly informed to the farmer in each zone. Some farmers try to increase the discharge to their zone by blocking the canal with stones, plant residues, and other obstacles. Irregular blocking of the canal should not be done, as a sudden increase of discharge from upstream can cause overflow at that point of blocking, flooding the surrounding fields and causing erosion around the canal, which can damage the facility as a result. Some farmers also destroy canal walls in order to direct water from the main canal to their plots, but many IWUOs have strict penalties for destroying facilities in irrigation scheme. These penalties are intended to limit illegal water abstraction that is not based on internal rules, and each farmer is required to take water from designated diversion facilities and canals, such as secondary and tertiary canals within the block.

2.6.2 Reducing wasteful use of irrigation water

In many of the paddy irrigation scheme, cascade irrigation (Plot to Plot irrigation) is practiced, but often water is allowed to flow continuously from the terminal plot to the drainage canal. This is due to the fact that the farmer of each plot in the section where the water flows is different, so that the water distribution is not managed throughout the zone. It would be preferable to prepare on-farm canal from each secondary or tertiary canal to each plot, so that water can be supplied without passing through other farmers' plots. Cascade irrigation can also affect agricultural productivity by causing leakage of chemical

fertilizers applied by the farmer on their plots.

2.6.3 Payment and collection of water service fees

As already explained, the IWUO's activities are financially supported by the water fees paid by each farmer. In order to carry out each of these activities without delay, it is important to receive timely payment of water service fees from each farmer. Many farmers ship their harvests through cooperatives and receive their sales after deducting water fees, but some farmers who are not members of cooperatives or large scale farmers who have their own sales channels need to pay water service fees individually to IWUO.

From the point of view of effective use of IWUO funds, users are encouraged to do what they can do themselves, rather than fully relying on the activities of IWUO for operation and maintenance. Users are encouraged to actively participate in the community work which is organized by IWUO in the irrigation scheme and zones, and to join in simple cleaning and maintenance activities.

2.6.4 Following Cropping calendar

The cropping calendar is optimised for each irrigation scheme, taking into account the natural environment and market conditions in each area, mostly by agronomists in cooperatives. Following the cropping calendar also enables the entire scheme to harvest produce at the same time as expected by the cooperatives, thereby enabling group shipping, which is expected to improve the bargaining power of the farmers in terms of prices to the market.

Water distribution plan is formulated based on the cropping calendar, so that water is available to each farmer at the right time and in the appropriate quantity if they follow the cropping calendar. This means that if they do not follow the cropping calendar, they do not receive irrigation water at the right time and have to be responsible for selling their products.

In case of large irrigation schemes, it is difficult to irrigate the whole scheme at the same time for tasks that require a lot of water, such as puddling, etc. The scheme can be divided into several blocks and the timing of puddling and rice planting can be adjusted on a weekly basis to allow the peaks in the water supply to be balanced.

2.7 Conclusion

Through this chapter, you have understood the importance of fair water distribution, the role of the IWUO in achieving this and the importance of action at the individual farmer level. The water you have been wasting in your field is a drop of water that someone else downstream could have used but didn't. When you visit your paddy plot tomorrow, please make sure that there is no waste water flowing from your field into the drainage canal. And also check if any farmers are illegally taking water from canals around your plot.

Chapter 3 Implementation structure for O&M and water management in irrigation scheme

Content Type	Concept and Theory		
Objectives	It is practically impossible for the manager or representative of an IWUO to be solely responsible for the day-to-day O&M and water management of an irrigation scheme. Therefore, it is more realistic and efficient to establish sub-committees under the IWUO to manage at each level such as for each scheme, irrigation zone, irrigation block and diversion facility. The positions required to manage the IWUO are also indicated, and these should be used as a guide to consider hiring the necessary staff.		
Outcomes	This chapter presents a case study conducted through the WAMCAB and shows the roles of those responsible person at each level. These case studies can be referred in other schemes as well.		
Lecturers:	RAB and District staff and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

3.1 Introduction

In this training manual a sub-committee of the Executive Committee (EC) in charge of O&M and water management is proposed to be the O&M team which is responsible for planning and managing the implementation of O&M and water management. And the Farmers' Repair Team (FRT) for implementation of technical repair work in each irrigation zone or block.

3.2 Roles and Responsibility of O&M Team

O&M team has responsibility to conduct planning and supervising the implementation and monitoring of activities related to the maintenance of irrigation facilities and water distribution within the irrigation scheme. For example, O&M team lead to formulate water distribution plan. As a practical example, the O&M team plans the meeting for formulation of Water distribution together with Cooperative and other stakeholders. And confirm operation record of irrigation facility to make sure the irrigation water is distributed along the plan.

In the case of IWUO consisting of more than one irrigation scheme, the member of O&M team is composed by the in charge of Infrastructure and members of the Scheme Management Committee (SMC). If the IWUO consists of a single irrigation scheme, O&M team is composed by member of SMC and members of the Zonal Committee (ZC).

The qualifications required of members of the O&M team are as follows.

- Willingness to actively and spontaneously participate in O&M and water management conducted by IWUO.
- Good relationship with the respective irrigation schemes and sub-organisations such as zone and block leaders
- Familiar with facilities of the entire scheme (location and function)
- Familiar with the current status of water distribution across the scheme (water supply routes and destinations of diverted water).

- Is familiar with basic civil engineering works. Or willingness to learn
- Familiar with the planning and implementation of activities related to O&M and water management, including planning, budgeting for such activities, arranging community work and materials in preparation for implementation, providing leadership during field activities, and monitoring during and after the activities.

If an IWUO has just established or has been established but has not functioned for many years, it is difficult to find personnel who meet these qualifications. In such cases, it is practical to select personnel who are familiar with the irrigation scheme and who are willing to work for the improvement of the scheme as a member of IWUO.

3.3 Roles and Responsibility of Farmers' Repair Team (FRT)

FRT has responsibility to lead regular monitoring of each irrigation zone or blocks. If there is any issue or problem on water distribution, those information will be reported to O&M team by Farmer repair Team (FRT). It is also responsible for the establishment of on-farm canals for improved water management and for awareness-raising among farmers about the importance of these canals.

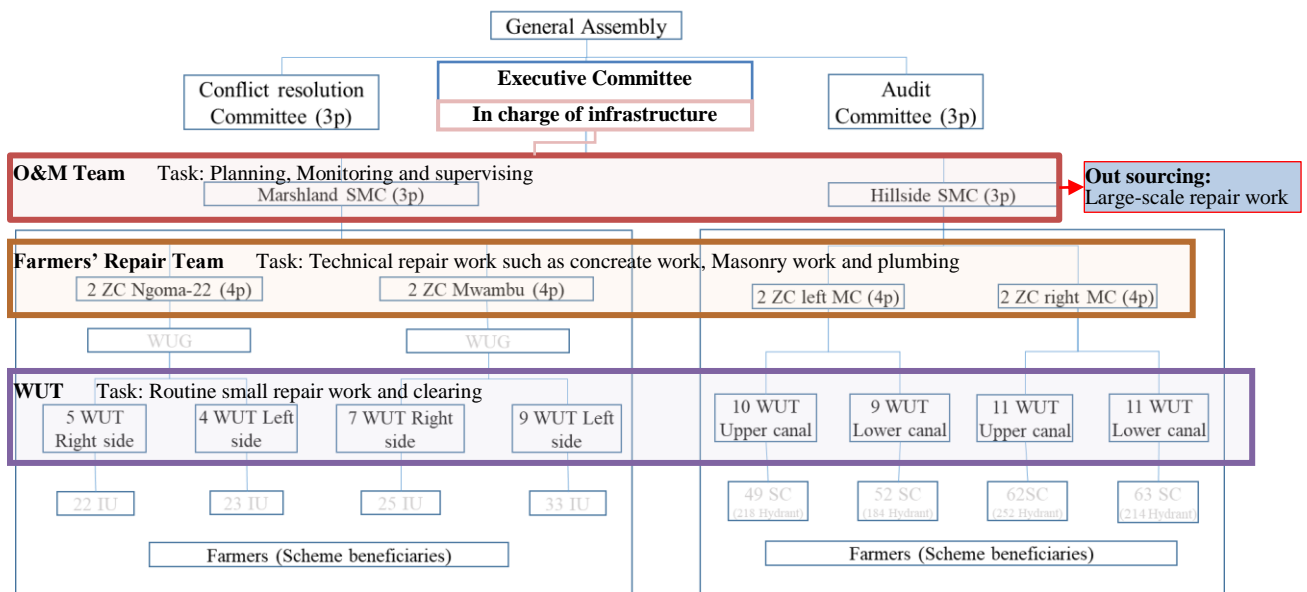
In the case of IWUO consisting of more than one irrigation scheme, the member of FRT is composed by the members of the Zonal Committee (ZC). If the IWUO consists of a single irrigation scheme, FRT is composed by member of Zonal Committee leaders or Water Users Team Leaders.

The qualifications required of FRT members are as follows.

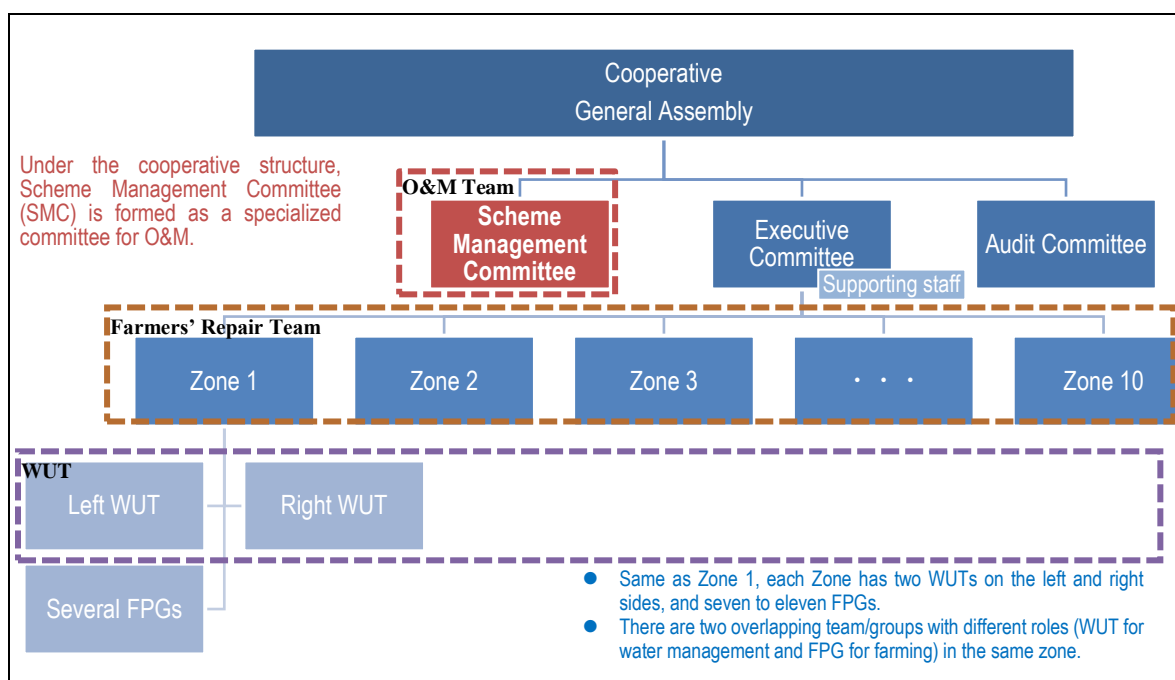
- Willingness to actively and voluntarily participate in O&M and water management carried out by IWUO.
- Have a good relationship with the WUT leaders and other related group in the respective irrigation zones/blocks
- Familiar with the knowledge (location and function) of facilities in the coverage area (scheme, irrigation zones/blocks) under its jurisdiction
- Familiar with the water distribution situation in the coverage areas of jurisdiction (water supply routes and diversion destinations)
- Familiar with basic civil work. or willing to learn, and capable of leading participants to implement actual repair activities.
- Capable to implement the planned activities.

3.4 Typical IWUO organisational chart and composition of O&M teams and FRTs

The figure below shows the organisational chart of a typical IWUO and the composition of the O&M team and FRT. This is the case of an IWUO consisting of several irrigation schemes that share in the same water source.



In cases where irrigation scheme is small and human resources are limited, instead of establishing an IWUO independently of the cooperative, an SMC may be established under the cooperative and be responsible for the management of the irrigated scheme. The organisational chart and the composition of the O&M team and FRTs in such cases are shown in the diagram below.



3.5 Other staff for water management

In addition, if daily operations for water distribution or facility operations are required, staff such as permanent operators need to be employed by the IWUO. Monitoring of water resources should also be conducted by IWUO staff or a dedicated staff can be hired and recorded.

The following staffs are playing their responsibility for proper O&M and water distribution in irrigation scheme to ensure the stable management of the IWUO. Their roles and responsibility are as follows.

3.5.1 Management staff

(1)IWUO Manager or Field Collaborator (FC)

- Perform day-to-day activities of IWUO such as updating water users list, office work, preparing financial statement, checking and follow up of water fee collection etc.;
- Support the IWUO to prepare Annual Action Plan, water distribution plan and O&M plan;
- Support the IWUO to prepare Performance Agreement Contract in collaboration with Cooperative every season;
- Support the IWUO to prepare irrigation calendar and cropping calendar in collaboration with Cooperative;
- Ensure that water is distributed fairly among the water users in accordance with the irrigation calendar;
- Support the IWUO to prepare the required documents of administrative procedures, such as IWUO registration and IMTA;
- Supervise the activities of different levels of IWUO structure;
- Supervise the activities of operators, agronomist and other staff under IWUO;
- Facilitate and support to organize meetings such as General Assembly, seasonal preparation;
- Contribute to building smooth relationships with District / Sectors / Cells, Cooperatives and other related stakeholders;

(2)Accountant

- Daily recording of different fund of IWUO and filing IWUO transaction document
- Perform as cashier in IWUO and filling cashbook for daily IWUO transaction.
- Procure necessary materials and equipment and submit to manager
- Report expenditures to manager and support documentation monthly.
- Making monthly of cash flow and report to manager,
- Receive water fees which delivery by hand especial for other water users which are not rice growers.
- Customer care of IWUO in the case manager is performing field work
- Support manager in making action plan and budget and preparation of GA,
- Performing others task of IWUO if asked by Executive Committee.
- Support for the response to audits.

3.5.2 Field operator

Depending on layout of the irrigation facilities and the size of the irrigation scheme and the financial capacity and its necessity, the following positions and personnel can be employed and working by IWUOs.

(1)Operator of the facility

They operate the facilities to take water from the source, open and close the gates or valve to divert water install and remove stop logs and operate the pumps in accordance with the water distribution plan and IWUO regulations.

(2)Irrigators

Responsible for operating diversion facilities from main to secondary canals (or secondary to tertiary canal) and monitoring the water distribution condition. (In some schemes, this is called the gate operator.)

(3)Security guards

Protect against outsiders and thieves harming IWUO-managed irrigation facilities and IWUO offices. They may also be engaged in guarding dam lakes where aquaculture is being conducted or other property such as orchard tree within the protection zone of the dam is present.

(4)Data recorder

Responsible for observing and recording rainfall measured by simple rain gauges, water levels in dams, water level gauges in canals, etc. The frequency of observation depends on the target facility and its purpose.

3.5.3 Capacity development of those staff

Many of the above staff may not be fully capable for their respective roles at the time of appointment or start of their employment. Therefore, they need to be given adequate explanations and training by managers or external technicians on the necessary tasks at the commencement of their working day or at any other time. The manual contains a technical reference for the roles required of each personnel in the following chapters, so stakeholders need to understand the content well.

Monitoring of those staff's performance is also required, such as periodic confirmation of observation data and on-site confirmation to ensure that the work or operation is being carried out properly and timely as planned and that there are no errors or mistakes in the methods used of the facility or equipment. If any incorrect operations or inappropriate conditions are identified, action is required, such as corrective measures or replacement of personnel.

3.6 Involvement of local leaders (SISC)

In O&M and water management of irrigation schemes, IWUOs sometimes face problems that cannot be solved by IWUOs alone. This can be the vandalism of facilities within irrigation scheme, farmers not paying water user fees, farmers not participating in community work, etc. One possible approach to address such challenges is to involve local community leaders, such as sector, cell or village leaders, to work together towards a solution.

Some irrigation schemes hold regular meetings as Sector Irrigation Scheme Committees (SISC), where IWUOs and cooperative participate to share and discuss issues in irrigation scheme and work together towards solutions. Participants in the SISC and example agendas are as follows.

Typical participants of the SISC meeting	Typical agenda of SISC meeting
<ul style="list-style-type: none">• Executive Secretary of sector• Sector agronomist,• Executive Secretary of cell• IWUO president• IWUO manager• Cooperative president• and different stakeholder in agriculture working in the sector	<ul style="list-style-type: none">• Cross cutting issues like erosion, animal invasion to the schemes.• Season preparation• Presentations of IWUO on O&M activities,• Sharing experience on preparation of expense order

Many irrigation schemes are often located across multiple sectors, in which case efforts are made to rotate the Chair of SISC meetings and to rotate the venue for meetings between sectors.

Even in the model sites of WAMCAB in the early stages of the project, there was sometimes lack of understanding of the IWUO's activities. In the case of non-payment of water use fees by individual farmers and damaging to the canals, Sector agronomists and IWUO managers made individual visits and

provided detailed explanations, which helped to gain understanding and cooperation for the activities. This kind of activity is one of the roles of local leaders.

Chapter 4 Water requirement and flow of its calculation

Content Type	Concept and Theory		
Objectives	This chapter provides an introductory explanation about water balance and shows the procedures for estimating irrigation water requirement. The objective is to understand the procedures for its estimation and the need to consider losses and other factors.		
Outcomes	IWUO leaders and other stakeholders will acquire basic knowledge about the irrigation water requirement and understand the concept of water balance and its importance.		
Lecturers:	RAB and District staff	Trainees:	Leaders of IWUO and FC (IWUO manager)

4.1 What is crop water requirement?

Crop water requirements (CWR) are defined as the depth of water [mm] **needed to meet the water consumed through evapotranspiration (ET)** by a disease-free crop, growing in large fields under non-restricting soil conditions including soil water and fertility, and achieving full production potential under the given growing environment. The consumed amount of water is needed to be supplied by irrigation. Therefore, it's important to know about the CWR.

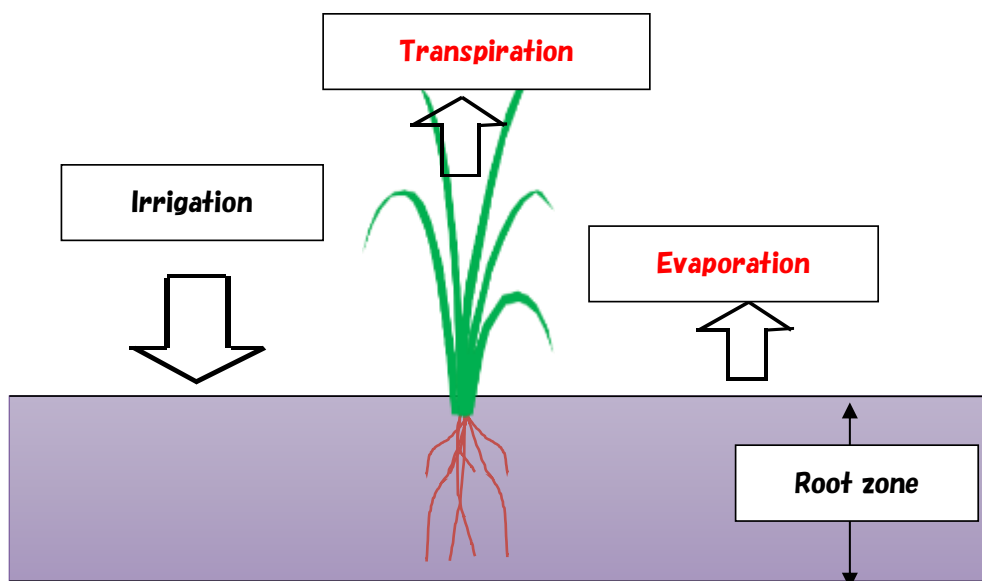
4.2 Evapo-Transpiration (ET)

Evapo-Transpiration (ET) is sum of Evaporation from the ground surface and Transpiration from the crop. This means that the following equation is used.

$$ET \text{ (mm/day)} = \text{Evaporation} + \text{Transpiration}$$

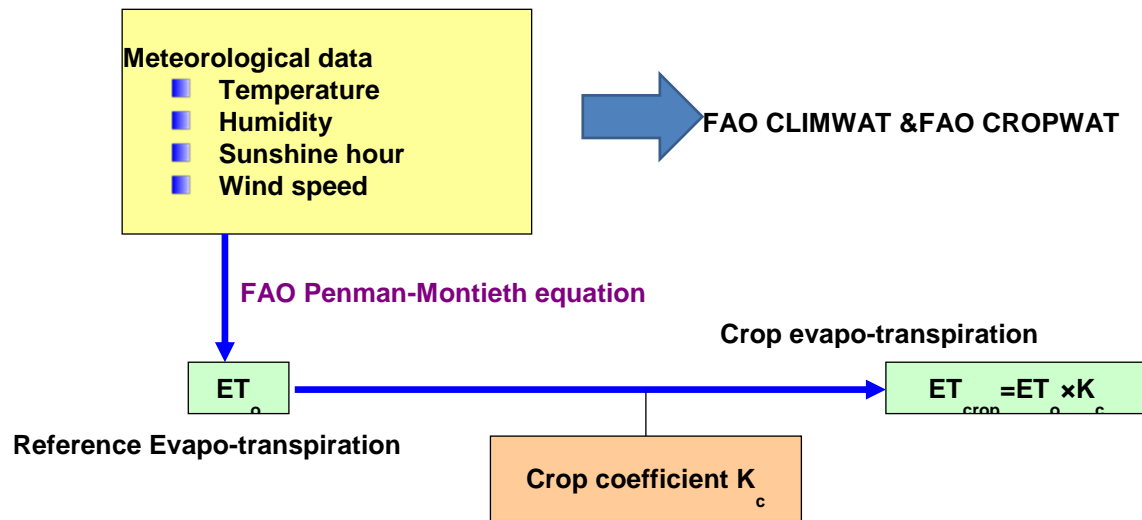
ET is equal to required water amount for crop growth.

Various methods have been developed to measure and estimate evapo-transpiration. In this manual, Penman-Montieth method will be explained how to determine ET, which is also explained in the FAO Irrigation and Drainage Paper No. 56.



4.3 Flow of calculation of Crop evapo-transpiration

The figure below shows the flow of calculation of ET_{crop} using FAO Penman Montieth equation. Each step is explained in detail in the next section.



4.4 Reference Evapo-transpiration (ET_O)

Reference Evapo-transpiration (ET_O) presents the evapotranspiration from a standardized vegetated surface and it's like an ideal condition. ET_O is required to obtain Crop evapotranspiration. Meteorological data such as temperature, relative humidity, sunshine hour and wind speed is required to compute ET_O in each month. If you don't have meteorological data for your irrigation scheme, FAO Climwat will provide necessary information for calculation of ET_O. The complicated calculation can be skipped using FAO Cropwat.

4.5 Crop Coefficient (K_c)

Crop Coefficient is a coefficient used to determine crop evapotranspiration as a ratio to a reference evapotranspiration, and is provided by FAO for each crop and growth stage.

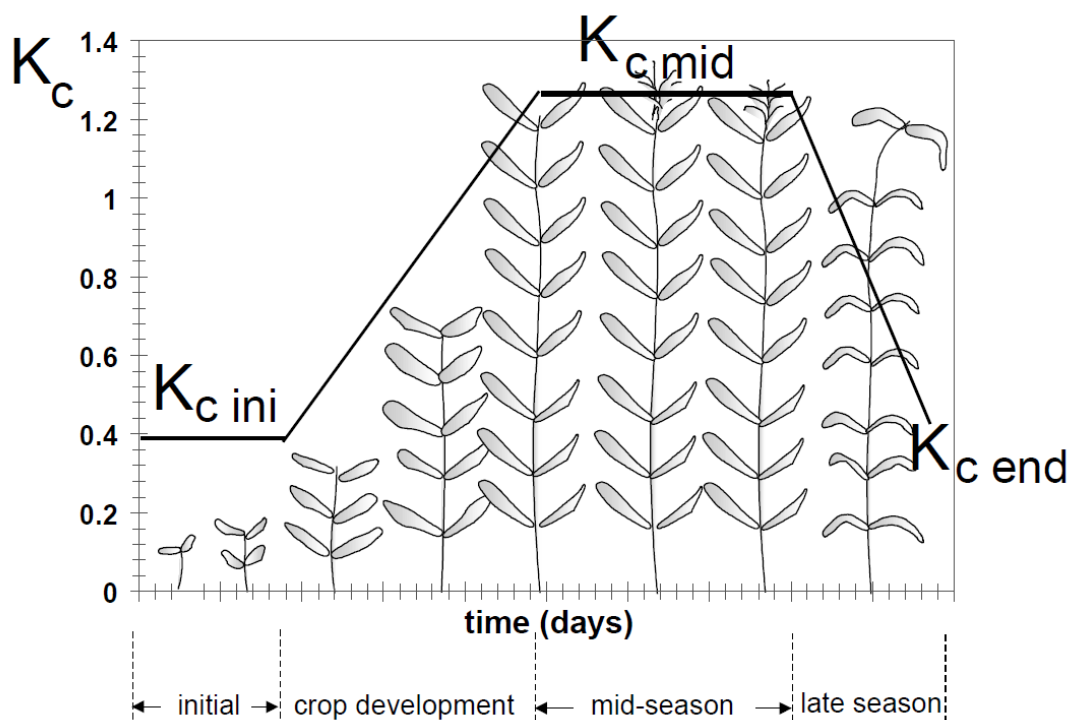


TABLE 11
Lengths of crop development stages* for various planting periods and climatic regions (days)

Crop	Init. (L_{ini})	Dev. (L_{dev})	Mid (L_{mid})	Late (L_{late})	Total	Plant Date	Region
a. Small Vegetables							
Broccoli	35	45	40	15	135	Sept	Calif. Desert, USA
Cabbage	40	60	50	15	165	Sept	Calif. Desert, USA
Carrots	20	30	50/30	20	100	Oct/Jan	Arid climate
	30	40	60	20	150	Feb/Mar	Mediterranean
	30	50	90	30	200	Oct	Calif. Desert, USA
Cauliflower	35	50	40	15	140	Sept	Calif. Desert, USA
Celery	25	40	95	20	180	Oct	(Semi)Arid
	25	40	45	15	125	April	Mediterranean
	30	55	105	20	210	Jan	(Semi)Arid
Crucifers ¹	20	30	20	10	80	April	Mediterranean
	25	35	25	10	95	February	Mediterranean
	30	40	30	10	110	March	Mediterranean

Source: FAO Irrigation and Drainage Paper No. 56

4.6 Crop evapo-transpiration (ET_{crop})

Crop evapo-transpiration (ET_{crop}) is products of ET_o and K_c and it show the amount which is consumed by the target crops. These parameters have different values depending on the climate of the growing season and the stage of growth of the crop, so the values will differ between different crops in the same region. The same crop can also have different values at different growing seasons.

$$ET_{crop} \text{ (mm/day)} = ET_o \text{ (mm/day)} \times K_c$$

Example: Calculate of the ET_{crop} for each month

Month	Feb	Mar	Apr	May	Jun	July	Aug
ET_o (mm/day)	1.7	2.8	3.9	5.3	6.2	6.3	5.5

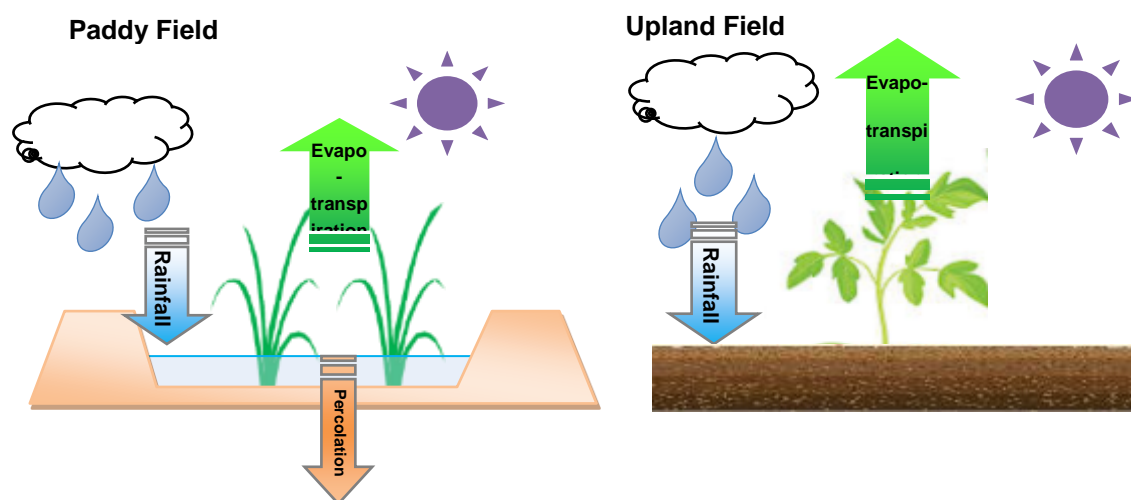
K (monthly mean)	0.40	0.45	0.90	1.15	1.15	1.15	1.00
ET (mm/day)	0.7	1.3	3.5	6.1	7.1	7.2	5.5

4.7 Water Balance Calculation

4.7.1 Net Irrigation Water Requirement

The purpose of irrigation is to supply Water Requirement for crop growth in each growing stage. Apart from ET_{crop} there are some other loss and supply of water to determine the amount of irrigation water. Net Irrigation Water Requirement represents the amount of water that needs to be supplied as irrigation, subtracting the loss of irrigated water and the supply from rainfall.

Net Irrigation Water Requirement = Loss by Evapotranspiration (Crop evapo-transpiration) + Loss by percolation – supply by rainfall



4.7.2 Water consumption factors in the plot level that need to be considered

In case of upland (Hillside) irrigation, the irrigation water requirement varies according to the soil type, as it has different water consumption and water holding capacity.

In case of Marshland irrigation, High amount of water is required at the time of land preparation for paddling. And Paddy fields maintain the water surface throughout most of the growing season, so losses due to percolation cannot be ignored.

Land preparation water (**varies depending on the soil texture**)

- Puddling water is considered to be 10 to 15 mm /day.
- Percolation is considered to be 1 to 10 mm/day.

When Net Irrigation Water Requirement is calculated for marshland irrigation, Crop water requirement in land preparation period should include land preparation water.

$$CWR \text{ (mm/day)} = ET_c \text{ (mm/day)} + \text{Land preparation water (mm/day)}$$

4.7.3 What is Effective Rainfall?

Some of the rainfall that reaches the ground evaporates or percolates downwards before it is used by crops. This means that not all of the rainfall is used by crop growth. Therefore, there is a concept called effective rainfall which is an estimate of the portion of rainfall that can be used for crop growth in the following manner.

1. A daily rainfall less than 5mm is neglected.
 2. If a daily rainfall exceeds more than 5mm/day and less than 80mm/day, 80% of the daily rainfall is considered to be effective.
 3. If a daily rainfall exceeds 80 mm/day, the effective rainfall is considered to be 64 mm/day
- ※This is typical method in Japan and there are several calculation method.

Example: Calculation of Effective Rainfall

Calculate effective rainfall for each day and obtain Total effective rainfall for half month.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rain fall (mm/day)	0	2	0	12	1	19	0	0	0	34	0	0	7	30	8
Effective Rain (mm/day)	0	0	0	9.6	0	15.2	0	0	0	27.2	0	0	5.6	24	6.4

Total of Effective Rainfall (mm/half month) = 88

4.7.4 Simple water balance on the plot level

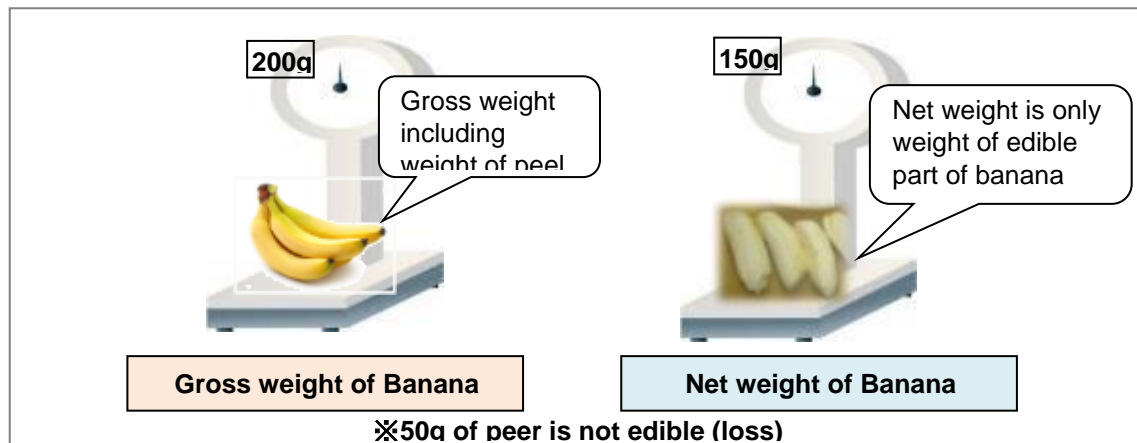
Considering the factors discussed to this point, it is necessary to consider whether irrigation is required or not, and If necessary, how much should be required for irrigation? This process is called 3.9.4 Simple water balance on the plot level.

- If Crop water requirement is smaller than **Effective rainfall such as** in case of heavy rainfall, Irrigation is not needed since sufficient quantities of water are provided by rainfall as compared to the amount of requirement.
- **If Crop water requirement** is greater than effective rainfall (e.g. rainfall is small and crop growth is intensive.) **Irrigation is needed.**
- Then, **Net Irrigation Water Requirement** is obtained the difference between Crop water requirement and Effective rainfall.

4.8 What is Gross and Net water requirement?

For example....

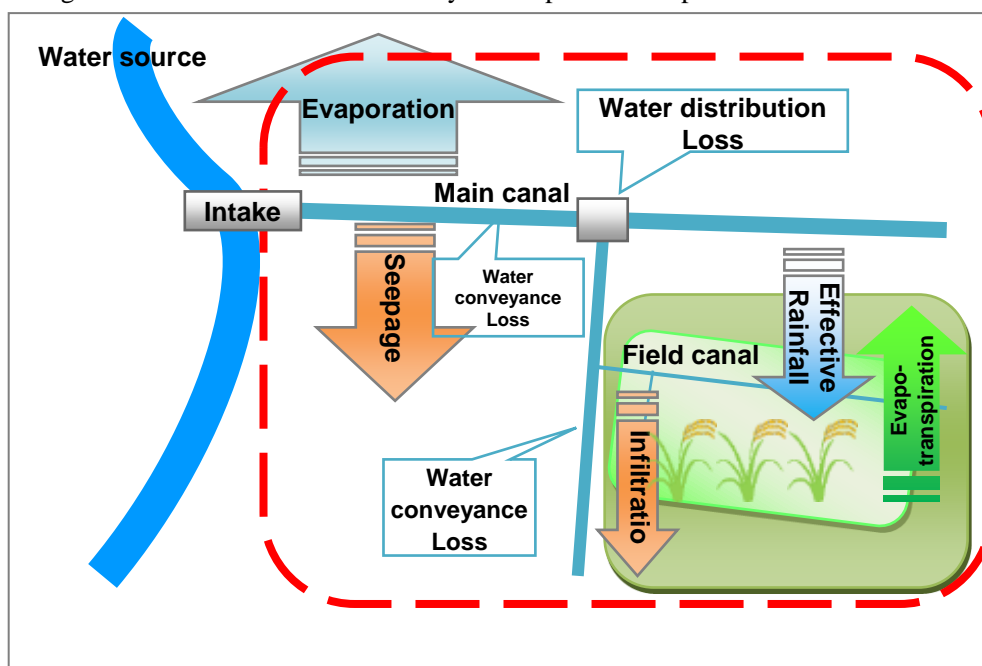
Gross weight of banana means whole weight including inedible part of the banana, and Net weight means weight of edible part of the banana.



In the irrigation scheme, there are also some of the loss of water. If water is not abstracted from the source taking into account the losses, the amount reaching the plots will be less than intended.

4.8.1 Main types of losses occurring in irrigation scheme

Water conveyance loss in the irrigation scheme are Evaporation & Seepage in canal and Water distribution loss such as leakage from stop log at turnout. Application loss in the plots are the amount of water irrigated in the field that is not used by the crop due to evaporation or infiltration.



4.8.2 Irrigation Efficiency (E_i)

Irrigation efficiency (E_i) is determined by the product of conveyance efficiency (E_c) and application efficiency (E_a) and is the ratio of the amount of water effectively used for crop growth in the plot to the amount of water taken from the water source.

$$\text{Irrigation efficiency: } E_i = E_c \times E_a$$

4.8.3 Conveyance efficiency (E_c)

Conveyance efficiency (E_c) is the ratio of the amount of water delivered to the plot to the amount of water taken from the water source.

$$\text{Conveyance Efficiency: } E_c = W_f / W_w$$

Conveyance efficiency determined by the condition of the canal in the scheme, and typical values are given in the table below.

Canal Condition	Conveyance Efficiency (E_c)
Earth lining	70%
Concrete lining	80-90%
Pipeline	95%

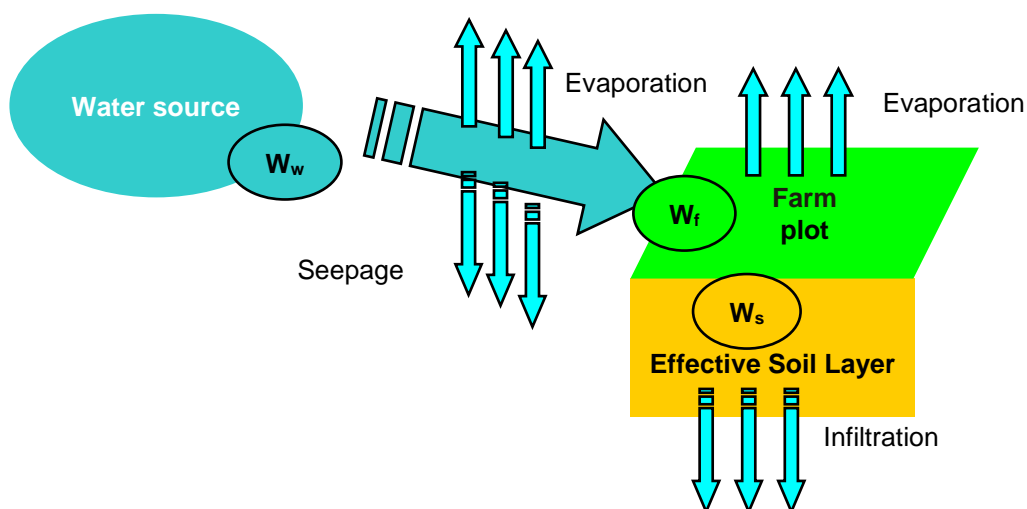
4.8.4 Application Efficiency E_a

Application Efficiency (E_a) is the ratio of the amount of water that reaches the field to the amount of water that remains within the effective soil layer and is used for crop growth.

$$\text{Application Efficiency } E_a = W_s / W_f$$

It varies depending on the irrigation method used in the plot and typical examples are given in the table below.

Irrigation method	Application Efficiency E_a
Surface irrigation	70%
Sprinkler irrigation	80-90%
Drip irrigation	95%



4.8.5 Calculation of Gross Water Requirement

Gross Water Requirement is Amount of water required for irrigation, taking into account losses from the

water source to the plot. Gross water requirements are obtained by dividing the net water requirement by the irrigation efficiency.

$$\text{Gross Water Requirement (mm/day)} = \text{Net Water Requirement} \div E_i$$

Net Water Requirement \doteq ET_{crop}: Crop Evapo-Transpiration (mm/day)

E_i : Irrigation Efficiency ($E_i = E_c \times E_a$)

The irrigation efficiency of using surface irrigation with a concrete canal scheme can be obtained as follows.

$$\text{Concrete lining} + \text{Surface irrigation} = 0.85 \times 0.70 = 0.60 (60\%)$$

The irrigation efficiency for drip irrigation in a pipeline scheme is given by the following equation

$$\text{Pipeline} + \text{Drip irrigation} = 0.95 \times 0.95 = 0.90 (90\%)$$

Example: $E_i=0.6$ (60%)

Month	Feb	Mar	Apr	May	Jun	July	Aug
ET _{crop} (mm/day)	0.7	1.3	3.5	6.1	7.1	7.2	5.5
E_i	0.6						
Gross Water Requirement (mm/day)	1.2	2.2	5.8	10.2	11.8	12.0	9.2

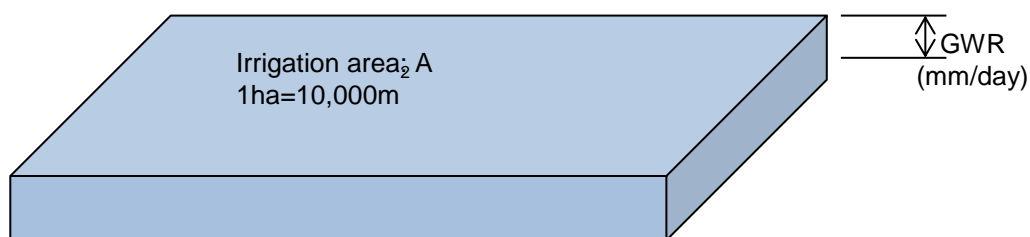
4.9 Irrigation Water Amount (IWA) (m^3/day) = $\text{GWR} \times A \times 10$

Irrigation Water Amount is based on the gross water requirement (mm/day) and converted into the amount of water required for the target area (m^3/day).

$$\text{Irrigation Water Amount (IWA) (m}^3/\text{day)} = \text{GWR} \times A \times 10$$

GWR: Gross Water Requirement (mm/day)

A : Irrigation area (ha)



Example: $A=1\text{ha}$

Month	Feb	Mar	Apr	May	Jun	July	Aug
Number of days	28	31	30	31	30	31	31
GWR (mm/day)	1.2	2.2	5.8	10.2	11.8	12.0	9.2
IWA	m³/day	12	22	58	102	118	92

Month	Feb	Mar	Apr	May	Jun	July	Aug
m³/month	336	682	1,740	3,162	3,540	3,720	2,852

4.10 Unit Gross (Irrigation) Water Requirement

Unit Gross (Irrigation) Water Requirement is the amount of gross irrigation water required per area, generally expressed in units of **m³/sec/ha** or **litter/sec/ha**. By multiplying this by the area of interest, the required discharge for that area can be determined.

