REPUBLIC OF KENYA
MINISTRY OF WATER AND IRRIGATION

SUSTAINABLE SMALLHOLDER IRRIGATION DEVELOPMENT AND MANAGEMENT IN SEMI-ARID LANDS PROJECT (SIDEMAN-SAL)

FINAL REPORT
VOLUME 1
Main Report

JUNE 2016

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.

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Summary

Introduction

1. This is the Final Report on the Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project (hereinafter referred to as "the Project"). The Project has been carried out in accordance with the Record of Discussions (R/D) agreed upon between the Government of Republic of Kenya and Japan International Cooperation Agency (JICA) on March 30, 2012.

2. The Purpose of the Project is that "Resilience against drought and food insecurity is improved through participatory smallholder community irrigation development, management and appropriate farming system".

3. The Outputs of the Project are:

    - Smallholder Community Irrigation facilities are constructed through participation of IWUA.
    - IWUA capacity is improved for effective Sustainable O&M and appropriate farming systems.
    - Capacity of technical staff is enhanced for participatory irrigation development.
    - SHIDD guideline is improved.

4. 13 Pilot Project Sites have been selected in Semi-Arid Lands of the Country in 8 Counties.

5. The Implementing Agencies is the Ministry of Water and Irrigation and JICA. The structure of the Project is as follows

    - Project Steering Committee (PSC) is the Policy Organ
    - Project Coordination Committee (PCC) in charge of technical matters
    - Project Management Team (PMT) responsible for execution of project activities
    - Pilot Scheme Coordination Committee (PSCC) responsible for implementation of project activities at scheme level

Project Background

6. During the period 2000-2003, JICA supported the 'Mini-project' whose objective was to come up with strategies for promotion of sustainable community-based smallholder irrigation development. The mini project was a result of an earlier JICA Study on Irrigation development around the foothills of Mt. Kenya (1997-1998) which identified several weaknesses in Smallholder Irrigation and Drainage Project (SHIDD). The major weaknesses identified at the time were farmers' organizations, lack of clear guidelines and low technical capacity of irrigation and Drainage development (IDD) Staff.

7. The GOK-JICA Project on Sustainable Smallholder Irrigation development and Management in Central and Southern Kenya (SIDEMAN) were conceptualized to pilot the outputs of the Mini-Project Namely, Smallholder irrigation development guidelines, Framework for Formation and Strengthening irrigation water users associations (IWUAs), and Training Master Plan for irrigation personnel. The Project was formulated to expand the SIDEMAN Method and experiences into the Semi-Arid Lands.

8. Smallholder Horticultural Empowerment Project (SHEP) was a bilateral technical cooperation project between the Governments of Kenya and Japan (Nov.2006- Nov.2009). The project purpose was "to develop capacity of the smallholder horticultural farmer groups supported by the project." The SHEP Approach refers to specific methods and techniques for empowering smallholder horticulture farmers. The concept of the SHEP Project was succeeded by the Smallholder Horticulture Empowerment and Promotion Unit Project (SHEP-UP) (Mar. 2010- Feb. 2015). The Project aims to introduce the SHEP approach into Semi-Arid Lands of the Country.

Selection of Pilot Sites

9. The agreed selection criteria for the Pilot Project Sites with scoring are as follows:

No.	Category Score	Item
1	2	Climatic Conditions
2	5	Land Tenure
3	10	Area
4	15	Water Resources
5	15	Crop Production
6	10	Irrigation Facilities
7	20	Organization in the Scheme
8	6	Accessibility
9	10	Markets and Market Information
10	7	Environmental Issues
Total	100	

Source: JICA Team

10. The following schemes were selected as a pilot project site under the Batch 1 and Batch 2.

List of Pilot Project Sites under the Batch 1

Scheme	County	Sub-County	Irrigation Area (ha)	No. of IWUA Members
Kasokoni	Taita-Taveta	Taveta	33	44
Mdachi	Kilifi	Ganze	30	82
Olopito	Narok	Narok North	77	82
Gatitu/Muthaiga	Laikipia	Laikipia West	57	252
Tumutumu	Meru	Igembe South	90	450
Kaben	Elgeyo-Marakwet	Marakwet East	362	530
Murachaki	Embu	Mbeere North	172	430
Muungano	Tharaka-Nithi	Tharaka South	167	418

Source: JICA Team

List of Pilot Project Sites under the Batch 2

Scheme	County	Sub-County	Irrigation Area (ha)	No. of IWUA Members
Challa/Tuhire	Taita-Taveta	Taveta	300	700
Mangudho	Kilifi	Ganze	16	40
Shulakino	Narok	Narok North	40	172
Kiamariga/Raya	Laikipia	Laikipia West	60	140
Kaumbura	Meru	Igembe South	200	500

Source: JICA Team

Feasibility Study and Detailed Design

11. As the implementation of the Batch 1 pilot project sites was to be fast-tracked, feasibility study and detailed design were outsourced to local consultants. During the study period, transfer of technology for the study was attempted to the SCIOs and the SCAOs in the Project so that they could carry out the study and design for the Batch 2 sites.

12. During the feasibility study, low productivity of irrigated crops was observed due to over-irrigation. Existing IWUA are not matured for management of the irrigation system. Existing irrigation system is run without proper water management and maintenance plan.