Unit Gross Water Requirement (m³/sec/ha) = GWR (mm/day) × 10/86400

Unit Gross Water Requirement (litter/sec/ha) = GWR (mm/day) × 10,000/86400

Example:

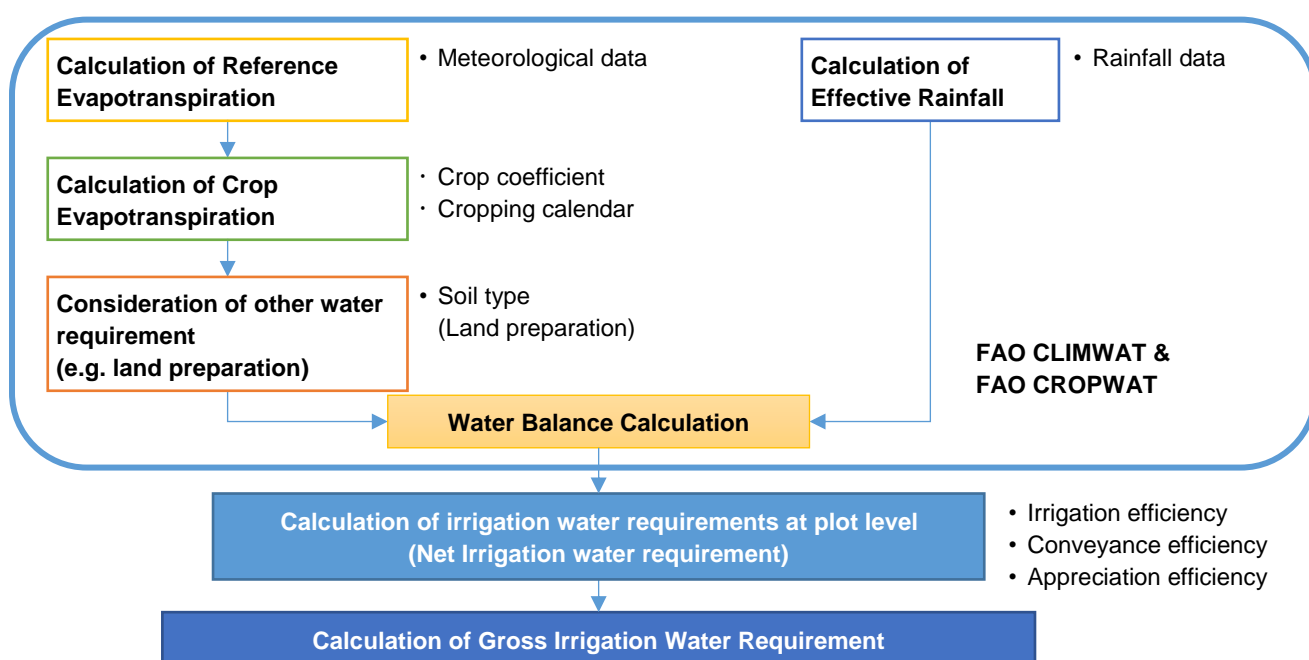
Month	Feb	Mar	Apr	May	Jun	July	Aug
GWR (mm/day)	1.2	2.2	5.8	10.2	11.8	12.0	9.2
Unit							
<u>m³/sec/ha</u>	0.00014	0.00025	0.00067	0.00118	0.00137	0.00139	0.00106
<u>litter/sec/ha</u>	0.14	0.25	0.67	1.18	1.37	1.39	1.06

Find the GWR (m³/sec) in March for an irrigation scheme with area of 100 ha.

100ha × 0.00025 m³/sec/ha (GWR in March) = 0.025 m³/sec

4.11 Flow of calculation of irrigation water requirement

Throughout this chapter, the method of determining the CWR from the meteorological data and the target crop to determine the required discharge to be supplied from the intake point has been described.



Chapter 5 How to use FAO Cropwat and Climwat

Content Type	Explanation of practical activities		
Objectives	This chapter describes the procedures for using FAO Cropwat and Climwat, from installation to Crop Water Requirement estimation. The objective of this chapter is to learn about the purpose, function, and use of these software.		
Outcomes	Understand the functionality of these software programs and be able to use them for their purposes.		
Lecturers:	RAB and District staff	Trainees:	FC (IWUO manager)

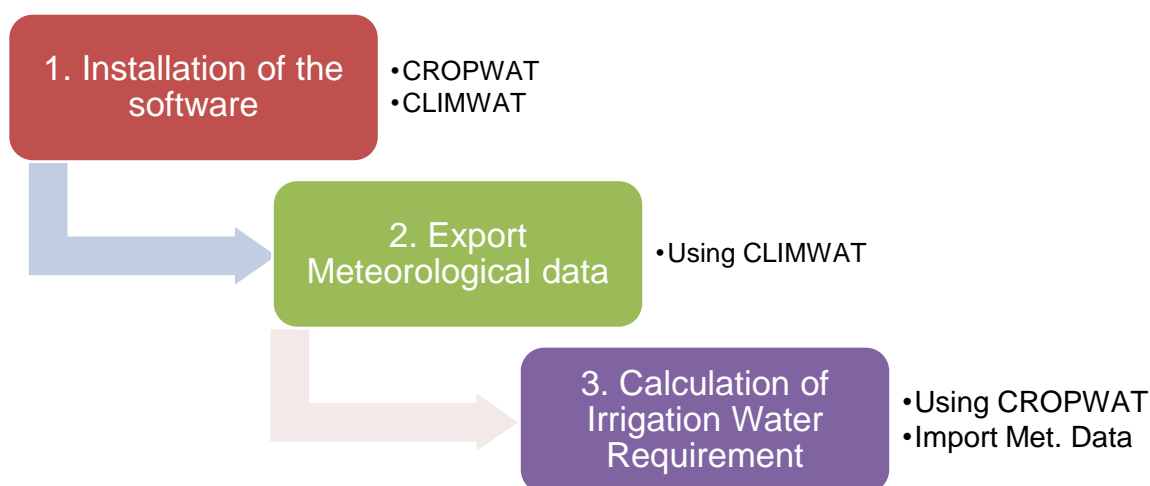
5.1 Introduction

Calculation of water requirement needs meteorological data and technical knowledge to determine the conditions for the calculation. However, software developed by FAO that is available for free can be used to calculate water requirement with relative simplicity, so this chapter explains how to use the software from its introduction to its actual use.

These software programs can provide simple estimates of irrigation water requirements and are useful as a first entry point when field information is limited. However, the weather data provided by the software is only available for three sites in Rwanda, and the calculations are based on many assumptions. Since the estimated results may differ from the actual conditions, this information should be used as an initial reference and adjustments should be made based on the actual conditions in the field. (It is not advisable to stick to the results of software calculations.)

5.1.1 Target for this chapter

This chapter has three main sections, as shown in the diagram below. The three steps are: 1. installing the software to be used, 2. exporting the meteorological data needed to calculate water requirement, and 3. setting the conditions for calculation of water requirement.

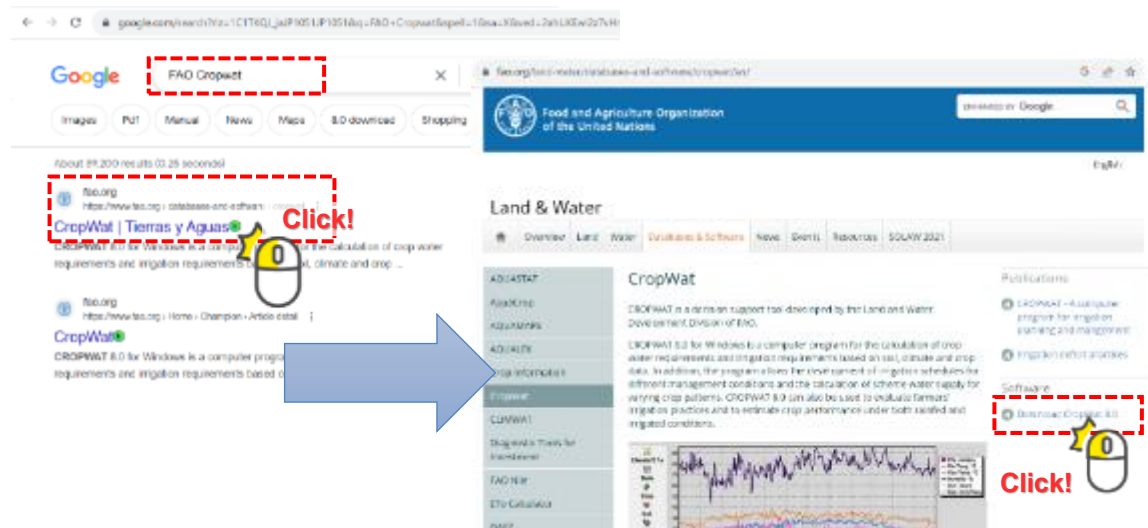


As this chapter requires a slightly more technical operation with the PC, the target users are assumed to be District, RAB Station and IWUO managers, who are likely to use the PC in their daily work.

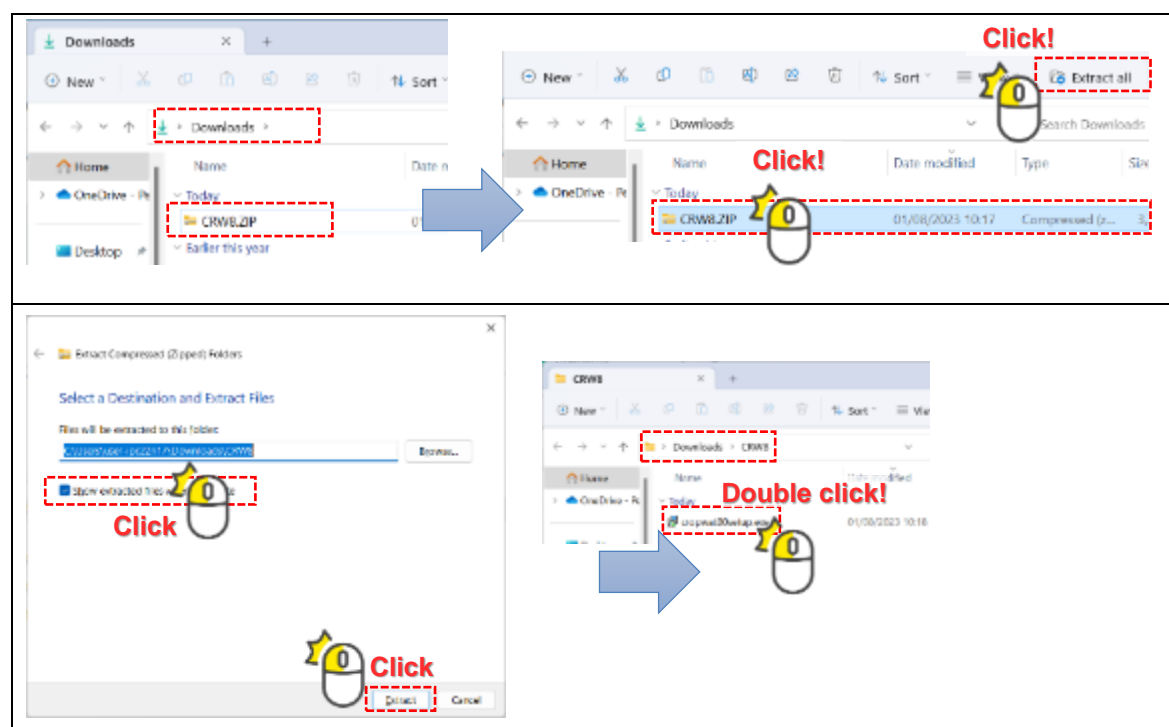
5.2 Installation of the software

5.2.1 FAO CROPWAT

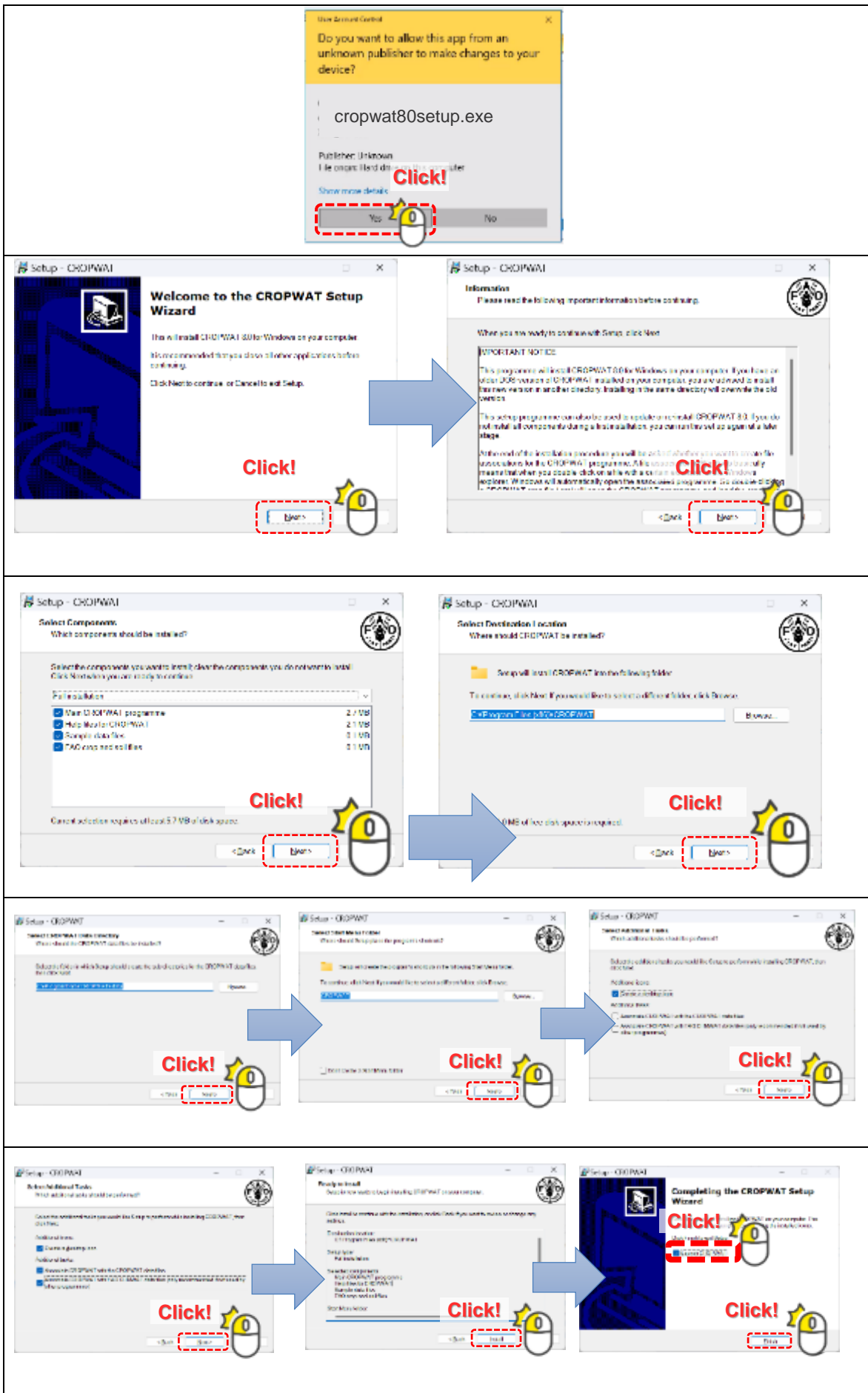
- Launch your Internet browser such as Google Chrome or Microsoft Edge, access a search engine, and search for “FAO CROPWAT”.
- Access the page shown in the picture on the right from the search results.
- Click “Download Cropwat 8.0”



- A zip file (CRW8.zip) containing the installer will be downloaded. Unzip the file and run “cropwat80setup.exe”.

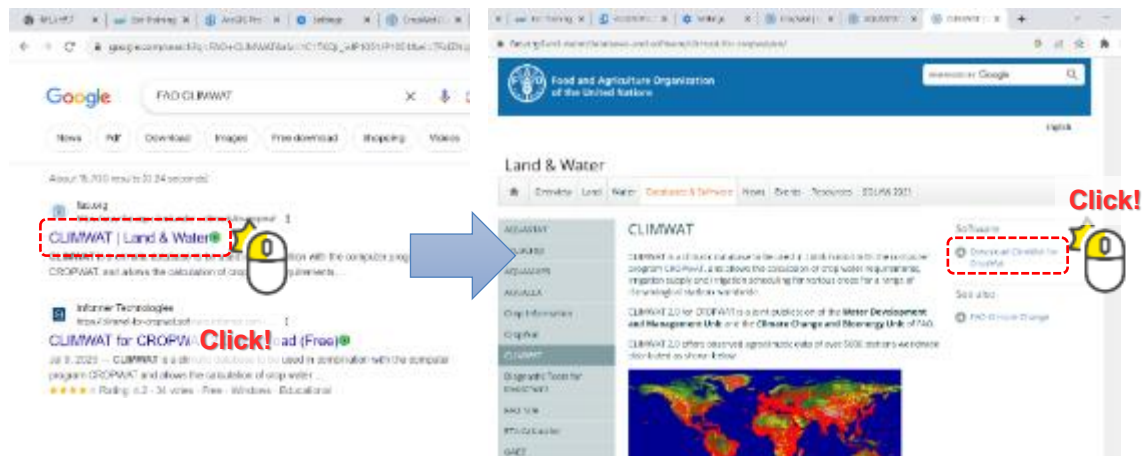


- Click on “Yes” and “Next” with the default settings.

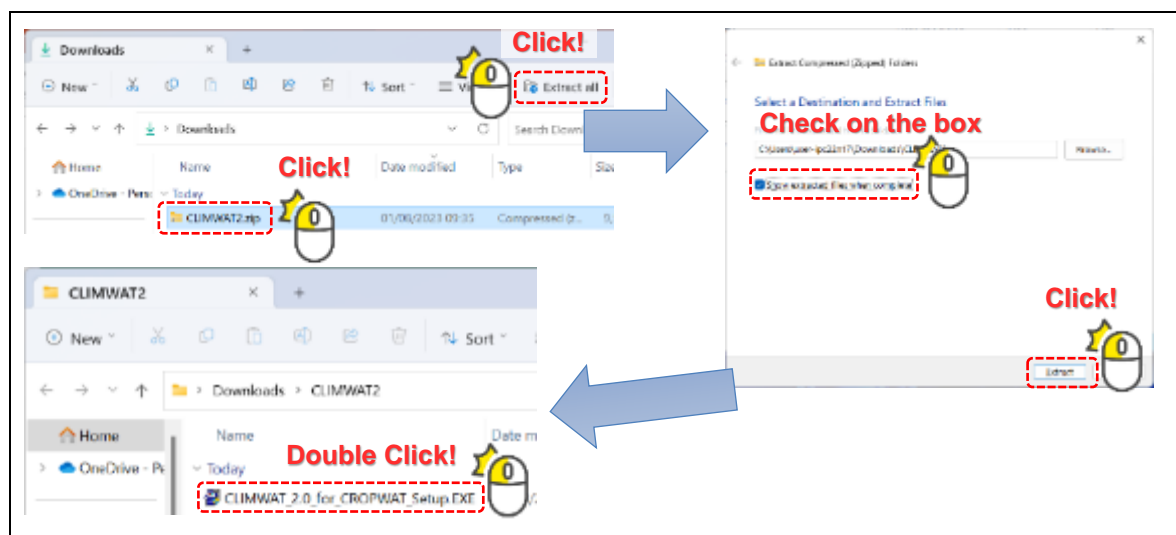


5.2.2 FAO CLIMWAT

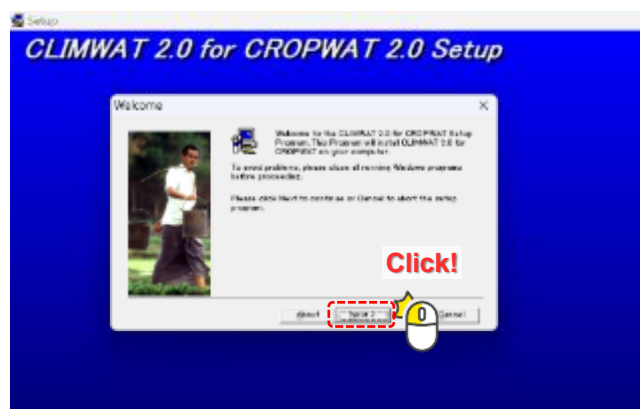
- Launch your Internet browser, access a search engine, and search for “FAO CLIMWAT”.
- Access the page shown in the picture on the right from the search results.
- Click “Download ClimWat for CropWat”



- A zip file (CLIMWAT2.zip) containing the installer will be downloaded. Unzip the file and run “CLIMWAT_2.0_for_CROPWAT_Setup.exe”.



- Click on Next with the default settings.





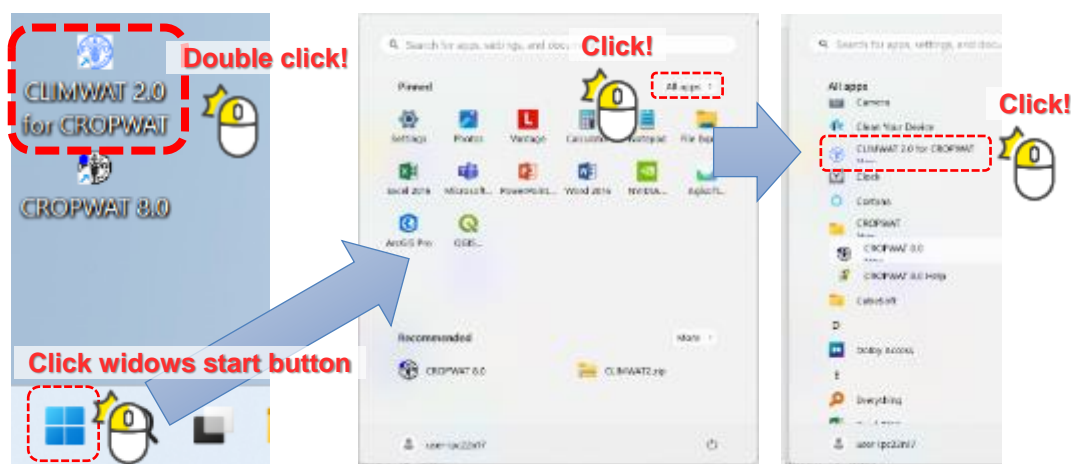
5.3 Export Meteorological data Using CLIMWAT

CLIMWAT is a climatic database to be used in combination with the computer program CROPWAT, and allows the calculation of crop water requirements, irrigation supply and irrigation scheduling for various crops for a range of climatological stations worldwide. CLIMWAT 2.0 for CROPWAT is a joint publication of the Water Development and Management Unit and the Climate Change and Bioenergy Unit of FAO. CLIMWAT 2.0 offers observed agro-climatic data of over 5000 stations worldwide distributed as shown below. The data can be extracted for a single or multiple stations in the format suitable for their use in CROPWAT¹.

¹ Source: <https://www.fao.org/land-water/databases-and-software/climwat-for-cropwat/en/>

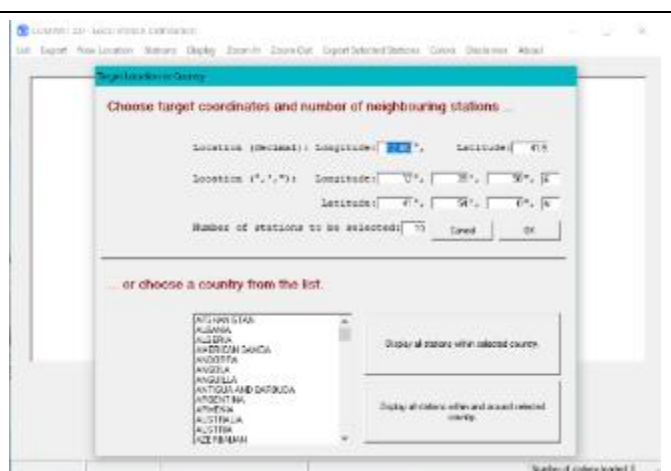
5.3.1 Launch the software

Double-click the desktop shortcut icon or click the Windows Start button and click the menu as shown below to launch the CLIMWAT.

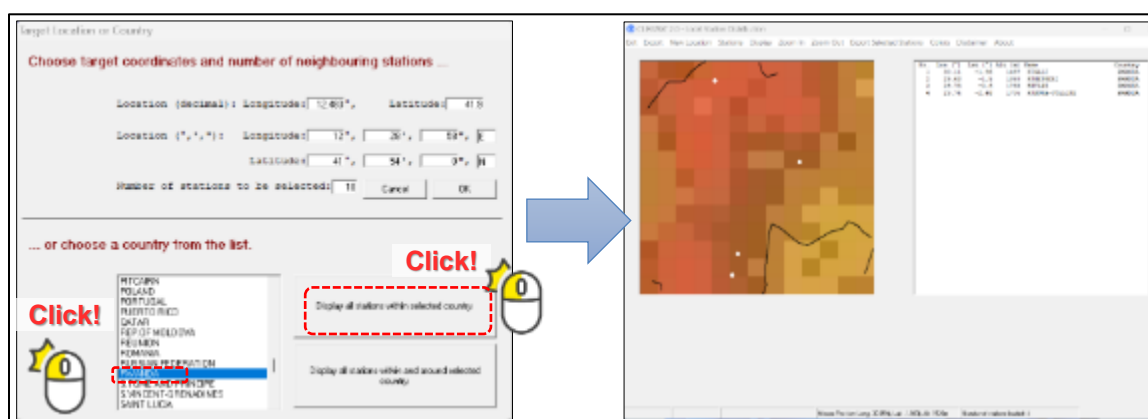


5.3.2 Target Location or Country

- If you know the coordinates (Latitude and Longitude) of the target site, enter the coordinates (in decimal degrees) at the top of the menu and click OK.
- Otherwise, first select the target country from the bottom of the menu and click "Display all station within selected county".
(If the target point is close to the border, click "Display all station within and around selected county".)



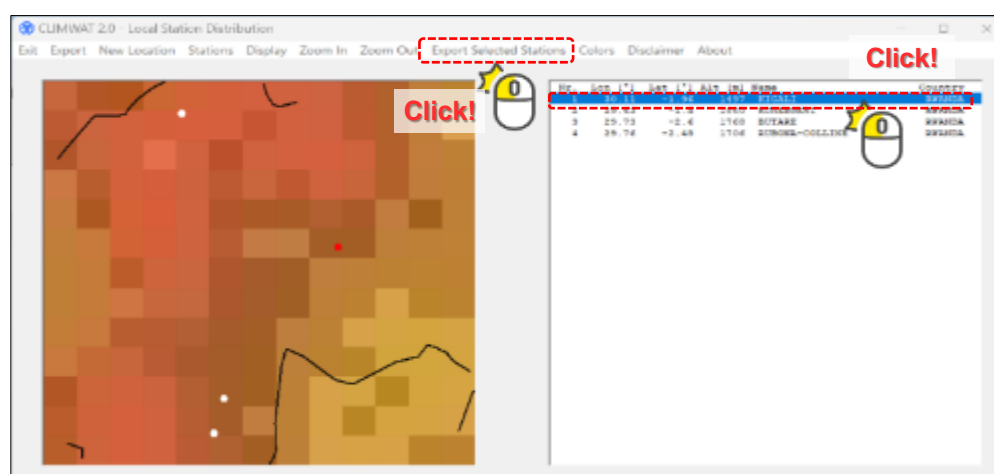
- In the example of operation, the procedure for exporting meteorological data for Kigali in Rwanda is shown.



- A map of the selected country is shown on the left and the location of the observatory is indicated by a dot.
- To select an observatory, click on it on the map.
- Table on the right shows the serial number, latitude, longitude, altitude, name of the observatory, and the country name.
- By clicking on the data in the table, the data is also selected and the points of the selected stations turn red on the map.



- Select the target station name in the table on the right and click "Export Selected Stations" on the menu bar.

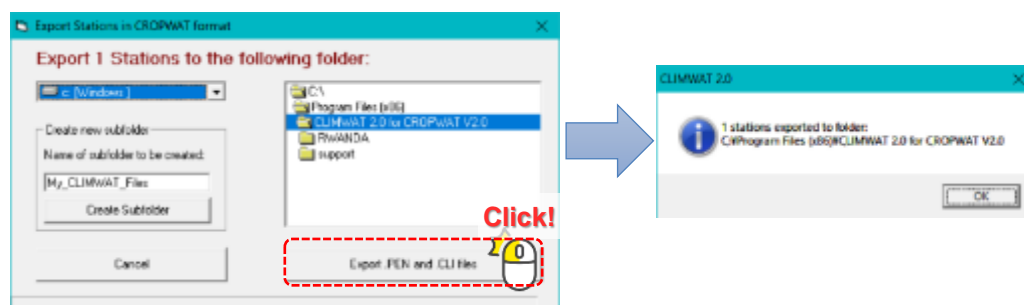


5.3.3 Export Stations in CROPWAT format

Select the export location, but leave the default settings first and click on "Export .PEN and .CLI files".

If you leave the default settings, the data will be stored in the folder "C:/Program Files (x86) /CLIMWAT 2.0 for CROPWAT V2.0".

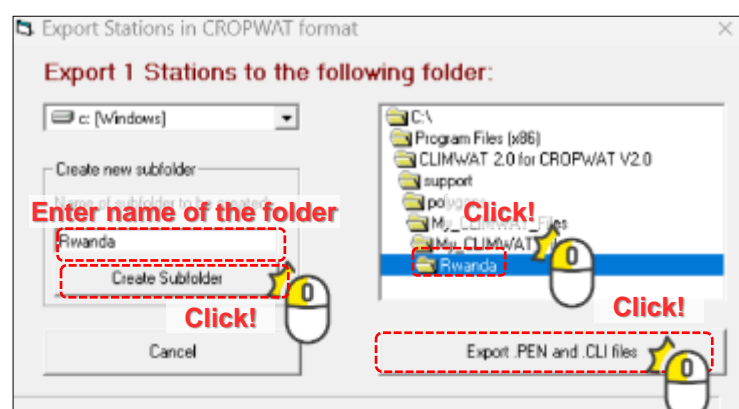
(When importing weather data in CROPWAT, refer to the save location above.)



5.3.4 Summary for Export from CLIMWAT

Through these steps, the necessary meteorological data has been exported from CLIMWAT.

When using data from various stations, it is recommended to create folders and organize them as shown in the figure.



5.4 Calculation of Irrigation water requirement using FAO CROPWAT

5.4.1 What is CROPWAT?

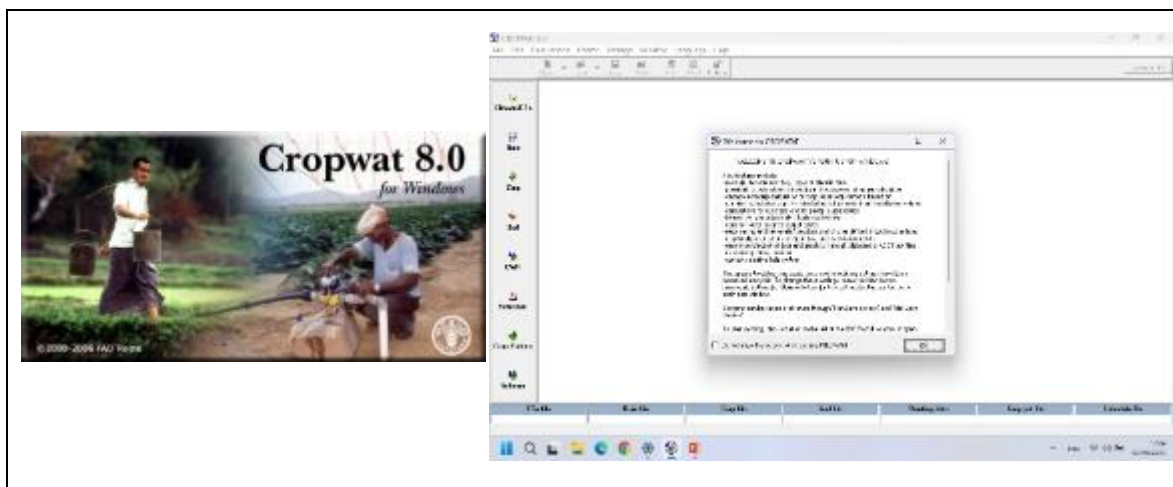
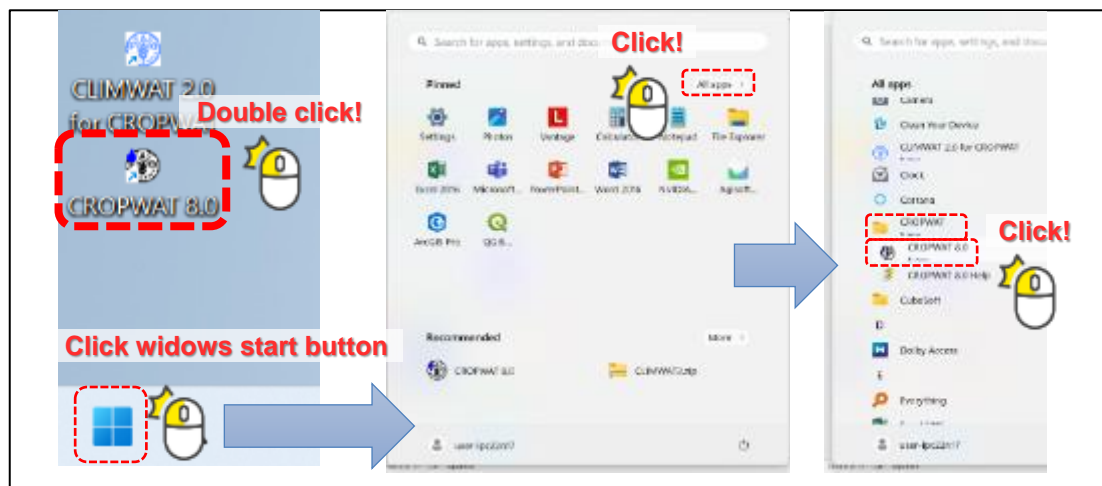
CROPWAT is a decision support tool developed by the Land and Water Development Division of FAO. CROPWAT 8.0 for Windows is a computer program for the calculation of crop water requirements and irrigation requirements based on soil, climate and crop data. In addition, the program allows the development of irrigation schedules for different management conditions and the calculation of scheme water supply for varying crop patterns. CROPWAT 8.0 can also be used to evaluate farmers' irrigation practices and to estimate crop performance under both rainfed and irrigated conditions.²

5.4.2 Launch the software

Double-click the desktop shortcut icon or click the Windows Start button and click the menu as shown

² Source: <https://www.fao.org/land-water/databases-and-software/cropwat/en/>

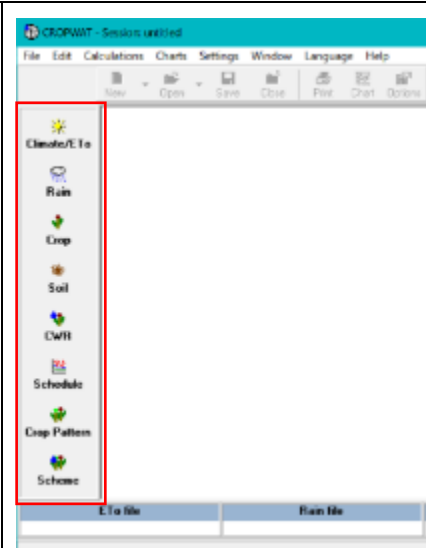
below to launch the CROPWAT.



5.4.3 CROPWAT interface

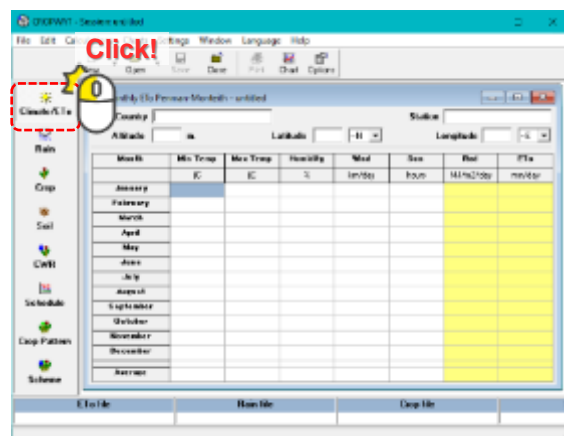
The picture on the right shows the main interface of Cropwat. Each of these functions is briefly described below.

- ☐ Climate/ETo :Input or import meteorological data for calculation of ETo
- ☐ Rain: Rainfall data for calculation of Effective rainfall
- ☐ Crop: Type of crop, cultivation schedule and period
- ☐ Soil: Soil condition related to water holding capacity
- ☐ CWR : Calculated crop water requirement
- ☐ Schedule : Irrigation schedule
- ☐ Crop Pattern : (Not used in this chapter)
- ☐ Scheme : (Not used in this chapter)



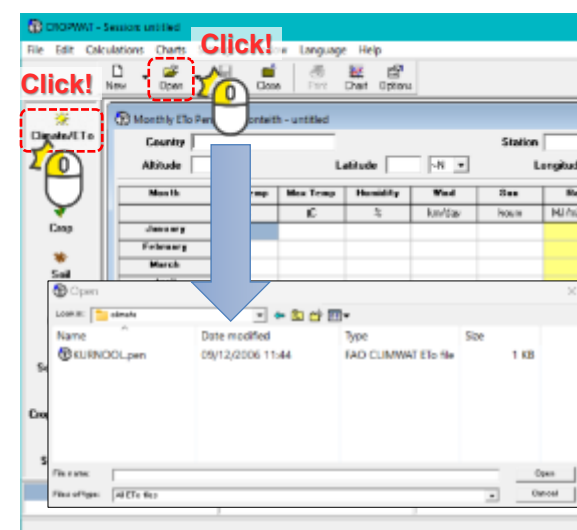
5.4.4 Climate/ET₀

- Click on "Climate/ET₀" to display the window shown in the image.
- Enter the meteorological data used for calculation of the Reference Evapotranspiration (ET₀).
- In this case, data is imported from CLIMWAT, but if observed meteorological data is available, ET₀ can be obtained by entering it together with the latitude and altitude of the observation point.

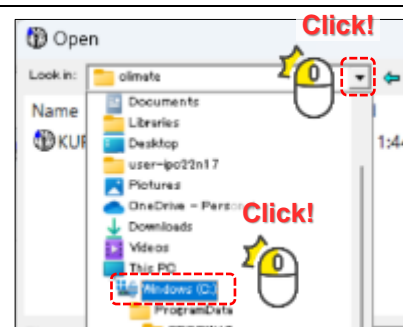


Import meteorological data exported by "CLIMWAT".

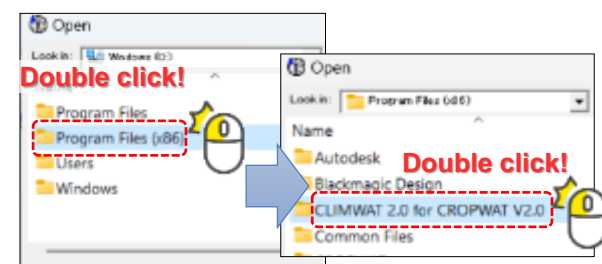
- Click "Open" icon.
- New window appear.



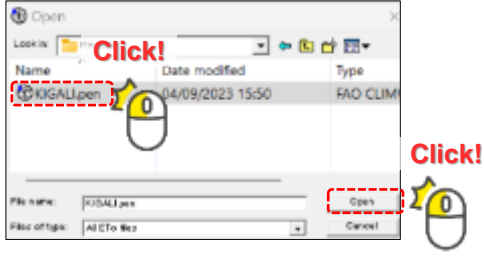
- Click on the triangle to the right of 'Look in:' in the newly opened window and click on 'Windows (C)'.




- Then double-click on the 'Program Files (x86)' folder and open it,
- Double-click on the 'CLIMWAT 2.0 for CROPWAT V2.0' folder and open it.



- Select and open the file exported in the previous section.
- In this **example**, select and open the file 'KIGALI.pen'.
- Depending on the settings of each individual PC, file extensions (such as .pen) may or may not be displayed. (They are shown in this picture).

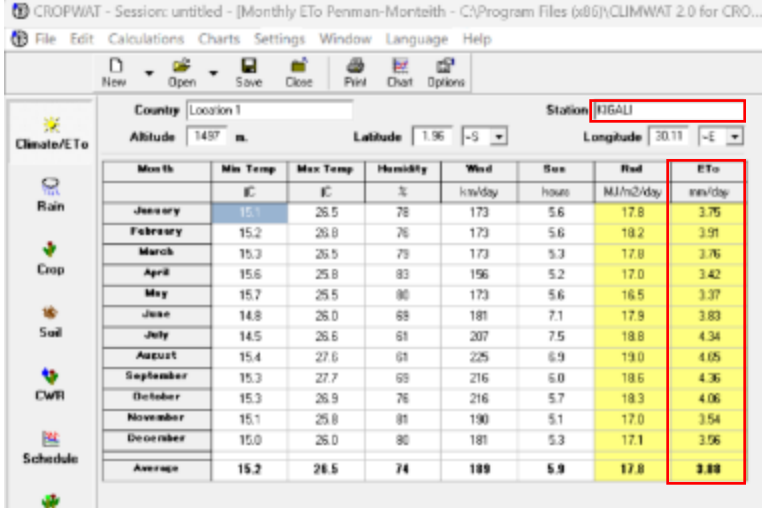


- Open the folder if you created a new folder when you exported the meteorological data on Climwat, and select the exported file.



Open the folder if a folder was created when exporting from CLIMWAT.

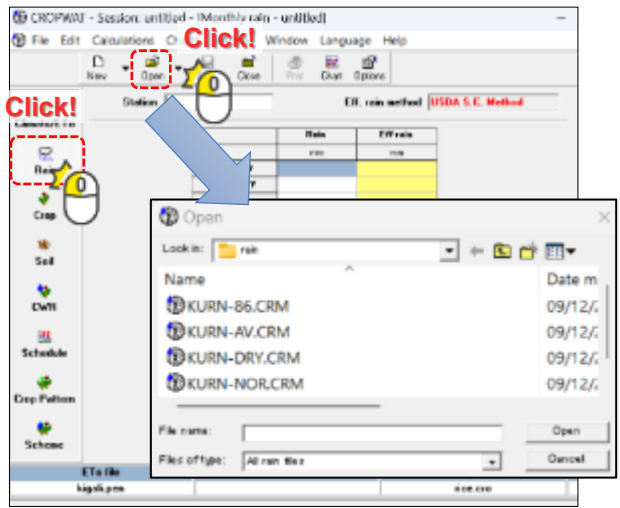
- Meteorological data exported from "CLIMWAT" is imported in this step.
- Automatically, ET_o is calculated and appears in the column on the far right of the table.

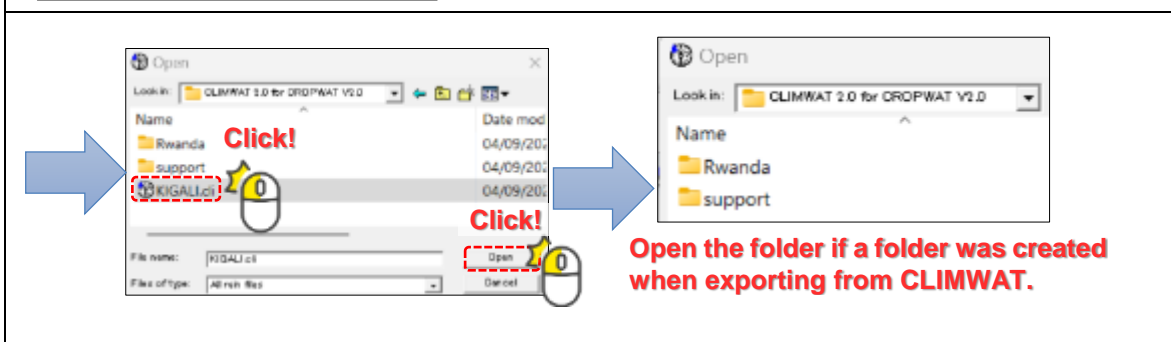
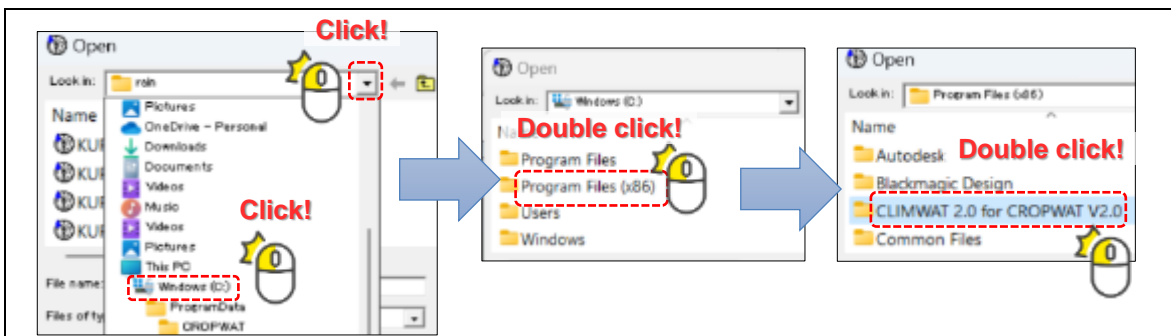


Month	Min Temp °C	Max Temp °C	Humidity %	Wind km/day	Sun hours	Rain mm/day	ETo mm/day
January	15.1	26.5	78	173	5.6	17.8	3.75
February	15.2	26.8	76	173	5.6	18.2	3.91
March	15.3	26.5	79	173	5.3	17.8	3.76
April	15.6	25.8	83	196	5.2	17.0	3.42
May	15.7	25.5	80	173	5.6	16.5	3.37
June	14.8	26.0	68	181	7.1	17.9	3.83
July	14.5	26.6	61	207	7.5	18.8	4.34
August	15.4	27.6	61	225	6.9	19.0	4.05
September	15.3	27.7	68	216	6.0	18.6	4.36
October	15.3	26.9	76	216	5.7	18.3	4.06
November	15.1	25.8	81	190	5.1	17.0	3.54
December	15.0	26.0	80	181	5.3	17.1	3.56
Average	15.2	26.5	74	189	5.9	17.8	3.88

5.4.5 Rain

- Click "Rain" icon.
- Import meteorological data exported from CLIMWAT using the same procedure as for Climate/ ET_o .

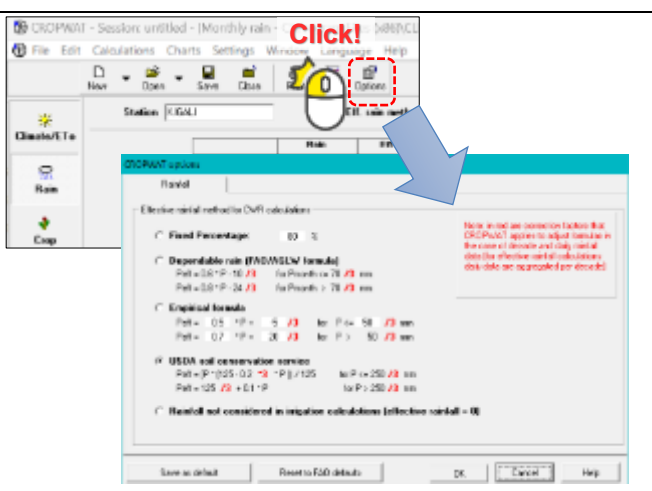




- The average monthly rainfall is imported and effective rainfall is calculated using the USDA S.C. Method in the default setting.

	Rain	Eff. rain
January	70.6	62.6
February	92.4	78.7
March	113.8	93.1
April	108.4	120.1
May	103.3	86.2
June	27.6	25.4
July	12.8	12.5
August	36.3	34.2
September	77.1	67.6
October	96.3	81.5
November	128.8	97.5
December	90.2	77.2
Total	1000.6	848.5

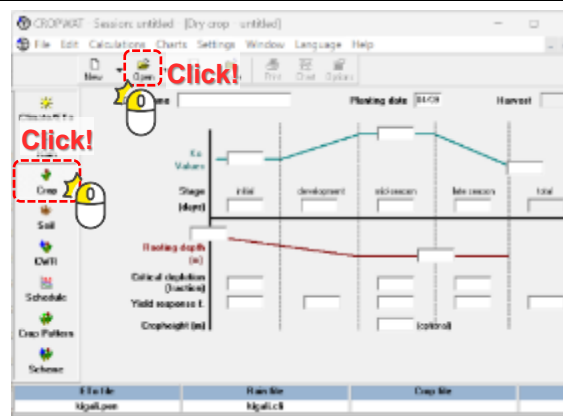
- The calculation method for effective rainfall can be selected from several conditions by clicking on the “Options” icon. (If the meaning of these options is not well understood, the default settings should basically be adopted.)



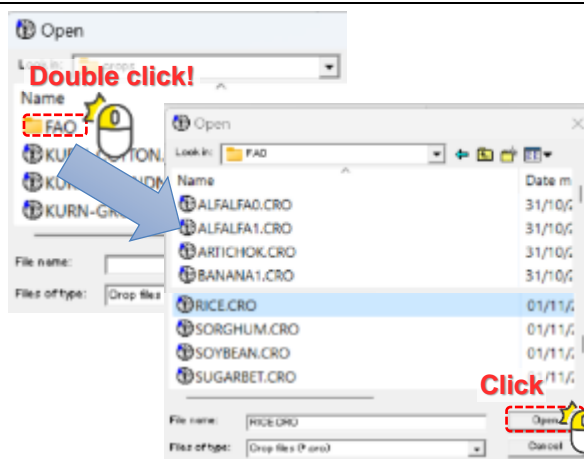
5.4.6 Crop

Set the conditions for the crops to be cultivated.

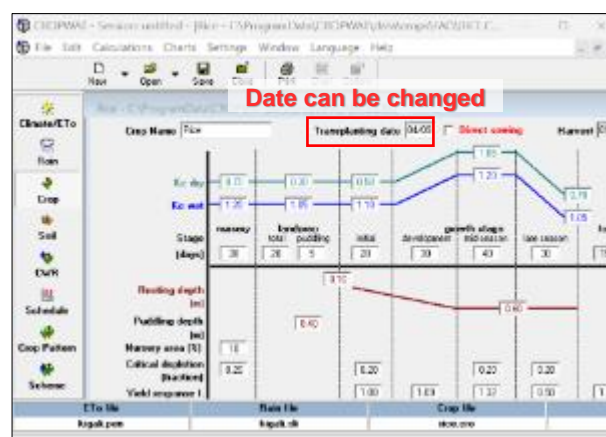
- Click on “**Crop**” icon.
- For the typical growing conditions of common crops, FAO has prepared a database, and the data will be imported.
- Click on “**Open**” icon.



- Double-click on the FAO folder and various crops will be shown.
- Here “RICE” is selected as an example.
- Depending on the settings of each individual PC, file extensions (such as .CRO) may or may not be displayed. (They are shown in this picture).



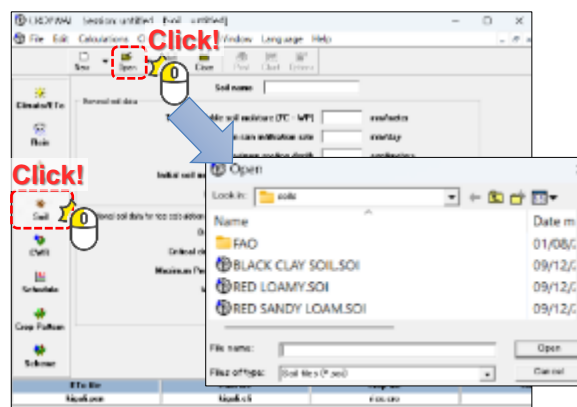
- The number of days in each growth stage of crop and parameters such as crop coefficients (K_c) are automatically filled in.
- The transplanting date (sowing date) can also be specified, and the date (DD/MM) at the time of the operation is entered as the default setting.



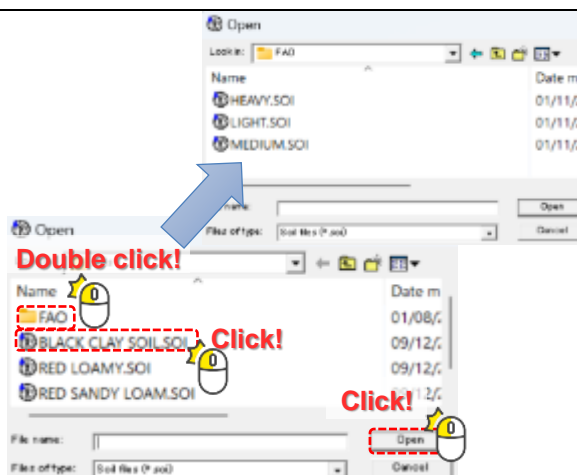
5.4.7 Soil

Set typical soil types of cultivated areas for the target irrigation scheme.

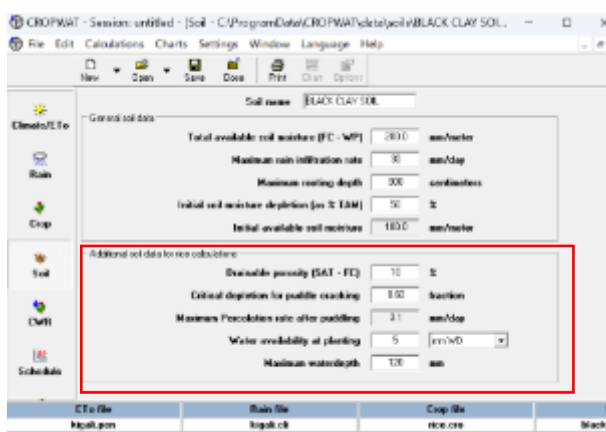
- Click on “Soil” icon.
- FAO has also created a database for typical soil data, and this information will be referenced and used.
- Click on “Open” icon.



- For soils, a total of six types are available.
- If “RICE” is selected, "BLACK CLAY SOIL" should be selected in principle (because if other soil types are selected, the parameters necessary for calculation of water requirement are not included in the dataset).



- Data is automatically imported.
- The lower part of the table is required parameters only when calculating water requirement for rice.



5.4.8 CWR

- Once the four parameters, Climate/ET_o, Rain, Crop and Soil are set properly, CWR (Crop Water Requirement) become be available.

CROPWAT - Session: untitled - [Crop Water Requirements]

File Edit Calculations Charts Settings Window Language Help

Climate To Rain Crop Soil CWR Schedules Crop Pattern Scheme

ET_o station: K.GALI Rain station: K.GALI Crop: Size: Planting date: 16/8

Month	Decade	Stage	Kc	ET _o	ET _c	ET _o - ET _c	ET _c - ET _o
			coeff	mm/day	mm/day	mm/day	mm/day
Jul	3	Har	1.20	3.52	0.5	0.5	0.5
Aug	1	Har/Lp	1.13	3.36	3.0	6.7	51.5
Aug	5	Har/Lp	1.06	4.35	48.5	102	28.5
Aug	3	Int	1.07	4.08	53.7	14.0	168.8
Aug	1	Int	1.10	4.90	48.0	19.4	29.6
Aug	3	Dens	1.12	4.75	47.9	26.7	23.2
Aug	1	Dens	1.15	4.08	48.0	25.5	22.4
Aug	5	Mid	1.19	4.88	48.0	27.1	28.9
Aug	3	Mid	1.19	4.63	50.9	28.9	22.0
Aug	1	Mid	1.19	4.42	44.2	31.9	12.4
Aug	5	Mid	1.19	4.21	42.1	34.2	6.0
Aug	3	Late	1.19	4.21	42.1	31.4	10.6
Aug	1	Late	1.15	4.08	48.0	27.8	13.0
Aug	5	Late	1.10	3.90	39.0	25.9	13.6
Aug	3	Late	1.05	3.01	35.7	15.2	2.8
					648.5	349.8	514.9

ET_o file: kgali.prm Rain file: kgali.rls Crop file: crop.cro Soil file: soil.cro

- Under current conditions, the maximum water requirement is expected in late August.
- 180.8 mm/ 10days of water per unit area is required.
- This means that 18.1 mm/ day of water is required. (180.8 mm divided by 10 days)

CROPWAT - Session: untitled - [Crop Water Requirements]

File Edit Calculations Charts Settings Window Language Help

Climate To Rain Crop Soil CWR Schedules Crop Pattern Scheme

ET_o station: K.GALI Rain station: K.GALI Crop: Size: Planting date: 16/8

Month	Decade	Stage	Kc	ET _o	ET _c	ET _o - ET _c	ET _c - ET _o
			coeff	mm/day	mm/day	mm/day	mm/day
Jul	3	Har	1.20	3.52	0.5	0.5	0.5
Aug	1	Har/Lp	1.13	3.36	3.0	6.7	51.5
Aug	5	Har/Lp	1.06	4.35	48.5	102	28.5
Aug	3	Int	1.07	4.08	53.7	14.0	168.8
Aug	1	Int	1.10	4.90	48.0	19.4	29.6
Aug	3	Dens	1.12	4.75	47.9	26.7	23.2
Aug	1	Dens	1.15	4.08	48.0	25.5	22.4
Aug	5	Mid	1.19	4.88	48.0	27.1	28.9
Aug	3	Mid	1.19	4.63	50.9	28.9	22.0
Aug	1	Mid	1.19	4.42	44.2	31.9	12.4
Aug	5	Mid	1.19	4.21	42.1	34.2	6.0
Aug	3	Late	1.19	4.21	42.1	31.4	10.6
Aug	1	Late	1.15	4.08	48.0	27.8	13.0
Aug	5	Late	1.10	3.90	39.0	25.9	13.6
Aug	3	Late	1.05	3.01	35.7	15.2	2.8
					648.5	349.8	514.9

ET_o file: kgali.prm Rain file: kgali.rls Crop file: crop.cro Soil file: soil.cro

5.5 Exercise

With the previous explanations, it is now possible to calculate the water requirement.

Through an exercise, try to understand what it means using the daily water requirement obtained in the previous explanation.

Exercise: How many m³ of water per day is needed to provide sufficient irrigation water for the entire cropped area?

Given condition:	Maximum water requirement : <u>18.1 mm/day</u>
	Command area: <u>100ha</u>

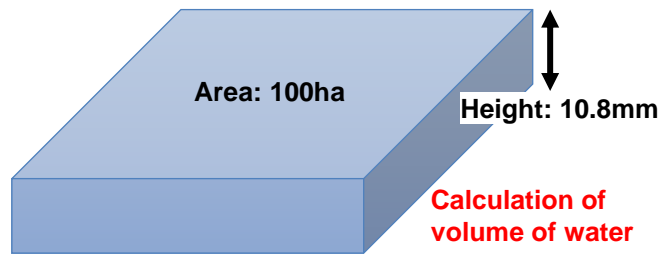
HINT (Unit conversion)

$$18.1 \text{ mm} \times 100\text{ha} = ???\text{m}^3$$

$$\square 18.1 \text{ mm} = ??? \text{ m}$$

$$\square 100 \text{ ha} = ??? \text{ m}^2 \text{ (1ha=10,000 m}^2\text{)}$$

Then, how many m³ of water per second
would need to be supplied?

**Answer:**

$$0.0181\text{m/day} \times 1,000,000\text{m}^2 = 18,100\text{m}^3/\text{day}$$

$$= 18,100 \text{ m}^3/\text{day}/24\text{hour} = 754 \text{ m}^3/\text{hour}$$

$$= 754 \text{ m}^3/\text{hour}/60\text{min} = 12.6 \text{ m}^3/\text{min}$$

$$= 12.6 \text{ m}^3/\text{min}/60\text{sec} = \underline{0.209 \text{ m}^3/\text{sec}}$$

Chapter 6 Preparation of Water distribution diagram

Content Type	Theory and Explanation of practical activities		
Objectives	This chapter introduces water distribution diagram, explains its purpose, and describes how to prepare it. These are not yet common in Rwanda, but the objective is to understand the meaning of this diagram and the procedure for its preparation.		
Outcomes	Understand the purpose of water distribution diagram and be able to prepare their own diagram for their irrigation scheme.		
Lecturers:	RAB and District staff	Trainees:	Leaders of IWUO, Local leaders and FC (IWUO manager)

6.1 Introduction

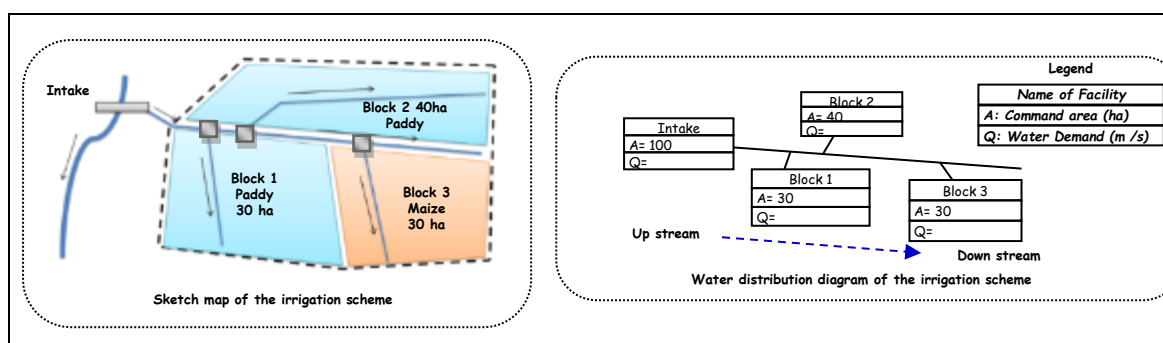
In this chapter, a detailed explanation of the preparation procedure for Water distribution diagram will be given for the example. Using the explanation as a reference, the **participants** will prepare a water distribution diagram based on the scheme maps of their own irrigation schemes.

6.2 What is Water Distribution Diagram

Water distribution diagram shows canal network, spatial distribution of irrigation blocks and diversion facilities and **how much irrigation water is required at each zone (block)**. This diagram is useful to know how much water should be divided at each diversion structure, how much water need to flow in the canal and how much water should be supplied to each irrigation zone or block.

By using Unit Gross (Irrigation) Water Requirement which is calculated and area of each zone (block), water distribution diagram is able to be prepared.

Based on the Sketch map of the irrigation scheme or satellite image, Water distribution diagram is prepared. The area of each zone (or block) is required, and this information is obtained based on the information in the water user list in general.



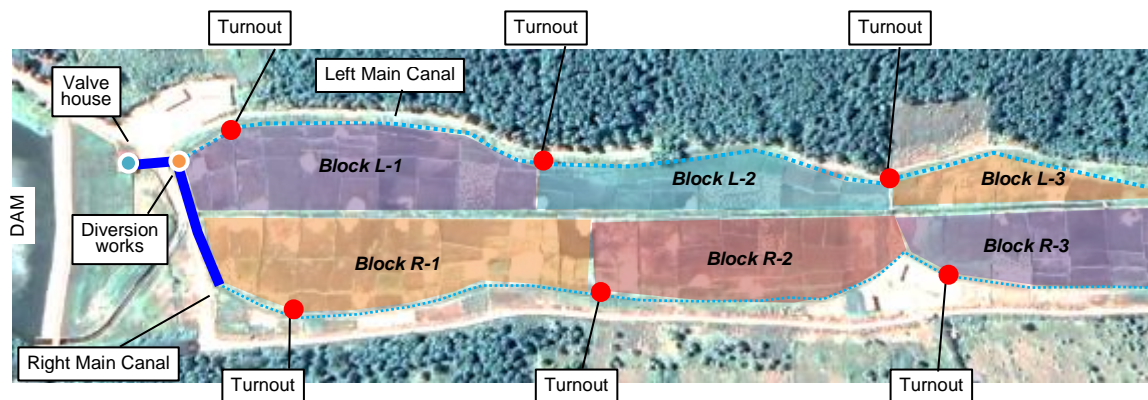
A detailed explanation of the preparation procedure for Water distribution diagram is given for the examples.

6.3 Schematic representation of the required facilities and information about them

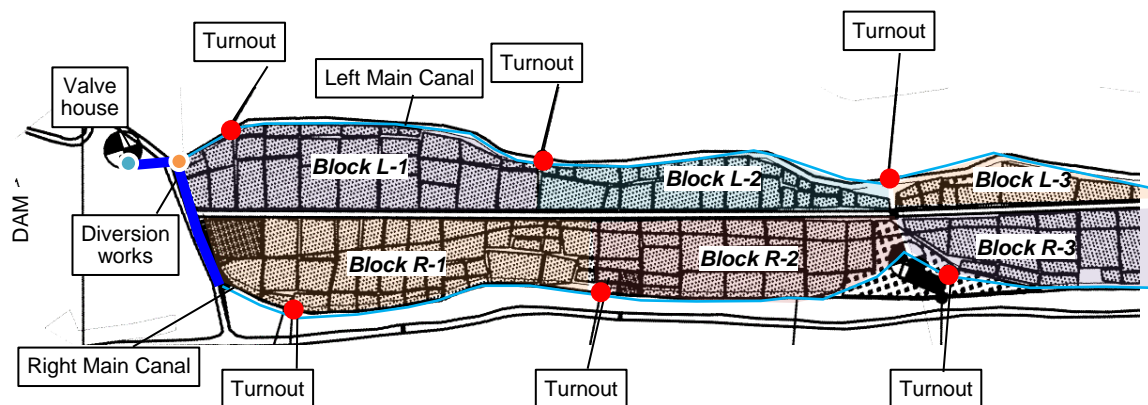
For the following facilities, a simplified diagram should be drawn to show the location and network.

1. Water source facilities (Dam, diversion weir on the river or stream, spring.)
2. The network of main canals from the water source facilities
3. Diversion facilities on the main canal and the area of farmland to be diverted from it (Division box, Turn out)

In this part, the procedure is explained with specific examples. When satellite imagery is used as a base map, the main facilities are captured to Water distribution diagram as follows.



When the existing map such as a drawing or hand sketch, Basically steps are same as previous explanation.

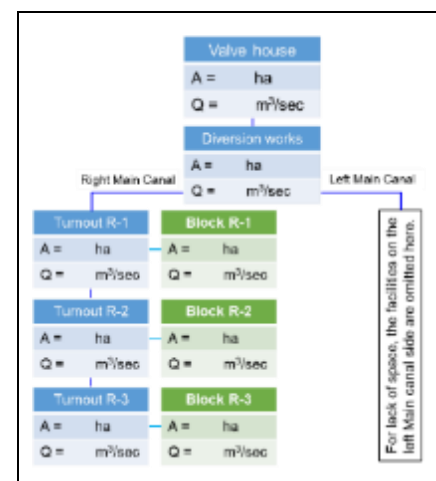


6.4 Draw a diagram based on the location of facilities.

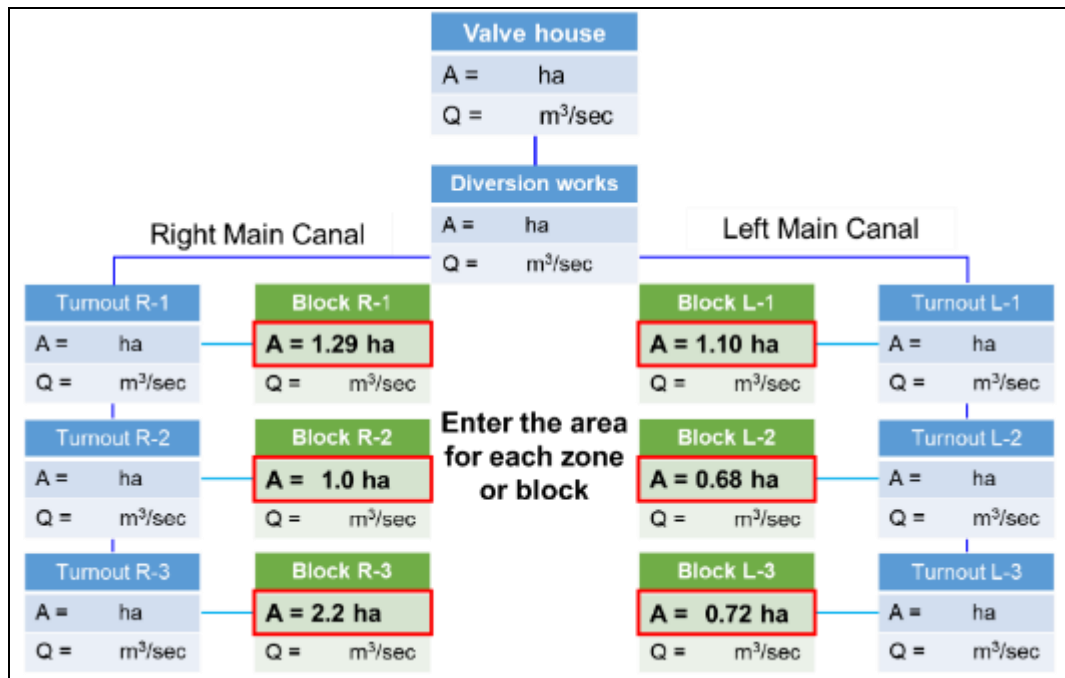
The location of each facility was identified from the map, drawings or sketches, then is displayed schematically.

When preparing the diagram, it is easier to understand if the upper part of the paper is presented as upstream and the lower part as downstream, as it is easier to imagine the flow of water intuitively. (It is not necessary to stick to the map orientation or actual direction)

Indicate the facility in a box like on the right, with columns for the name of the facility, the beneficiary area and the discharge rate. (At this stage, the area and discharge columns can be left blank.)



The area of each zone (or block) needs to be filled by summing up the each farmer's area based on the water users' list. (If no information is available, a simple measurement is done using Google Earth).



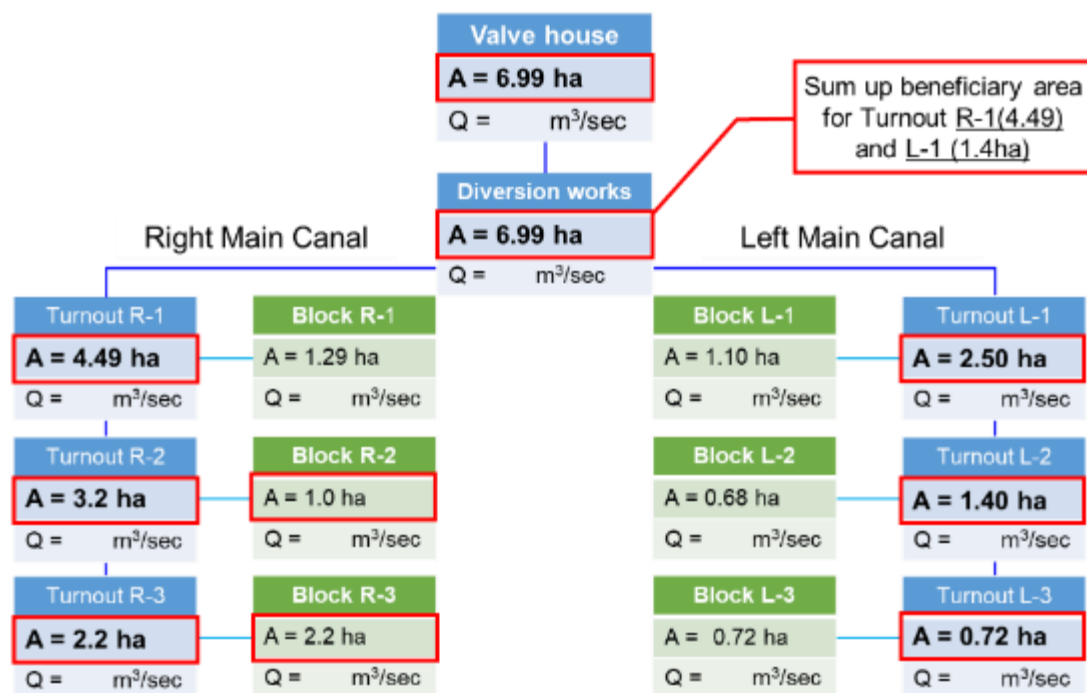
From the downstream side, the beneficial area covered by each facility is summed up.

In the case of Turnout R-3, the area of Block R-3 is entered.

In the case of Turnout R-2, it is the sum of the beneficiary area of Block R-2 and the beneficiary area irrigated by Turnout R-3.

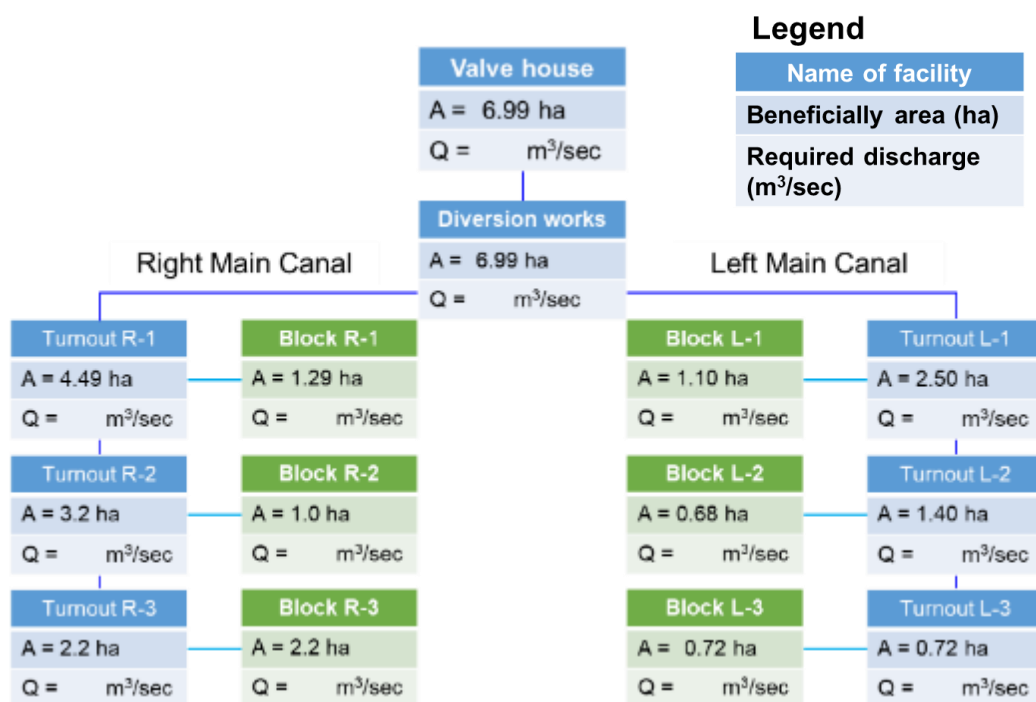
A similar process is applied to each facility to calculate the beneficiary area up to the water source facility.

In the example, the results are as follows.



The outcome of this practice is a sketch showing the location of the facilities and the beneficiary area for

each facility and plot, as shown in the diagram on the right.



6.5 Practise 1

Prepare a Water distribution diagram as an exercise to calculate a water distribution plan based on the current water distribution conditions for the participant's own irrigation scheme.

6.6 Example 1: Formulation of Water Distribution Plan in case of time sharing method

In this practice, a Water Distribution Plan will be considered under the following conditions.

Main Crop: Rice

Gross water requirement :

Land preparation period: 0.0027 m³/sec/ha

Ordinal period (after transplanting to harvest): 0.0010 m³/sec/ha

Irrigation hours: 12 hours

Water sharing method: Time sharing method (every other day on the left and right side).

6.6.1 Converting unit growth water requirement according to irrigation time

The calculation method will be explained here using the gross water requirement for the ordinary period (0.0010 m³/sec/ha). As the irrigation time is 12 hours, the amount of water to consider this can be obtained from the following equation.

Required discharge at a given irrigation time

$$= \text{Gross unit water requirement} \times \text{Area} \times \frac{24 \text{ hour}}{\text{Irrigation time}}$$

As the area of each Block is multiplied in a later process, it is handled here as the Area. (the actual area for each zone or block will be used later)

$$= 0.0010 \text{ m}^3/\text{s}/\text{ha} \times \text{Area} \times \frac{24 \text{ hour}}{12 \text{ hours}} = \underline{0.0020 \text{ m}^3/\text{sec}/\text{ha}} \times \text{Area}$$

6.6.2 Converting unit growth water requirement according to irrigation interval

The unit gross water requirement (GWR) obtained is then used to determine unit GWR according to the irrigation interval based on the water distribution method.

In this case, both sides of the river are irrigated every other day, so the amount of water for two days required to be supplied in one irrigation day.

Required discharge at a given irrigation interval

$$= \text{Unit Gross Water Requirement} \times \text{Area} \times \text{Irrigation Interval (Days)}$$

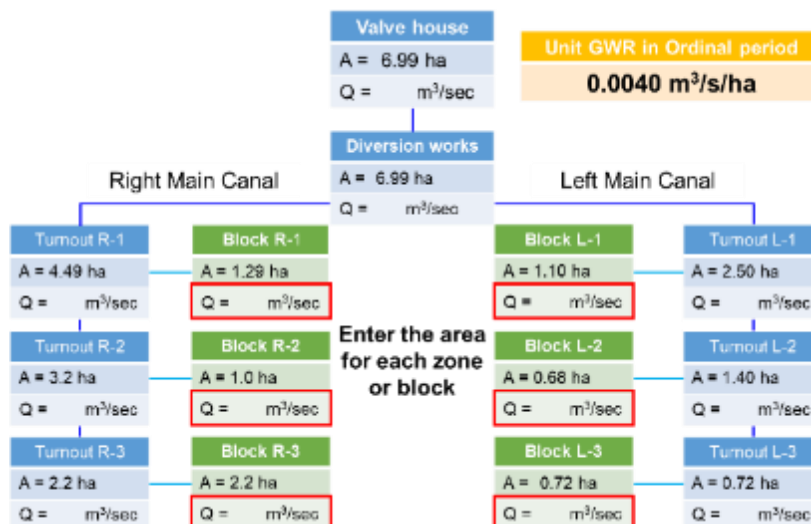
$$= 0.0020 \text{ m}^3/\text{s}/\text{ha} \times \text{Area} \times 2 \text{ Days} = \underline{0.0040 \text{ m}^3/\text{sec}/\text{ha}} \times \text{Area}$$

The volume of supply (discharge) required for each irrigation day is calculated in the next section using the unit water requirement obtained from the calculations explained up to this point.

6.6.3 Calculation of irrigation water requirement to each block based on water distribution conditions.

Based on the unit Growth Water Requirement above, the discharge to be supplied to each facility or irrigation block is calculated using water distribution diagram. At first, it is obtained by multiplying the Area for each block by unit GWR.

For example. Block R-1 is $1.29 \text{ (ha)} \times 0.0040 \text{ (m}^3/\text{sec}/\text{ha)} = 0.00516 \text{ (m}^3/\text{sec)}$

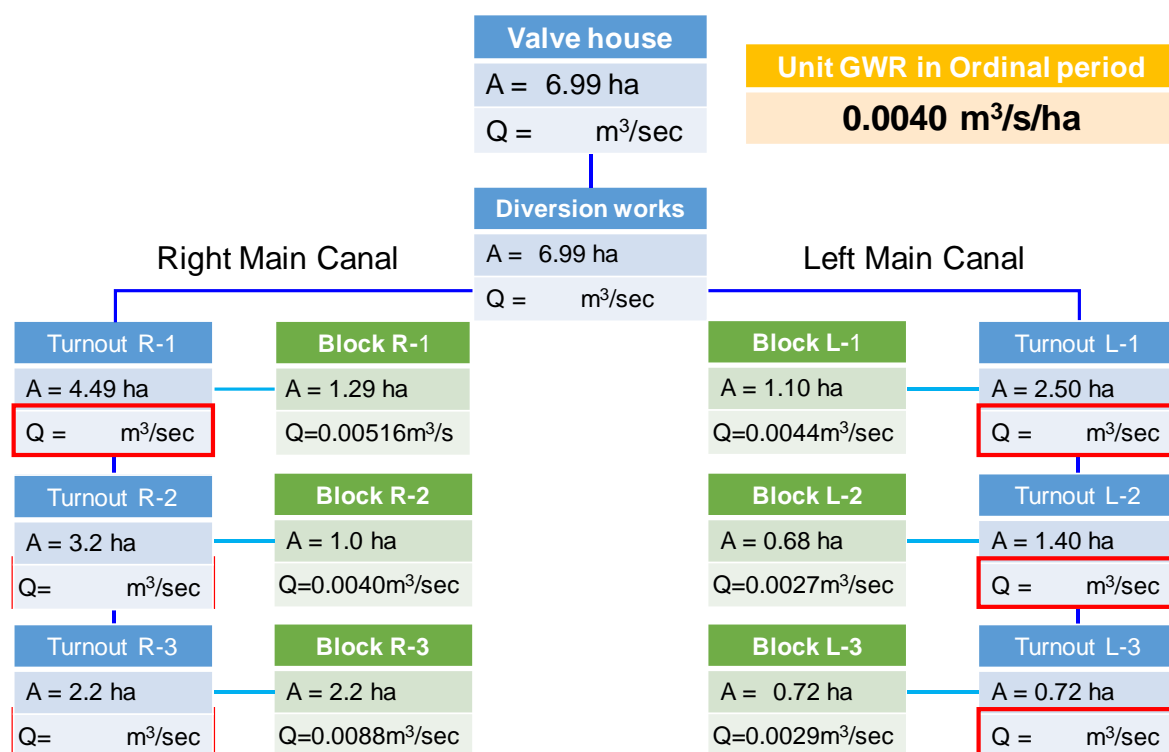


6.6.4 Calculation of irrigation water requirement to each facility (Turnout) based on water distribution conditions.

Once the discharge of all Blocks has been determined, the discharge of each facility's beneficiary Block is summed up from the downstream side, similarly to the calculation of the area.

- For Turnout R-3, $Q = 0.0088 \text{ m}^3/\text{sec}$
- For Turnout R-2, $0.0088 + 0.0040 \text{ m}^3/\text{sec} = 0.0128 \text{ m}^3/\text{sec}$

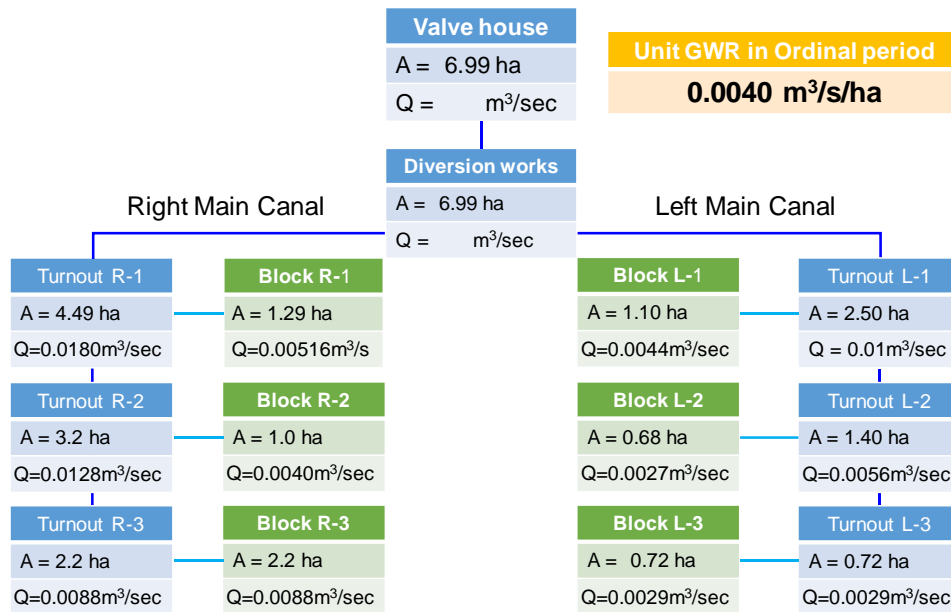
Calculate Discharge for other facilities as well.



6.6.5 Calculation of irrigation water requirement to each facility (Diversion works)

Once the discharge calculations for each Turnout have been completed, also calculate the discharge at the Division works.

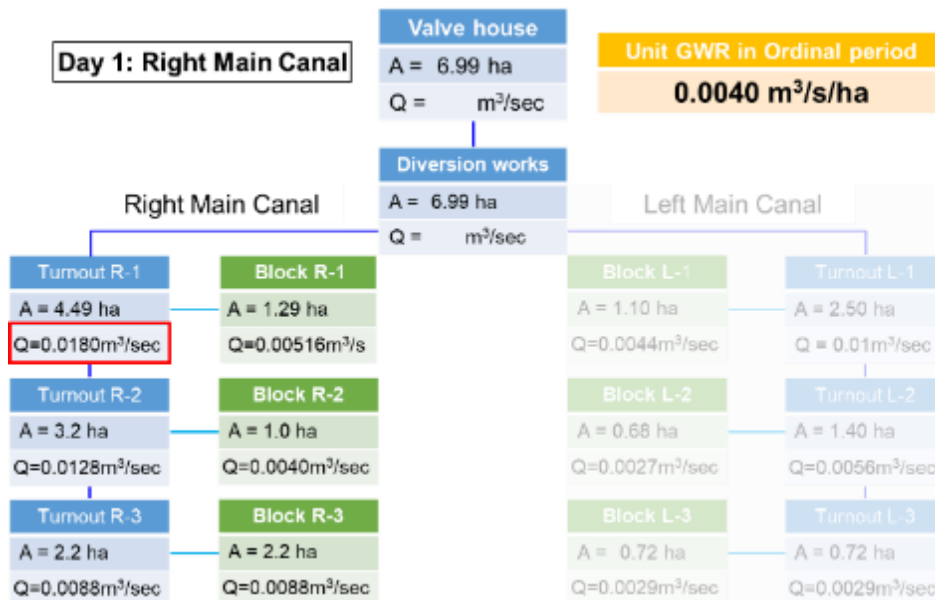
In this step, let's prepare the case for Day 1 (For Right Main Canal) and Day 2 (For Left Main Canal) respectively.



6.6.6 Required discharge per irrigation day

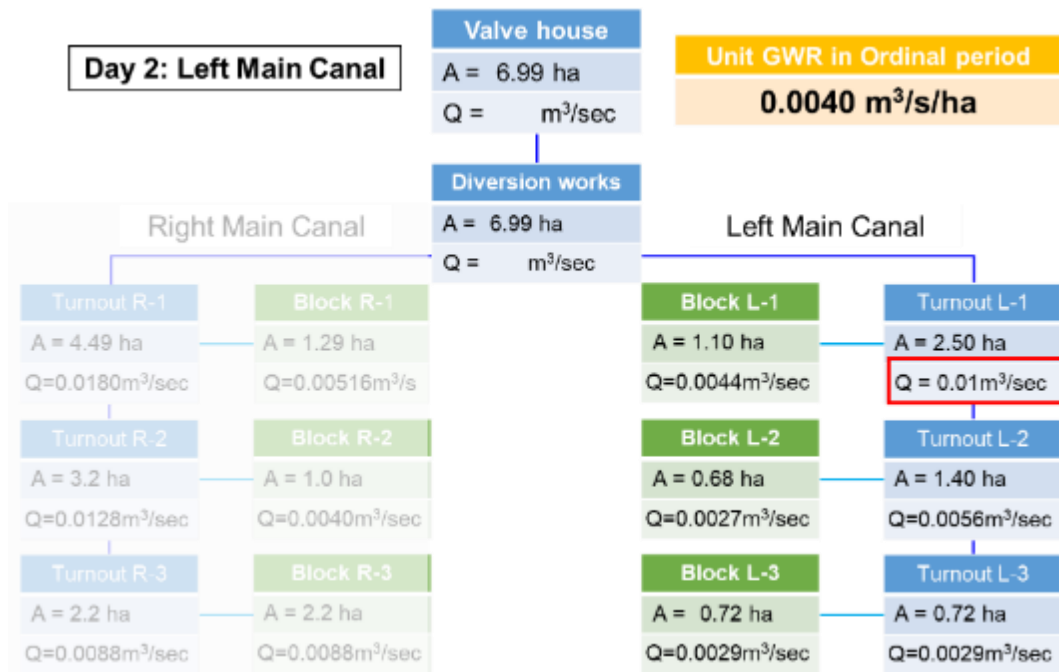
(1) For Day 1

Let's start with Day 1 for the Right Main Canal, it is required to supply $0.0180 \text{ m}^3/\text{sec}$ of irrigation water toward Turnout R-1, so $0.0180 \text{ m}^3/\text{sec}$ of water needs to be diverted at Diversion works to Right Main Canal.



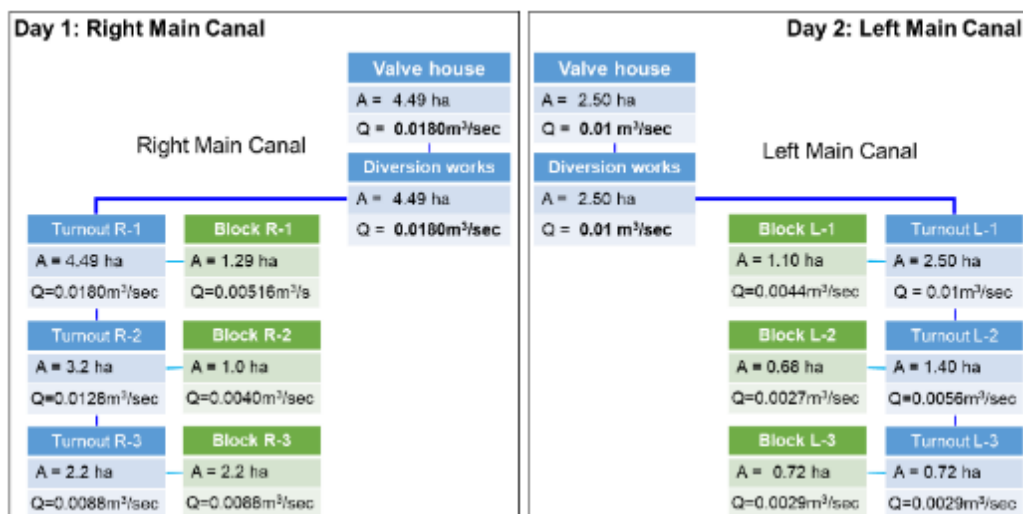
(2) For Day 2

Then for Day 2 for the Left Main Canal, it is required to supply $0.010 \text{ m}^3/\text{sec}$ of irrigation water toward Turnout L-1, so $0.010 \text{ m}^3/\text{sec}$ of water needs to be diverted at Diversion works to Left Main Canal.