13. Based on the provided agro-economical data (obtained/ rendered) from regional agricultural service stations, national agronomical census and the interviews with regional agricultural service officials, local farmers and relating personnel, the proposed crops were selected as shown below;

Proposed Crops in Batch 1 Pilot Project Sites

Crop \ Scheme	Kasokoni	Mdachi	Olopito	Gatitu/Muthaiga	Kaben	Murachake	Tumutumu	Muungano
Maize	○	○	○	○	○	○	○	○
Beans*	○	○		○	○	○	○	○
Tomato	○	○	○	○	○	○	○	○
Onion	○		○		○	○	○	○
French bean	○		○	○				
Cabbage				○				
Kale		○	○					
Okra		○						
Amaranth		○						
Ground nut						○	○	
Sweet potato					○			
Irish potato			○					
Mango					○			
Banana	○					○	○	○

*Beans including Green gram for intercropping

Source: JICA Team

Proposed Crops in Batch 2 Pilot Project Sites

Crop/ Scheme	Challa/Tuhire	Mangudho	Shulakino	Kiamariga/Raya	Kaumbura
Maize	○		○	○	○
Beans*	○		○		
Tomato	○	○	○	○	○
Onion	○	○	○	○	○
Cabbage			○	○	
Water melon		○			○
Banana	○				
Green maize		○			
Amaranth		○			
Capsicum			○	○	
Garlic				○	
Pawpaw					○

*Beans including Green gram for intercropping

Source: JICA Team

14. In the detailed design, irrigation facilities to be constructed/rehabilitated in each scheme were proposed as summarised below. Scope of construction works under the Project was discussed and agreed taking into consideration available funds and time frame.

Proposed Irrigation Facilities in Batch 1 Schemes

		Kasokoni	Mdachi	Olopito	Gatitu Muthaiga	Kaben	Murachaki	Tumutumu	Muungano
Intake Works									
New Construction/ Rehabilitation (Rehab)/ NA		Rehab	New	New	NA (Existing)	New	Rehab	Rehab	New
Weir Length	(m)	15.6	16.0	16.0		16.0	20.0	8.0	24.0
Weir Height	(m)	2.2	1.7	1.5		1.75	1.50	1.20	1.00
Type of Irrigation Network		Open Canal	Open Canal	Pipe Lines	Pipe Lines	Open Canal	Pipe Lines	Pipe Lines	Pipe Lines
		Main	Main	Main	Main	Conveyance	Conveyance	Conveyance	Main
Number of Lines	(Nos)	1	1	1	2	1	1	1	2
Total Length	(m)	1,886	458	3,646	9,065	13,000	2,125	1,271	12,613
Related Structures	(Nos)	39	5	26	75	36	13	11	90
		Feeder	Sub Branch	Sub-main	Feeder	Main	Main	Main	Distribution
Number of Lines	(Nos)	20	2	5	25	1	1	3	224
Total Length	(m)	5,546	1,231	2,943	8,738	5,853	10,875	11,547	12,613
Related Structures	(Nos)	192	19	36	149	22	70	80	418
			Tertiary	Distribution		Feeder	Sub-main	Sub-main	
Number of Lines	(Nos)		10	3		11	19	3	
Total Length	(m)		2,548	564		6,773	13,000	11,191	
Related Structures	(Nos)		108	6		65	213	67	
				Feeder			Feeder	Feeder	
Number of Lines	(Nos)			5			46	100	
Total Length	(m)			6,455			29,667	56,805	
Related Structures	(Nos)			5			192	475	

NA: Not Applicable

Source: JICA Team

Proposed Irrigation Facilities in Batch 2 Schemes

		Tuhire Challa	Mangudho	Shulakino	Kiamariga Raya	Kaumbura
Intake Works						
New Construction/ Rehabilitation (Rehab)/ NA		Rehab	New	Rehab	Rehab	New
Weir Length	(m)	12.7	40.0	11.3	4.5	10.0
Weir Height	(m)	1.0	1.5	3.0	1.0	1.50
Type of Irrigation Network		Open Canal	Pump Feed Pipe Lines	Pipe Lines	Pipe Lines	Open Canal
		Conveyance	Main	Main	Main	Main
Number of Lines	(Nos)	1	2	2	2	1
Total Length	(m)	1,083	1,977	2,795	3,900	3,190
Related Structures	(Nos)	2	10	25	40	4
		Branch	Link		Secondary	Secondary
Number of Lines	(Nos)	1	1		8	8
Total Length	(m)	745	100		3,561	3,015
Related Structures	(Nos)	3	0		8	60
		Secondary	Submain			Terriary
Number of Lines	(Nos)	5	7			60
Total Length	(m)	14,902	923			6,000
Related Structures	(Nos)	175	9			120
			Distribution			
Number of Lines	(Nos)		10			
Total Length	(m)		740			
Related Structures	(Nos)		10			