6.6.7 Conclusion

Based on the results obtained up to this step, the required discharge to be taken on Day 1 and Day 2 respectively and supplied to each canal, turnout and block are shown using Water Distribution Diagram.



6.7 Example 1: Formulation of Water Distribution Plan in case of flow sharing method

In this practice, a Water Distribution Plan will be considered under the following conditions.

- Main Crop: Rice
- Gross water requirement :

Land preparation period: 0.0027 m³/s/ha

Ordinal period: 0.0010 m³/s/ha

- Irrigation hours: 24 hours

- Water sharing method: Flow sharing method (Irrigate everyday)

6.7.1 Converting unit growth water requirement according to irrigation time

In this case, the irrigation time is 24 hours and the irrigation is done every day, so the Unit GWR is calculated using the following formula.

Required discharge at a given irrigation time

$$= \text{Gross unit water requirement} \times \text{Area} \times \frac{24 \text{ hour}}{\text{Irrigation time}}$$

6.7.2 Converting unit growth water requirement according to irrigation interval

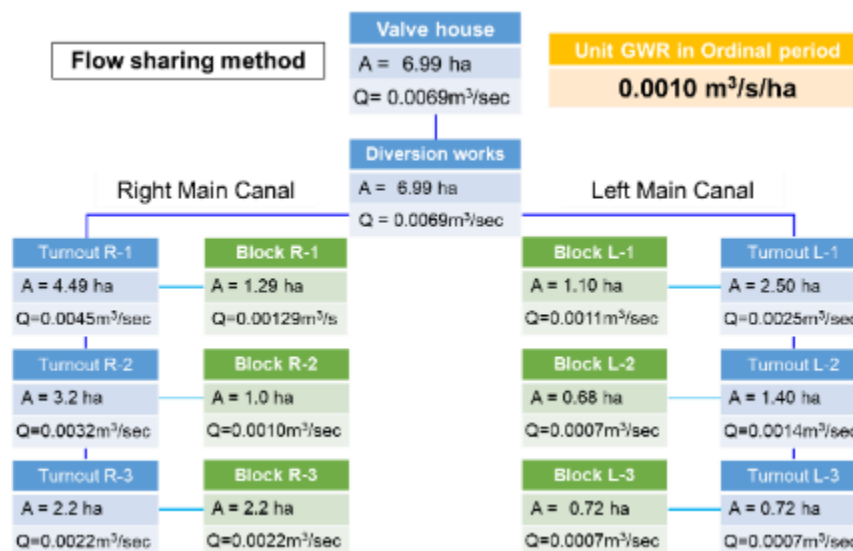
Required discharge at a given irrigation interval

= unit Gross water requirement \times Area \times **Irrigation Interval (Days)**

$$= 0.0010 \text{ m}^3/\text{s}/\text{ha} \times \text{Area} \times \frac{24 \text{ hour}}{24 \text{ hours}} \times 1 \text{ (everyday)} = \underline{0.0010 \text{ m}^3/\text{s}/\text{ha}} \times \text{Area}$$

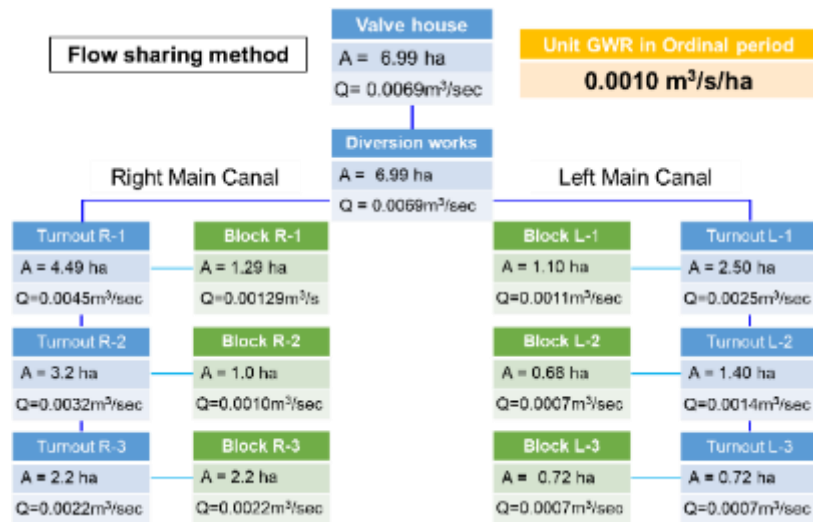
When adapting Flow sharing method to distribute irrigation water, the discharge indicated here need to be supplied to each canal every day.

Flow sharing methods of water distribution seem to be easier to manage because the same amount of water is supplied every day.



6.7.3 Required discharge per irrigation day

However, it should be noted that if there is excessive water abstraction upstream or if the canal is not properly maintained and managed, inequitable water distribution between the upstream and downstream sides is likely to occur.



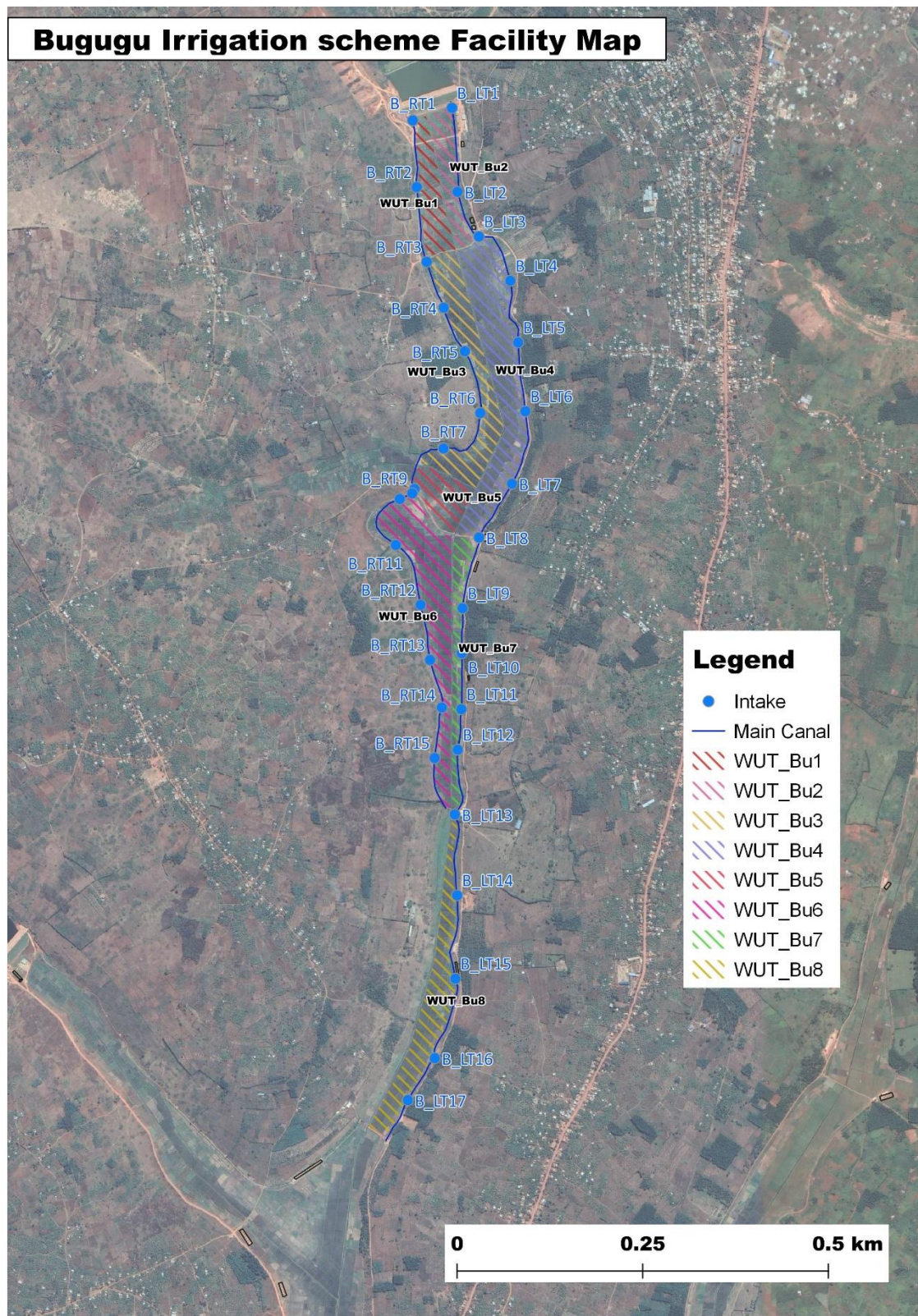
6.8 Practise 2

Perform the following practical exercise to prepare water distribution plan based on the current water distribution conditions for the own irrigation scheme.

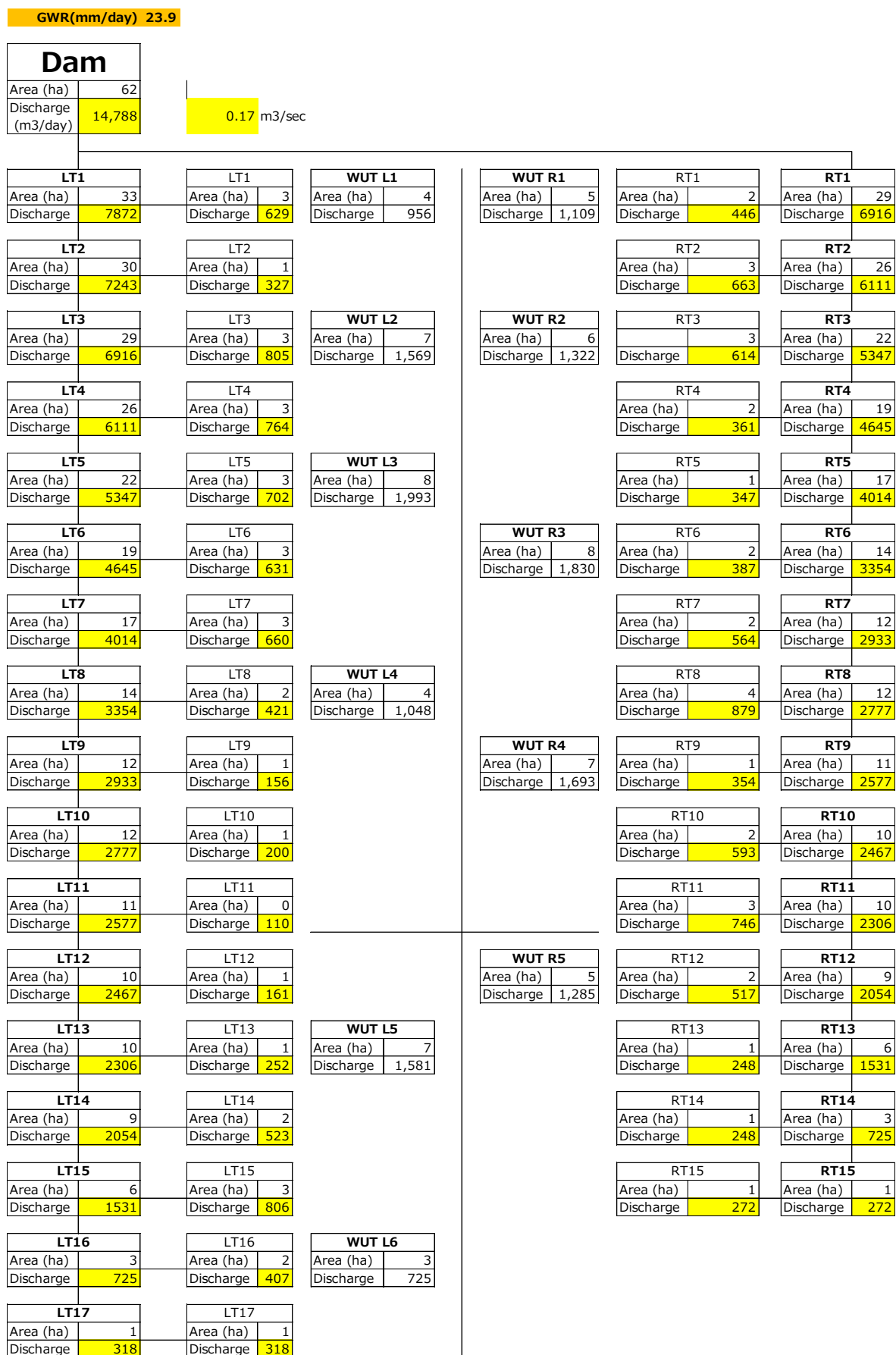
1. (Prepare a Water distribution diagram, it has been done in Practice 1)
2. Determine water distribution methods and Gross Water Requirement
3. Formulate water distribution plan and analyse it

6.9 Example of water distribution diagram

Below is a Facility map of the Bugugu irrigation scheme.



Based on the facility map above, Water distribution diagram was prepared as follow.



Below is an example of a water distribution diagram for the flow sharing case.

GWR(mm/day) 23.9

Dam	
Area (ha)	62
Discharge (m3/day)	14,788

0.17 m³/sec

WUT L Zone A	
Area (ha)	23
Discharge	5,566
Discharge	11132

WUT L Zone B	
Area (ha)	10
Discharge	2,306
Discharge	4612

WUT R Zone A	
Area (ha)	25
Discharge	5,954
Discharge	11908

WUT R Zone B	
Area (ha)	5
Discharge	1,285
Discharge	2570

Chapter 7 Monitoring of water distribution status

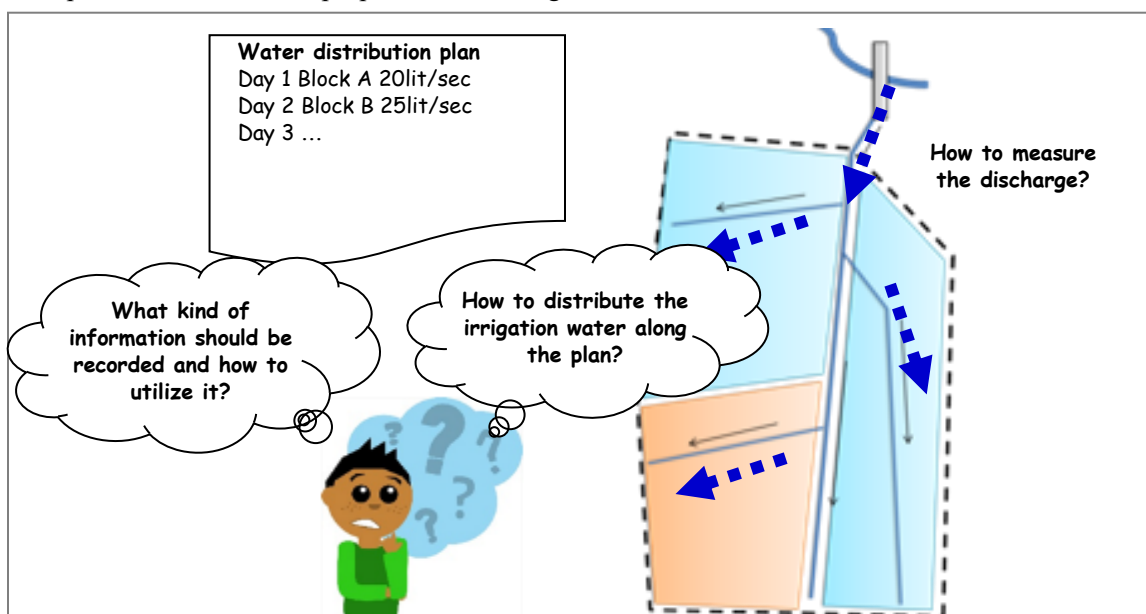
Content Type	Theory and Explanation of practical activities		
Objectives	This chapter describes how to distribute the planned discharge when distributing irrigation water based on the plans within irrigation scheme. Understanding how to implement these practices is the objectives of this chapter.		
Outcomes	Through understanding the content of this chapter, stakeholders will be able to understand and practice how to monitor and calculate discharge and how to estimate discharge from water levels.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

7.1 How to distribute irrigation water along the plan?

How to distribute irrigation water along the plan? The flow how to distribute the irrigation water along the formulated water distribution plan and monitor those activity and how to feedback to next season is explained in this part.

7.2 Target for this chapter

This chapter is aimed at IWUO managers or Field collaborators who control and supervise water distribution operations and operators who perform day-to-day facility operations, and includes content to help them understand the purpose and meaning of each task.

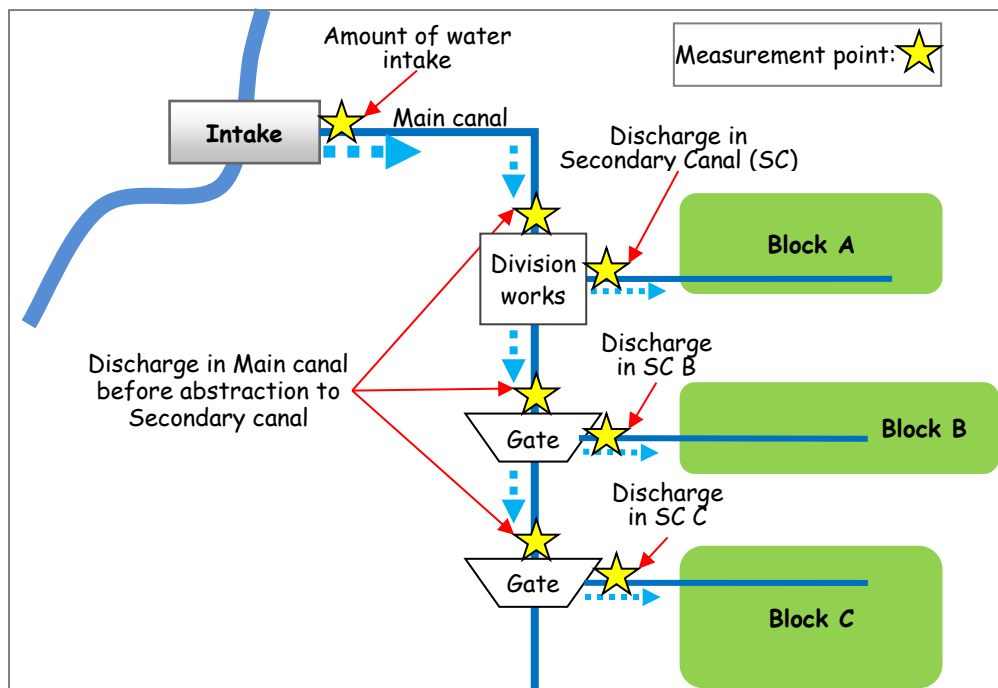


7.3 Methodology of discharge measurement for proper water distribution

Where should be measured discharge in the canal for water distribution?

In terms of water distribution management, it is shown in figure below which points should be measured discharge in the irrigation system. In general, typical discharge measurement points are at the

intake point to know how much water is abstracted from the water source, the points of main canal before the diversion work, and the starting point of the secondary canal to know how much water are distributed to each block.



How to measure discharge in canal?

The discharge of the canal is obtained with velocity and cross section area of canal. There are various methods for measuring discharge. Floating method is the simplest measurement method therefore, this method is introduced in this manual.

Items for measurement:

- Tape measure for measurement of width of water surface
- Stop-watch
- Rod or staff gauge for measurement of depth. (Tape measure can be substituted)
- Twigs or stones to mark the start point and end point
- Floating object such as leafs, twig or something floating

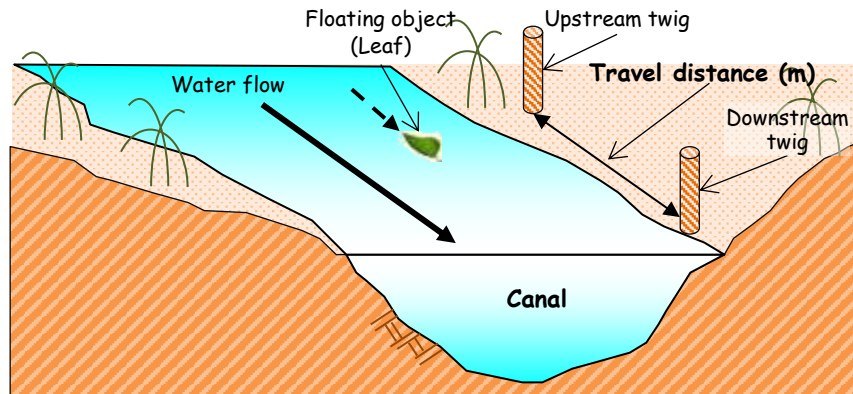
Measurement procedure of velocity

1. Choose the measurement section. Straight way and minimum turbulence on a place of good visibility is preferable.
2. Set the twigs or stones at starting point and end point of measurement and measure the distance (= travel distance) between starting point and end point. It is preferable that the travel distance is about 5 to 10 meters or more.
3. Drop the floating object into the centre of canal upstream of the starting point.
4. Start the stop-watch when the floating object cross the start point and stop the stop-watch when the object crosses the end point.

5. Repeat the measurement at least 3 times and use the average in further calculation.
6. The surface velocity is obtained when the travel distance is divided by the travel time.

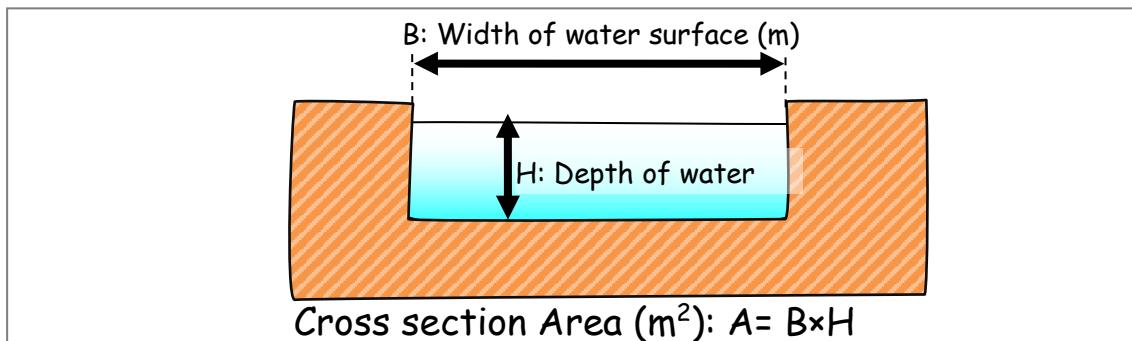
$$\text{Surface velocity (m/sec)} = \text{travel distance (m)} \div \text{travel time (sec)}$$
7. Average velocity of the canal obtained as a products of surface velocity and 0.8

$$\text{Average velocity (m/sec)} = \text{Surface velocity (m/sec)} \times 0.8$$

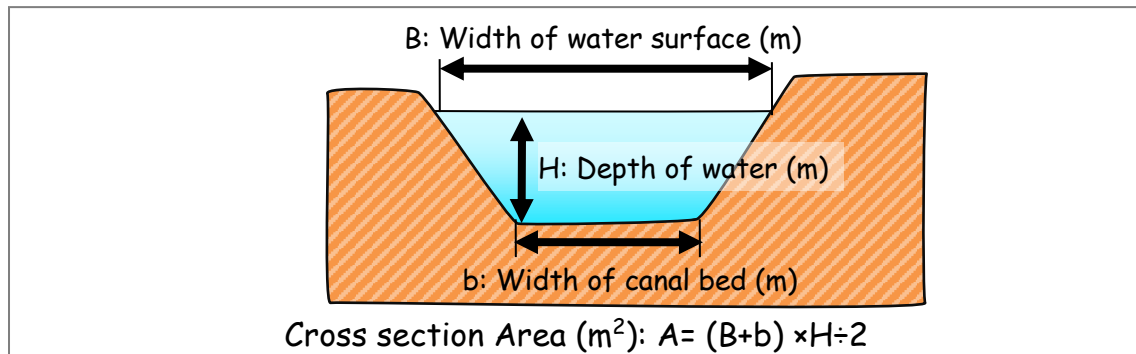


Measurement procedure of cross section area

- 1) Measure the width of water surface (m) and depth of water (m) in the canal in case of rectangular cross section.
- 2) Rectangular cross section area (m^2) is obtained as a product of width of water surface (m) and depth of water (m).



- 1) Measure the width of water surface (m) and canal bed (m) and depth of water (m) in the canal in case of trapezoid cross section.
- 2) Trapezoid cross section area (m^2) is obtained as a product of depth of water (m) and average width between water surface (m) and canal bed (m).



The discharge in the canal is obtained as follows with average velocity and cross section area of the canal.

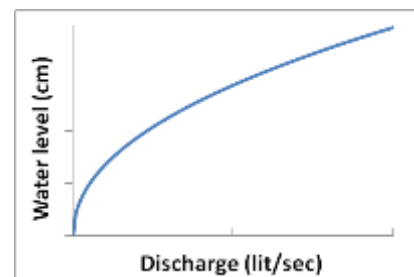
Discharge in canal (m³/sec) = Average velocity (m/sec) × Cross section area of the canal (m²)

7.4 Required Water Level for Each Canal

Water level and discharge have correlation as shown in figure below. As the water level rises, the discharge increases. It is possible to estimate discharge from water level using this correlation.

In order to estimate the discharge, it is needed to draw a curve which has the correlation between water level and discharge. This curve is called rating curve or H-Q curve.

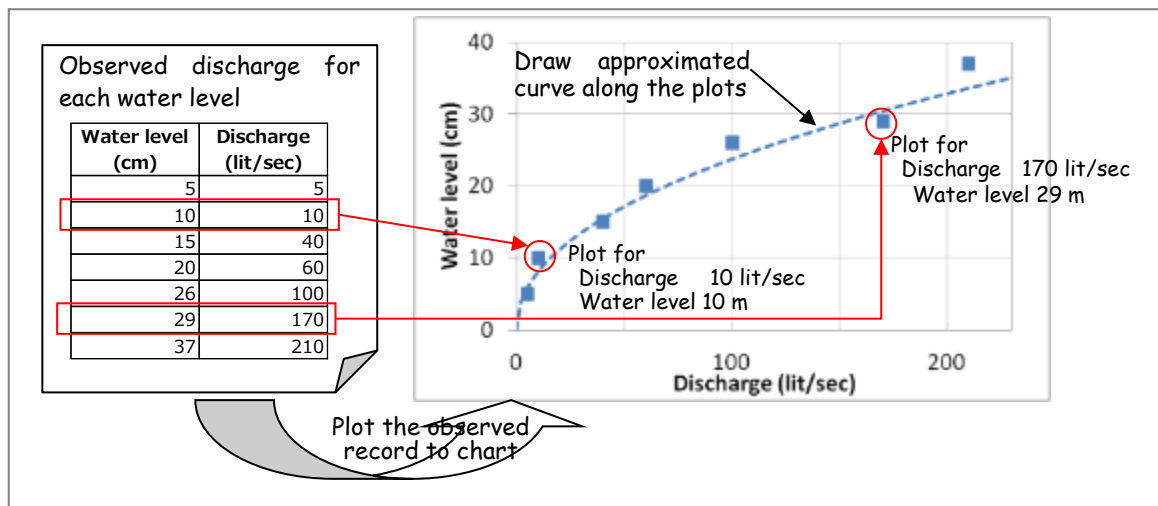
Each canal has different correlation due to different cross sectional area, lining condition etc. So it is necessary to draw the curve for each canal. Even the same canal, the condition will change due to scouring or sedimentation, so it is necessary to check rating curve regularly.



How to draw Rating curve (H-Q curve)?

- 1) Measure water flow velocity and water level at a point in a canal for different cases (at least 5 different water levels).
- 2) Calculate the discharge using the following formula for all measurements.

$$\text{Discharge} = \text{Water flow velocity} \times \text{Area of water flow in a canal}$$
- 3) Draw horizontal axis for discharge and vertical axis for water level by using ruler and write the scale referring the maximum water level and discharge for each axis. (See below)
- 4) Plot the discharge and water level on the chart based on the observed data.
- 5) Draw approximated curve along the plots. It is better not to connect the plots but to draw the smooth curve passing near the all plots.

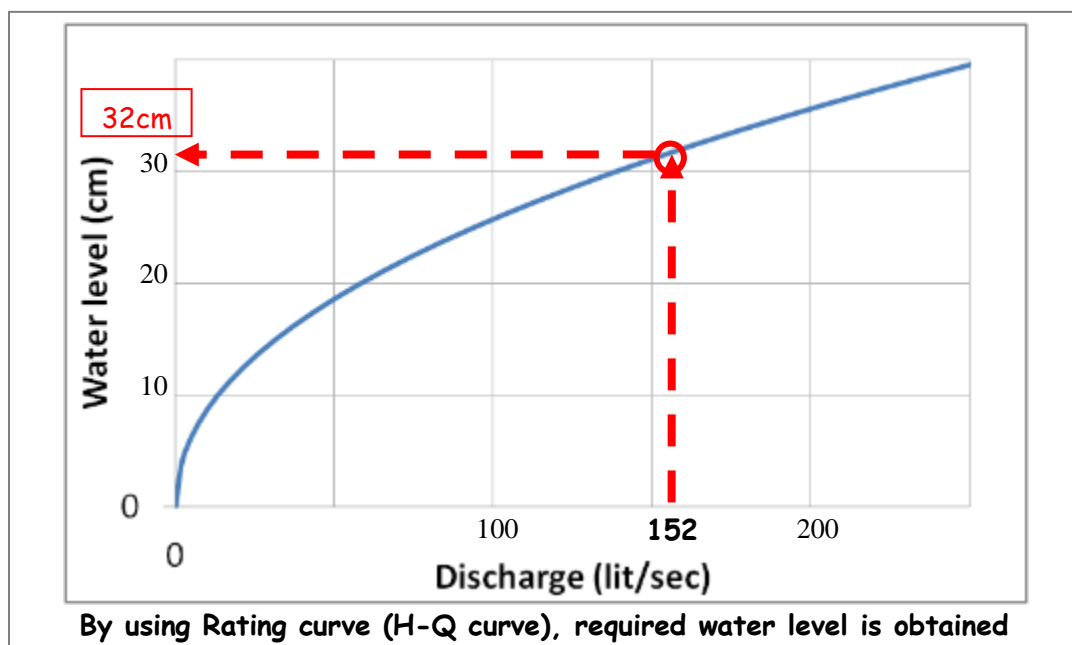


How to estimate discharge from water level from the rating curve (H-Q curve)?

You have already made a rating curve after field measurement as shown in figure below. And a water distribution plan says 152 lit/sec of discharge is required to Secondary canal B.

Procedure:

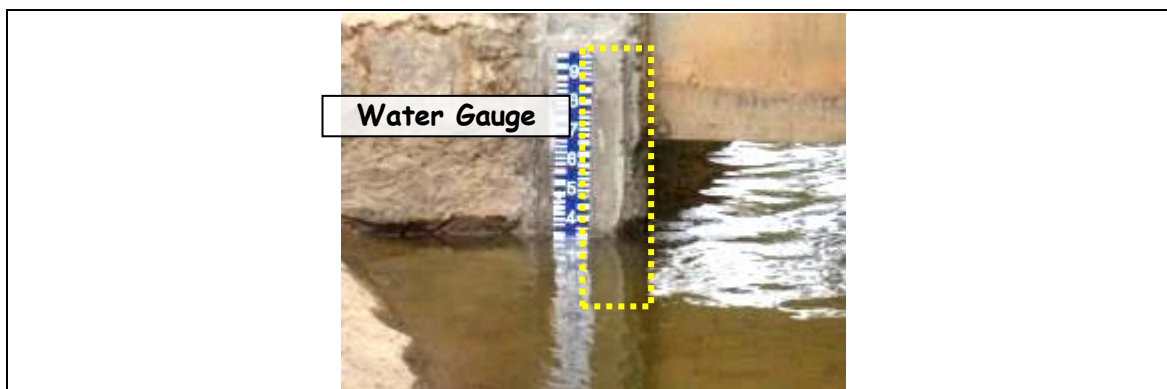
1. Find 152 lit/sec on discharge.
2. Vertically go up to the curve.
3. Then, go to water level.
4. Read the water level. You will get 32 cm water level.
5. Adjust water level in Secondary B canal to be 32 cm of water level.



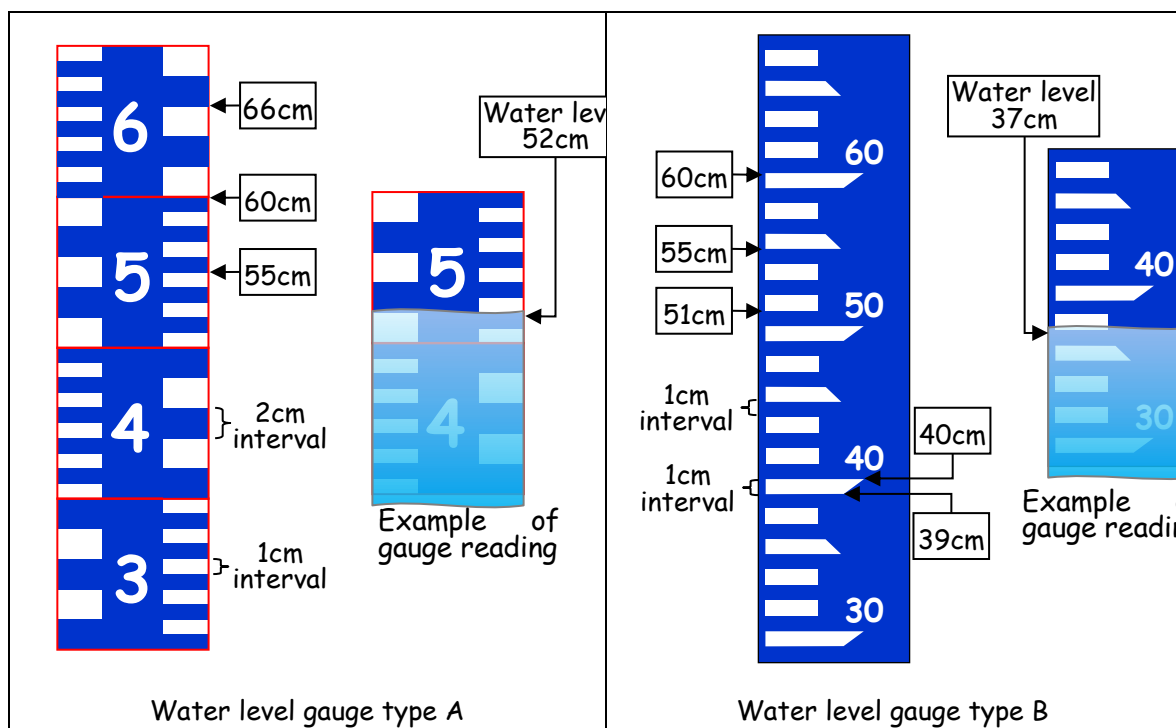
You have gotten 32 cm to deliver 152 (litter/sec) in the canal. But you may not know how to measure the water level. There are some methods to measure water level in the field.

The most popular method is using a water gauge with calibration. You just see the water level at the

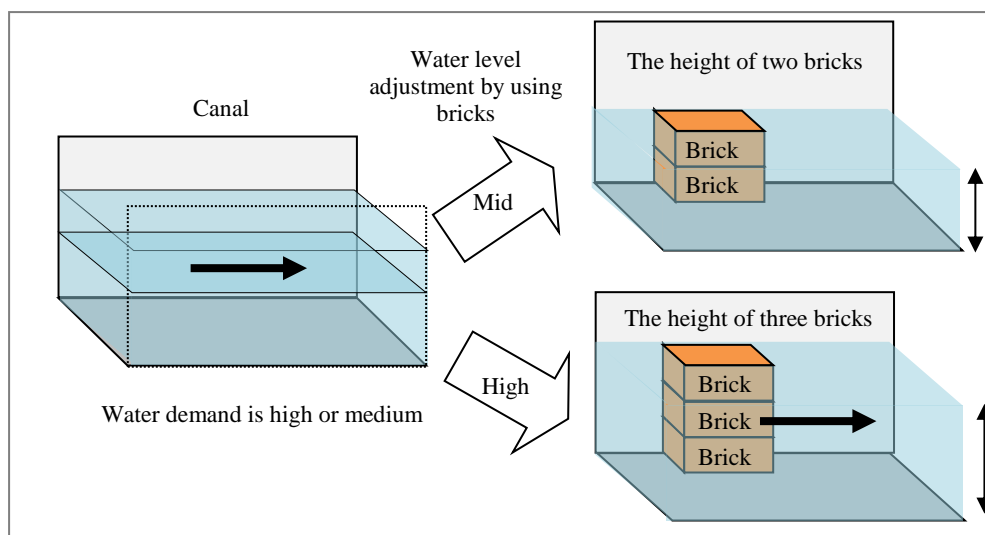
gauge as shown in Figure below. Also painting on the canal wall is easier to measure the water level. But paint will disappear as time goes by. Instead of painting, you can scratch (mark) the canal wall.



There are various types of water level gauge. Figure shows typical water level gauges and explanation how to read it. The persons in charge of the operation of the gate must understand how to read the water level gauge.



Instead of water level gauge, water level can be measured by using bricks or stones with fixed shape. For example, when water demand is medium, the height corresponding to two bricks is sufficient water depth, and when water demand is high, the height corresponding to three bricks is also sufficient water depth. It is very rough method but easy to applied. If the blocks or stones are too big compare to the width of the canal, it is needed to take care of influence of dam up caused by the blocks or stones.



7.5 Sample recording data format for monitoring of water distribution

Following is the sample data format for monitoring the water distribution record. These records provide accountability for the fact that equitable water distribution has been conducted. Periodically, IWUO staff should request these records from persons in charge of water distribution to ensure that proper operations are being conducted.

Location:

Name of recorder:

Date	Time	Operation	Water level (cm)	Converted discharge (m3/sec)
		Closed the turnout		
		Opened the turnout		

Chapter 8 Proper water management techniques and Daily monitoring for water management in Demonstration plots

Content Type	Concept , Theory and Explanation of practical activities		
Objectives	This chapter provides an introduction to proper water management practices introduced in the WAMCAB activities and an explanation of how to keep records of water management at the field level. The objective of this chapter is to understand the purpose of these and how to implement them.		
Outcomes	Knowledge of proper water management for paddy rice cultivation will be fostered and waste in irrigation water use will be reduced.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

8.1 Purpose of water management and daily monitoring

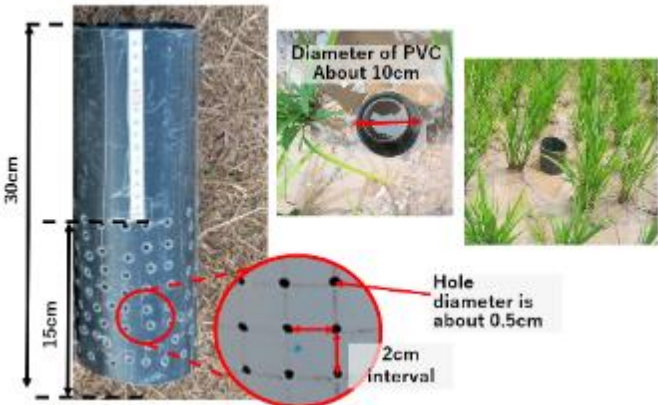
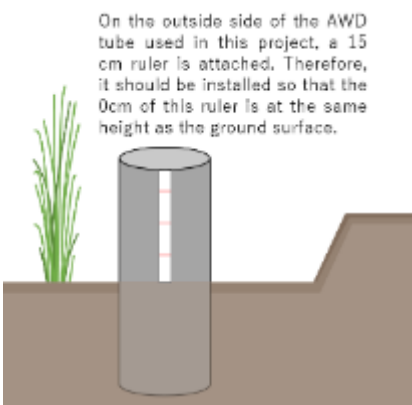
The purpose of water management is to provide the water needed for crop growth in an efficient manner, without loss or waste. Monitoring involves quantitatively recording the amount of water supplied to each plot and the amount of water consumed by rice growth and losses, and evaluating its efficiency based on the differences in water consumption between the different treatments in each test plot. Thus, daily monitoring is very important.

This document explains the purpose of each treatment in the demonstration plot and the items to be monitored on a daily basis.

8.2 Treatment and purpose of each demo plots

For this season's trials in the demonstration plots, four treatments will be established as follows:

- a) **Proper Water Management (PWM):** Without cascade (or plot-to-plot) irrigation, constantly irrigate the paddy fields at regular intervals to maintain the water surface. A peg is installed in the plot to measure the water level and to record changes in the water level from a reference height.
- b) **Alternate Wetting and Drying (AWD):** Irrigation water is provided when the water level reaches -15 cm (15 cm depth below the ground surface) without maintaining the water level. The number of irrigations is therefore reduced compared to PWM, and the total amount of water used for irrigation is also reduced. Detail of the AWD tube for monitoring the ground water level is shown below.

	
Specification of AWD Tube	Installation of AWD Tube

- c) **AWD + Prevention of Lateral Movement (PLM):** In order to more accurately evaluate the water-saving impact of AWD, metal sheets are placed along the ridge to a depth of about 40 cm and prevent lateral movement of the water.
- d) **Proper Water Management + Plastic Sheet (PS):** This will be conducted only on demo plots in Rwamagana. Trial to prevent lateral movement of water and reduce losses by using plastic sheets, which are cheaper and more readily available than metal sheets. Also to estimate the amount of lateral penetration loss compared to PWM.

8.3 Daily water management and monitoring

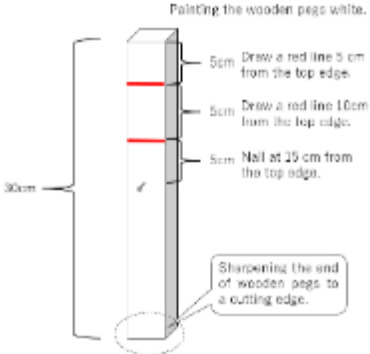
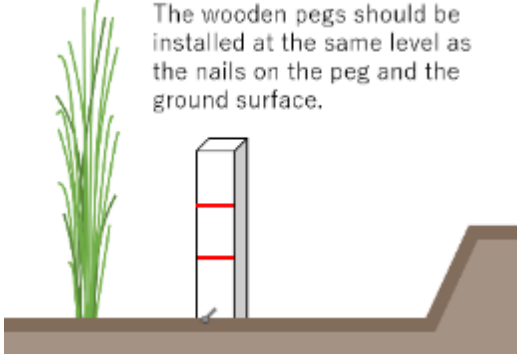
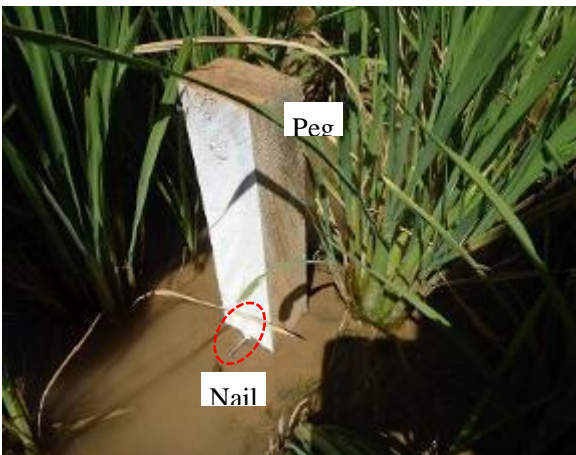

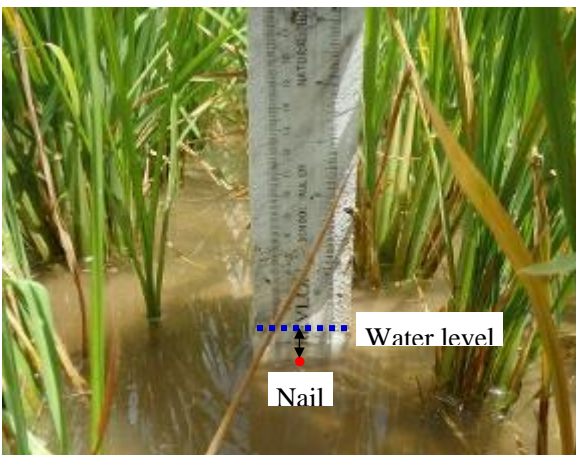

8.3.1 Preconditions

- There is no cascade (or plot-to-plot) irrigation at all plots within the demo plots.
- Irrigation is done through the inlets of each field canal. They are properly closed and no water flows in or out except during irrigation.
- Water outlets for field drains are properly closed from within each field.