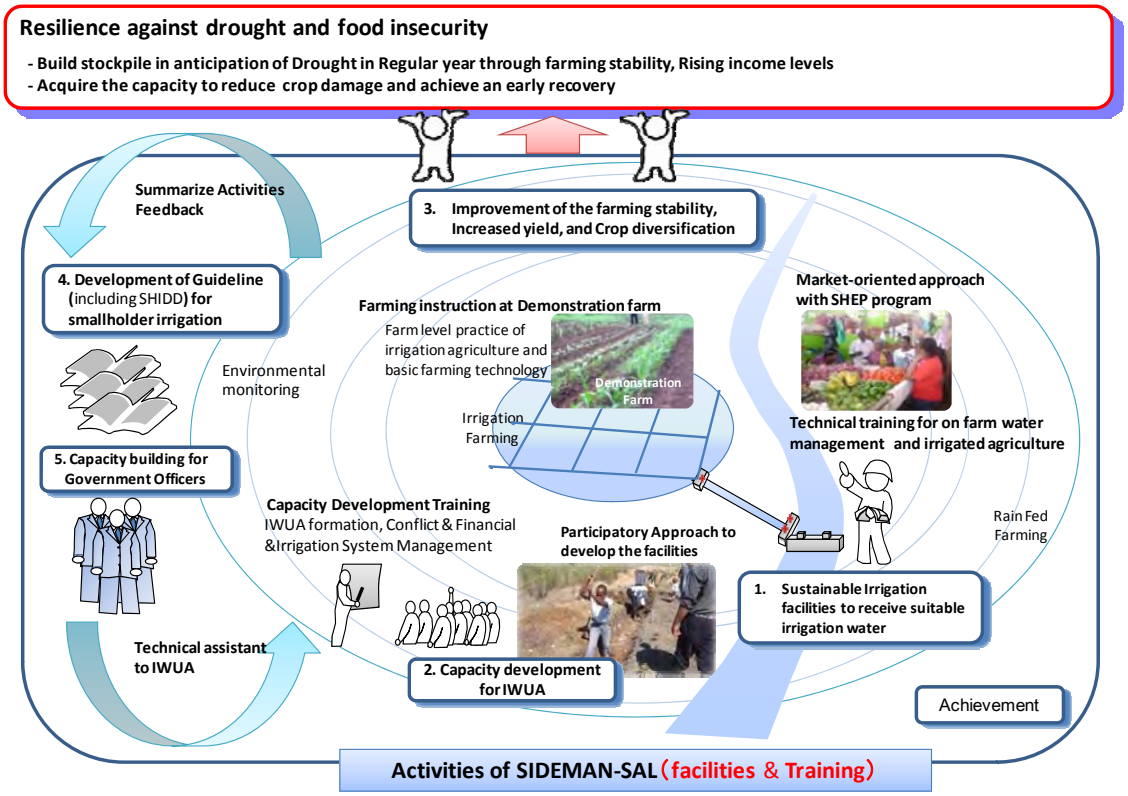
NA: Not Applicable

Source: JICA Team

Basic Approach of Implementation for Pilot Projects

15. To achieve the purpose of the Project, the term of "Resilience against drought and food insecurity" was defined as follows, on which the activities based on the findings obtained in the process of implementing the project would be developed and reorganized.

- Farmers will improve farm income and acquire the stable farming system through stable production of crops, increase of yield, and crop diversification brought by stable irrigation water supply and improvement of farming technology. Those activities, during normal season, enable the farmers to stock foods and enhance their capacity to reduce crop damage and achieve an early recovery against series of drought.



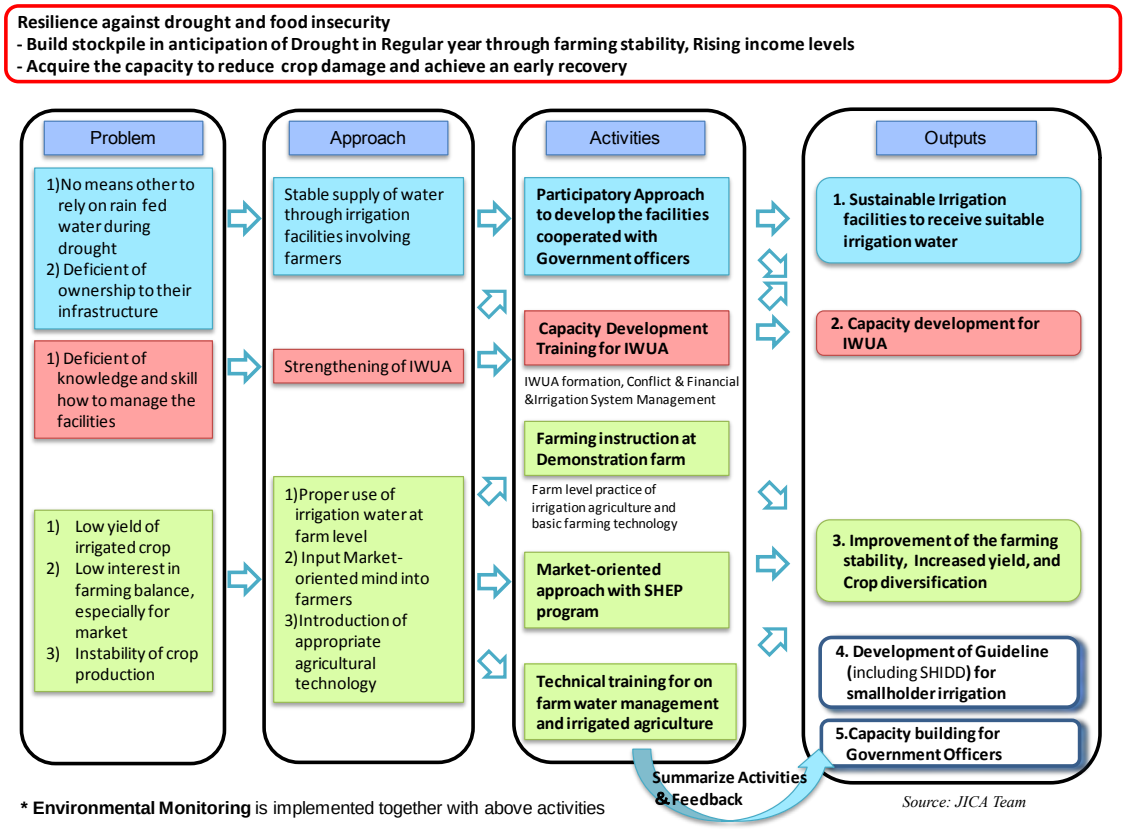
16. Major achievements and activities of the Project are as follows.