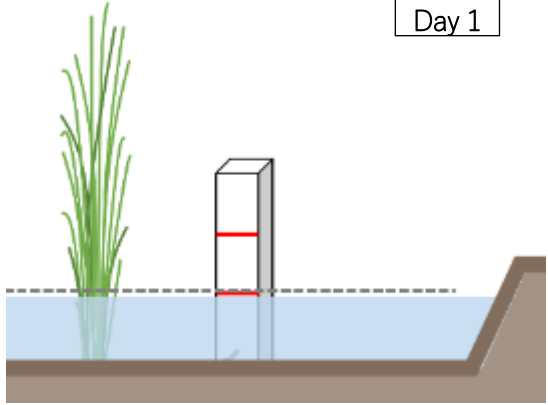
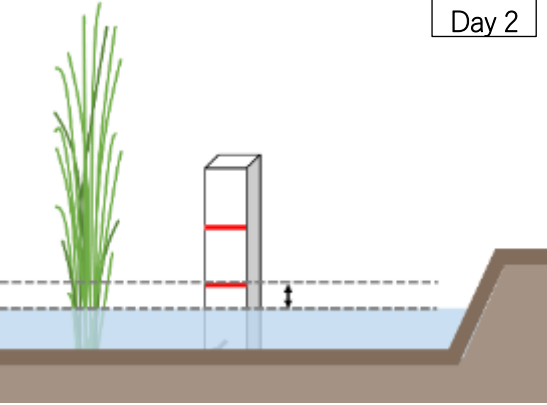
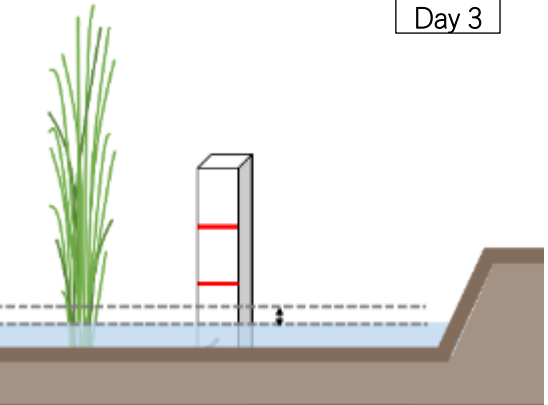
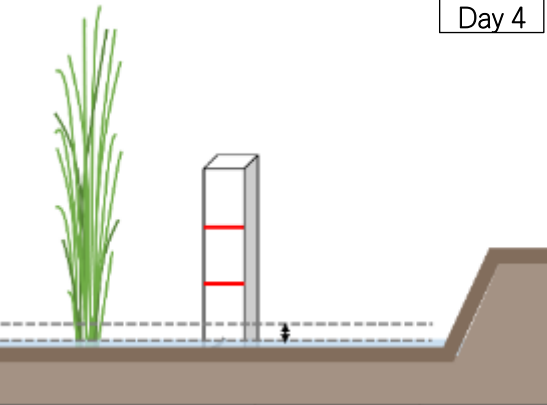
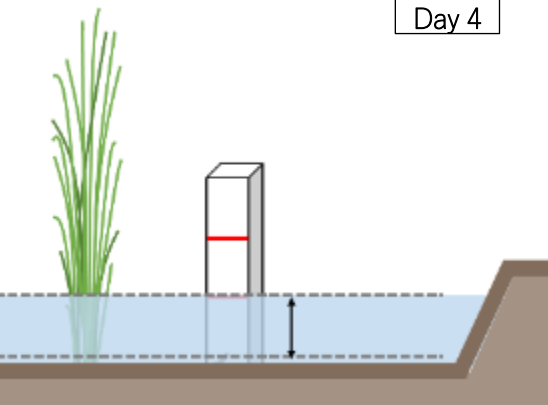
8.3.2 Irrigation methods and monitoring items

(1) PWM

- Measure the surface water level at scheduled times each day, using a ruler and a peg installed in the plot as a reference. Explanation of the measurement method is given below, together with photographs.

 <p>Painting the wooden pegs white.</p> <p>30cm</p> <p>5cm Draw a red line 5 cm from the top edge.</p> <p>5cm Draw a red line 10cm from the top edge.</p> <p>5cm Nail at 25 cm from the top edge.</p> <p>Sharpening the end of wooden pegs to a cutting edge.</p>	 <p>The wooden pegs should be installed at the same level as the nails on the peg and the ground surface.</p>
<p>Details about the wooden peg</p>	<p>Installation of wooden peg</p>
 <p>Peg</p> <p>Nail</p>	 <p>Ruler</p>
<ul style="list-style-type: none"> The pegs are made from square timber, painted white in advance to make it easier to read the scale on the ruler. Adjust a peg to make sure a nail on it is at the same level as the ground surface. 	<ul style="list-style-type: none"> When measuring the water level in a paddy field, the ruler is placed on a nail and the height to the water surface is measured. The installation of the nail ensures that the reference height for each water level measurement is stable and reduces the error in the measurement.
 <p>Water level</p> <p>Nail</p>	
<p>Measurement of water depth in paddy fields</p>	

- Irrigation is carried out when the water surface level reaches near the ground surface at the plot. When water is supplied to the plot for irrigation, also measure the time it takes for the water level to reach 5cm from ground level after irrigation. When the water level reaches the target level, close the water inlet and check that no water enters or flows out from the plot.

 <p>Day 1</p>	 <p>Day 2</p>
<p>At the start of the measurement, irrigation is carried out and the water level is brought to a height of 5 cm above the nail.</p>	<p>At a fixed time on the following day, measure the water level from the nail at that time. As the water will be sufficient, no irrigation is carried out.</p>
 <p>Day 3</p>	 <p>Day 4</p>
<p>At scheduled times, measure the water level from the nail at that time. As the water will be sufficient, no irrigation is carried out.</p>	<p>At scheduled times, measure the water level from the nail at that time. As the water level becomes lower, irrigation is carried out. Record the time taken to reach the marked 5cm on wooden peg.</p>
 <p>Day 4</p>	<p>Return to the explanation of day 1 and continue the monitoring in the same way.</p>
<p>Since it is difficult to adjust the water level exactly to the height of the marked red line on the wooden peg, the water level is measured again and the water level after irrigation is recorded.</p>	

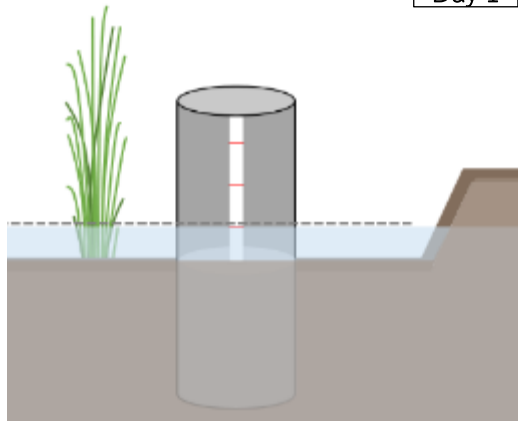
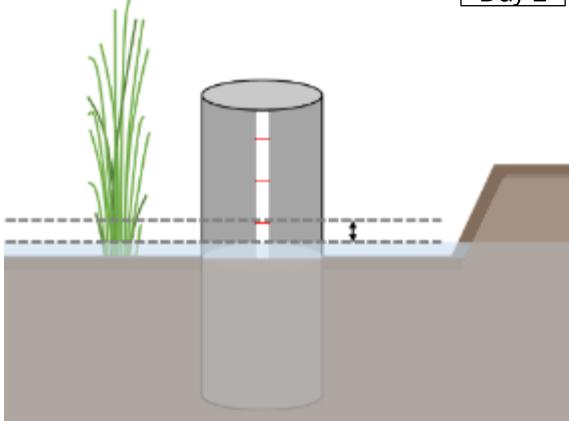
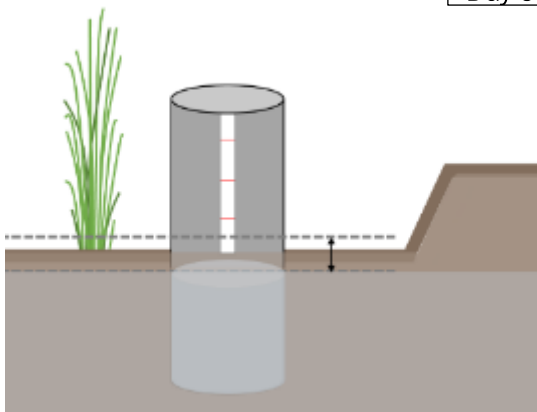
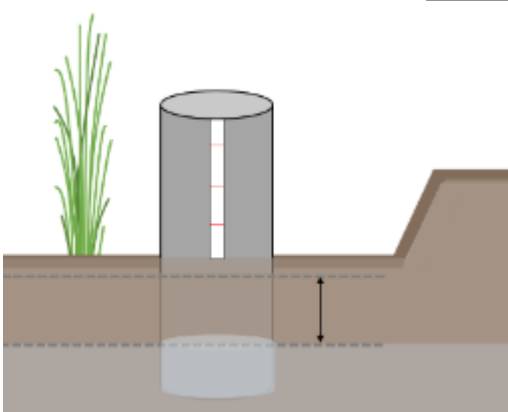
- When measuring the day after a rainfall, the water level may be higher than the day before.
- Check for leaks from the ridges.

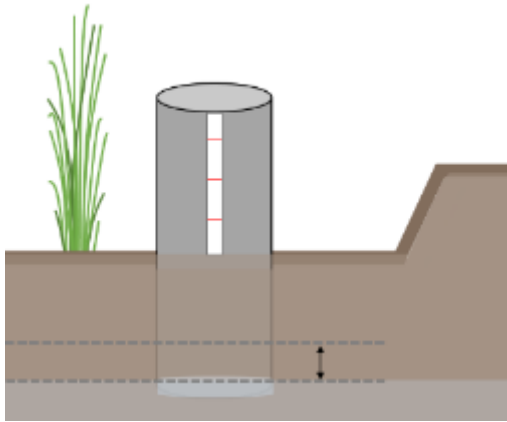
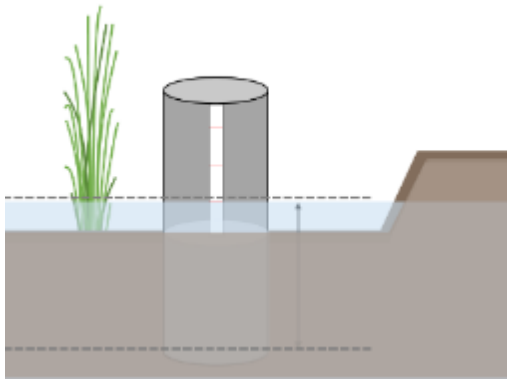
(2)AWD

- For the AWD treatments, the water surface is maintained the same as for PWM and water level

is monitored until 30 days after transplanting, since this is the early growth period and the tolerance to drought is low; after 30 days, water management for AWD is carried out as described below.

- Measure the surface water level at scheduled times each day using scale on AWD tube. When the groundwater level reaches the ground surface, measure the water level inside the AWD tube and measure the depth from the ground surface using ruler.
- When the groundwater level reaches -15 cm below the surface, irrigation should be carried out. Water should be supplied to a height of 5 cm above the ground surface.

 <p>Day 1</p>	 <p>Day 2</p>
<p>At 30 days after transplanting, the water level shall be adjusted to 5 cm above the ground surface; if the water level is higher than 5 cm, the water level at that time will be recorded and monitoring started.</p>	<p>On the following day, the water level shall be observed at a scheduled time. If the water level is higher than the ground surface, measure the water level with a ruler on the side of the AWD tube.</p>
 <p>Day 3</p>	 <p>Day 4</p>
<p>At a scheduled time, the water level shall be measured. When the water level is lower than the ground surface, measure the water level inside the AWD Tube. At this time, the ground surface is set at 0 cm and the depth from that point is measured.</p>	<p>At a scheduled time, the water level shall be measured.</p>

	
<p>At scheduled times, measure the water level inside of the AWD tube. As the water level almost reaching - 15cm, irrigation is carried out. Record the time taken to reach the 5cm on AWD Tube.</p>	<p>Since it is difficult to adjust the water level exactly to the height of the marked red line on the wooden peg, the water level is measured again and the water level after irrigation is recorded.</p>

- When measuring the day after a rainfall, the water level may be higher than the day before.
- Check for leaks from the ridges.

(3)AWD+ Prevention of Lateral Movement (PLM)

- Same as AWD.

(4)Proper Water Management + Plastic Sheet (PS)

- Same as PWM.

8.4 Methods for estimating water consumption rate and amount of irrigation water

- The amount of water consumption for each plot can be calculated by multiplying the difference in water levels between the previous day and the day of the measurement by the plot area of interest. If there has been rainfall prior to the measurement on the day, this is taken into account in the calculation.
- For the amount of water supplied by irrigation, the increment in water level from the water level before irrigation (probably 0 cm above the ground surface) to the water level after irrigation is multiplied by the area.
- The total amount of irrigation water during the growing season is compared to assess the water saving potential of each treatment.

Box Introduction of SRI

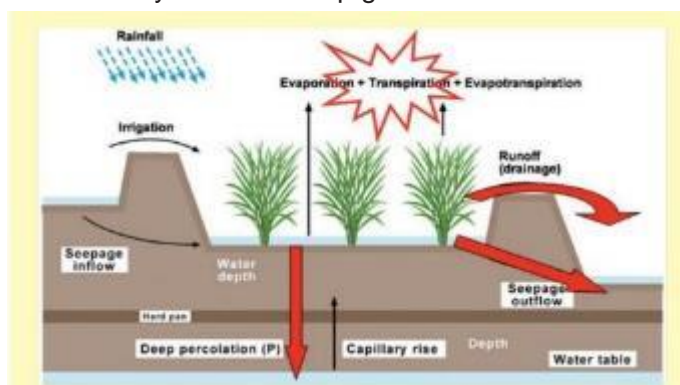
In addition to AWD, there is the System of Rice Intensification (SRI), a globally well-known method of water-saving rice cultivation. Although it was not introduced to the Project, following is a description of SRI from “The System of Rice Intensification: Responses to Frequently Asked Questions” (Uphoff, Norman, 2015).

1. **Transplant young seedlings**, preferably 8-12 days old and as a rule less than 15 days old. These small plants should be grown in an unflooded nursery and then removed gently, with minimum trauma to their roots, being replanted in the main field carefully, quickly and shallow (1-2 cm).
2. **Wider spacing between plants**, with seedlings planted singly, one per hill instead of 3-6, and in a square pattern, usually 25 x 25 cm. Plant densities in the field are reduced by 70-90%. This gives plants' roots and canopies more room to grow and spread, acquiring more nutrients and sunlight.
3. **Soil in the field is kept moist but not continuously flooded**, intermittently wetted and dried, so that the soil is mostly aerobic, never hypoxic. Good drainage of the soil can be almost as important as the provision of irrigation water. A lack of oxygen in the soil will suffocate the plants' roots and also the aerobic soil organisms that can provide many beneficial services to the plants.
4. **Control weeds with repeated use of a mechanical hand weeder**. This will aerate the soil better than possible with hand weeding or use of herbicides. Active soil aeration can enhance paddy yields by 1-2 tons per hectare.
5. **Enhance soil organic matter as much as possible**, adding compost or other biomass to the soil. This will improve the soil's structure and functioning as well as provide the plants with more complete and balanced nutrition.

Chapter 9 Water saving irrigation in paddy (Alternate wetting and dry in Rice Cultivation)

Content Type	Theory and Explanation of practical activities		
Objectives	The content of this chapter is a summary of the explanatory document about AWD prepared by IWMI. It is aimed to help farmers understand that it is not necessary to maintain a water surface in the paddy field all the time, even when strict AWD practices are difficult to implement.		
Outcomes	More farmers will understand and engage in AWD practices, resulting in reduced water wastage within irrigation schemes.		
Lecturers:	RAB and District staff, and FC (IWUO manager)	Trainees:	Leaders of IWUO, Local leaders and general farmers

The traditional paddy practice often leads to losses of water via surface run-off, seepage and percolation that accounts for 50-80 percent of total water input. The water losing through evapotranspiration is only useful for crop growth.



SOURCE: IRRI

With the growing demand for food production, decreasing trend in water resources availability, the traditional paddy cultivation will face tremendous difficulties in near future.

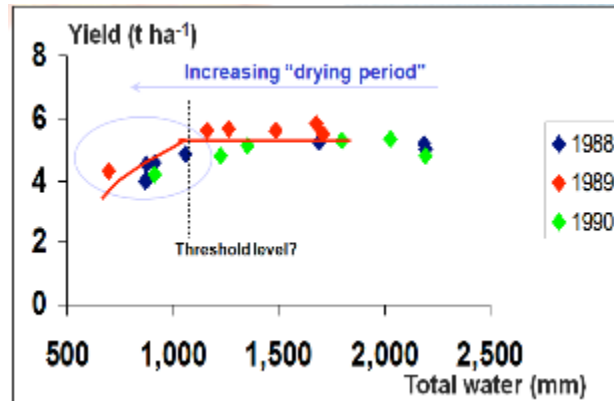
How much water do people use?

Litters of water	
Daily drinking water	2-5 litters of water
Daily household use	20-500 litters of water
1 kg of Rice	3,000-50,00 litters of water input to the field

Alternate Wetting and Drying (AWD) is found to be an important adaptation method to overcome the shortages and climate change impacts. The practice is based on the knowledge that rice can grow even up to 30% reduced water supply during the main growing period compared to conventional irrigation. To determine the timing of irrigation, the water level in the soil is monitored by a perforated plastic tube, which is inserted into the rice field. AWD requires irrigation when the water level drops to 15 cm below the soil surface.

Numerous studies were conducted on the manipulation of depth and interval of irrigation to save

water use without any yield loss. The studies show that continuous submergence is not essential for obtaining high rice yields. Hatta (1967) and other researchers reported that maintaining a very thin water layer, saturated soil condition, or alternate wetting and drying could reduce water applied to the field by about 40–70 percent compared with the traditional practice of continuous shallow submergence, without compromising on yield.



Remember: Rice does not always need flooding AWD Saves 10-30% of irrigated water.

Alternate Wetting and Drying (AWD)

Alternate Wetting and Drying (AWD) is a water-saving practice where lowland (paddy) rice farmers can apply to reduce their water use in irrigated fields. In AWD, irrigation water is applied to flood the field a certain number of days after the disappearance of ponded water. Hence, the field is alternately flooded and non-flooded. The number of days of non-flooded in AWD between irrigations can vary from 1 day to more than 10 days depending on the soil type.

A farmer can use field water tube (perforated) in his field to monitor the water levels in the subsurface of the soil, while practicing AWD.

Making the field water tube:



- ✓ The field water tube can be made from a plastic pipe or of any other similar structures like tube.
- ✓ Cut this material to a 1 foot length with a diameter of 4 inches to easily see the water level inside the tube.
- ✓ Drill the bottom 6 inches of the tube with holes on all sides; these holes should be about 0.5cm each and 2cm away from one another.

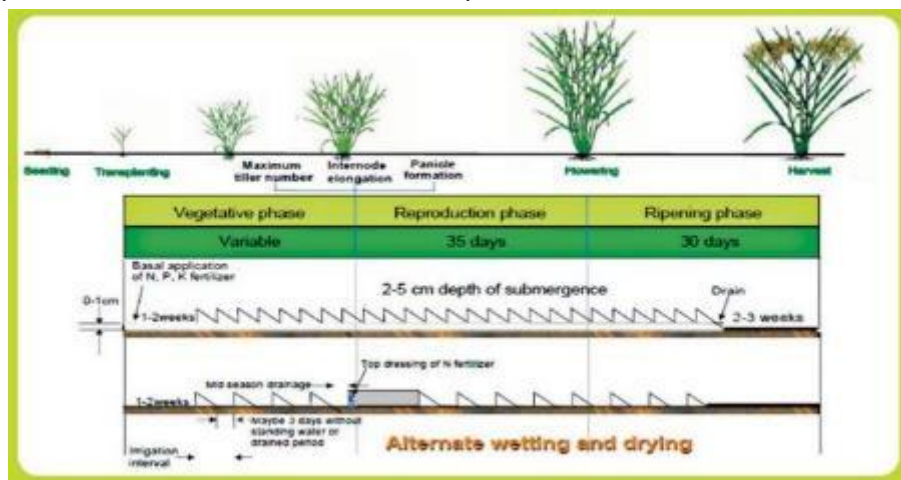


- ✓ Place the tube in a readily accessible part of the field, close to the bund (not less than 1m away) for easy monitoring. The location should be representative of the average water depth in the field (i.e. it should not be in a high spot or a low spot).
- ✓ Insert the tube up till 6 inches depth so that half of its length remains on the surface
- ✓ Remove the soil inside the tube so that the bottom of the tube can be seen. Ensure that the level of water inside the tube is the same as the level of water on the field.



Practicing Alternate Wetting and Drying (AWD)

- ✓ AWD can be implemented and monitored by considering the depth of ponded water on the field by using field water tube. The depth of ponded water will gradually decrease after each irrigation.
- ✓ When the ponded water is dropped to 15 cm below the surface of the soil, irrigation should be applied to re-flood the field with 5 cm of ponded water.



Safe AWD

AWD can be started 30 days after transplanting (or with a 10-cm tall crop in direct seeding). When weed population is high, AWD can be postponed for 2-3 weeks until weeds have been suppressed by the ponded water.

The fertilizer recommendations can be similar to that of normal flooded method. Apply nitrogen fertilizer preferably on the dry soil just before flooding.

From one week before to one week after flowering, ponded water should always be kept at 5 cm depth above soil level to avoid water stress which could result to potentially severe yield loss.

After flowering, during grain filling and ripening, the water level can drop again to 15 cm below the surface before flooding.

Main idea of safe AWD:

- ✓ Water is available in the root zone below subsurface, which is not visible.
- ✓ Water tube can create information to the farmers about scheduling of next irrigation.
- ✓ Scheduling of irrigation varies with soil type, hydrology, variety Keep first 2 weeks flooded if many weeds.

A practical indicator to irrigate under safe AWD

- ✓ Safe AWD = Irrigate when water depth -15 cm
- ✓ Keep flooded 10 DAT (weeds) and at flowering

Benefits of AWD technology

- ✓ Water savings up to 15-25 percent with no yield penalty. In pump irrigation systems, it reduces pumping costs and fuel consumption and an increased income. AWD promotes good root anchorage and reduces the crop lodging problems.
- ✓ Better root anchorage to reduce lodging



- ✓ The AWD method has increased yield up to 14 % compared to the normal irrigation method. The water use efficiency has increased up to 70 % compared to 57 % under normal method during Rabi 2013. There is a general trend of increased yields compared to the previous year (2012) yields. But the increase was more in the fields adopted with AWD compared to the continuous irrigated fields. The increased yields not only attributed to the increased tiller number under AWD, but also to the varietal performance and the congenial conditions like few pest and disease incidence during the crop period



*Water Management and Capacity Building Project
(WAMCAB)*



Text

For

Farm Management
to Irrigation Scheme

February 2025

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Annex

Annex-1: Cultivation Technique of Horticulture

Annex-2: Prerequisite knowledge for agronomist

Annex-3: Crop calendar (rice)

Annex-4: Crop calendar (horticulture)

Annex-5: Template of Contract Form for Crop Production and Supply

Annex-6: Equipment Maintenance Log and Equipment Borrowers Log

Annex-7: Template of Performance Contract

Abbreviations

FPG	Farmer Producing Group
IWUO	Irrigation Water User's Organization
JICA	Japan International Cooperation Agency
MOPA	Mobile ordering and processing application
NAEB	National Agricultural Export Development Board
PicROPP	Project for Increasing Crop Production with. Quality Extension Service in the Eastern
RAB	Rwanda Agricultural and Animal Resource Board
RICA	Rwanda Institute for Conservation Agriculture
SMAP	Smallholder Market-oriented Agriculture Project in Rwanda
SWD	Seasonal Water Distributors
WAMCAB	The Project for Water Management and Capacity Building in the Republic of Rwanda

Introduction

SMAP prepared horticulture technical manual in collaboration with Rwandan government and issued officially in 2019. This manual focuses on cultivation techniques of crops and vegetable farmer used to cultivate and new cash crop SMAP introduced during project.

WAMCAB project started in 2019 and consisted of three Phase. In Phase 2, Technical Guidance Phase, WAMCAB implemented technical training and cooperative management by following SMAP manual and coached farmers how to cultivate crop and vegetable regularly in demo farm. On the other hand, through these activities, WAMCAB found tips to further improve productivity and ensure sustainability to be able to operate at low cost. Furthermore, through activities related to organizational strengthening of cooperatives, a good relationship with IWUO was established and farming activities were improved. This text provides such techniques based on our new finding and experience.

Table 1 Technical manuals prepared by SMAP project

 <p>SMAP Cooperative Management and Gender Mainstreaming Technical Manual for Market-oriented Agriculture</p> <p>September 2019 Smallholder Market-oriented Agriculture Project in Rwanda (SMAP)</p> <p>SMAP Cooperative Management and Gender Mainstreaming Technical Manual</p>	 <p>SMAP Marketing Technical Manual for Market-oriented Agriculture</p> <p>September 2019 Smallholder Market-oriented Agriculture Project in Rwanda (SMAP)</p> <p>SMAP Marketing Technical Manual</p>
 <p>SMAP Horticulture Technical Manual for Market-oriented Farming</p> <p>September 2019 Smallholder Market-oriented Agriculture Project in Rwanda (SMAP)</p> <p>SMAP Horticulture Technical Manual</p>	 <p>SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity</p> <p>September 2019 Smallholder Market-oriented Agriculture Project in Rwanda (SMAP)</p> <p>SMAP Rice Cultivation Technical Manual</p>

Objective

The purpose of this text is to (1) supplement the manual created by the SMAP project, (2) introduce activities and good practices that have achieved results through the activities of WAMCAB, and (3) introduce how to work well with IWUO.

The target readers are local government (RAB Station, District, Sector agronomist), Service Providers, cooperative agronomists and other human resources responsible for cooperative management and farm management.

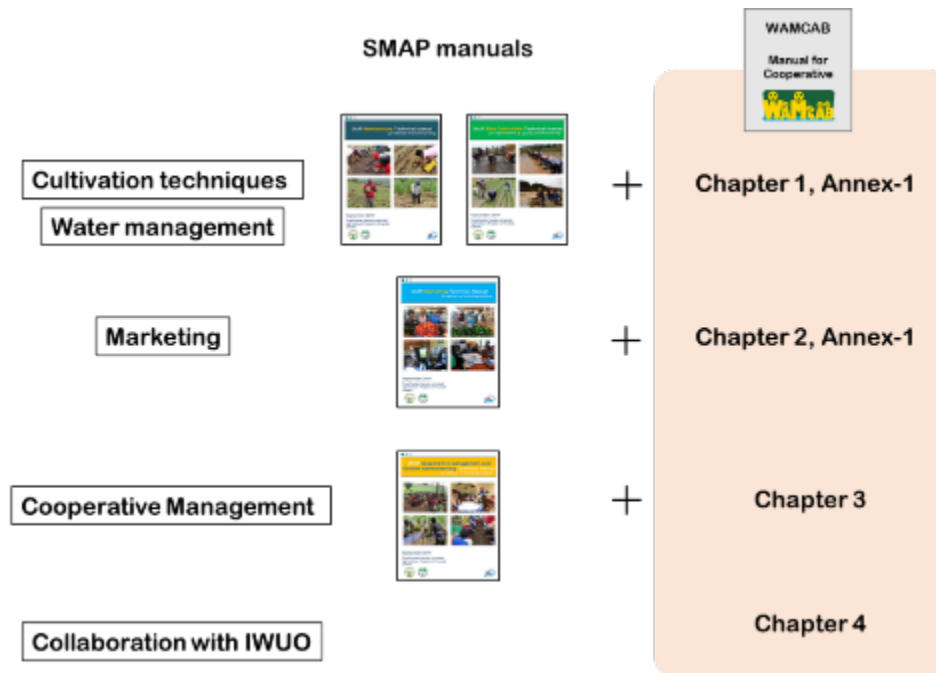


Fig 1 Relationship between SMAP manual and this text

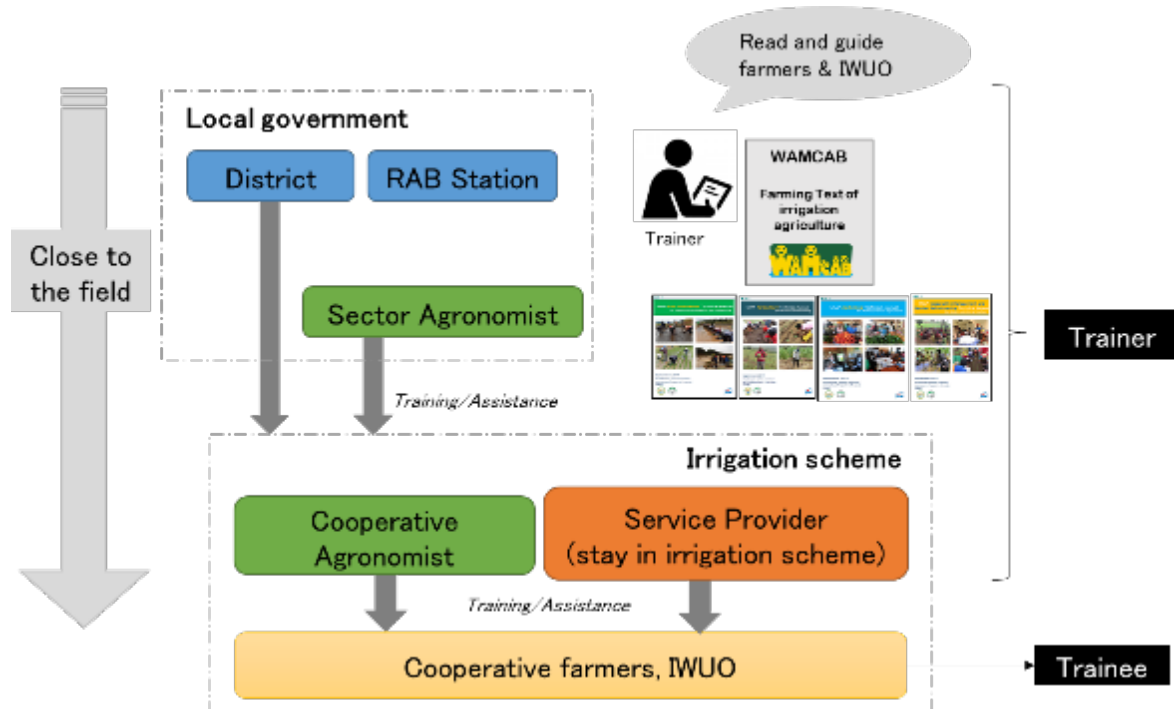


Fig 2 Trainers and how to use the text

Chapter 1 Farming Techniques

Chapter 1 presents the techniques and activities that have shown positive impact through WAMCAB's activities. For manuals on cultivation technique of horticultural crops and rice, please refer to SMAP manual¹.

1.1 Horticulture cultivation techniques

1.1.1 Furrow irrigation

(1) What is furrow irrigation?

Furrow irrigation is a method of laying out the water channels in such a way where gravity plays the role of providing just enough water for suitable plants to grow. It is usually made by the planned placement of ridges and furrows. Furrow irrigation is suitable for many crops, especially row crops. Crops that would be damaged if water covered their stem or crown should be irrigated by furrows. The following crops can be irrigated by furrow irrigation:

- ✧ Row crops such as maize, sunflower, sugarcane, soybean;
- ✧ Crops that would be damaged by inundation, such as tomatoes, vegetables, potatoes, beans;
- ✧ Fruit trees such as citrus, grape

(2) Furrow layout

A ridge is the part of the layout of the field that is elevated at different angles based on the type of soil. This is where the crops are planted. The furrows are the troughs that let the water flow through it.

Furrow irrigation uses furrows between planted ridges. First, the soil is prepared into vertical channels (furrows) and make ridges. Then, water is released directly into each furrow, running down the furrow's length and seeping into the soil at the root level. The layout conditions are shown in the figure below.

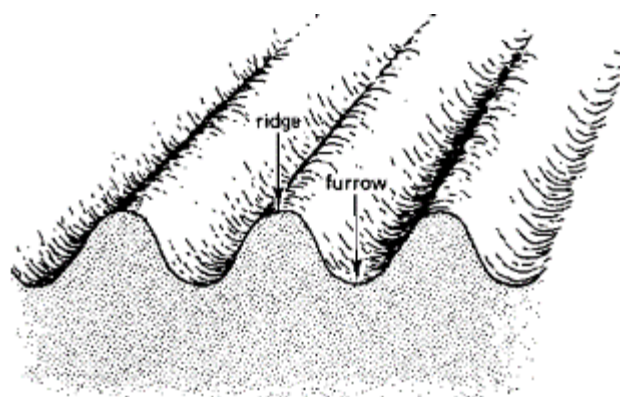


Fig 3 Top view and cross-section of furrows and ridges

¹ SMAP Horticulture Technical Manual and SMAP Rice Cultivation Technical Manual

Table 2 Layout conditions

Factors	Recommended condition
Slope	Although furrows can be longer when the land slope is steeper, the maximum recommended furrow slope is 0.5% to avoid soil erosion. Furrows can also be level and are thus very similar to long narrow basins. However a minimum grade of 0.05% is recommended so that effective drainage can occur following irrigation or excessive rainfall. If the land slope is steeper than 0.5% then furrows can be set at an angle to the main slope or even along the contour to keep furrow slopes within the recommended limits. Furrows can be set in this way when the main land slope does not exceed 3%. Beyond this there is a major risk of soil erosion following a breach in the furrow system. On steep land, terraces can also be constructed (see Basin Irrigation) and furrows cultivated along the terraces.
Soil type	In sandy soils water infiltrates rapidly. Furrows should be short (less than 110 a), so that water will reach the downstream end without excessive percolation losses. In clay soils, the infiltration rate is much lower than in sandy soils. Furrows can be much longer on clayey than on sandy soils.
Stream size	Normally stream sizes up to 0.5 l/sec will provide an adequate irrigation provided the furrows are not too long. When larger stream sizes are available, water will move rapidly down the furrows and so generally furrows can be longer. The maximum stream size that will not cause erosion will obviously depend on the furrow slope; in any case, it is advised not to use stream sizes larger than 3.0 l/sec.
Irrigation depth	Applying larger irrigation depths usually means that furrows can be longer as there is more time available for water to flow down the furrows and infiltrate.
Cultivation practice	When the farming is mechanized, furrows should be made as long as possible to facilitate the work. Short furrows require a lot of attention as the flow must be changed frequently from one furrow to the next. However, short furrows can usually be irrigated more efficiently than long ones as it is much easier to keep the percolation losses low.
Field length	It may be more practical to make the furrow length equal to the length of the field, instead of the ideal length, when this would result in a small piece of land left over (Figure 27). Equally the length of field may be much less than the maximum furrow length. This is not usually a problem and furrow lengths are made to fit the field boundaries.

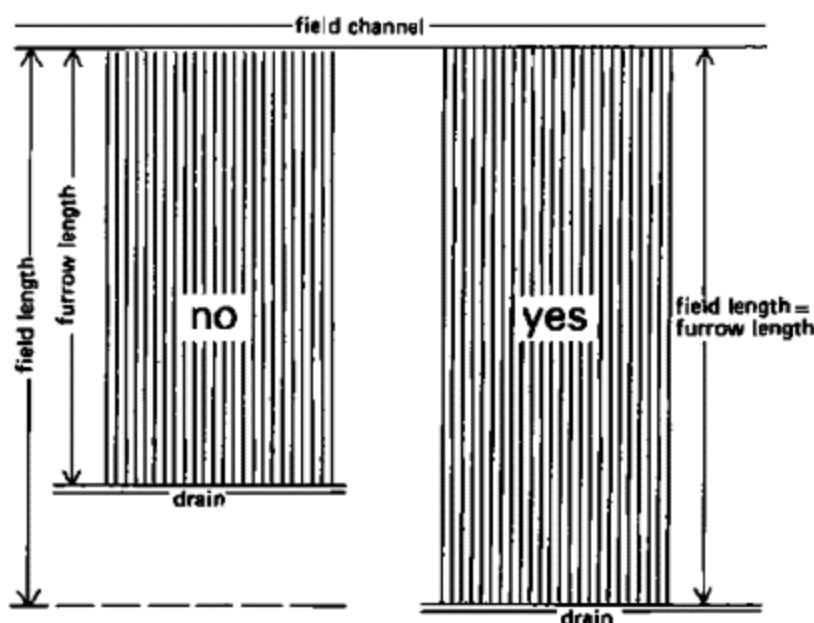


Fig 4 Level of field and irrigation canal

Source: FAO CHAPTER 3. FURROW IRRIGATION

(3) Advantages of furrow irrigation

- Cheap technique among other irrigation techniques.
- Reduce labor used during water application.
- Reduce the irrigation frequencies.
- A quick mass area irrigation is possible.
- Uniformity of water supply all along the ridge.
- Reduce fungal diseases for crops because water is not applied to entire crop.

- Low investment required to buy equipment.
- Recirculating irrigation runoff water is possible.
- Reduce chemical leaching in furrow irrigation.

Disadvantages of furrow irrigation

- Supplying canal should be high elevated toward fields.
- Not efficient on sandy soils; water soaks in before it reaches end of field.
- Skill of design of field is required.
- Salts are accumulated in ridges of soil between the furrows if temperature is high and evaporation speed is fast (arid area).



Column: Trial of furrow irrigation that makes effective use of night storage in Nyabuyogera



Background:

Nyabuyogera irrigation scheme is located in Gisagara district, Save sector is one of WAMCAB model site. The source of water is mainly springs which make a stream, and Nyabuyogera doesn't have sufficient irrigation facilities to distribute water to the fields. In addition, there is a shortage of irrigation water. Farmers irrigate using watering can, bucket, and picking water from canals around plots. Due to inefficient irrigation techniques, WAMCAB practiced irrigation technique and conducted trial on furrow irrigation on french bean, which is among main crop in season B, and C at Nyabuyogera.

Challenge:

Majority of plots are high elevated compared to water supplying canals and there is water shortage in many zones of Nyabuyogera irrigation scheme, this furrow irrigation techniques is only possible where water supply are is elevated compared to fields to be irrigated.

Countermeasure:

In response to water shortage WAMCAB provided a technique to overcome the challenge by introducing reservoir (night storage) where there is springs, and after construction of night storage wherever possible (where there springs) fields may be leveled and furrow irrigation technique may be applied. The entire irrigation scheme has been surveyed and it was found that only two zones (zone 7 and zone 8) have few plots which furrow irrigation can be adapted without much work of land leveling or raising irrigation canal.

Effect:

Farmers learnt from the established trial, demonstration field installed by WAMCAB one farmer adopted the techniques, and more others from identified fields where furrow irrigation technique is practical will be facilitated to apply this technique within next season B and C.

1.1.2 Overlapping season A and B

Overlapping season is said that crops can be planted for next season while crops for previous season are

still in the field.

Some irrigation schemes in Rwanda are designed to operate as complimentary irrigation to rain fed agriculture since rain fed was being affected by climate change. The rain pattern has been changed and rain shortage affects cropping. Applying full irrigation in hillside all along the season is not possible in most irrigation scheme especially on food crops (maize, beans, soybean, cassava, etc.). There are area with possibility to full irrigate all along the season, however the operational cost is expensive and difficult for farmers to cover the cost, in addition to these.

Mostly this happen for season B , and most of the time previous season which A, the crop mostly grown is maize, and second crop to be grown in season B is preferably fabaceae family crops such as beans, soybean, ground nuts.

Referring on meteorological data which specifies the starting date of effecting rain to start planting crops of season B which overlap the previous season since maize is still in field and the harvesting of maize may be schedule 30 days to 45 days from the effective rainfall started.

Farmers are advised to prepare land without uprooting maize and start planting crops of their choice.

Step by step on how it is done

- (1) Reading and analyzing meteorological data mentioning time of effective rainfall.
- (2) Selecting the crop to be grown in season B and procurement of all inputs.
- (3) Scheduling nursery, land preparation and all season activities (make crop calendar).
- (4) Removing old leaves and excessive leaves from maize.
- (5) Preparing land gently (carefully).
- (6) Making planting stations referring on recommended spacing.
- (7) Follow the protocol on good agronomic practice of the crop selected.
- (8) When maize is ready to be harvested, they harvest carefully, maize straw can be remained in field to serve as support (stakes) for climbing beans planted. Stakes are removed by cutting from ground when other crops which do not need have been planted.

1.2 Rice cultivation techniques

1.2.1 Land preparation for new paddy plot

Do you have land that has been left uncultivated?

By performing the following field maintenance, new fields can be developed and the rice cultivation area can be expanded.

A) Field identification

The selection of the field to be prepared for rice cultivation is the first activity. The field should be identified where the level of the field should be below the level of irrigation canal.

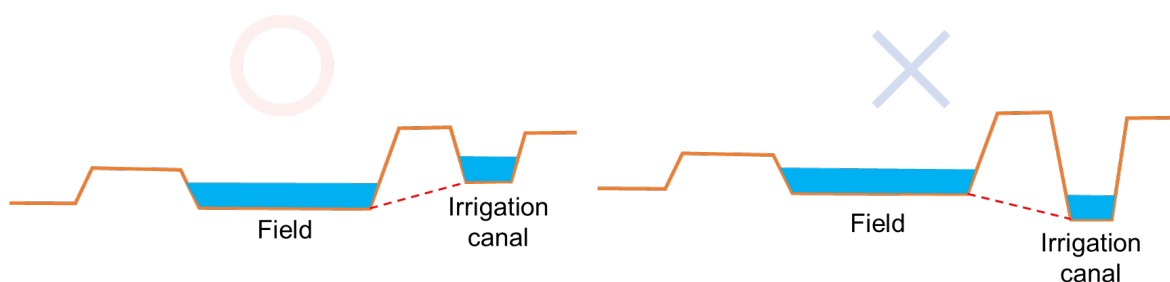


Fig 5 Level of field and irrigation canal

B) Demarcation

Show the size and borders and cleaning of the field, then removing the soil to get appropriate level compare water level in canal.

C) Soil band making

Compacting the soil band surrounding the field to maintain water in field. Width of soil band is from 30-40cm and depth is depending on soil structure. A width of 30-40 cm is appropriate, as a width wider than 40 cm may cause small animals such as rats to make wholes and destroy the channel.

D) Field leveling (*additional step*)

Put water in the field and remove top soil from the highest part to lowest part to get same level.