Outputs	Activities
(1) Sustainable Irrigation facilities to receive suitable irrigation water	(1) Participatory Approach to develop the facilities cooperated with Government officers
(2) Capacity development for IWUA	(1) Capacity Development Training for IWUA IWUA formation, Conflict & Financial &Irrigation System Management
(3) Improvement of the farming stability, Increased yield, and Crop diversification	(1) Farming instruction at Demonstration farm (2) Market-oriented approach with SHEP program (3) Technical training for on farm water management and irrigated agriculture
(4) Development of Guideline (including SHIDD) for smallholder irrigation	A result of the above activities
(5) Capacity building for Government Officers	A result of the above activities

* Environmental Monitoring is implemented together with above activities

Source: JICA Team

17. The major Activities (Components) of the project were determined as follows based on problems identification of the current situation.



Construction of Irrigation Facilities

18. After completion of the detailed design, a Memorandum of Understanding (MOU) has been signed among three (3) parties; i) National Government of Kenya - JICA represented by GOK and JICA Mission representative, ii) IWUA in each scheme, iii) County Government concerned (SCIO, other county officers).

19. The MOU covered

- Component of the farmers works and Contractor's works,
- Amount of the farmers' contribution,
- Schedule of construction works,
- Farmers' obligation to the construction works,
- GOK-JICA's obligation to the construction works,
- County government's obligation to the construction works,
- Quality control, and
- Safety control.

20. The construction works were categorised into two, namely, farmers' participatory works, and outsourced works undertaken by private contractors.

21. As for the farmers' participatory works, JICA fund and/ or GOK fund shall supply:

- Materials for pipelines such as pipes and accessories, cement, fine and coarse aggregates,

- Skilled labour such as mason, pipe fitter, for the construction works, and
- Equipment and labour for excavation of soft rock/ hard rock layers.

22. The IWUA members were requested to contribute:

- Unskilled labour such as for simple excavation, simple backfilling with compaction, mixing and pouring of concrete with guidance of skilled mason;
- Transportation and arrangement of construction materials from storage to working site.
- Assistance in i) pipe laying and fitting works, ii) canal lining, related structure construction
- Construction of water storage

23. The County Government shall;

- Assist the farmers groups and schemes committee when they require support to enforce their regulation in solving of disputes during irrigation scheme planning, design, implementation operation and maintenance phases.
- Collaborate with the Ministry and other institutions to implement the irrigation scheme successfully.

24. The Construction works undertaken by the private contractors were conducted except Gatitu-Muthaiga scheme, and their works covered mainly the construction of intake weirs and some of the conveyance/ main pipelines and related structures; those are rather difficult to conduct the works by the IWUAs from viewpoints of technical aspects and time frame.

25. The scope of the construction works for each site is presented below.

Name of Sites	IWUA Works	Contractors' Works
Kasokoni	Rehabilitation of Main Canal	Rehabilitation of Intake Weir Construction of Flood Protection Dike Construction of Building for O&M
Olopito	Construction of Main, Sub-Main, Distribution and Feeder Pipelines	Construction of Intake Weir Construction of Conveyance Pipeline Construction of Structures in the Main Pipeline Construction of Gully Crossing and Stream Crossing Construction of Building for O&M
Tumutumu	Construction of Main, Sub-Main and Feeder Pipelines	Improvement of the Intake Weir Construction of Conveyance Pipeline Construction of Building for O&M
Gatitu/Muthaiga	Construction of Main and Feeder Pipeline	-
Mdachi	Construction of Main, Secondary and Tertiary Canals	Construction of Intake Weir Construction of Building for O&M
Murachaki	-	Improvement of Intake Weir Construction of Building for O&M
Muungano	-	Construction of Intake Weir Construction of Building for O&M

Name of Sites	IWUA Works	Contractors' Works
Kaben	Construction of Structures in the Conveyance Canal	Construction/ Improvement of critical Structures along the Conveyance Canal
Tuhire/Challa Harambee	Rehabilitation of Secondary Canals	None
Mangudho	Construction of Pipeline System	Construction of Pump House and reservoir
Shulakino	Construction of Pipeline System	Rehabilitation of Intake Weir
Kiamariga/Raya	Rehabilitation/Extension of Pipeline System	None
Kaumbura	Rehabilitation of Irrigation Canals	None

Source: JICA Team

26. The PMU provided the SCIO with technical guidance for the construction supervision, such as quality control, safety control, guidance to the IWUA works.

27. The achievement of the construction works as of end of April 2016 is as follows.

Scheme	Facilities	Canals/Pipelines	Length			Remaining work Detail
			Full Scope	JICA Fund	Remaining	
	Nos		M	m	m	
Batch-1						
Kasokoni	1 (Intake Works)	Main Canal	1,886	1,886	0	(1) Excavation of drainage canal (2) Rock excavation of drainage canal
Mdachi	1	Main Canal	458	458	0	(1) Construction of secondary canal
	(Intake Works)	Secondary canal	1,231	0	1,231	(2) In-field system
		Tertiary canal	2,556	0	2,556	
Olopito	1	Main line	3,646	3,511	135	(1) Rock excavation downstream of main pipeline
	(Intake Works)	Sub main line	2,941	311	2,630	(2) Sub-main Downstream
		Distribution line	564	0	564	(3) In-field
		Feeder line	6,431	673	5,758	
Gatitu Muthaiga		Main line	9,105	5,996	3,109	(1) Material and labour cost for construction of chambers and crossing (downstream): (2) Feeder pipelines downstream
		Feeder line	8,736	3,930	4,806	(3) In-field system downstream
Kaben	7 (Critical Sections)	Critical Sections				
Murachaki	1 (Intake Works)	Intake Works				
Tumutumu	1	Conveyance line	1,271	1,271	0	(1) Main and Sub-main: Material and labour cost for construction of chambers and crossing (downstream)
	(Intake Works)	Main line	11,547	9,153	2,394	(2) Construction of Main and Sub-main pipelines downstream
		Sub main line	11,412	4,457	6,955	(3) Distribution and In-field system downstream
		Distribution line	54,983	15,294	39,689	
Muungano	1 (Intake Works)	Intake Works				
Batch-2						
Tuhire Challa		Secondary Line	2,750	1,375	1,375	(1) Lining works for secondary canals (2) Construction of road crossing
Mangudho	2 (Pump House, Reservoir)	Rising Main Line	738	738	0	
Shulakino	1 (SB)	Main Pipe Line	1,745	1,729	16	
		Distribution	475	0	475	
Kiamariga Raya		Kiamariga Main	2,440	2,440	0	(1) Construction of Distribution Pipelines in Kiamariga
		Kiamariga Distribution	1,901	0	1,901	(2) Rehabilitation of intake weir
		Raya Main	1,460	0	1,460	(3) Rehabilitation of Raya pipeline system
		Raya Distribution	1,660	0	1,660	
Kaumbura		Main Line	2,360	1,000	1,360	(1) Lining works on the main canal

Source : JICA Team

28. Technical guidance as well as training course/workshop conducted by PMT led to improve capacity of the SCIO for the construction supervision.

29. For IWUAs with poor progress of the construction works, community mobilization was carried out by the PMT to expedite the works. The activities covered door to door mobilisation, block meeting, general assembly for ratifying an action plan and monitoring the construction works. The continuous support and monitoring by the County officials and the PMT staff resulted in improvement of the work progress.

Capacity Development for IWUA Members

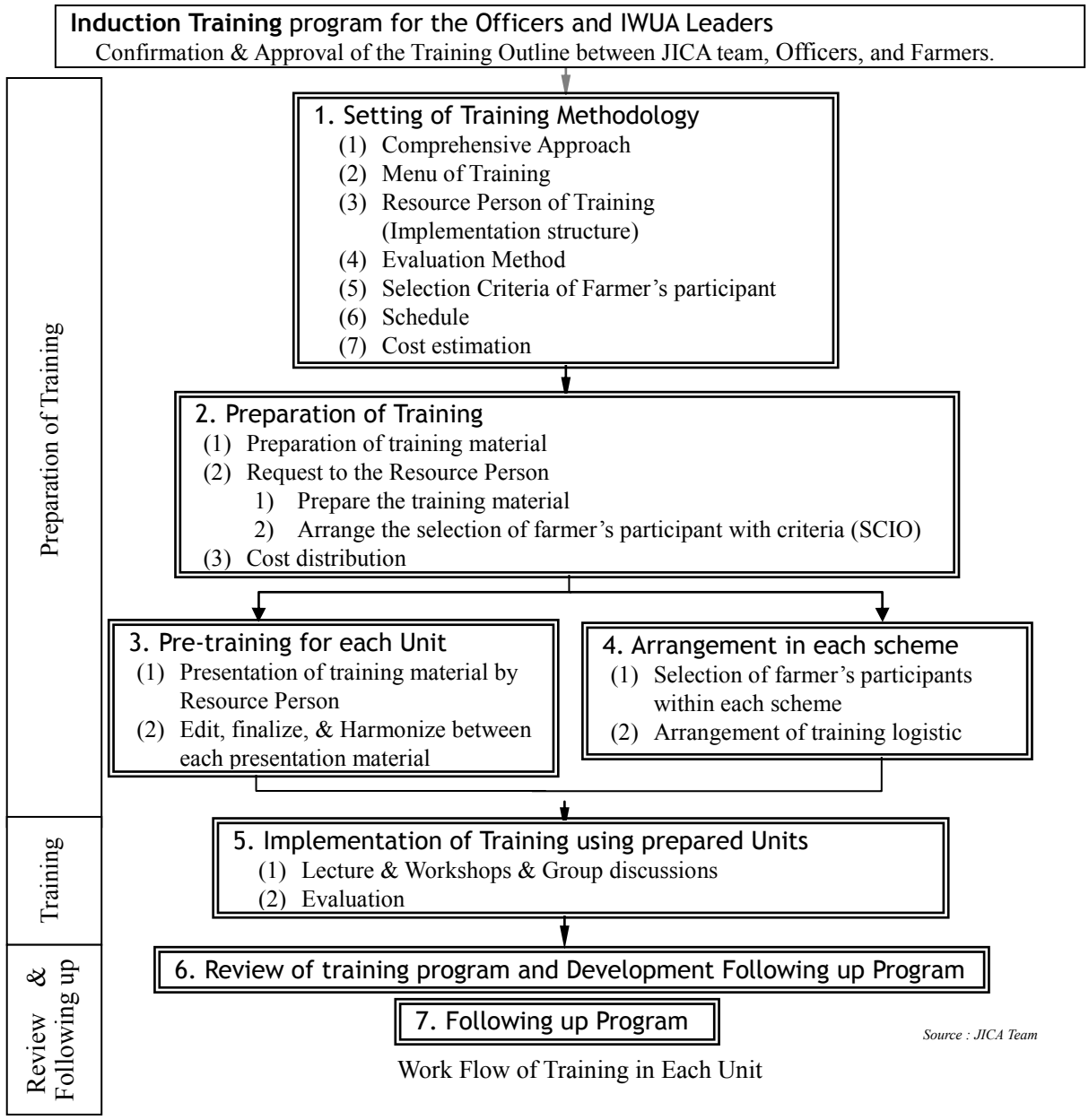
30. On development of irrigation facilities, organisational strength of the IWUA for Operation and Maintenance including water management becomes key role. Therefore, the project gave priority to strengthen IWUA delivering proper knowledge and skill for handling the irrigation facilities with training and practice on site. As a result of that, the IWUA is expected to have self-sustaining management ability.