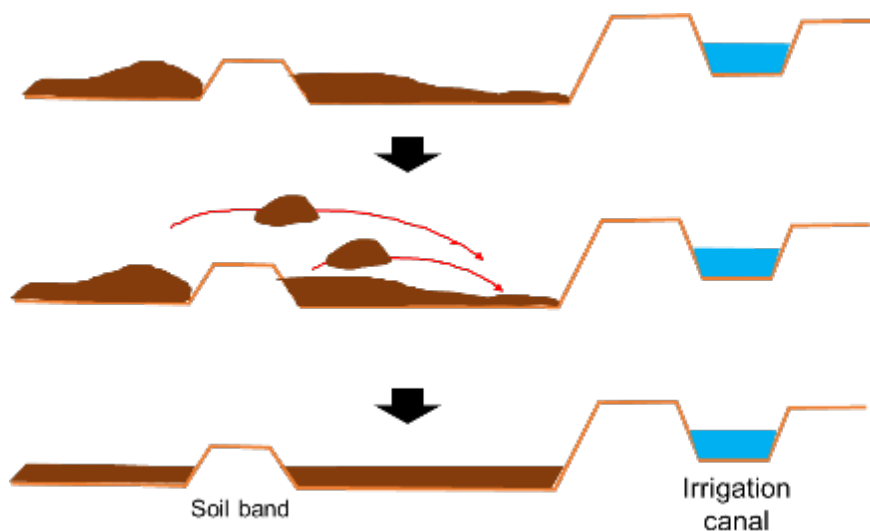


Fig 6 Field leveling (additional step)

E) Plowing

This activity should be practiced after field levelling at same time with incorporation of rice straws/ plowing –in rice straws.

F) Land leveling

This activity consists of soil levelling within the field and spreading well composed manure in field.

Column: Cultivation area expanded by applying proper land preparation



Background:

Cyaruwego is among rice growing cooperative under WAMCAB project model sites, is located in Rwamagana district, Kigabiro, Munyaga, Rubona and Mwurire sectors. It has irrigation facilities such as water storage dams and canals, and rice can be cultivated through irrigation even in the dry season when rainfall is low. After constructing those irrigation facilities, the new paddy field were developed from upland areas to paddy field, but some of land owners have had no skills and experience about field selection, land preparation and management for new field.

Challenge:

In season of 2022A, there was a big problem linked to water for irrigation and poor yield, especially for those new developed paddy field due to poor leveling, no compaction/ reinforcement of soil band, lack of soil improvement by organic matter. It was required for farmers to get enough skills about good land preparation.

Countermeasure:

The cultivation training related to these has been conducted, and the selection of the field and the appropriate management method has been shared through demo plot. The representative's farmers have participated in this training and learnt practically how to do.

Effect:

After the training, farmers understood how to solve the problem in their field by imitating the some practice for land leveling, rice straws incorporation and soil band compacting; so that, the problem linked to water management was solved and the yield was increased. It means, proper land preparation play a big role to increase the production and profit.



Photo. Land preparation in new field through FFS

1.2.2 Soil amendment

Organic growing medium amendments usually are derived from plants or plant products that occur naturally (peat moss from peat bogs), or are the by-products of processing plants or mills (sawdust, cedar chips, bark, bagasse, rice hulls) or waste disposal plants (compost, processed sewage sludge, bio solids). The main purpose of using organic amendments is to loosen the soil and create large pores to increase water permeability. After input of organic, an aggregated structure is formed in soil, which enhances drainage and stimulates root development. An additional benefit of organic amendments is also the fact that organic matter feeds soil microbes, which in turn release nutrients into the soil, thereby increasing soil fertility.

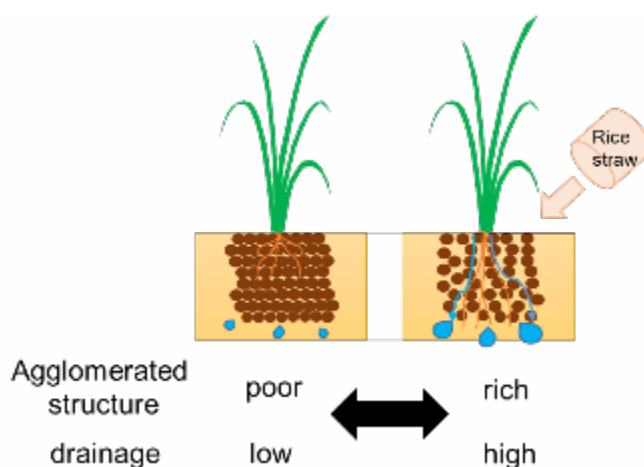


Fig 7 The difference of soil structure

As a representative example of soil amendment, methods by using local material, rice straw is shown below,

(1) Utilization of rice straw

There are three main types of composting. If you are new to using straw, we recommend Method (2), which is the cheapest method. If you want to promote composting, it is necessary to lower the C/N ratio to about 30 by adding nitrogen as the C/N ratio of rice straw is as high as about 70, Method (1).

(1) Composting at field using shopped rice straw, urea, water, and soil or manure

☞ "Please refer to SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity", page V-6~V-8.

(2) Composting in field by putting a pile of rice straw in the corner of field and let it decompose

(3) Taking rice straw at home in cowshed so that it will be used as manure then taken it back in field as manure

(2) Set internal regulation of cooperative to prompt straw use

The soil amendment using rice straw plowing in or making pile in corners of plots is not being implemented by farmer's members of cooperative or group of farmers after mobilization because some farmers sell rice straw. Therefore, it is recommended you to raise this as meeting resolution in general assembly meeting and put it into internal rules and regulations of cooperative for members to follow and implement as law.



Specific instructions are in manual “SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity” (page. V-6-V-8).

Column: Amendment of internal regulation have improved the application rate of use of rice straw.



Background:

COOPRORIZ Ngiryi is among rice growing cooperative under WAMCAB project model sites, is located in Gisagara district, Musha sector. During first phase of WAMCAB project, which was baseline survey, the soil test conducted, marked the low organic matter all over Ngiryi irrigation scheme. Different trainings on improvement of soil fertility and soil amendment planned and executed. Different techniques of soil amendment using rice straw conducted, the adoption was low, below 30% of all farmers members adopted using rice straw for soil fertility improvement.

Challenge:

Rice straw is expensive in the zone where Ngiryi is located, farmers after harvesting they used to sell rice straw on good price, so instead of using it for soil fertility improvement in paddy fields, it used to be sold to use outside the irrigation scheme as animal feed or mulching other crops including banana plantations, all of these mentioned reasons affected negatively the used of rice straw by farmers in paddy fields.

Countermeasure:

For the cooperative to overcome this challenge, during one of cooperative general assembly, the issue of soil fertility improvement was one of meeting agenda, participants took some resolution regarding the use of rice straw for paddy field amendment, one of resolution was to put the follow up responsibility in hand of FPG Leaders and report back to executive committee the implementation process in their respective FPGs, then farmer members who do not respect it, the plot will be given to other member for the valorization for one season.

Effect:

As the result of GA meeting resolutions two seasons followed, farmers adopted rice straw usage as soil amendment in their field at the rate of 95%.

1.2.3 Irrigation calendar

(1) What is Irrigation calendar?

Irrigation calendar is the process used by irrigation system managers to determine the correct frequency

and duration of watering.

Irrigation calendar is the decision of when and how much water to apply to a field. Its purpose is to maximize irrigation efficiencies by applying the exact amount of water needed to replenish the soil moisture to the desired level.

The importance of irrigation calendar is that it enables the irrigator to apply the exact amount of water to achieve the goal and increase irrigation efficiency. A critical element is accurate measurement of the volume of water applied or the depth of application. A farmer cannot manage water to maximum efficiency without knowing how much was applied.

Uniform water distribution across the field is important to achieve the maximum benefits from irrigation scheduling/management. Accurate water application prevents over or under irrigation. Over irrigation wastes water, energy and labor; leaches expensive nutrients below the root zone, out of reach of plants; and reduces soil aeration, and thus crop yields. Under over irrigation stresses the plant and causes yield reduction. Therefore, if you use any irrigation facility such as dam, pump, I recommend IWUO to prepare irrigation calendar.



For schemes with irrigation facilities under IWUO management, it is important to prepare an irrigation calendar. The irrigation calendar should include the following items,

- (1) Days and hours of irrigation
- (2) Prohibited activities
- (3) User requirements

An example is shown next page,

XXX IWUO

-Scheme name-

Tel: 0123 456 789, E-mail: XXX@gmail.com

IRRIGATION CALENDAR (2023 A)

CROP: RICE

I. Explanations

The irrigation scheme of XXX is divided into two zone for irrigation:

- **ZONE A:** starting from turnout 1-8 right and 1-6 left
- **ZONE B:** starting from turnout 9-15 right and 7-17 left

(1)

	Z O N E	DAYS and HOURS					
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	<u>ZONE A</u>	06H00'-18H00'		06H00'-18H00'		06H00'-18H00'	
2	<u>ZONE B</u>		06H00'-18H00'		06H00'-18H00'		06H00'-18H00'

II. REMARK:

1. The turnouts are allowed to be opened and closed by only the water distributor by the order of leaders of Irrigation Water Users Organization.
2. Someone who will open or close water without authorization from IWUO leaders and even it is not his/her time for irrigation will be punished.
3. Someone who has a problem of water should quickly inform the agronomist of cooperative for having a solution.
4. Members are requested to clean in their irrigation canals and field leveling in order to make it easily for water accessibility.

(2)

(3)

Done dd / mm, yyyy

Name:

Manager of Irrigation Water Users (IWUO)

Fig 8 Example of irrigation calendar

1) What is crop calendar? (Horticulture / Rice)

Crop calendar is the schedule of cultural operation needed in crop production with respect to time.

In the crop calendar, all farming activity such as land preparation, sowing/planting, fertilization, chemical apply, harvesting / post-harvesting needed to be shown with respect to time. Since delays in agricultural activities due to weather and other external factors can shift the harvest time, it is advisable that the crop calendar be updated accordingly.

The crop calendar should include the following items,

- (1) Crop
- (2) Activities
- (3) Monthly schedule of each activity
- (4) Duration of agricultural activities which needs irrigation

An example is shown below,

Fig 9 Example of Crop calendar (horticulture)

CROP CALENDER IN NGOMA 22 SCHEME HILLSIDE, 2022–2023 (KOTUNGO COOPERATIVE)																																			
NO		ACTIVITIES		MOUTHS OF YEAR																															
				2022												2023												2022							
				SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		APLY		MAY		JUNE		JULY		AUGUST									
				15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30								
SEASON A 2023: MAIZE, BEANS, SOYA BEANS, CHILI ,VEGETABLES AND FRUITS																SEASON B 2023: MAIZE, BEANS, SOYA BEANS, CHILI ,VEGETABLES AND FRUITS																SEASON C –2023: VEGETABLES AND FRUITS			
1	LAND PREPARATION	FIRST PLOUGHING																																	
		LIME APPLICATION																																	
		SECOND PLUGHING																																	
		ORGANIC MARURE,SEEDS AND FERTILIZERS																																	
2	GATHERING INPUTS	MANURE/ COMPOST, SEED, NPK, DAP AND UREA																																	
3	SOWING / NURSERY Preparation																																		
4	PLANTING																																		
5	PEST AND DISEASE MANAGEMENT																																		
6	FIRST WEEDING																																		
7	FERTILIZERS APPLICATION																																		
8	SECOND WEEDING AND EARTHLING UP																																		
9	HARVESTING																																		
10	DRYING																																		
11	STORAGE AND MARKETING																																		

Fig 10 Example of Crop calendar (rice)

CROP CALENDAR 2023B

Zone	FPG	AREA	LAND PREPARATION	NURSERY PREPARATION	SOAKING SEED	SOWING	TRANSPLANTING	FOLLOW UP FIRST WEEDING, TOP DRESSING, SPRAYING	IRRIGATION SCHEDULE
1	FPG 1 name	3.1	10 - 20 /11/2022	26/11/2022	28/11/2022	30/11/2022	21/12/2022	15 - 25/1/2022	every day
	FPG 2 name	4.5							every day
	FPG 3 name	5.98							every day
	FPG 4 name	2.6							Monday to Tuesday mid day
	FPG 5 name	2.08							Monday to Tuesday mid day
	FPG 6 name	1.89							every day
	FPG 7 name	6.48							Mid day Tue, Wed, Sat & Sun
	FPG 8 name	2.88							Mid day Tue, Wed, Sat & Sun
	FPG 9 name	3.72							Monday to Tuesday mid day
	FPG 10 name	1.14							every day
TOTAL		34.37							
2	RUHABYO1	4.86	KUVA KUWA 01 - 10 /12/2022	19/12/2022	21/12/2022	23/10/2022	13/01/20223	28/1 -10/2/2022	Monday to Tuesday mid day
	RUHABYO2	6.75							Mid day Tue, Wed, Sat & Sun
	RUHABYO3	5.1							Mid day Tue, Wed, Sat & Sun
TOTAL		16.71							
3	NYIRABIDUHA	4.8	KUVA KUWA 5-20/12	26/12/2022	28/12/2022	30/12/2022	20/1/2023	10 -20 /2 /2022	Monday to Tuesday mid day
	AGASENYI1	7.3							Mid day Tue, Wed, Sat & Sun
	AGASENYI2	2.28							Mid day Tue, Wed, Sat & Sun
	BISHUNGO	5.65							Monday to Tuesday mid day
	KIGAGA1	4.2							every day
	KIGAGA2	3.72							Mid day Tue, Wed, Sat & Sun
	KIGARAMA	6.9							Mid day Tue, Wed, Sat & Sun
	KAJINJA	7.2							Mid day Tue, Wed, Sat & Sun
	NYABITARE	9.05							every day
	GISEKE3	2.64							every day
TOTAL		53.74							
4	MUDUHA1	7.59	KUVA 09 -23/12/2022	2023/2/1	2023/4/1	2023/6/1	27/1/2023	15-25/2/2022	Monday to Tuesday mid day
	MUDUHA2	5.88							Mid day Tue, Wed, Sat & Sun
	MUSHA	5.91							Monday to Tuesday mid day
	BUTEKA	6.45							every day
TOTAL		25.83							
5	AKAZABABA	5.65	12-27/12/2022	2023/6/1	2023/9/1	2023/11/1	2023/2/2	20-30/2/2022	Monday to Tuesday mid day
	CYABIGEGA	6.8							Monday to Tuesday mid day
	MIGOGO	6.25							Monday to Tuesday mid day
	NYANKONO2	4.15							Monday to Tuesday mid day
TOTAL		22.85							
		153.5							

2) How to reflect crop calendar to irrigation calendar?

Cooperative is in charge of all farming activities including procurement of inputs to be used all along the season, growing different crops depend on the market resulted from the market survey done prior to the season start, then selling the harvested produce, cooperative runs as business entity.

On the other hand, Irrigation Water Users Organization (IWUO) main responsibilities in irrigation scheme, are operation, maintenances and management of irrigation scheme mainly aiming the sustainability of irrigation infrastructures. IWUO is in charge of water management they put in place the water distribution plan referring on existing irrigation facility and available quantity of water and irrigation scheduling refer on crop water requirements.

Therefore, these two organizations operating in the same irrigation scheme have to be coordinated to have same crop calendar to be efficient and effective.

During season preparation period, both stakeholders organize meeting (jointly) and cooperative side share the crop calendar they drafted, then IWUO analyses crop calendar if inserting the water distribution plan may work. If it does not fit, IWUO recommend the crop calendar which is practical and possible according to possible water distribution plan referring on irrigation facilities and the amount of water available.

1. Cooperative organizes seasonal preparation meeting and prepare crop calendar.
2. Hold joint meeting (IWUO and cooperative) to prepare irrigation calendar.
3. Announced in Zone level and collect opinions or requests from cooperative.
4. Hold joint meeting (IWUO and cooperative) to finalize and follow up of implementation.

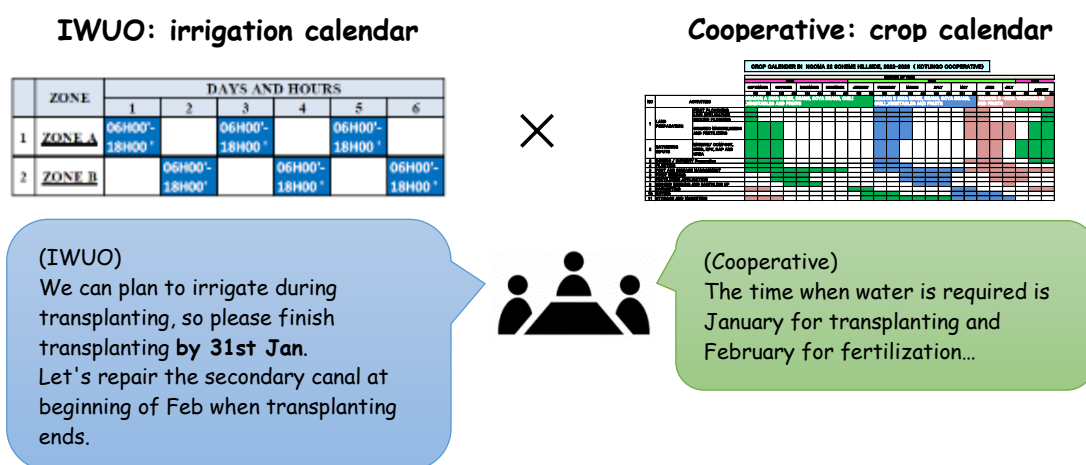


Fig 11 Joint meeting to revise both calendars

1.2.4 AWD

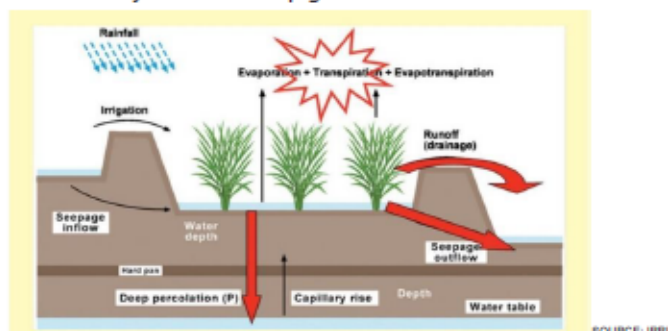
Alternate Wetting and Drying (AWD)

Alternate Wetting and Drying (AWD) is a water-saving practice where rice farmers can apply to reduce their water use in irrigated fields. Irrigation water is applied to flood the field a certain number of days after the disappearance of ponded water. Hence, the field is alternately flooded and non-flooded. The number of days of non-flooded in AWD between irrigations can vary from 1 day to more than 10 days depending on the soil type.

A farmer can use field water tube (perforated) in his field to monitor the water levels in the subsurface of the soil, while practicing AWD. The next page shows an excerpt from the WAMCAB manual for Output 4 on how to introduce AWD.

Chapter 6 Water saving irrigation in paddy (Alternate wetting and dry in Rice Cultivation)

The traditional paddy practice often leads to losses of water via surface run-off, seepage and percolation that accounts for 50-80 percent of total water input. The water losing through evapotranspiration is only useful for crop growth.



With the growing demand for food production, decreasing trend in water resources availability, the traditional paddy cultivation will face tremendous difficulties in near future.

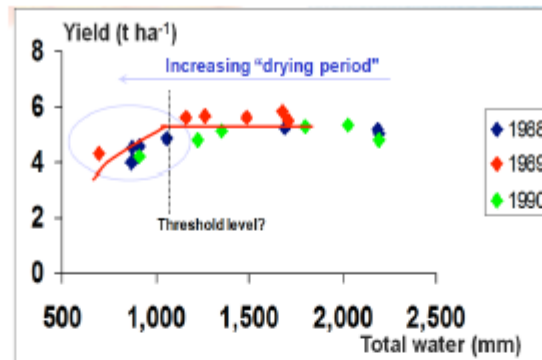
How much water do people use?

	Liters of water
Daily drinking water	2-5 liters of water
Daily household use	20-500 liters of water
1 kg of Rice	3,000-50,00 liters of water input to the field

Alternate Wetting and Drying (AWD) is found to be an important adaptation method to overcome the shortages and climate change impacts. The practice is based on the knowledge that rice can grow even up to 30% reduced water supply during the main growing period compared to conventional irrigation. To determine the timing of irrigation, the water level in the soil is monitored by a perforated plastic tube, which is inserted into the rice field. AWD requires irrigation when the water level drops to 15 cm below the soil surface.

Numerous studies were conducted on the manipulation of depth and interval of irrigation to save water use without any yield loss. The studies show that continuous submergence is not essential for obtaining high rice yields. Hatta (1967) and other researchers reported that maintaining a very thin water layer, saturated soil condition, or alternate wetting and drying could reduce water applied to the field by about 40–70 percent compared with the traditional practice of continuous shallow submergence, without compromising on yield.

Fig 12 (1) Introduction of AWD referred from Output 4 manual



Remember: Rice does not always need flooding AWD Saves 10-30% of irrigated water.

Alternate Wetting and Drying (AWD)

Alternate Wetting and Drying (AWD) is a water-saving practice where lowland (paddy) rice farmers can apply to reduce their water use in irrigated fields. In AWD, irrigation water is applied to flood the field a certain number of days after the disappearance of ponded water. Hence, the field is alternately flooded and non-flooded. The number of days of non-flooded in AWD between irrigations can vary from 1 day to more than 10 days depending on the soil type.

A farmer can use field water tube (perforated) in his field to monitor the water levels in the subsurface of the soil, while practicing AWD.

Making the field water tube:



- ✓ The field water tube can be made from a plastic pipe or of any other similar structures like tube.
- ✓ Cut this material to a 1 foot length with a diameter of 4 inches to easily see the water level inside the tube.
- ✓ Drill the bottom 6 inches of the tube with holes on all sides; these holes should be about 0.5cm each and 2cm away from one another.



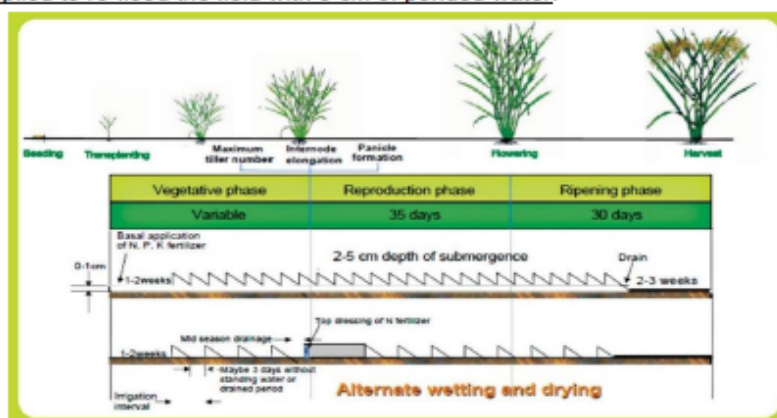
Fig 11 (2) Introduction of AWD referred from Output 4 manual

- ✓ Place the tube in a readily accessible part of the field, close to the bund (not less than 1m away) for easy monitoring. The location should be representative of the average water depth in the field (i.e. it should not be in a high spot or a low spot).
- ✓ Insert the tube up till 6 inches depth so that half of its length remains on the surface
- ✓ Remove the soil inside the tube so that the bottom of the tube can be seen. Ensure that the level of water inside the tube is the same as the level of water on the field.



Practicing Alternate Wetting and Drying (AWD)

- ✓ AWD can be implemented and monitored by considering the depth of ponded water on the field by using field water tube. The depth of ponded water will gradually decrease after each irrigation.
- ✓ When the ponded water is dropped to 15 cm below the surface of the soil, irrigation should be applied to re-flood the field with 5 cm of ponded water.



Safe AWD

AWD can be started 30 days after transplanting (or with a 10-cm tall crop in direct seeding). When weed population is high, AWD can be postponed for 2-3 weeks until weeds have been suppressed by the ponded water.

The fertilizer recommendations can be similar to that of normal flooded method. Apply nitrogen fertilizer preferably on the dry soil just before flooding.

From one week before to one week after flowering, ponded water should always be kept at 5 cm depth above soil level to avoid water stress which could result to potentially severe yield loss.

Fig 11 (3) Introduction of AWD referred from Output 4 manual

After flowering, during grain filling and ripening, the water level can drop again to 15 cm below the surface before flooding.

Main idea of safe AWD:

- ✓ Water is available in the root zone below subsurface, which is not visible.
- ✓ Water tube can create information to the farmers about scheduling of next irrigation.
- ✓ Scheduling of irrigation varies with soil type, hydrology, variety Keep first 2 weeks flooded if many weeds.

A practical indicator to irrigate under safe AWD

- ✓ Safe AWD = Irrigate when water depth -15 cm
- ✓ Keep flooded 10 DAT (weeds) and at flowering

Benefits of AWD technology

- ✓ Water savings up to 15-25 percent with no yield penalty. In pump irrigation systems, it reduces pumping costs and fuel consumption and an increased income. AWD promotes good root anchorage and reduces the crop lodging problems.
- ✓ Better root anchorage to reduce lodging



- ✓ The AWD method has increased yield up to 14 % compared to the normal irrigation method. The water use efficiency has increased up to 70 % compared to 57 % under normal method during Rabi 2013. There is a general trend of increased yields compared to the previous year (2012) yields. But the increase was more in the fields adopted with AWD compared to the continuous irrigated fields. The increased yields not only attributed to the increased tiller number under AWD, but also to the varietal performance and the congenial conditions like few pest and disease incidence during the crop period

Fig 11 (4) Introduction of AWD referred from Output 4 manual

1.2.5 Seasonal Water Distributor (SWD)

IWUO aims to achieve sustainable irrigation for its fields through proper water management, irrigation facility repair, and O&M activities. However, in some cases, IWUO, with its small staff, is unable to reach out to manage canals at the field level. This is even more so when the area of the scheme is large.

Furthermore, not all schemes in Rwanda have maintained irrigation facilities, and many schemes irrigated

from water resources such as spring and river. In season A, some cooperatives are forced to reduce cultivation area due to water shortage in the dry season. To break out of this situation, WAMCAB developed simple techniques and devised existing technique and achieved sustainable irrigation in such natural environment. The following is the procedure for SWD operation.

(1) Establishment of water distribution system implemented by cooperative

1. Estimate the amount of water available in each season and calculate the number of irrigable cultivation area on this estimate.
2. Each FPG selects one Seasonal Water Distributors, hereinafter referred to as SWD.
3. SWD has responsibility to open / close canal at field level and plot level and apply water to each plot. Depend on water distribution plan and current condition of water level, each FPG decides specific frequency of irrigation.
4. Provide incentive such as money equivalent of 1 kg / plot of paddy rice with SWD.

This system reduces water wastage and irrigates fields during the dry season. Furthermore, sustainability can be ensured by utilizing existing groups of cooperatives such as FPG. It is recommended that the lowest level group be utilized, as a group with many constituent members will increase the amount of work that one person has to bear.



Fig 13 SWD closes field canal by putting soil



Column: Cultivation area doubled due to SWD placement.

Background:

The rice cooperative where is located in Gisagara District irrigate water from spring and they faced water shortage in season A. Although IWUO maintained irrigation infrastructure and facility to be managed properly, farmers waste of water all along the season and it made this water shortage more serious.

Challenge:

No one had been assigned to open and close the farm canals where is the closest to the field of water management because of understaffing of IWUO staff.

Farmers were forced to reduce cultivation area due to severe water shortage.

Countermeasure:

IWUO and cooperative discussed and concluded to deploy “Seasonal Water Distributor (SWD)” who is in charge of opening / closing of farm canals. They selected responsible person from each FPG and FPG leader instructed them how to manage, frequency of open / close, etc.

Effect:

It reduced water wastage. In addition to introducing SWD, the cultivation area of season A increased from 65 ha to 110 ha as a result of field improvements such as AWD, maintenance of field waterways, and compaction of ridges.

1.2.6 Improvement of profitability

Farmers' income is a good indicator of farming feasibility through the large ratio of income to farm costs. The income of rice farmers also has an impact on the level of poverty and household food security of farmers, which is related to the ability of farmers to meet food needs based on the income received from rice farming.

Firstly, farmers are required to know the income and expenditure situation. It is recommended to record income and expenditure regularly in your notebook. Accounting records not only allow you to keep track of your expenses and income as figures, but also allow you to check unnecessary expenses and prevent wasteful spending. If you can prevent wasteful spending, you will be able to pay school fees, maintain your home, and improve your living services.



As for the recording method, it is easier to organize by creating a table like <Book keeping style> following. However, farmers who do not have the habit of keeping records should first prepare a notebook and a pen and write down the expenses and income of agricultural activities in the notebook like < Free style >.

<Book keeping style>

Date	Particulars	Unit Cost	Quantity	Incoming	Expenditure	Balance
1 June 2015	Balance from May 2015			16,150		16,150
12 June 2015	Seed (Tomato, RWF 500/can)	500	5		2,500	13,650
18 June 2015	Seeds (Cabbage, RWS400/can)	400	8		3,200	10,450
18 June 2015	Fertilizer (RWF 250/kg)	250	10		2,500	7,950
19 June 2015	Office Rental				4,000	3,950
20 June 2015	Transportation Cost to Market	1,000	1 time (return)		1,000	2,950
30 June 2015	Membership Fee (15 members)	1,000	15	15,000		17,950
30 June 2015	Total			31,150	13,200	17,950

Source: SMAP Cooperative Management and Gender Mainstreaming Technical Manual for Market-oriented Agriculture

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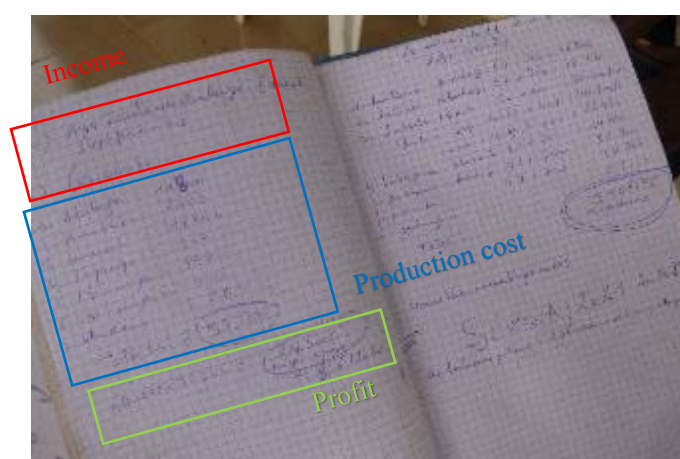


Fig. Record book of one farmer in Ngoma 22

Profit = Productivity * Price – Cost, for the farm gate price of paddy rice it is not decided by farmers, many actors within value and supply chain of rice decide on the paddy rice selling price, for farmers to increase the profitability of rice crops, they will play with only two factors which are **productivity** and **production cost** which are fully controlled by farmers, for farmers to achieve optimum yield (unlock the productivity potential of rice varieties they deal with) it requires adoption of precision agriculture which means application of good agricultural practices effectively and efficiently, this will led farmers to maximize the productivity and minimizing the production cost.

Strategy to improve profitability

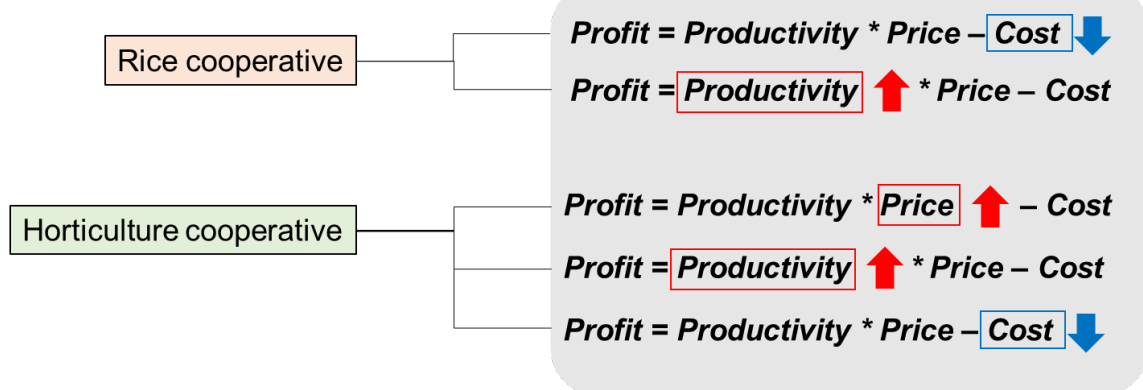



Fig 14 Different strategy to improve profitability depend on cooperatives

Profit = Productivity * Price – Cost \downarrow

How to cut costs...

- ☐ Effective use of fertilizer (apply appropriate amount of fertilizer)
- ☐ Use of organic fertilizer
- ☐ Weeding at the right time (If it is not the right time, labor costs will be incurred and the yield will be reduced)




Making organic pesticide

Profit = $\boxed{\text{Productivity}} \uparrow * \text{Price} - \text{Cost}$

How to improve productivity...

- ☐ Respect cultivation techniques
- ☐ Select varieties adapted to the field



Optimizing spacing

Fig 15 Concrete examples for improving profitability

Chapter 2 Market Linkages

When preparing agricultural activity plan, it is important to consider sales channels as well as agricultural activities such as planting and transplanting. Even if you apply advanced cultivation techniques and increase yields or decrease production costs, the farmer will have less income available to him if he sells to middle man that reduces the farmer's income.

For this reason, we recommend to conduct market survey². It is important to list potential sales channels in advance, survey the selling price of each, how transportation costs are borne, and determine the most profitable sales channel.

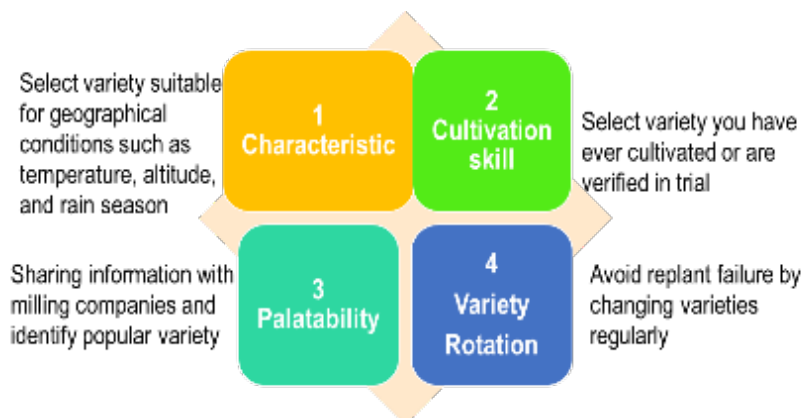


2.1 Rice

2.1.1 Variety selection

Do rice farmers grow the same variety every season? Market-oriented agriculture may seem more compatible with horticultural crops, but by selecting varieties that match market needs, rice farmers are also practicing market-oriented agriculture.

Farmers and cooperatives involved in rice value chain at production level (growers) it is highly recommended to contact and sit together with milling companies even before deciding which rice varieties to be focused on. It is better to grow varieties that are recommended by those milling companies since they are the one who know and have access on consumer preferences. At the same time, it is recommended to consider from 4 aspect, characteristic, cultivation skill farmer has, palatability and variety rotation.



2.1.2 Market information

When you collect information about varieties, use the questionnaire below to collect the following items: Variety, yield, sales price, characteristic, area to be cultivated and consumer preferences. Sales price will be decided between farmers, MINECOM and milling companies accordingly, so please consider sales

² Please refer to the SMAP manual for specific methods and recommended formats.

price collected as rough indication.

When selecting, it will be a material for discussion among cooperative members. It is desirable that collecting information be carried out on a regular basis and updated (2-3 times/season).

Table 3 Survey sheet

Variety	Short / Long	Yield (t/ha)	Sales Price (Rwf/kg)	Characteristic	Area to be cultivated	Consumer preferences.
Fashingabo	Long	4.5	450 Rwf/kg as of 2022B	-Spacing 15/15 -Plant height 69cm -Number of tillers 28 -Number of panicles 23 -Diseases Not much , small blast -Panicle size; 22cm with many grains on panicle - it has cold resistant	- Rwamagana - Gisagara - Ngoma	It is more popular and in demand than the short variety.
...

For survey sheet of horticulture, please refer to “SMAP Marketing Technical Manual for Market-oriented Agriculture”, page II3.

Once an agreement is reached, it is strongly recommended that both parties enter into a contract between milling company and cooperative during seasonal preparation.

2.1.3 Trial cultivation

When there is new variety recommended by buyers (milling companies) or RAB, the new rice variety should be tried if it is adapted your area in season A and B. After the adaptability is confirmed and it shows good productivity and resistance to pest and diseases, variety may be introduced to farmers of rice cooperative growers.

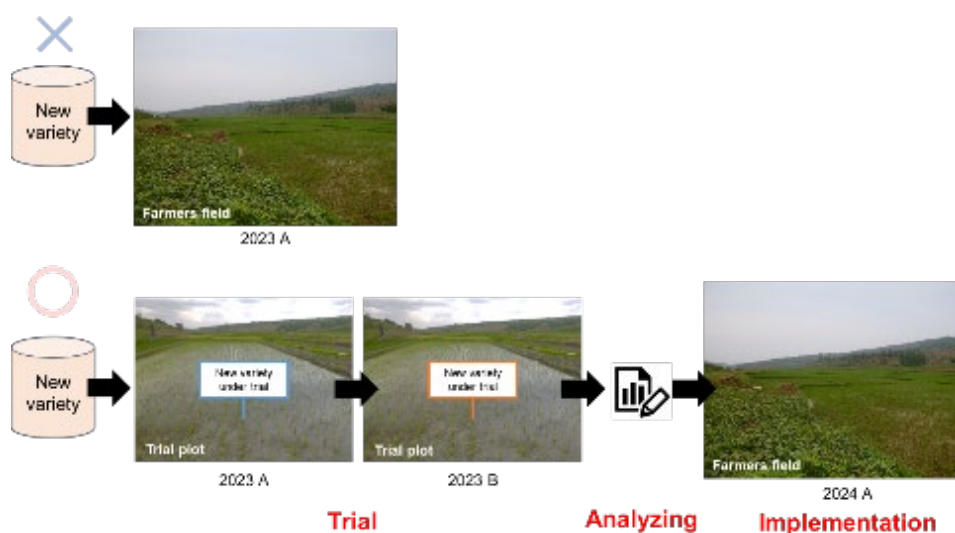


Fig 16 Flow from receipt of new variety seed to field cultivation

Column: 15 rice varieties work shop in Cyaruhogo

WAMCAB and RAB have collaborated to test 15 rice varieties through RAB trial to ensure its performance with the purpose to help farmers to find the best varieties that could help them to increase productivity.

The workshop was organized in sprouting season to be easily to know grow performance of each varieties and it was good opportunity for farmers to identify varieties adapted to Cyaruhogo area. In addition to farmers, Union staff who have contracts with seed sellers and rice millers were also invited to the workshop, and they were made aware of the varieties that are expected to produce high yields in the Cyaruhogo area. Based on the agreement between the farmers and the Union staff, 7 of the 15 varieties were finally selected as suitable varieties and some of them were cultivated next season.

Table. Result of yield

No	Variety	Type	Yield (t/ha)
1	V30	Short	7.9
2	Umujagi	Short	7.5
3	Yun Er thian	Short	7.2
4	Yun Yin	Short	7.0
5	Yun-keng	Short	6.1
6	Tubuka	Medium	8.0
7	WATT (Insindagirabigega)	Long	7.5
8	Muturage	Medium	5.9
9	Gakire	Medium	5.1
10	Imbaturabukungu	Long	7.4
11	Buryohe	Long	6.4
12	Nemeyubutaka	Long	6.8
13	Mbakungahaze	Long	7.3
14	Rumbuka	Long	7.4
15	Fashingabo	Long	6.8



Photo. Nursery of several varieties (left) and farmers observed grow performance (right)

2.2 Contract farming

2.2.1 What is contract farming?

At the heart of contract farming (CF) lies an agreement between farmers (producers) and buyers: both agree in advance on the terms and conditions for the production and marketing of farm products. These conditions usually specify the price to be paid to the farmer, the quantity and quality of the product demanded by the buyer, and the date for delivery to buyers. In some cases, the contract may also include more detailed information on how the production will be carried out or if inputs such as seeds, fertilizers and technical advice will be provided by the buyer (referred from FAO).

2.2.2 Type of contract farming

Contract farming can be structured in a variety of ways depending on the crop, the objectives and resources of the sponsor and the experience of the farmers. Contracting out production is a commercial decision to facilitate an adequate supply within a designated period and at an economic price. Any crop or livestock product can theoretically be contracted out using any of the models; however, certain products favour specific approaches. Broadly speaking, contract farming arrangements fall into one of five models:

1. The centralized model
2. The nucleus estate model
3. The multipartite model
4. The informal model
5. The intermediary model

Table 4 Characteristic of contract farming

Type	Characteristic	Crop / Area
1. The centralized model	<ul style="list-style-type: none">This is a vertically coordinated model where the sponsor purchases the crop from farmers and processes or packages and markets the product.In Africa, the contracting out of crops to farmers under centralized structures is common.	<ul style="list-style-type: none">Tobacco, cotton, sugar cane and bananas and with tree crops such as coffee, tea, cocoa and rubber
2. The nucleus estate model	<ul style="list-style-type: none">In this case the sponsor of the project also owns and manages an estate plantation, which is usually close to the processing plant. The estate is often fairly large in order to provide some guarantee of throughput for the plant, but on occasion it can be relatively small, primarily serving as a trial and demonstration farm.	<ul style="list-style-type: none">oil palm and other crops (Indonesia and Papua New Guinea)
3. The multipartite model	<ul style="list-style-type: none">The multipartite model usually involves statutory bodies and private companies jointly participating with farmers. Multipartite contract farming may have separate organizations responsible for credit provision, production, management, processing and marketing.	<ul style="list-style-type: none">China, Mexico, Kenya, and West Africa
4. The informal model	<ul style="list-style-type: none">This model applies to individual entrepreneurs or small companies who normally make simple, informal production contracts with farmers on a seasonal basis.Crops usually require only a minimal amount of processing. Material inputs are often restricted to the provision of seeds and basic fertilizers, with technical advice limited to grading and quality control matters.	<ul style="list-style-type: none">fresh vegetables, watermelons and tropical fruits
5. The intermediary model	<ul style="list-style-type: none">The style to have subcontract of crops to intermediaries.Large food processing companies and fresh vegetable entrepreneurs purchase crops from individual "collectors" or from farmer committees, who have their own informal arrangements with farmers.	<ul style="list-style-type: none">Southeast Asia (Thailand, Indonesia)

Created with reference to link below,

[Contract farming - Partnerships for growth \(fao.org\)](https://www.fao.org/partnerships-for-growth/)

2.2.3 Procedure of contract farming in Rwanda

First, the buyer visits the potential site and assesses the local conditions, then they submit collected information to MINICOM.

Taking into account the local conditions in the site, the buyer presents the cooperative with required terms and conditions of the contract (quantity, size, quality, and selling price). The cooperative needs to consider whether the cultivation can meet those conditions. If there are any terms and conditions that are inconvenient for the cooperative, or if there are any points that are unclear, the cooperative confirm them with the buyer.

After that, the cooperative visits District officer who is in charge of cash crop / business and development unit and inform what they have discussed with the buyer and asks them to confirm that the cultivation is indeed feasible from a technical aspect. Once validated, the contract is approved. For export, RICA officials visit the site to confirm that this cultivation takes environmental conservation into account. Once cleared, the contract between the supplier and the agricultural cooperative is approved and the contract is signed.