31. Taking into consideration view of counterparts and the SCIOs and the SCAOs and experience during the initial project implementation period, major activities of the capacity development for IWUA were set as shown below.

Training Course	Major Subject
Unit 1 (Social Mobilization and IWUA Formulation)	➢ Role and responsibility of IWUA ➢ Process of IWUA Formation ➢ By-law and Registration as Legal Entity ➢ Legal Framework (Water act, WRMA)
Unit 2 (Leadership and Conflict Management)	➢ IWUA Organization and its function ➢ Leadership in IWUA ➢ Conflict and Conflict Resolution
Unit 3 (Financial Monitoring and Record Keeping)	➢ Introduction of Financial Management ➢ Record Keeping ➢ Financial Reporting
Unit 4 (On-farm Water Management and Agronomy)	➢ Soil and Water ➢ Crop Water Requirement ➢ Formulation of Crop Calendar ➢ Irrigation Method ➢ Nursery and Field Practice ➢ Post Harvest and Processing
Unit 5 (System operation and Maintenance)	➢ Responsibility of IWUA in O&M ➢ Water Distribution ➢ Water flow measurement and monitoring ➢ Planning and Conducting Maintenance ➢ Collection of O&M Fee (Water Fee)

Source: JICA Team

32. Flow of the training programme is shown below. To strengthen the capacity of the SCIOs and the SCAOs as a trainer, the Project stressed importance of conducting training of trainer (TOT) course and pre-training programme before conducting the training programmes to the IWUA members.



Work Flow of Training in Each Unit

33. Evaluation tools for the capacity building, such as Course evaluation, Pre and Post Knowledge Evaluation, and Pre and Post IWUA Functionality Survey, were introduced to the Project so that PDCA cycles for the training programme could be realized.

34. The participants in the training and the trainers (SCIOs/SCAOs) appreciated methodology of the training programme, including Pre-training, training materials, facilitators, and logistics.

35. The results of the Knowledge Evaluation per unit depicting the percentages of the farmers in the various scoring levels as well as the average mark for each scheme are as follows.

Summary of Knowledge Evaluation Result

Unit	Pre Training	Post Training	Difference
Unit 1	66%	74%	7%
Unit 2	60%	68%	8%
Unit 3	62%	71%	9%
Unit 4	63%	67%	4%
Unit 5	68%	75%	6%
All Trainings	**64%**	**71%**	**7%**

*100% is full marks. There is a slight difference between the scheme questionnaires; however these are compared in the same row.

Source : JICA Team

36. The average score was 64% and 71% Pre and Post the training respectively, therefore, on average, the knowledge level was improved by 7 points.

37. The results of the Functional Survey before/after training programme revealed that the programme definitely contributed to enhance management capacity of the IWUA, which should lead to improve resilience.

Summary of Functionality Survey Result

Group	Scheme	Pre-Training	Post-Training
Same score or slightly Decline	Kasokoni	64.0	58.0
	Mdachi	34.0	35.5
	Olopito	37.5	36.3
Increase	Tuhire Challa	54.5	61.0
	Kaben	38.5	42.5
	Murachaki	40.0	48.5
Remarkable Increase	Gatitu/Muthaiga	37.0	49.0
	Tumutumu	35.3	46.0
	Muungano	41.5	58.0
	Kiamariga/ Raya	58.5	66.0
	Mangudho	22.5	58.0
	Shulakino	39.5	54.0
	Kaumbura	64.5	76.5

Source: JICA Team

*Irrigation operation does not start in any scheme as of 11th Dec 2015 except Gatitu-Muthaiga, Kasokoni, Tuhire Challa, and Kiamariga Raya

38. The SCIOs and the SCAOs are expected to support the IWUA so that the organization can implement an action plan, which was prepared and presented at the training course for sustainable management of their irrigation scheme. Further, the officers are tasked to disseminate the output of the activities for other irrigation schemes.

Agriculture

39. For the purpose of inducing farmer awareness of the market-oriented farming management, the SHEP Approach was introduced with the collaboration of SHEP UP project. The SHEP Approach was developed by the Smallholder Horticultural Empowerment Project (SHEP) that was a bilateral technical cooperation project between the GOK and JICA.

40. In consideration of the fact that the pilot project sites of the SIDEMAN-SAL are located in the land areas under condition of Semi-Arid (ASAL) Lands, the activities that were anticipated to

contribute augmentation of the resilience of local communities in ASAL area through improvement in their livelihood and nutrition status with alternative selection (diversity) of agricultural enterprises/ produces and with stable productivity of their staple food crops are also required. For this purpose, the Project introduced to farmers the use various technologies known as Low Input Sustainable Agriculture (LISA) technologies. This composed of the Kenyan Traditional Vegetable program, the Push-pull technology and "Bokashi" fermented organic materials technology.

41. Selection of model farmer groups for the Batch-1 pilot project sites followed the selection procedure being taken by SHEP Approach. In each pilot project sites, an existing formal/ informal farmer group of between fifteen (15) and fifty (50) group membership was selected. Gender was also considered in selection of group representatives. A couple of farmer representatives consisted of a male and a female membership were selected/ invited in each workshop.

42. Also two to three farmers were selected as a pilot farmer in a model group for the trial introduction of the Low Input and Sustainable Agriculture (LISA) technologies. The demand-driven approach was also applied in the selection of candidate technologies in the trial introduction of Kenyan traditional vegetables.

43. The major activities in 2 Sub-counties relating to the training in the SHEP approach were, Sensitization Workshop, Baseline Survey, FABLIST Forum, JEF2G Training, Group Activities, FT-FaDDE , and In-Field Training.

44. In pilot schemes located in 6 sub-counties where the SHEP Approach is NOT in practice, the core components of SHEP Approach were introduced by the SHEP experts. The introduced activities were, Baseline Survey Workshop, Abbreviated Market Condition Survey & Crop Planting Calendar Making Workshop, and Record Keeping Management Workshop

45. To analyze the changes in farm economy, the Annual Baseline Survey of the model farmer groups was implemented. Submission of the survey data of the farmer group members, consisting of 1) Crop Production and Income (CPI) Analysis Data, and 2) General Horticultural Crop Production and Post Harvest Handling Technique (GHCP&PHHT) and 3) Group Empowerment Indicator (GEI) were requested to all SCAOs of the pilot project sites. Since only about a half of the year (6 months) has passed from previous survey that was held at October 2014, the data of the crop production and farm income (the 3rd in Batch-1 and 2nd in Batch-2 pilot schemes) were derived only from the previous short-rain season.

46. It was not observed drastic changes in the overall trends in the major enterprises produced by the model farmer groups. Maize or green maize was planted at all pilot schemes, and farmers cultivated beans or other leguminous (i.e. peas) crops as intercrop with those maize/ green maize. Major enterprises produced by the model farmer groups in Murachaki, Tumutumu and Kaumbura schemes consist only on grain crops.

47. To identify the capacity changes of both individual farmers and farmers groups in adopting basic horticultural production techniques, the GHCP&PHHT surveys were conducted annually for model farmer groups.

48. It was observed that a small proportion of farmers have conducted "Pre-cultivation Preparation" such as undertaking market survey (Q1) and preparing crop planting calendar (Q2) in the 1st survey (before training), however on the 2nd survey, most farmers in all schemes except Tumutumu and Kiamariga-Raya schemes had conducted market survey and crop planting calendar making. The percentages of farmer members who implemented the cost income analysis (Q20) were dramatically increased compared to that in previous year(s).

49. The observation above mentioned proved that the series of training sessions and practices of the core components of SHEP Approach was actually taken across the members of farmer groups, and the knowledge obtained at the training contributed the increment of the farmer's competence/ capacity of the Market-Oriented Agriculture.

50. Farmers indicated the following benefits from Kenyan Traditional Vegetables program;

    a) The vegetables provide nutritional value to the family members

    b) There is a ready market for the KTVs at price higher than that of kales

51. Farmers indicated the following benefits from the Push-pull technology

    h) The Push–pull technology has reduces production cost (cost of stalk borer control and weeds control are highly reduced

    i) The desmodium increases nitrogen in soil hence improves soil fertility

52. There was some confusion that some of the group members did not belong to the IWUA, that resulted in complains by the IWUA members who were not members of the model group. To avoid the confusion the SCAOs should consider/ clearly define whether the all group member should be located/ resident in the pilot scheme area or not when select / formulate the model farmer groups at new SIDEMAN-SAL pilot schemes.

53. For the selection of those 1st and 2nd prioritised crops, the farmer group members had taken into account not only the market prices but also the interest, preference, experience, availabilities of planting materials and resources, and technical feasibility of farmer group members.

54. To identify whether the market survey contributed to the dispersion of risk on market prices and the diversification of crop production, need the analysis of selection processes should be made by the farmers.

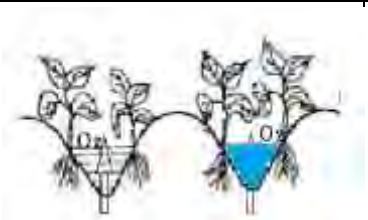
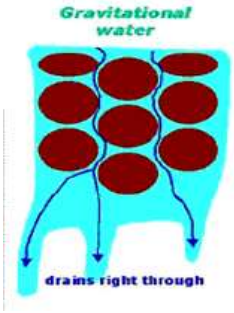
55. Improving irrigated crop yield is urgent issue to solve before construction of irrigation facility. To achieve it, the Project proposed the method which maintains adequate moisture and air in soils under irrigation practice.