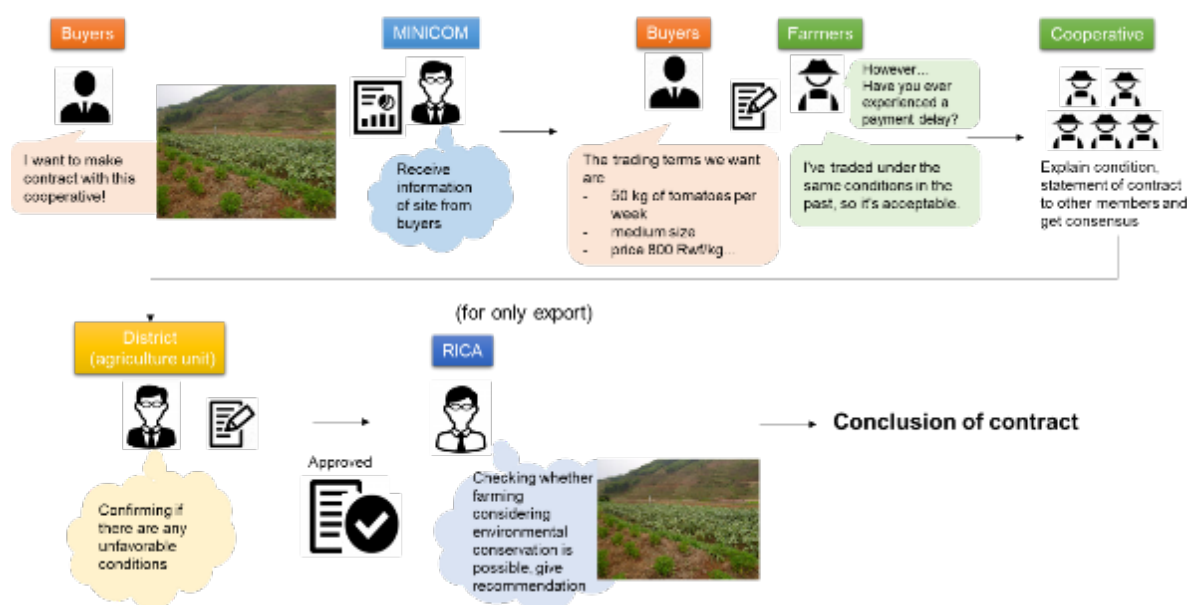



Fig 17 Procedure to make contract

2.2.4 Advantage and Disadvantage

Contract farming may have advantages as well as disadvantages, as illustrated below. The cooperative who are willing to make contract needs to recognize both aspects before starting.

Advantage for farmers	Advantage for buyers
<ul style="list-style-type: none"> Easier to prepare crop / irrigation calendar as the cultivation conditions are specified in the contract As sales price is higher compared to local market, income is improved and farmer is motivated Easier to collect water fee as production is shipped through cooperative Earn one season of income at a time and easier to save money Easier to get bank loan 	<ul style="list-style-type: none"> Consistent supply of raw materials Products conform to quality and safety standards Reduced input and labour costs when compared to integrated production on company-owned land Better chance to secure products of consistent quality Can help to overcome land constraints Production more reliable than open-market purchase

Disadvantage for farmers	Disadvantage for buyers
<ul style="list-style-type: none"> ■ High hurdles for trading conditions (required consistent supply, high quality, etc.) ■ There is a possibility that the content of the contract may not be respected due to the convenience of the company (delay in pick up production and payment, etc.) ■ Affects food security (growing only certain crops increases the price of grains and vegetables for home consumption) ■ Prices of inputs supplied by companies tend to be higher than market prices ■ Growing only certain crops causes repeated cultivation damage ■ Difficult to establish unless agricultural cooperatives are organized (negotiation skill is required) 	<ul style="list-style-type: none"> ■ High transaction costs from contracting with many small farmers ■ Risks of side-selling if farmers decide to break the contract and sell to others ■ Potential misuse of inputs if farmers use seeds and fertilizers provided ■ Loss of flexibility to seek alternative supply ■ Reputational risk if things go wrong 

Created with reference to link below,

<https://www.fao.org/in-action/contract-farming/background/what-is-contract-farming/en/>

2.2.5 Challenges and Difficulties

The problems that became apparent when contract farming was introduced at some cooperatives are shown below,

- Difficult for farmers to meet quality standard
- Limited post-harvest handling knowledge and skills
- Supply weekly is difficult (in case of fresh vegetable)
- Farmer are not aware how to sort and grade to meet request from buyers, so when production is sorted again in pack house, then the production will be reduced.

NAEB also acknowledges the difficulty of contract farming for export, and raise the following two issues as challenges.

<p>Quality management</p> <ul style="list-style-type: none"> • Limited post-harvest handling knowledge and skills – Currently reject levels of fresh horticulture produce such as French beans are as high as 30-40% of production on out-grower farms due to limited post-harvest handling capabilities and equipment, higher than the industrial average of 10-15%.⁷² • Compliance with quality and safety standards requirements – The EU, which is the largest market for high-value horticulture crops, has strict regulations around the maximum residue levels (MRLs) for pesticides, maximum levels for certain contaminants, and plant health (sanitary and phytosanitary – SPS) issues. While horticulture commodities fetch higher prices in the EU than in other places, the investments required for Rwandan products to comply with the EU requirements are also substantial.

(Reference from NAEB Strategic Business Plan 2019-2024).

2.2.6 Recommendation

(1) Seek technical advice from District.

Generally, drafts of contract are prepared by the buyers. Therefore, the term or condition vary depend on buyers. It is necessary to confirm whether the farmer can meet the cultivation conditions, quality, and post-harvest treatments written in the contract. There is a challenge that knowledge and skills of cultivation techniques and post-harvest are limited, it is preferable you to seek advice from a cash crop officer of District before signing the contract.

(2) Propose to add a specification about technical assistants

The quality required is different when selling to the local market and when selling to the buyers, with the latter requiring higher quality. Therefore, you propose the buyers to send a technician to the site and instruct how to cultivate. This should be clearly stated in the contract, so suggest that the buyers add this to the contract.

(3) Consult with stakeholders before entering into a contract

Once a draft contract is shared with cooperative by the buyer, be sure to set up a face-to-face meeting to discuss it. The meeting should include not only the buyer and the cooperative, but also District.

At the meeting, please confirm the terms of the contract one by one and clear up any uncertainties. If there are any terms that you would like to add, such as the assignment of a technician, insurance coverage, etc., please discuss them with the buyer.

The cooperative should not sign immediately on the spot, but share the details of the discussions with the executive committee or other members to obtain agreement from them.

(4) Witness of NAEB in contract agreement

As mentioned in Advantage and Disadvantage, there are aspects of contract farming that are risky. If the buyer does not comply with the contract or does not keep its promises, the farmer suffers damage.

If the above happens, support by the local government, NAEB which has mandate to drive Rwandan's agri-exports revenues growing by supporting export sectors across production, marketing and policy interventions is very important (e.g., issuing a letter to the buyers, raising the issue with central government, etc.). Therefore, be sure to consult with cash crop officer from District before signing a contract. NAEB can be added to WITNESS for export crops.

(5) Complete signing of contract before starting cultivation

A contract is a formal written document in which both parties promise to assume certain responsibilities. It is also a document that proves that both parties have reached an agreement. Therefore, the step of concluding a contract must be taken before starting any agricultural activity.

If you start cultivation without signing a contract, conditions may be added that are favorable to the contractor, or the contract cultivation itself may be stopped. Therefore, be sure to complete the signing of

the contract before starting contract farming activities.

(6) Cooperative need to be highly skilled to be successful.

Prerequisite of cooperative to start contract farming

Cultivation technique

- ✓ There is know-how of cultivation technology that is conscious of post-harvest processing (e.g. grading, sorting, spray program)
- ✓ Have supplied crops constantly

Organizational capacity

- ✓ Organization
- ✓ Book keeping
- ✓ Cooperative & Leadership
- ✓ Record Management
- ✓ Problem solving
- ✓ Negotiating skill
- ✓ Collaboration with local government

These capacity development are described in detail in the SMAP manual, please refer to it.

(7) Format of contract

When reviewing the contract with the buyers, please refer to the template for the clauses that should be agreed upon. Following is the example of contract farming between Ngoma22 cooperative and chili company using the format drafted by RAB.

CONTRACT AGREEMENT FOR PEPPER (CHILLI) TEJA VARIETY

This agreement is made between:

....., a company operates under the laws of Rwanda with registered in the RDB at, engaged in agricultural investments with its registered office located in Kigali City, Kicukiro District, Kicukiro Sector, Cell of, represented by, whose telephone number is and email address is (hereinafter referred to as the "buyer"),

and

COOPERATIVE, a cooperative operates under the laws of Rwanda with registration in the RCA, holding certificate no, engaged in the cultivation of vegetables and fruits in District, Eastern Province, with its registered office situated in District, Sector, Cell of, represented by, with contact telephone number: and email address:..... (hereinafter referred to as the "Farmer").

ARTICLE ONE: OBJECTIVES OF THE AGREEMENT

The parties intend to implement the TEJA chili farming and trading project. The cooperative will cultivate this crop in accordance with requirements made with the Consumer (buyer) and will deliver all produce, excluding any that are unfit for sale (including diseased, damaged, or spoiled chili). Produce selection (sorting) will take place (conducted) on-site, and the cooperative will be able to record the quantity supplied to the company just on site after sorting.

ARTICLE TWO: PRICES

Both parties agreed that TEJA chili variety will be bought basing on followings:

ITEM	PRICE
Dried teja chili (garade 1)	1500 frw/kg season 2024A
Dried TEJA chili (garade 2)	.....
DriedTEJAchili (garade 3)	.....

When the price on the market increases by 15% or decreases by 15%, the Buyer and the

Cooperative will sit together and agree on a new appropriate price.

ARTICLE THREE: FARMER'S RESPONSIBILITIES

- 1) To avail land for cultivation of at least 45 hectares.
- 2) To plant seeds(variety) that the farmer has agreed upon with the buyer;
- 3) To use the type of fertilizer and the agreed-upon quantity with the buyer;
- 4) To use pesticides agreed upon with the buyer;
- 5) The farmer must irrigate the crops as advised by the Agronomist;
- 6) During irrigation, they must avoid causing runoff that could carry away the used fertilizer;
- 7) To consult agronomists so that the yield will be sufficient and of good quality;
- 8) To collect all the produce needed by the buyer, removing any that are not up to standard at the agreed price;
- 9) Not to sell the produce elsewhere unless there is prior agreement with the buyer, which must be documented;
- 10) To pay the buyer 100% of the cost of seeds before starting cultivation, according to the market prices agreed upon unless credit is granted;
- 11) To pay 100% of the cost for pesticides and fertilizers at the agreed prices unless credit is granted;
- 12) Not to enter into agreements with another person to cultivate on the mentioned land unless agreed upon with the buyer or if the contract has expired;
- 13) To deliver well sorted produce based on the buyer requirements;
- 14) To employ sufficient workers for harvesting and selection so that the produce is transported timely and properly;
- 15) To use appropriate equipment for harvesting and sorting the produce;
- 16) To properly package the produce in suitable containers to prevent damage;
- 17) To insure the TEJA chili crop every planting season;
- 18) Not to employ children under the age of eighteen (18).

ARTICLE 4: BUYER RESPONSIBILITIES

- 1) Assisting farmers in obtaining seeds, fertilizers, pesticides, and other necessary tools to ensure they achieve good yields and maintain their produce when they cannot obtain them themselves; however, the costs are covered by the farmer, and the expenses are deducted from the yields, providing the remaining amount, as agreed upon regarding market prices;
- 2) Informing farmers about the characteristics of the produce needed in the market (type, quality, size, color, and other relevant factors) before they start planting;
- 3) Informing farmers about the cost or value of inputs needed from the beginning of the agricultural season until harvest time;
- 4) Assisting farmers by advising them to improve their production;
- 5) Buying all the produce that meets the criteria confirmed by a company (buyer) employee in collaboration with the responsible Cooperative staff on-site where it is dried;
- 6) In case of unexpected changes in the pickup of produce, the company (buyer) must

notify the farmer at least 24 hours in advance. The buyer must not exceed 48 hours to come and pick up the produce from the time they communicated the changes;

7) Providing technical advice to farmers on irrigation methods that do not adversely affect the quality of the produce and the soil's nutrients, and on combating erosion in their fields;

8) Showing farmers how to harvest and select produce at least three (3) days before the first harvest begins;

9) Helping farmers obtain appropriate harvesting tools (sickles, baskets);

10) The costs of packaging and transporting the produce from the agreed collection point as per these agreements are to be borne by the Buyer;

11) The management of packaging materials provided by the buyer concerns the buyer or their representative;

12) Entering into a Memorandum of Understanding (MoU) for collaboration with the district of, so that the company finds ways to cooperate with farmers' cooperatives, including, and the district must supervise the cooperation between the buyer and the Cooperative

ARTICLE 5: HARVEST COLLECTION AND PAYMENT

1) Collection and transportation of the harvest is done at an agreed collection point between both parties, where the farmer knows the weight collected by the buyer;

2) The buyer purchases the harvest from the cooperative at the price indicated in section 1;

3) The buyer collects the harvest from the collection point located at the cooperative and pays for all harvested produce before carrying it away;

4) Payments are made through the KOPERATIVE account with account number opened at the Bank of, in the name of the Cooperative

5) The buyer pays the Cooperative deducting any debts owed, with the payment for each debt installment to be agreed upon by both parties at the time of debt issuance.

ARTICLE 6: RESPONSIBILITIES OF AGRONOMISTS

Responsibilities of the Company Agronomist

1) To assist farmers in obtaining seeds suitable for the produce desired by the buyer;

2) To help farmers understand the type and proper amount of fertilizer based on market requirements;

3) To assist farmers in using the correct type of pesticide and appropriate dosage according to market standards;

4) To provide advice and training to farmers to help them increase both the quality and quantity of the harvest to ensure they achieve at least 75% of the required quality and quantity;

5) To help farmers obtain suitable tools for harvesting (harvesters, crutches, tarps).

Responsibilities of the Cooperative Agronomist

- 1) To assist farmers in obtaining seeds suitable for the produce desired by the buyer through the Company Agronomist;
- 2) To help farmers understand the type and correct amount of fertilizer based on market requirements as determined by the Company Agronomist;
- 3) To assist farmers in using the correct type of pesticide and proper dosage according to market needs as dictated by the Company Agronomist;
- 4) To provide advice and training to farmers to help them achieve the agreed quality and quantity of produce, ensuring they attain at least 75% of the required quality and quantity;
- 5) To help farmers procure suitable tools for harvesting (harvesters, crutches, tarps) based on the Cooperative Agronomist's recommendation.

ARTICLE 7: FORCE MAJEURE

- 1) For the purposes of this agreement, unforeseen hazards are defined as any occurrence that arises after the contract is signed that is unexpected, beyond the control of both parties, and prevents one or both from fulfilling their obligations, including, but not limited to, war, protest, civil unrest, transportation or communication service interruptions, significant changes in agricultural laws or policies in the producing country, embargoes, sanctions, strikes, and other labor disputes, riots, epidemics, earthquakes, storms, droughts, fires, floods, or other extraordinary weather events, explosions, lightning, or acts of terrorism.
- 2) In the event of unforeseen circumstances preventing the harvest from being obtained due to: weather changes, flooding, severe drought, insecurity, accidents, thereby hindering the farmer from fulfilling his obligations, the farmer shall be covered by the insurance he took out, if there is debt owed to the buyer, the buyer shall be paid first.
- 3) As soon as reasonably possible after an unforeseen event begins, the affected party shall notify the other party in writing of what occurred, the date it started, the duration it may last, or the effects of the unforeseen event on its ability to perform all contractual obligations, along with substantial evidence showing those unforeseen events.
- 4) The affected party shall do everything possible to mitigate the effects of the unforeseen event on fulfilling its obligations.
- 5) Should it comply with the preceding clause, if a party is prevented, restricted, or delayed in starting any obligations based on this force majeure agreement (the affected party), the affected party shall not be considered in breach of this agreement or any other liability for failure or delay in completing those obligations.
- 6) Whenever possible at all times, such obligations may be suspended by the agreements made between the parties during the duration of the unforeseen events, and no compensation or penalties shall be due for the delay in pending actions.
- 7) If the obligations are suspended due to unforeseen events for more than 30 days from notifying the affected parties of the unforeseen risks, or if suspension is not possible at all times, the other party may terminate the agreement and any payment obligations related

to the needs during the planting period, and both parties shall engage in good negotiations to establish new agreements for providing the harvest.

ARTICLE 8: WHEN THE AGREEMENT WILL BEGIN TO BE ENFORCED

This agreement will begin to be enforced on the date it is signed by both parties and will last for two (2) years, but the price will be agreed upon at the beginning of each growing season.

ARTICLE 9: REGULATIONS GOVERNING THIS AGREEMENT

This agreement is made and governed by the laws applicable in the Republic of Rwanda.

ARTICLE 10: WAIVER OF CONSEQUENCES DUE TO NON-COMPLIANCE WITH THE AGREEMENT

- 1) Any consequences arising from the failure to purchase the Cooperative's produced goods, the Buyer shall bear and pay for all such goods at the price determined in this agreement.
- 2) If the Cooperative sells production to another buyer not mentioned in this agreement, it shall bear the consequences arising from the non-compliance with this agreement in relation to the Buyer not adhering to the agreements with those to whom they supply goods, including those from this Cooperative.
- 3) Consequences arising from goods coming from outside the Cooperative shall be borne by the Cooperative since goods found to contain items from outside will be rejected and not taken by the Buyer.

ARTICLE 11: REQUEST FOR COMPENSATION

Without prejudice to other rights or remedies arising from this agreement, the aggrieved party may request compensation for any cost, loss, or expenses incurred due to non-compliance with this agreement in accordance with the applicable laws.

ARTICLE 12: RESOLUTION OF DISPUTES

- 1) Disputes arising from the implementation or interpretation of this agreement shall be resolved through mutual agreement; if this is not possible, the relevant authorities and courts with jurisdiction in the Republic of Rwanda shall be engaged.
- 2) Both parties shall work together to implement the solutions outlined in this article, and shall use this method appropriately to resolve any emerging issue, aiming to preserve, as much as possible, the ongoing relationship between the parties to achieve the goals of this agreement as stated in Article 2 above;
- 3) Unless unforeseen circumstances arise, the party breaching any obligations within this agreement (the breaching party) shall have exceeded this agreement;
- 4) When one party (the aggrieved party) becomes aware that the other party has exceeded the agreement or has failed to comply with its obligations, it shall immediately notify the breaching party and take all reasonable measures to mitigate the consequences of the violation whenever possible. All costs incurred or the difference in value provided by the aggrieved party must be compensated by the breaching party.
- 5) When the breaching party has been informed or otherwise becomes aware that it has

exceeded or failed to comply with its obligations, it shall immediately take all appropriate measures at its own expense to remedy or rectify the deficiencies within 7 days including:

6) Replacing any items that do not meet the agreed-upon production requirements in this agreement;

7) Replacing anything that does not comply with the necessary requirements according to this agreement;

8) Changing or modifying any processes that do not align with the methods or any required procedures outlined in this agreement, following specific instructions provided by the aggrieved party or any other authorized entity; and/or.

9) Ceasing the supply of items previously being supplied, or accepting the supplied items as they are, as mutually agreed upon between both parties.

ARTICLE 13: TERMINATION OF THE AGREEMENT

1) This agreement may be terminated by either party for valid reasons, including failure to fulfill obligations contained within it. Termination of this agreement must be in writing with a notice period of fifteen (15) days.

2) If the breaching party has failed to comply with obligations and attempts to resolve or correct issues that have arisen between the parties, it must inform the other party in writing within 30 days before the agreement is suspended;

3) If the breaching party fails to meet its obligations, the aggrieved party may terminate the agreement by notifying the other party 14 days in writing in advance. The following items are considered a breach of obligations:

(i) The Buyer has failed to take delivery of the specified goods at least once;

(ii) The Buyer has failed to pay for goods within more than 10 days of the due date;

(iii) The Farmer has engaged in any activities aimed at selling goods to another buyer (produced on the land mentioned in this agreement).

(iv) The Farmer has failed to deliver the goods meeting the required specifications at least once.

ARTICLE 14: ORIGINAL DOCUMENTS

These agreements are made in three original documents, where each party retains a copy, and another is kept by the Notary who signs them.

Executed in on the/...../.....

COMPANY

represented by:

COOPERATIVE

represented by:.....

.....

Notary

ANNEX: TECHNICAL SPECIFICATIONS TEJA DRY CHILLI

SN	(Parameters)	TEJA (garade ya 1)	TEJA (garade ya 2)	TEJA (garade ya 3)
1	Color	bright or deep red with Lustre.		
2	Shape	Well Shaped with Even Size.		
3	Odor	Characteristic Pungent aroma of Chilli, No unpleasant Smell.		
4	Flavor	Mediym pungency, No Unpleasant Smell,		
5	Admixture	0.5% Max , No Stalk, Pedicile or Foreign Matter.		
6	Moldy Fruit	2% Max, Free of Decay and Spoilage.		
7	Discolored or molted fruit	5% MAX.		
8	Moisture	11-12% (<i>To be discussed after measuring</i>)		

Chapter 3 Cooperative management

3.1 New Cooperative Law

This chapter is for proposing amendment of SMAP Cooperative Management and Gender Mainstreaming Technical Manual following the amendment of the cooperative law by RCA.

3.1.1 Article 6: Protection of the name “cooperative”

The name “Cooperative” is protected and its use is exclusively reserved for a cooperative with legal personality. Each cooperative has its own name.

The National Agency cannot approve any name of a cooperative:

- 1° which, or the use of which, would contravene any Law;
- 2° which may be misleading;
- 3° which is against good morals;
- 4° which is identical to that of another cooperative with legal personality.

3.1.2 Article 86: Distribution of net surplus and loss

In case a cooperative makes profit, the net surplus is distributed as follows:

- 1° at least fifty percent (50%) of the net surplus is assigned as dividend to members, but one half ($\frac{1}{2}$) of this is paid out to members and the other half ($\frac{1}{2}$) is retained in the cooperative to increase the share of a member in the capital;
- 2° not more than ten percent (10%) of the net surplus is deposited into the education and training fund;
- 3° the compulsory savings of members is equivalent to ten percent (10%) of the net surplus. The remaining net surplus equivalent to thirty percent (30%) is distributed as follows: 1° an amount of not more than thirty percent (30%) is deposited into the general reserves of the cooperative; 2° bonuses paid out to members which cannot exceed fifty percent (50%) in proportion to the activities carried out by every member with the cooperative; 3° incentive bonuses to the Board of Directors, Supervisory Committee and employees, which may not exceed ten percent (10%);
- 4° not more than ten percent (10%) used for any other matter not specified above that may help the cooperative execute its responsibilities. Any time the cooperative incurs a loss, it earmarks, for the following year, for funds to compensate the loss before planning the allocation of dividends. However, concerning a cooperative which has already invested while its members do not want to reinvest their net surplus, the Board of Directors may present to the General Assembly an alternative for distributing dividends but must notify the National Agency.

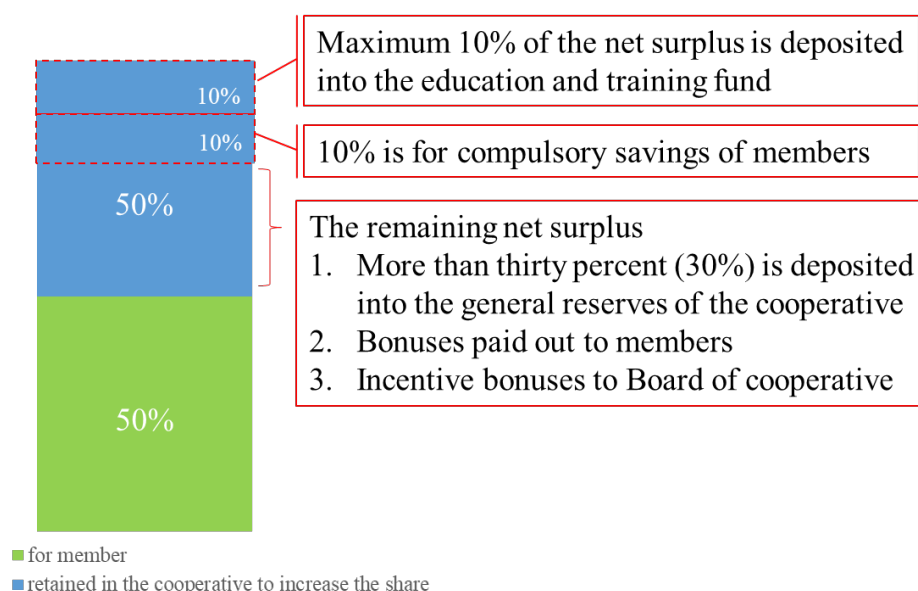


Fig 18 Overview diagram of distribution of net surplus

Source: Official Gazette n° Special of 14/05/2021(<https://gazettes.africa/archive/rw/2021/rw-government-gazette-dated-2021-05-14-no-special.pdf>)

3.2 Organization of cooperative

3.2.1 Organization

Agricultural cooperatives are organizations established to achieve the same goal. Organization of members is important if they are to share the same objectives and work together to achieve their goals. To control multiple members, the staffing and organizational chart of the agricultural cooperative must be clearly defined.

(1) General Assembly meeting

General Assembly is the supreme organ of a cooperative. It is vested with extensive powers to deliberate and take decisions of relevance to a cooperative. General Assembly of a primary cooperative which has more than one hundred (100) members who carry out their activities in different locations is exclusively composed of members' representatives elected by their peers.

Table 5 Types of General Assembly meetings

Types	Holding time
Ordinary General Assembly meetings	March and October
Extraordinary General Assembly meetings	whenever necessary

[When you organize meeting...]

It is communicated to members at least seven (7) days before the meeting in the case of an ordinary meeting or at least three (3) days in the case of an extraordinary meeting. Local authorities in charge of the development of cooperatives and the organs of the cooperative umbrella organizations the cooperative

is affiliated to, must be invited to a General Assembly meeting in which they play an advisory role, but do not take part in decision-making or vote.

[Chairperson of General Assembly meeting]

The meeting of the General Assembly is chaired by the chairperson of the Board of Directors or, in his or her absence, by the Vice Chairperson. In the absence of both, members of the Board of Directors elect the chair of the meeting from among themselves.

Table 6 Agenda of each meeting

Type		Agenda	
Ordinary General Assembly meetings	Common functions	✓	to consider and approve the agenda;
		✓	to consider and approve the minutes of the previous General Assembly meeting;
		✓	to elect and remove members of different organs;
		✓	to adopt or amend the bylaws and internal rules and regulations of the cooperative;
		✓	to consider and adopt the report of the Board of Directors on the activities of the preceding year and reports of other committees;
		✓	to examine and approve the accounts of the cooperative;
		✓	to decide on the grouping with other cooperatives to form a union, a federation or confederation or on the merging of a cooperative with another cooperative, cessation of its activities, its transformation into a company, its dissolution or liquidation;
		✓	to appoint a liquidator and a liquidation committee;
		✓	to consider any other issue related to the cooperative of which notice has been given to the members as prescribed by the bylaws of the cooperative.
	Special functions (March)	✓	to consider the financial statements of the cooperative for the previous year duly audited and the audit report;
		✓	to consider the manner in which any available surplus and interest are distributed or invested in other activities of the cooperative;
		✓	to approve the ceiling for deposits and investments;
		✓	to consider and approve the maximum amount of money the cooperative may borrow;
		✓	to approve incentive bonuses granted to members of the organs and employees of the cooperative;
		✓	to consider losses incurred by the cooperative and take related measures;
		✓	to consider any other issue related to the cooperative of which notice has been given to the members as prescribed in the bylaws of the cooperative.
		✓	(option) to share irrigation calendars and revise accordingly.
	Special functions (October)	✓	to consider and approve the action plan of the cooperative for the following year;
		✓	to approve the budget for the following year;
		✓	to approve the estimates of income and expenditure for the following financial year;
		✓	to appoint an external auditor and approve his or her remuneration;
		✓	to consider any other issue concerning the cooperative of which notice has been given to the members as prescribed in the bylaws of the cooperative
		✓	(option) to share irrigation calendars and revise accordingly.
Extraordinary General Assembly meetings	Common functions	✓	to consider and approve the minutes of the previous General Assembly meeting;
		✓	to consider and adopt urgent matters that cannot wait until the next Ordinary General Assembly meeting except the approval of the use of the cooperative's property.

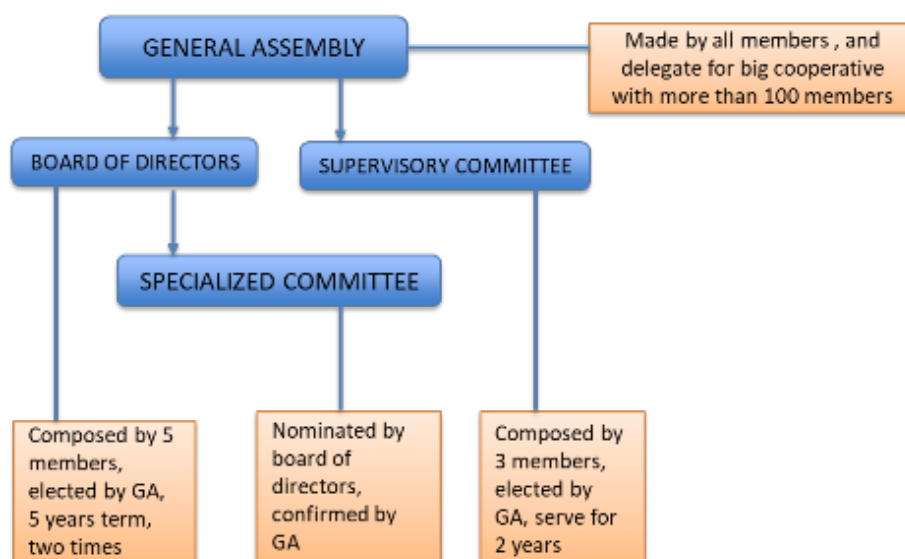


Fig 19 Governance organs of a cooperative

The desirable organizational chart of cooperative is shown in the figure below.

To facilitate the activities, the field is divided into several sections and it is called Zone and FPG. FPG is the smallest unit and one leader is allocated in each Zone and FPG. All member belongs any Zone and FPG.

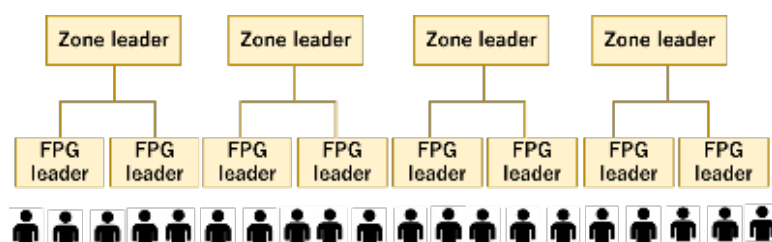


Fig 20 Recommended organizational chart for agricultural cooperative

3.2.2 Responsibility of Zone leader and FPG leader

Zone leader:

Below is an example of actual cooperative, so details should be discussed in General Assembly meeting and agreed.

- ✓ Identification of members and keep record of member list
- ✓ Seasonal preparation
 - Organize zone meeting to prepare season
 - Select crop to be cultivated next season
 - Creation of crop calendar
 - Fix the date of land preparation and submit to executive committee
 - Follow up members' activities, report to executive committee
- ✓ Give feedback to zone member on general assembly meeting (connector between executive

committee and zone member)

- ✓ Collect of production to be supplied through cooperative and report to executive committee
- ✓ Organize community (agricultural activities and IWUO activities)
- ✓ Conflict resolving within zone
- ✓ Establishment of demo plot in each zone and facilitation of FFS (option)

FPG leader:

- ✓ Support zone leader

The responsibility can be changed depend on size of Zone and FPG

3.2.3 Recommendation

- (1) Decide the necessary staff and their term of Zone leader and FPG leader according to the size and needs of the commitment.
- (2) (For cooperatives with irrigation facilities) decide the number of Zone and FPG groups and number of people according to the size and location of irrigation facilities at general assembly meeting.

3.3 Registration of agro dealer

3.3.1 Purpose and Advantage of being agro dealer

- (1) Timely and bulk supply of agricultural materials
- (2) Cooperative members can save the cost for transportation of agriculture input.
- (3) Increased income for agricultural cooperatives by selling to outside of cooperative.
- (4) The amount is automatically deducted from sales production after harvest, so that it is easier for members to manage money.

3.3.2 Procedure to obtain certificate of agro dealer (stakeholder)

Step 1. (Sector level)

Cooperative has to write a letter address to the executive secretary at sector level, where it is located with the following contents;

- Purpose to be Agro-dealer
- Identification of cooperative (Location, main activities, etc.)

Then, sector agronomist check the request of cooperative through the letter and executive secretary of Sector approves. After it signed by executive secretary, it should be submitted to the District.

Step2. (District level)

After the District receiving the document from the sector, the District come to visit and check cooperative if the conditions required for Agro-dealer such as storage, pallet and employees are respected. After that, District agronomist informs RAB staff in charge of agro-dealer at province level for system registration.

After fulfilling the above requirements and having approval by the district, RAB staff coaches how to use MOPA application. MOPA is installed in any smartphone and used for ordering and selling agricultural inputs and it is easy monitoring on operation/activities of Agro-dealer by sector agronomist.



Step3. (RAB level)

License for agro-dealer to deal with seed and fertilizer, it is approved and delivered by District and RAB after six months of working. For license of pesticide, it is approved and delivered by RICA. Before that, the District use to provide provisional license.

After registration of agro dealer and when you distribute agricultural input, you need to fill required information in application and it is recommend you to record list of farmers including basin information such as name, belonging, telephone number, type of fertilizer, quantity, unit price and total cost. This information is used for audit committee.

List of farmers who received fertilizer through cooperative

AMAZINA /Names	Zone	UMUDUGUDU /Village	AKAGALI /Cell	TELEPHONE	Type of fertilizer	IBIRO /Quantity (kg)	IGICIRO CYA KIMWE/unit price (Rwf)	IGICIRO CYA BYOSE /Total cost (Rwf)

Fig 21 Format of distributing agricultural input through cooperative

3.4 List of books

- RCA recommends to use following 14 lists and every cooperative organization shall keep proper books of accounts and other books for the purpose of recording all transactions relating to its undertaking, funds, activities and properties.
- These books of accounts shall be kept in such manner that truly reflects the financial status of the Cooperative Organization, so that the internal or external auditor can have access to them at any time.

1. Cash book

A cash book is a financial journal that contains all cash receipts and disbursement. A cash book is type of account in which you record the receipt and payment of money that has been received or paid out.

Date	N° of activity	Reason	Received money	Used money	balance

2. Bank book or passbook

Book in which a bank customer keeps a record of the money added to and taken from a bank account.

Date	N° of activity	Reason (saving, withdraw)	Saved money	withdraw	balance

3. Debtor's book

A debtor's book refers to the records of customer invoices and payment. Outstanding amounts are reflected according to the length of time they have been outstanding.

Name of person who received loan:

Date	Reason	No of receipts	Total loan	Paid loan	unpaid	Period of payment	Signature of customer

4. Creditor's book

A creditor' refer to the party that has delivered a product, service or loan and is owed money by one or more debtors.

Name of who give the loan:

Date	N° of receipt	Reason	Received loan	Period of payment	Paid loan	unpaid

5. Register of members' shares

The register includes each person's name, address, and the number of shares owned. The register of members of a company limited by shares includes details of the shareholders who own the company and the shares they hold.

Date	Name of member	ID N°	Living place	Total share to be paid	Paid share	Unpaid share

6. Purchase book

Purchase book contains all the relevant information related to the credit purchased of the goods, such as name of the vendor, quantity. The purchase book is a record of all purchase made by a cooperative organization . It is used to track the cost of goods purchased and the supplier of those

Date	N° of receipt	Purchased item	Quantity	Unit price	Total cost

--	--	--	--	--	--

7. Sales book

A sale book is a book of original entry or a subsidiary book that is used to record the credit sales of the goods.

Date	Nº	Sold item	Quantity	Unit sale	Total sale

8. Stock documents

A stock document is a physical piece of paper that represents the situation of stock, include all information of like quantities of inputs or chemical, farming materials.

No	Date	Reason	Unit Price	Item move in/kept	Items took out	Present item

9. Intangible documents

It general refers to statutory creations, such as copyright, trademarks, or patents. It excludes tangible property like real property (land, buildings, and fixtures) and personal property (Ships, automobiles, tools,).

COOPERATIVE IDENTIFICATION					
Date	Obtained Item/material	Value	Depreciation	Total depreciation	the remaining value in books

10. Invoice:

It is a document given to the buyer by seller to collect payment. It includes the cost of the products purchased.

Location: Date: Invoice nº: Mr. /Ms..... you must pay equivalent amount of .....because of the following things;

Type of Items	Quantity	Unit price	Total cost
Total			
Signature of seller		Amount paid in Cash:	
		The Remained :	
		Time to finish payment:	

11. Delivery note

A delivery note is a document that accompanies a shipment of goods. It provides a list of products and quantity of the goods included in the delivery.

Cooperative:		
Date		
Delivery note N°		
Sender		
Destination		
Type of Items	Quantity	Remark
Name of transporter:		
Items have been received properly. Date:		
Name of receiver:		
Signature of transporter		Date:
Signature of receiver.....		

12. Balance sheet

Balance sheet is a summary of the financial balances of an individual or organization. It provides a summary of a business at given point in time. It's a snapshot of an organization's financial position, as broken down.

The location of Assets		The source of assets	
The use of assets	Value of assets	Source or original of assets	value
Fixed assets(land, houses Mobile assets(computer, farming materials)		Property assets (Member's shares)	
Asset linked to the business of agriculture inputs		Assets from out side (support by Donors)	
Loans			
Available money on accounts			
Total		Total	

13. Income statement / statement of Expenditure

It is a financial statement that shows the situation of expenditure in cooperative organization

Date	explanation	Verification			value	approval
		N° in cash book	Date in bank book	Date in creditor's book		

14. Income statement/ statement of Revenues

It is a financial statement that shows the situation of income in cooperative organization.

Date	explanations	verification			value	approval
		N° in cash book	Date in bank book	Date in creditor's book		

3.5 Equipment

This section introduces simple management of small tools and equipment of cooperatives. Tools and equipment are categorized in two basing mode of use, first is equipment managed by one person those are include laptop, computers, office tools, motorbikes, etc. Second is materials which is used by multiple people from one individual or team to other, those include winnower machine, knapsack sprayer, moisture meter, printer, motor pump, etc.

Benefit of tools and equipment management

- (1) Equipment is properly utilized, maintained and safeguarded.
- (2) Staff makes maximum use of equipment by following the written procedures and good practice.
- (3) Comprehensive, timely, and reliable information on the skills and practice of staff responsible for various equipment related activities.

Different log sheets are needed for the good management of tools and equipment.

Equipment Maintenance Log

Equipment Maintenance log is used to assure that all the equipment are still intact and are properly working. This log (printed) can be kept in cooperative office or storage and responsible person shall be cooperative agronomist. A few items are included in an equipment maintenance log are as follows:

1. The equipment used including its parts and overall appearance
2. Inspection results of the equipment's working and functional condition
3. The name of the person who inspected the equipment

4. The date and specific time when an equipment is inspected
5. The corrective actions that are needed to be done for an equipment to be fully utilized.

Table 7 Format of Equipment Maintenance Log

Equipment Maintenance Log						
Name of Equipment	Winnower machine		Supplier's contact details:	Rwanda Agri-machine Company		
Label			Date of purchase	5th Oct, 2022		
Serial number	N-05		Person responsible for equipment	Cooperative agronomist		
			Date put into service:	15th Oct, 2022		
Date	Type of Maintenance	Maintenance performed by	Date of validation before put into service	Validation performed by	Next maintenance planned on (date)	Remarks
10/12/2022	Cleaning and oiling into hande part before storing	FPG leaders	13/10/2022	Cooperative agronomist	1/3/2023	The rice husks were not completely removed, so please remove them all (by Cooperative agronomist)

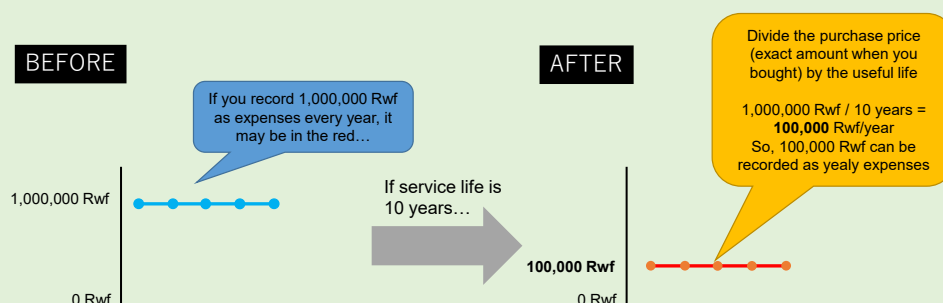
What is depreciation?

The original idea of depreciation is that fixed assets whose value decreases due to deterioration or deterioration over time should be divided into fixed amounts or ratios each year.

For example, consider winnower machine.

The cooperative purchased new winnower machine for 1 million Rwf. What if they didn't depreciate it? If 1 million yen is used as expenses, it may be in the red even though it was in the black every year until then. If you are in the red, you may even be cut off from the bank loan.

Therefore, by depreciating the 1 million Rwf and gradually using the purchase price as an expense, the annual profit will be accurately represented.



$$\text{Depreciation} = \frac{\text{Purchase price (exact amount when you bought)}}{\text{Useful life (usable period of the asset)}^*}$$

*The useful life (usable period of the asset) is the period of "how long the asset can be used", and it differs for each asset.

When procuring new equipment, it is important to check the useful life and purchase price, and set a depreciation value that will be recorded as an annual expense.

Equipment and tool borrowers log

It is very important for an organization to have an equipment borrowers log so that they can record all the equipment that are being borrowed by others (internally within the organization or externally out of organization). Information that should be included in an equipment borrowers log are as follows:

1. The equipment to be borrowed.
2. The name of the person who borrowed the equipment
3. The belonging (zone, FPG, Audit committee, executive committee or employee) who borrowed equipment.
4. The date and time when the equipment is borrowed and its status.
5. The expected date and time of returning the equipment.
6. The date when the equipment will be returned and its status. (plan)
7. The person who allowed the equipment to be borrowed.

Table 8 Format of Equipment Borrowers Log

Equipment Borrowers Log										
Name of	Knapsack Sprayer				Supplier's contact details	Rwanda Agri-machine Company				
Label					Date of purchase	30th Sep, 2022				
Serial number	N-05				Person responsible for	Cooperative agronomist				
					Date put into service:	2nd Oct, 2022				

Date	Name of the person who borrowed	Borrower belonging	Date and time of borrowing	Status of equipment excellent: functioning well good: functioning, but it needs to be maintained Not good: not functioning well	Expected time of returning the equipment	Signature of borrower	Date the equipment returned	Status of equipment excellent: functioning well good: functioning, but it needs to be maintained Not good: not functioning well	Signature of borrower when the equipment returned	Remarks
20/10/2022	Edouard	Zone 3, FPG 4	20/10/2022, 10 am	Excellent · Good · Not good	27/10/2022	Edouard	27/10/2022	Excellent · Good · Not good	Edouard	
				Excellent · Good · Not good				Excellent · Good · Not good		
				Excellent · Good · Not good				Excellent · Good · Not good		
				Excellent · Good · Not good				Excellent · Good · Not good		

Should there be operating problems in a given equipment or there are equipment that are not returned for a long period of time, it must immediately be reported so that preventive measures may be applied and it will not affect the operations of the organization in the coming days of use.

Chapter 4 Collaboration with IWUO

4.1 Performance agreement

4.1.1 Objective

Performance contract is between the Water Users Organization which is responsible for the proper management, maintenance of irrigation infrastructures and the sustainable and fair distribution of water for rice production by the cooperatives. Each cooperative is responsible for monitoring rice production, improve the productivity and marketing (quoted from the performance agreement between Cyaruhogo and the cooperatives).

4.1.2 Performance agreement details

The contract template consists of the following items.

1. Clarification

2. Specific Agreement

3. General Agreement

Article 1: General Purpose of the Agreement

Article 2: Water Fee Collection to the maintenance of irrigation infrastructure

Article 3: Responsibilities of the Water Users Organization

Article 4: Responsibilities of the Cooperative

Article 5: General provisions linking the two parties

Article 6: Conflict Resolution

Article 7: Termination

Article 8: Duration of this Agreement

Article 9: Conclusion

Article 3: Responsibilities of the Water Users Organization (quoted from the performance agreement between Cyaruhogo and the cooperatives)

3.1 Request the cooperative to submit the size of the land prepared for production during each production season

3.2 Supply the necessary quantity of water required for irrigating the land according to the agricultural activity and the agreed irrigation schedule of the season

3.3 The IWUO will make sure that fair distribution of water has reached to all the field through the elected leaders (WUT, ZC, and SMC) and by mobilizing Seasonal Water Distributor at every irrigation unit.

- 3.4 Once the fund from water fee is deposited to the account of IWUO, the responsible persons from IWUO (treasurers, secretary and President) shall transfer
- 3.4.1 5% of the cash to the account of Trust Fund
- 3.4.2 15% to the account of Reserve Fund
- 3.4.3 The remaining (80%) shall be used for O&M of the scheme as agreed in the constitution of IWUO.
- 3.5 Responsible for management, maintenance and repair of infrastructures inside the schemes
- 3.6 Transparent use of collected water fee in the operation, maintenance and management of the scheme and prepare seasonal report of the activity including financial report and share with cooperative.
- 3.7 Organize training on efficient use of available water, how to control flood and erosion from hillsides, fair distribution of irrigation water within each irrigation unit.
- 3.8 Compliance with the general rules governing the IWUO and in particular the internal regulations.
- 3.9 Update water user list of all members of the cooperatives water users every season.
- 3.10 Submit to each Cooperative a list of members who do not comply with the rules and regulation of the IWUO that affect the irrigation scheme to be punished / levied on production.
- 3.11 Organize quarterly and whenever necessary meetings to connect the Water Users Organization with the Cooperatives in order to improve performance and interaction

Article 4: Responsibilities of the Cooperative

- 4.1 The cooperative will prepare the agricultural calendar and irrigation schedule per block or per the existing producers groups and submit to IWUO before the beginning of each season.
- 4.2 The cooperative shall organize its member to prepare their land for the production of rice on time and at similar period per farmers group so that fair distribution of water can be achieved.
- 4.3 Submit the size of land prepared during each season for proper planning of the available water distribution to the field.
- 4.4 Upon harvesting, the cooperative shall collect water fee from its member according to the size of the land and the agreed rate and deposit the collected water fee to IWUO Bank Account number XXX opened in the BPR (Banque Populaire du Rwanda)
- 4.5 The receipt of the transaction shall be submitted to IWUO treasurer or secretary as evidence of payment for the service given by IWUO.
- 4.6 Help IWUO in applying the monetary punishment levied by IWUO on members who fail to obey the rules and regulation agreed by the general assembly of IWUO.
- 4.7 If IWUO doesn't fulfill responsibility, cooperative shall report or compliant to IWUO governing body for discussion and resolution.

1)Quinoa

Market demand of quinoa

Quinoa is a flowering plant; it is grown for its edibles seeds rich in proteins, dietary fiber, B vitamins and dietary minerals in amounts greater than in many. Regarding market demand, quinoa is a new crop introduced for the first time in Rwanda in 2015 by sustainable seed System Lab at Washington State University with the purpose to test its adaptability in Rwanda. Currently, the farmers have no more experience about how to cultivate this newly crop and how to use for consumption even the buyers or exports are not engaging official in this business. So that, market demand is still limited.



(1)Land preparation

The soil destinating for Quinoa cultivation should be fertility and well prepared that soil should be sandy soil , well aerated easy drained , first plowing and second plowing should be conducted even land leveling then, digging the whole with spacing of range between 40cm to 80cm or 50cmto 1m depending the soil quality.

(2)Sowing activity

Sowing of quinoa is conducted at the beginning of season A in October and season B in February, it can be directly sown in main field ,whole should be prepared with spacing of 40cm within rows and 80cm between rows or 50cm within rows and 1m between rows depending the soil structure. Two or three sees should be sowed in one whole and covered with small layer of soil for easy germinating. 10kg of seed can be used per hectare for sowing.



(3)Fertilization

Cultivation of quinoa require some input like fertilizers for growing and production, from sowing we can use manure 20t to 25t/ha and 200kg of NPK and 100kg of Urea in two months after sowing.

(4)Weeding and pest control

Weeding is one of farming activity which is very important for quinoa crop, normally in one month after sowing you can start weeding and thinning, then in two months you can start air-thing up and pest control , the important pest for quinoa is green aphid/insect ,those insect attaque the leaves of plant. Those activities should be done properly in order to keep good growing of quinoa plant.

(5)Harvesting

Harvesting of quinoa , quinoa is ready for harvest between 90-120 days after planting when all the green leaves have fallen off the plant and the plants are just seed heads on a stalk, the maturity panicles/heads should be removed from the plant and drying at proper material/ plastic sheets. Then, after well dried threshing and winnowing, then Bagging and selling. The average productivity is 1.5t/ha.

FACTORS THAT FAVOUR VEGETABLE PRODUCTION IN RWANDA

- (i) Favorable climate: The country has a wide variation in altitude (0 – 4000 m a.s.l) coupled with adequate rainfall, irrigation infrastructures are being developed and good sunshine.
- (ii) High cost of petroleum products and other fuel sources in the western temperate countries leading to increased cost of maintenance of greenhouses.
- (iii) Availability of plenty of water is an asset that can be utilized to produce throughout the year cheaply and ensure regularity, which is a major requirement for export market.
- (iv) Existence of potential export market in Europe and Middle East.
- (v) Availability of a big regional market-Uganda, Tanzania, DRC, Burundi.
- (vi) A considerable Domestic market will allow the consumption of what is not exported as export market targets best quality products.
- (vii) Abundant agricultural wastes can be utilized for production of liquid organic fertilizers, which can be used to produce organic products that fetch high premium prices on international markets.
- (viii) Private sector participation, which ensures efficient management of the industry with minimal government interference.
- (ix) Affordable labour force that can be exploited to produce quality and competitive horticulture products on the regional and international.
- (x) Availability of international and local seed companies e.g. Rwanda seed Company, Kenya Seed Company which readily provide a variety of high quality seeds to farmers.

CHALLENGES FACING RWANDAS VEGETABLE INDUSTRY

- (i) Low capital and technology input.
- (ii) Farmers lack technical knowledge needed for the production of adequate and quality horticultural products. Knowledge also lacks among the technicians.
- (iii) Farmers lack clean planting materials either because they are expensive or business men may import them without confirming origin or quality and hence plant poor quality materials that produce less and susceptible to diseases.
- (iv) Inadequate use of manure, fertilizer, or pesticides because they are either unavailable or costly leads to lower than average production.
- (v) Poor cultural practices-Land cultivation/preparation/ Weeding/Pest management.
- (vi) Dependence on rain fed with no irrigation systems is a major constraint as horticulture exports require regular and reliable supply, which is not possible under rain, fed conditions.
- (vii) Horticulture is a capital and labour intensive activity that requires considerable capital for acquiring the appropriate equipment and technologies and farmers lack this as they lack access to financing.
- (viii) Horticultural producers are not organized that is important for either marketing of their produce hence, they are exploited or their products are not sold.

- (ix) Less effort has been put to horticulture research and most information is lacking on production, post-harvest, pest and disease management, and varieties suitable for the differing agro-ecological zones and because of this extension does not any base to promote horticulture.
- (x) Poor post-harvest, marketing and processing practices
- (xi) Difficulty to penetrate by producers and exporters of fresh produce to world Market due to competition, change in consumers' tastes and demands.
- (xii) Regulatory measures of quality and standards of food safety, ethical and environmental conditions under which food is produced and distributed. E.g European Union (EU) market (measures and private codes of practice in response to quality and standards of food safety.
- (xiii) Lack of horticulture post infrastructure such as pack houses, cold-storage facilities and refrigerated transport results into poor quality and unreliable products hence making it difficult access market to international
- (xiv) Lack of market information particularly on prices, product.
- (xv) Stringent Regulations, like EurepGAP. "EurepGAP is an international quality system scheme that guarantees a safe production process for fresh fruits and vegetable products."; its "principles are based on not only food safety but also on environmental protection, occupational health, safety and welfare".
- (xvi) Maximum Residue Levels (MRLs) set by overseas markets.
- (xvii) Traceability requirements.

VEGETABLE GROWING/CROPPING SYSTEMS

1. **Monocrop vs intercropping:-** Monocrop – one vegetable grown in the farm.
Intercrop – two types of vegetables grown in the same piece of land at the same time
2. **Multiple cropping index:** - Several vegetables grown together in the same piece of land at the same time
3. **Open field vs. protected production:-** Open field – vegetables grown in the open field.

Protected production – vegetables grown under plant growing/protected structures greenhouse, lath house, hot bed.
4. **Soil production vs. soilless production:-** Soil production – soil based media is used as the growing media

Soilless production – soilless media is used e.g. water, vermiculite, coco peat, perlite etc.
5. **Home vs. Market Oriented Production:-** Home oriented – production for home consumption Market oriented – production for sale.

CROPPING PATTERNS IN VEGETABLE PRODUCTION

(a). Rotational Cropping Where vegetables in the different plots are rotated

Advantage

- Enable efficient use of nutrients.
- Reduce disease and nematode problems.
- Increase nutrient supply (legumes included).

Important that;

- Vegetables from same family do not follow each other in a rotational scheme.
- Shallow - rooted vegetables follow deep-rooted and vice versa to improve on nutrient utilization
- Include a legume in the rotation to improve soil fertility
- Check whether the selected crop for planting will grow during the season of the year for which it is scheduled during planning.

(b) Successional Cropping

Practice of planting the same vegetable on several dates 2 or 3 weeks apart, or planting early, mid-season and late cultivars at the same time. It is used because vegetables have a very short but relatively uniform growth period and tend to be ready for harvest at one time. Successional cropping therefore ensures continuous supply of a given vegetable to the market.

(c) Intercropping

Also referred to as catch cropping. It is the growing of 2 crops in the same area at the same time. Practice makes maximum efficient use of land. In general, rapidly maturing crops e.g. amaranthus, okra, radish, lettuce or spinach are grown between the rows of slower growing crops such as tomatoes or pumpkins. By the time the space is required for the longer duration crop, the early maturing crop will have been harvested. Plants grown together in an intercropping system must be compatible in their cultural requirements, so that operations e.g. spraying and irrigation can be done for both crops at the same time. Crops should not share similar pests and diseases. They should also not compete for same nutrients.

(d) Relay Intercropping

The second crop is sown or transplanted after the first crop has become well established and may be approaching flowering stage.

(e) Multiple Cropping

Different vegetable crops are grown in association. It is a traditional practice in many warm climatic conditions. It has the main advantage of reducing the proliferation of pests and diseases compared with monoculture systems. A more efficient use of land is achieved since the crop's nutritional requirements vary; hence, the rate of depletion of specific soil nutrients is reduced.

ESTABLISHMENT OF A VEGETABLE FARM

SITE SELECTION

In site selection, the soil, climate, topography, biotic factors and physical factors/situational analysis must be considered.

(a) Soil

Vegetables do well in a wide range of soil types as long as they are fertile, deep and well drained. Heavy clays are difficult to work especially when wet. May need to add organic matter to improve it. Sand soils are less fertile and low in water holding capacity. They may also be improved by addition of organic matter. Ideal soils for most vegetables are the medium clay loams, which also have to be properly used and supplied with both nutrients and organic matter to retain fertility. Ideal pH for most vegetables is 5.5 – 7.7 although some tomato and pepper cultivars can tolerate slightly more acidic soils conditions. Soils should be free of pests, diseases and nematodes. Ideal soils for vegetables production should be deep and lack hard pans.

(b) Climatic Factors

(i) Rainfall

Total amount, distribution and quality are important. Many vegetable crops are sensitive to excess water in the root zone and are damaged by heavy rainfall. Thus, the type of vegetable crop to be grown will be determined by the rainfall pattern. Rainfall distribution will also influence the type of vegetable to be grown unless there are arrangements for irrigation to be done during dry periods. For rainfed vegetable production, rainfall should be uniformly distributed in order to achieve optimum yields.

(ii) Temperature

Temperature growth range for most vegetables is 0 – 40 °C. Below 0 °C, some vegetables go dormant and there is freezing injury. Above 40 °C, most vegetables die because of denaturation of protein component of cells. Optimum temperature ranges for seed germination of warm season vegetables are 24-30 °C, while for cool season vegetables are 5-15 °C. Each vegetable performs best at a given temperature range (Optimum temperature range) under which there is a good balance between photosynthesis and respiration favoring good growth and yielding. Low temperature reduces water uptake and plant growth.

Optimum temperature speeds up growth while excessively high temperature may damage plants. Temperature influences;

- Seed germination – Cool season vegetable seeds do not germinate at $> 25^{\circ}\text{C}$, while warm season vegetables will not germinate at $< 10^{\circ}\text{C}$.

- Root and shoot growth: Increase in temperature increases root and shoot growth to a point beyond which further increase in temperature results in a decrease in growth. High soil temperature favors root growth at the expense of shoot growth and vice versa. Thus, a good balance between soil and air temperature is necessary for good performance.

- Flowering: Some vegetables e.g. onions require low temperature treatment (vernalization) so as to initiate flowering. Temperatures of -2°C to 10°C for several weeks are usually required for vernalization. Few annuals e.g. spinach, lettuce, can be vernalized by high temperatures.

(iii) Light

Duration, intensity and quality affect vegetable growth. Light duration = length of day under light. It influences:

- Photosynthesis

- Flower bud formation: LDP (Long day plants) e.g. spinach, radish, lettuce; SDP (Short day plants) e.g. some cvs of potato, sweet potato; Day neutral e.g. tomato, pepper etc.

- Development of storage organs: some cultivars of potatoes, grano type onions, red Italian onions require SD (Short day) to form tubers or bulbs.

Light intensity

= no. of quanta or photons reaching a given area. It influences;

- Photosynthesis

- Pigmentation e.g. in eggplants, rutabaga, red cabbage colour intensifies with exposure. In blanched leek or asparagus, hilling of soil around lower parts of stems results in white colour.

Light quality:

Radiation should be within the PAR 400 – 700 nm. Note: Long day plants grown under short day conditions will have lower carbohydrate and protein accumulation resulting into weak vegetative growth and Non-Flowering. Short day plants if grown under long day conditions will have abundant carbohydrates and protein resulting in vigorous growth and non-flowering.

(iv) Relative Humidity

Measure of water vapour in the atmosphere. It influences transpiration losses, which would affect water, and nutrient up take, disease development, take of transplanted seedlings.

(v) Wind Air in motion.

Direct effect is damage to plants if very strong; indirect is in pollen dissemination, disposal of pests and/or diseases, soil erosion, increasing evapo-transpiration. If the site is windy, it may be necessary to construct windbreak.

(c) Topography

Surface of the soil in relation to other area. It affects temperature and drainage of the site. Steep slopes are subject to erosion and are low in fertility. Hill bottoms are fertile but water logged and poorly drained. Thus, gentle sloping sites are the best.

(d) Biotic Factors

Vegetables production is also influenced by other living organisms like man (can manipulate environment, can be a pest), birds, moles, insects, nematodes (can all be pests), bacteria and fungi (beneficial or harmful). Beneficial biotic interactions to vegetable production;

- Animals act as predators to insect pests e.g. lady bird beetle (dbm), birds (many pests)
- Some bacteria fix atmospheric N in legumes.
- Some fungi and bacteria decompose organic matter to release nutrients.
- Some fungi like Mycorrhizal help in the transport of mineral nutrients and water to the plants.
- Earthworms and termites aerate the soil as they make holes.
- Bees pollinate crops

Harmful interactions;

- Some insects feed on leaves, stems, roots, flowers or fruits of vegetables
- Some fungi, bacteria and viruses cause diseases
- Microorganisms sometimes compete for nutrients with plants especially when undecomposed organic matter is applied
- Weeds compete for plant nutrients and increase production cost.

(e) Physical Factors/ Situation Analysis

- Availability of quality water for irrigation.
- Availability of market and transport facilities, for instance, it is not practical to produce a perishable crop e.g. tomato when market is situated a considerable distance unless excellent transport facilities exist.
- Availability of labour – this especially applies to seasonal or casual labour.

PLANNING OF A VEGETABLE FARM

Once a suitable site has been selected, careful planning of layout and production would be the next task. In planning a vegetable farm, the following have to be considered:

(a) Crops: Decide on which vegetable crops to grow. This will depend on the demands of the available market and climate. Study the market carefully and adjust production accordingly.

(b) System: Decide on which system you are going to use e.g. open vs. protected etc.

(c) Layout: After deciding on the range of crops to be grown and the systems, the layout of the land must be planned. Care is needed since if a bad layout is carried out initially, it will be costly to change. Remember roads, irrigation pipelines or buildings are involved, thus if sited wrongly, such items will be difficult and expensive to resite

(d) Cropping plan: Work out the rotation plan to be followed and details of the cropping plan. This should be done early enough.

(e) Land preparation: The cost of clearing and preparing land must be considered

(f) Labour needs: Important to plan for needed labour especially when manual labour is needed.

(g) Fencing and windbreaks: If fencing or windbreak is needed, decide on the type and material to be used as well as the placement.

(h) Compost area: Decide on the location of the compost area and whether you will need a compost heap or pit. A compost heap/pit is necessary to provide a place for the disposal of organic debris and serves as a source of organic matter for use in the farm. It is generally located close to the nursery, in an area, which is unsuitable for crop production.

(i) Nursery siting/area: Lightly shaded areas are preferred or may construct a lath house. Preferably, nursery area should be utmost 2% of total area. Will also need to decide on the type of nursery to use seedbed or containerized. If seedbed, raise, flat or sunken.

(j) Irrigation and distribution method: Decide whether irrigation will be needed. If yes, decide on the system to be used and the water source.

PROPAGATION AND CROP ESTABLISHMENT Propagation

(a) **Sexual propagation:** Use of seeds. It is the most common method in vegetable propagation. A good seed must be clean, viable, disease free, true to type or name and priced. Different kinds of seeds differ greatly in storage. The length of the time that a seed remains viable differs from seed to seed. In general, many seeds cannot be stored safely for a long time due to poor storage conditions. Seeds of most commercially grown vegetable crops normally remain viable for 2-3 years. Under optimum storage conditions, seeds of some species may remain viable up to 15 year.

(b) **Vegetative/asexual propagation (VP):** Vegetative parts such as shoots, roots, and leaves are used. Several methods of VP exist, and they include;

(a) **Specialized structures e.g.** bulbs, corms, rhizomes, tubers, runners etc.

(b) **Use of cuttings** – sweet potato, cassava

(c) **Layering** – sweet potato (d) Budding and grafting – tomato, potato, sweet pepper, cucurbits.

Crop Establishment

Vegetable seeds or vegetative propagation materials may be established

1. Directly in the final bed
2. Indirectly through transplanting.

Direct Sowing / Planting

Seeds are sown in the final bed where they are expected to grow to maturity. In this case, the vegetables are sown at the recommended spacing. Once seedlings establish, they are thinned to achieve the desired population. Vegetables to be directly sown are those that;

- Germinate and grow vigorously with minimal care
- Cannot withstand root disturbance e.g. root vegetables
- Respond poorly to transplanting e.g. cucurbits

Advantage

- Eliminates transplanting shock, which is likely to check seedling growth while the plants reestablish their root systems
- Leads to early maturity compared to transplanting
- Crops develop some level of drought tolerance due to rapid growth of taproot.

Indirect sowing / Planting

It is the most common method as most vegetable seeds are tiny and expensive. Seeds are sown in seed boxes, trays or other suitable containers or nursery beds for transplanting as seedlings. Regardless of shape or size, containers used should offer good drainage. If nursery beds are used, they should be well prepared, leveled and made to a fine tilth. Beds can be raised (high rainfall), flat (moderate rainfall) or sunken (low rainfall). Whatever type of bed is to be used, the soil should be prepared to a fine tilth and well decayed organic matter and small amount of phosphatic fertilizer added. If soils are heavy, add coarse sand or compost to improve the texture. Seeds may then be scattered on the surface of the media or drilled in rows thinly covered to a depth of 2-3 times of its diameter. Thereafter, water bed adequately. Provide a light shade or mulch until germination begins. In nursery beds, mulch is removed once germination occurs and a light shade constructed. As seedlings grow, they are gradually exposed to increased light intensity so that by the time they are ready for transplanting, they are adapted to full light conditions (hardening off). In cases where there is overcrowding in the nursery, pricking off (removing of seedlings from an overcrowded nursery to a spacious one) should be done to allow better growth.

Advantages:

- Indirect sowing achieves efficient utilization of seeds
- Allows selection of healthy seedlings for growing
- Better protection of seedlings
- Better control of seedling diseases and pests
- Better germination
- Earlier crop

Transplanting

Process of removing seedlings from nursery bed to final where they are expected to grow to maturity. It is done when seedlings/transplants are 10-15 cm high. It is necessary to harden off seedlings for at least a week before transplanting. Water nursery bed thoroughly 3-4

hours before transplanting. Transplant in the evening or on cloudy days. Avoid damaging seedlings during transplanting. Transplant only healthy seedlings. Transplant seedlings at same level or slightly deeper than they were in the nursery. Apply a starter fertilizer immediately after transplanting. A light shade may be necessary during sunny days. Water seedlings regularly until they establish. 1-2 weeks after transplanting, may need to do gapping to fill in holes where transplants never took off.

Plant Density and Spacing

Spacing influences plant densities, which affect the performance of crops. In general, as plant density increases per unit area, a point is reached at which each plant begins to compete for certain essential growth factors such as nutrients, sun light, water, oxygen and carbon dioxide resulting in reduced yields. Spacing of crops varies with plant, environmental and cultural factors.

- Plant factors – species and crop variety
- Environmental factors – rainfall, soil fertility, season, etc.
- Cultural factors – diseases and pest control, cultivation method, pruning, training etc.

CROP MANAGEMENT PRACTICES

1) Mulching

Application of organic or inorganic material to the soil surface. It is one of the most beneficial practices in vegetable production

- Advantages
- Reduces weed growth.
 - Reduces spread of diseases through reducing splashing of pathogens from soil.
 - Conserves moisture.
 - Reduces evapotranspiration.
 - Reduces erosion.
 - Regulates soil temperature – thickness, type, and colour.
 - Increases microbial activity in the soil.
 - Increases soil nutrient status.
 - Increases soil organic matter hence improving soil structure.

- Pest control e.g. colour of plastic mulches.

Disadvantages

- Fire hazard especially organic mulch.
- Increases cost of production.
- Nutrient locking.
- Increases snails, slugs etc.
- When synthetic mulches are used, apply them before planting. Organic mulch is usually applied after planting.

2) Support

It is beneficial especially if growing vegetables with a climbing habit (bean, chayote, garden peas etc) or tall vegetables (tomato). It improves production and quality by;

- Maintaining fruits off ground, thus keeping them clean.
- Exposing crop to light hence increased photosynthesis.
- Reducing disease infection-reducing RH in canopy, splashing of soil) i.e increasing aeration.
- Makes harvesting easier.
- Application of foliar feed, pesticides or acaricides is made easier. Support can be achieved through various ways
- Staking – single or multiple stem staking
- Trellising – polls and wires used whatever method is used, it is essential that the system is strong enough to support the fruit laden crop.

3) Earthing Up

Refers to a form of tillage whereby soil is thrown into mounds to provide good growth conditions to root vegetables about to be planted or throwing mounds of soil around established vegetables with the aim of;

- Propping up young plants with a tendency to droop because soil is compacted or eroded
- Encourage developing adventitious roots that will feed the crop better

- Burying weeds
- Covering developing tubers – potato
- Loosen and aerate the soil for better crop development. To be effective, earthing up must be done before plants develop adventitious roots (tomato, maize) or just when the roots on which the first tubers will grow start to appear (potato, sweet potato, yam). Earthing up in tuberous crops must be done in such a way that the actual tubers are never exposed to light to achieve good colour e.g. potato. Ridging is as useful as earthing up. Ridges are long narrow mounds separated by furrows.

4) Fertilization

Application of fertilizer to plants. Fertilizer can be

- Organic – plant and animal manures
 - Inorganic – commercial fertilizers – industrially manufactured
- (a) **Organic Fertilizers:** Include compost, FYM, blood meal, dried bones, wood ash, green manure etc. They are usually applied pre-plant. They are beneficial to many vegetables but may cause quality reduction (forking in carrot; cracking in many root vegetables) if not well decomposed. Importance; add organic matter and nutrients to the soil. Organic fertilizers release nutrients slowly due to low rate of decomposition e.g. 20-50% of total N is released in the 1st year and the rest in subsequent years. This may be undesirable in vegetables that need high N levels in the 1st year. P availability from organic fertilizers especially animal manure is mostly higher than in commercial fertilizers. Detrimental effects of fresh organic fertilizers include locking up of nutrients during decomposition process and may carry some harmful microorganisms.
- (b) **Inorganic Fertilizers:** all materials applied to the soil to supply plants with nutrients except animal manure and other organic waste.

Importance/Advantages

Have readily available nutrients, contain consistently balanced nutrients according to grade not like organic fertilizers, which depend on the source, are less bulky and lack microorganisms.

5. The preharvest interval (PHI): is the minimum amount of time between the last application of a pesticide and when the crop can be harvested. Harvest is the cutting of the crop or removal of the produce from the plant. The PHI is found on the pesticide label.

6. Spraying program (spray schedule): a table or chart indicating at what time or stage of development of a plant various pesticidal sprays should be applied.

CROP CALENDAR 2023B

Zone	FPG	AREA	LAND PREPARATION	NURSERY PREPARATION	SOAKING SEED	SOWING	TRANSPLANTING	FOLLOW UP FIRST WEEDING, TOP DRESSING, SPRAYING	IRRIGATION SCHEDULE
1	FPG 1 name	3.1	10 - 20 /11/2022	26/11/2022	28/11/2022	30/11/2022	21/12/2022	15 - 25/1/2022	every day
	FPG 2 name	4.5							every day
	FPG 3 name	5.98							every day
	FPG 4 name	2.6							Monday to Tuesday mid day
	FPG 5 name	2.08							Monday to Tuesday mid day
	FPG 6 name	1.89							every day
	FPG 7 name	6.48							Mid day Tue, Wed, Sat & Sun
	FPG 8 name	2.88							Mid day Tue, Wed, Sat & Sun
	FPG 9 name	3.72							Monday to Tuesday mid day
	FPG 10 name	1.14							every day
TOTAL		34.37							
2	RUHABYO1	4.86	KUVA KUWA 01 - 10 /12/2022	19/12/2022	21/12/2022	23/10/2022	13/01/20223	28/1 -10/2/2022	Monday to Tuesday mid day
	RUHABYO2	6.75							Mid day Tue, Wed, Sat & Sun
	RUHABYO3	5.1							Mid day Tue, Wed, Sat & Sun
TOTAL		16.71							
3	NYIRABIDUHA	4.8	KUVA KUWA 5-20/12	26/12/2022	28/12/2022	30/12/2022	20/1/2023	10 -20 /2 /2022	Monday to Tuesday mid day
	AGASENYI1	7.3							Mid day Tue, Wed, Sat & Sun
	AGASENYI2	2.28							Mid day Tue, Wed, Sat & Sun
	BISHUNGO	5.65							Monday to Tuesday mid day
	KIGAGA1	4.2							every day
	KIGAGA2	3.72							Mid day Tue, Wed, Sat & Sun
	KIGARAMA	6.9							Mid day Tue, Wed, Sat & Sun
	KAJINJA	7.2							Mid day Tue, Wed, Sat & Sun
	NYABITARE	9.05							every day
GISEKE3	2.64	every day							
TOTAL		53.74							
4	MUDUHA1	7.59	KUVA 09 -23/12/2022	2023/2/1	2023/4/1	2023/6/1	27/1/2023	15-25/2/2022	Monday to Tuesday mid day
	MUDUHA2	5.88							Mid day Tue, Wed, Sat & Sun
	MUSHA	5.91							Monday to Tuesday mid day
	BUTEKA	6.45							every day
TOTAL		25.83							
5	AKAZABABA	5.65	12-27/12/2022	2023/6/1	2023/9/1	2023/11/1	2023/2/2	20-30/2/2022	Monday to Tuesday mid day
	CYABIGEGA	6.8							Monday to Tuesday mid day
	MIGOGO	6.25							Monday to Tuesday mid day
	NYANKONO2	4.15							Monday to Tuesday mid day
TOTAL		22.85							
		153.5							

Prepared by:

Approved by:

Informed to:

CROP CALENDAR 2023B

Zone	FPG	AREA	LAND PREPARATION	NURSERY PREPARATION	SOAKING SEED	SOWING	TRANSPLANTING	FOLLOW UP FIRST WEEDING, TOP DRESSING, SPRAYING	IRRIGATION SCHEDULE
1									
TOTAL		0							
2									
TOTAL		0							
3									
TOTAL		0							
4									
TOTAL		0							
5									
TOTAL		0							
		0							

Prepared by:

Approved by:

Informed to:

CROP CALENDER IN

		MONTHS OF YEAR																							
		SEPTEMBER				OCTOBER				NOVEMBER				DECEMBER				JANUARY				FEBRUARY			
		15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30
NO	ACTIVITIES																								
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									

Legend



CROP CALENDER IN NGOMA 22 SCHEME HILLSIDE, 2022-2023 (KOTUNGO COOPERATIVE)

			MONTHS OF YEAR																															
			2022												2023														2022					
			SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		APLY		MAY		JUNE		JULY		AUGUST									
			15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30				
NO	ACTIVITIES		SEASON A 2023: MAIZE, BEANS, SOYA BEANS, CHILI ,VEGETABLES AND FRUITS												SEASON B 2023: MAIZE, BEANS, SOYA BEANS, CHILI ,VEGETABLES AND FRUITS												SEASON C -2023: VEGETABLES AND FRUITS							
1	LAND PREPARATION	FIRST PLOUGHING																																
		LIME APPLICATION																																
		SECOND PLUGHING																																
		ORGANIC MARURE,SEEDS AND FERTILIZERS																																
2	GATHERING INPUTS	MANURE/ COMPOST, SEED, NPK, DAP AND UREA																																
3	SOWING / NURSERY Preparation																																	
4	PLANTING																																	
5	PEST AND DISEASE MANAGEMENT																																	
6	FIRST WEEDING																																	
7	FERTILIZERS APPLICATION																																	
8	SECOND WEEDING AND EARTHLING UP																																	
9	HARVESTING																																	
10	DRYING																																	
11	STORAGE AND MARKETING																																	

Legend

SEASON A 2023: Main crop is MAIZE, the second is CHILI and BEANS
 SEASON A 2023: Main crop is BEANS, the second is CHILI and MAIZE
 SEASON A 2023: Main crop is CHILL, the second is CHILI and MAIZEVEGETABLES AND FRUITS
 Like Tomatoes, Sweet peper, Beet root,green beans , cabbage..

CONTRACT AGREEMENT FOR PEPPER (CHILLI) TEJA VARIETY

This agreement is made between:

....., a company operates under the laws of Rwanda with registered in the RDB at, engaged in agricultural investments with its registered office located in Kigali City, Kicukiro District, Kicukiro Sector, Cell of, represented by, whose telephone number is and email address is (hereinafter referred to as the "buyer"),

and

COOPERATIVE, a cooperative operates under the laws of Rwanda with registration in the RCA, holding certificate no, engaged in the cultivation of vegetables and fruits in District, Eastern Province, with its registered office situated in District, Sector, Cell of, represented by, with contact telephone number: and email address:..... (hereinafter referred to as the "Farmer").

ARTICLE ONE: OBJECTIVES OF THE AGREEMENT

The parties intend to implement the TEJA chili farming and trading project. The cooperative will cultivate this crop in accordance with requirements made with the Consumer (buyer) and will deliver all produce, excluding any that are unfit for sale (including diseased, damaged, or spoiled chili). Produce selection (sorting) will take place (conducted) on-site, and the cooperative will be able to record the quantity supplied to the company just on site after sorting.

ARTICLE TWO: PRICES

Both parties agreed that TEJA chili variety will be bought basing on followings:

ITEM	PRICE
Dried teja chili (garade 1)	1500 frw/kg season 2024A
Dried TEJA chili (garade 2)	.....
DriedTEJAchili (garade 3)	.....

When the price on the market increases by 15% or decreases by 15%, the Buyer and the Cooperative will sit together and agree on a new appropriate price.

ARTICLE THREE: FARMER'S RESPONSIBILITIES

- 1) To avail land for cultivation of at least 45 hectares.
- 2) To plant seeds(variety) that the farmer has agreed upon with the buyer;
- 3) To use the type of fertilizer and the agreed-upon quantity with the buyer;
- 4) To use pesticides agreed upon with the buyer;
- 5) The farmer must irrigate the crops as advised by the Agronomist;

- 6) During irrigation, they must avoid causing runoff that could carry away the used fertilizer;
- 7) To consult agronomists so that the yield will be sufficient and of good quality;
- 8) To collect all the produce needed by the buyer, removing any that are not up to standard at the agreed price;
- 9) Not to sell the produce elsewhere unless there is prior agreement with the buyer, which must be documented;
- 10) To pay the buyer 100% of the cost of seeds before starting cultivation, according to the market prices agreed upon unless credit is granted;
- 11) To pay 100% of the cost for pesticides and fertilizers at the agreed prices unless credit is granted;
- 12) Not to enter into agreements with another person to cultivate on the mentioned land unless agreed upon with the buyer or if the contract has expired;
- 13) To deliver well sorted produce based on the buyer requirements;
- 14) To employ sufficient workers for harvesting and selection so that the produce is transported timely and properly;
- 15) To use appropriate equipment for harvesting and sorting the produce;
- 16) To properly package the produce in suitable containers to prevent damage;
- 17) To insure the TEJA chili crop every planting season;
- 18) Not to employ children under the age of eighteen (18).

ARTICLE 4: BUYER RESPONSIBILITIES

- 1) Assisting farmers in obtaining seeds, fertilizers, pesticides, and other necessary tools to ensure they achieve good yields and maintain their produce when they cannot obtain them themselves; however, the costs are covered by the farmer, and the expenses are deducted from the yields, providing the remaining amount, as agreed upon regarding market prices;
- 2) Informing farmers about the characteristics of the produce needed in the market (type, quality, size, color, and other relevant factors) before they start planting;
- 3) Informing farmers about the cost or value of inputs needed from the beginning of the agricultural season until harvest time;
- 4) Assisting farmers by advising them to improve their production;
- 5) Buying all the produce that meets the criteria confirmed by a company (buyer) employee in collaboration with the responsible Cooperative staff on-site where it is dried;
- 6) In case of unexpected changes in the pickup of produce, the company (buyer) must notify the farmer at least 24 hours in advance. The buyer must not exceed 48 hours to come and pick up the produce from the time they communicated the changes;

- 7) Providing technical advice to farmers on irrigation methods that do not adversely affect the quality of the produce and the soil's nutrients, and on combating erosion in their fields;
- 8) Showing farmers how to harvest and select produce at least three (3) days before the first harvest begins;
- 9) Helping farmers obtain appropriate harvesting tools (sickles, baskets);
- 10) The costs of packaging and transporting the produce from the agreed collection point as per these agreements are to be borne by the Buyer;
- 11) The management of packaging materials provided by the buyer concerns the buyer or their representative;
- 12) Entering into a Memorandum of Understanding (MoU) for collaboration with the district of, so that the company finds ways to cooperate with farmers' cooperatives, including, and the district must supervise the cooperation between the buyer and the Cooperative

ARTICLE 5: HARVEST COLLECTION AND PAYMENT

- 1) Collection and transportation of the harvest is done at an agreed collection point between both parties, where the farmer knows the weight collected by the buyer;
- 2) The buyer purchases the harvest from the cooperative at the price indicated in section 1;
- 3) The buyer collects the harvest from the collection point located at the cooperative and pays for all harvested produce before carrying it away;
- 4) Payments are made through the KOPERATIVE account with account number opened at the Bank of ,..... in the name of the Cooperative
- 5) The buyer pays the Cooperative deducting any debts owed , with the payment for each debt installment to be agreed upon by both parties at the time of debt issuance.

ARTICLE 6: RESPONSIBILITIES OF AGRONOMISTS

Responsibilities of the Company Agronomist

- 1) To assist farmers in obtaining seeds suitable for the produce desired by the buyer;
- 2) To help farmers understand the type and proper amount of fertilizer based on market requirements;
- 3) To assist farmers in using the correct type of pesticide and appropriate dosage according to market standards;
- 4) To provide advice and training to farmers to help them increase both the quality and quantity of the harvest to ensure they achieve at least 75% of the required quality and quantity;
- 5) To help farmers obtain suitable tools for harvesting (harvesters, crutches, tarps).

Responsibilities of the Cooperative Agronomist

- 1) To assist farmers in obtaining seeds suitable for the produce desired by the buyer through the Company Agronomist;
- 2) To help farmers understand the type and correct amount of fertilizer based on market requirements as determined by the Company Agronomist;
- 3) To assist farmers in using the correct type of pesticide and proper dosage according to market needs as dictated by the Company Agronomist;
- 4) To provide advice and training to farmers to help them achieve the agreed quality and quantity of produce, ensuring they attain at least 75% of the required quality and quantity;
- 5) To help farmers procure suitable tools for harvesting (harvesters, crutches, tarps) based on the Cooperative Agronomist's recommendation.

ARTICLE 7: FORCE MAJEURE

- 1) For the purposes of this agreement, unforeseen hazards are defined as any occurrence that arises after the contract is signed that is unexpected, beyond the control of both parties, and prevents one or both from fulfilling their obligations, including, but not limited to, war, protest, civil unrest, transportation or communication service interruptions, significant changes in agricultural laws or policies in the producing country, embargoes, sanctions, strikes, and other labor disputes, riots, epidemics, earthquakes, storms, droughts, fires, floods, or other extraordinary weather events, explosions, lightning, or acts of terrorism.
- 2) In the event of unforeseen circumstances preventing the harvest from being obtained due to: weather changes, flooding, severe drought, insecurity, accidents, thereby hindering the farmer from fulfilling his obligations, the farmer shall be covered by the insurance he took out, if there is debt owed to the buyer, the buyer shall be paid first.
- 3) As soon as reasonably possible after an unforeseen event begins, the affected party shall notify the other party in writing of what occurred, the date it started, the duration it may last, or the effects of the unforeseen event on its ability to perform all contractual obligations, along with substantial evidence showing those unforeseen events.
- 4) The affected party shall do everything possible to mitigate the effects of the unforeseen event on fulfilling its obligations.
- 5) Should it comply with the preceding clause, if a party is prevented, restricted, or delayed in starting any obligations based on this force majeure agreement (the affected party), the affected party shall not be considered in breach of this agreement or any other liability for failure or delay in completing those obligations.
- 6) Whenever possible at all times, such obligations may be suspended by the agreements made between the parties during the duration of the unforeseen events, and no compensation or penalties shall be due for the delay in pending actions.
- 7) If the obligations are suspended due to unforeseen events for more than 30 days from notifying the affected parties of the unforeseen risks, or if suspension is not possible at all times, the other party may terminate the agreement and any payment obligations related to the needs

during the planting period, and both parties shall engage in good negotiations to establish new agreements for providing the harvest.

ARTICLE 8: WHEN THE AGREEMENT WILL BEGIN TO BE ENFORCED

This agreement will begin to be enforced on the date it is signed by both parties and will last for two (2) years, but the price will be agreed upon at the beginning of each growing season.

ARTICLE 9: REGULATIONS GOVERNING THIS AGREEMENT

This agreement is made and governed by the laws applicable in the Republic of Rwanda.

ARTICLE 10: WAIVER OF CONSEQUENCES DUE TO NON-COMPLIANCE WITH THE AGREEMENT

- 1) Any consequences arising from the failure to purchase the Cooperative's produced goods, the Buyer shall bear and pay for all such goods at the price determined in this agreement.
- 2) If the Cooperative sells production to another buyer not mentioned in this agreement, it shall bear the consequences arising from the non-compliance with this agreement in relation to the Buyer not adhering to the agreements with those to whom they supply goods, including those from this Cooperative.
- 3) Consequences arising from goods coming from outside the Cooperative shall be borne by the Cooperative since goods found to contain items from outside will be rejected and not taken by the Buyer.

ARTICLE 11: REQUEST FOR COMPENSATION

Without prejudice to other rights or remedies arising from this agreement, the aggrieved party may request compensation for any cost, loss, or expenses incurred due to non-compliance with this agreement in accordance with the applicable laws.

ARTICLE 12: RESOLUTION OF DISPUTES

- 1) Disputes arising from the implementation or interpretation of this agreement shall be resolved through mutual agreement; if this is not possible, the relevant authorities and courts with jurisdiction in the Republic of Rwanda shall be engaged.
- 2) Both parties shall work together to implement the solutions outlined in this article, and shall use this method appropriately to resolve any emerging issue, aiming to preserve, as much as possible, the ongoing relationship between the parties to achieve the goals of this agreement as stated in Article 2 above;
- 3) Unless unforeseen circumstances arise, the party breaching any obligations within this agreement (the breaching party) shall have exceeded this agreement;
- 4) When one party (the aggrieved party) becomes aware that the other party has exceeded the agreement or has failed to comply with its obligations, it shall immediately notify the breaching party and take all reasonable measures to mitigate the consequences of the violation whenever possible. All costs incurred or the difference in value provided by the aggrieved party must be compensated by the breaching party.

- 5) When the breaching party has been informed or otherwise becomes aware that it has exceeded or failed to comply with its obligations, it shall immediately take all appropriate measures at its own expense to remedy or rectify the deficiencies within 7 days including:
- 6) Replacing any items that do not meet the agreed-upon production requirements in this agreement;
- 7) Replacing anything that does not comply with the necessary requirements according to this agreement;
- 8) Changing or modifying any processes that do not align with the methods or any required procedures outlined in this agreement, following specific instructions provided by the aggrieved party or any other authorized entity; and/or.
- 9) Ceasing the supply of items previously being supplied, or accepting the supplied items as they are, as mutually agreed upon between both parties.

ARTICLE 13: TERMINATION OF THE AGREEMENT

- 1) This agreement may be terminated by either party for valid reasons, including failure to fulfill obligations contained within it. Termination of this agreement must be in writing with a notice period of fifteen (15) days.
- 2) If the breaching party has failed to comply with obligations and attempts to resolve or correct issues that have arisen between the parties, it must inform the other party in writing within 30 days before the agreement is suspended;
- 3) If the breaching party fails to meet its obligations, the aggrieved party may terminate the agreement by notifying the other party 14 days in writing in advance. The following items are considered a breach of obligations:
 - (i) The Buyer has failed to take delivery of the specified goods at least once;
 - (ii) The Buyer has failed to pay for goods within more than 10 days of the due date;
 - (iii) The Farmer has engaged in any activities aimed at selling goods to another buyer (produced on the land mentioned in this agreement).
 - (iv) The Farmer has failed to deliver the goods meeting the required specifications at least once.

ARTICLE 14: ORIGINAL DOCUMENTS

These agreements are made in three original documents, where each party retains a copy, and another is kept by the Notary who signs them.

Executed in on the/...../.....

.....

COMPANY

represented by:

COOPERATIVE

represented by:.....

.....

Notary

ANNEX: TECHNICAL SPECIFICATIONS TEJA DRY CHILLI

SN	(Parameters)	TEJA (garade ya 1)	TEJA (garade ya 2)	TEJA (garade ya 3)
1	Color	bright or deep red with Lustre.		
2	Shape	Well Shaped with Even Size.		
3	Odor	Characteristic Pungent aroma of Chilli, No unpleasant Smell.		
4	Flavor	Mediym pungency, No Unpleasant Smell,		
5	Admixture	0.5% Max , No Stalk, Pedicile or Foreign Matter.		
6	Moldy Fruit	2% Max, Free of Decay and Spoilage.		
7	Discolored or molted fruit	5% MAX.		
8	Moisture	11-12% (<i>To be discussed after measuring</i>)		

Equipment Maintenance Log

Name of Equipment	Winnower machine	Supplier's contact details:	Rwanda Agri-machine Company
Label		Date of purchase	5th Oct, 2022
Serial number	N-05	Person responsible for equipment	Cooperative agronomist
		Date put into service:	15th Oct, 2022

[illegible]

Equipment Maintenance Log

Name of Equipment		Supplier's contact details:	
Label		Date of purchase	
Serial number		Person responsible for equipment	
		Date put into service:	

[illegible]

Equipment Borrowers Log

Name of	Knapsack Sprayer	Supplier's contact details	Rwanda Agri-machine Company
Label		Date of purchase	30th Sep, 2022
Serial number	N-05	Person responsible for	Cooperative agronomist
		Date put into service:	2nd Oct, 2022

[illegible]

Equipment Borrowers Log

Name of		Supplier's contact details	
Label		Date of purchase	
Serial number		Person responsible for	
		Date put into service:	

[illegible]