56. Proper irrigation interval: It is said that proper irrigation interval can play a major role in increasing the water use efficiency and the crop productivity. In the schemes, crops were irrigated too much water at the time because irrigation interval is too long. It is recommended that the shorter irrigation interval be applied.

57. Raised beds: Planting on raised beds allows excess moisture to drain out of the root zone and also permits air to move around the plant roots, which reduce the potential for root rot.

58. Comparison between the local and the proposed irrigation methods by the Project is summarised in the following Table.

Main Contents of the Demonstration Farms

Plot	Local Method	Proposed Method
Name	Local Furrow Irrigation	Furrow Irrigation on Wide Raised Bed
Irrigation and cultivation method		
Irrigation interval	About 10 days with a lot of water at a time	Twice per week with a small quantity of water
Characteristic of the method	- It is easy to generate root rotting caused by water logging. - The irrigated water can not be absorbed by crop because the most is gravitational water.	- Root is grown healthy because drainage of soil is improved by making ridge and proper irrigation method. - It is easy to save water because irrigation is just around the roots and much of water is capillary water that plant can absorb.
Schematic diagram of soil water		

Source: JICA Team

59. Main objectives of the demonstration farm were:

- To confirm the effects in other scheme and other crops,
- To expand the technology to farmers, and
- To measure the water saving effect through their activities if possible.

60. Main contents applied to each scheme are summarised below.

Demo Farm Type	Scheme	Crop	Growing Period	Companion Plant
Test farm	Mdachi	Okra	2015 Jan - 2015 Apr	-
	Kasokoni	Okra, Tomato	2015 Feb - 2015 Jul	Onion
	Tumutumu	Kale, Tomato, Watermelon	2015 May - 2015 Sep	Onion
	Gatitu/Muthaiga	Cabbage	2015 May - 2015 Sep	-
Actual irrigation farm	Kasokoni	Tomato	2015 Oct - 2016 Feb	Onion

Source: JICA Team

61. Comparison to the yield and irrigation water amount between the proposed and the local methods is shown in the following table. Main results are;

    a. Proposed method under Demonstration farm implemented with actual irrigation facilities (2nd Demo farm) produced 3 times (59.1-60.8 tons per ha) as Kenya standards yield, 21.0 tons per ha, FAO.

    b. Irrigation water amount of the proposed method was from 1/3 to 1/4 lower than that in the local method.

    c. The yields of all the crops under the proposed method showed 1.5 - 2.0 times higher than that in the local method except the crops attacked by mites. Furthermore, some remarkable results showed much higher yield than FAO standard.

Scheme	Demo Farm Type	Crop	Block	Irrigation Method	Yield (t/ha)		Water Amount (mm / total growing period)		Growing period
					Demo Farm	FAO	Irrigated Water	Crop water need*1 *2	
Kasokoni	Test farm	Okra	A	Proposed	7.0*3	2.0	76	502	Dry to Rainy season *2015 Feb- Jul*
				Local basin	17.9		243		
			B	Proposed	3.7		244		
				Local basin	2.8		878		
		Tomato	A	Proposed	5.4*3	21.0	76	400-800	
				Local basin	15.0		217		
			B	Proposed	24.3		314		
				Local basin	11.3		1,085		
	Actual irrigation farm	Tomato	A	Proposed	60.8	21.0	124	400-800	Rainy to Dry Season *2015 Oct to 2016 Feb*
				Local basin	31.2		353		
			B	Proposed	59.1		94		
				Local basin	46.2		412		
Gatitu/Muthaiga	Test farm	Cabbage	A	Proposed	182.0	25 - 35	111	350-500	Dry Season *2015 May to Sep*
				Local Furrow	56.0		429		
			B	Proposed	126.0		283		
				Local Furrow	49.0		450		

Source: JICA Team

*1 Journal of Basic and Applied Sciences, 6(9): 196-206, 2012 V.C. Patil, 196

*2 FAO CHAPTER 3: CROP WATER NEEDS http://www.fao.org/docrep/s2022e/s2022e07.htm

*3 Crops was damaged by insect and disease.

62. Especially, the irrigation water amount of basin irrigation was about 3.5 times of that in the proposed method. In the case of furrow irrigation, it used more than double of water than that in the proposed method.

63. From the results of the demonstration farm, the proposed irrigation method is proven to be very effective in the water saving and increase in crop yield.

64. In the Mdachi irrigation scheme, level of EC (Electric Conductivity = Salinity level) in irrigation water is from 2 to 4 dS/m. That value was much higher than that in the other irrigation schemes. Therefore, that scheme had a risk of incurring salinity accumulation problem in soil. The farmers should control irrigation water, and check the salinity of irrigation water before irrigating. In the case that the Salinity level is high, they should stop irrigation. In the field, it is proposed for farmers to implement irrigation farming, keeping the following three points in mind.

    a. Avoid over-irrigation and monitor both salinity level of irrigation water and soil, and observe any symptom of salt damage to the crop.

b. Suspend cropping when the salinity problem takes place. After rainfall, monitor the declining level of soil salinity. Restart the cultivation after the salinity level becomes normal.

c. For clay soil field, deep plough and apply manure/compost in farm yard ensuring soil permeability and Plant a salt tolerant crop.

Staff Capacity Development

65. During a whole Project implementation period, namely, planning and implementation of construction of irrigation facilities, operation and maintenance, and agricultural farming, the Project carried out a capacity building program, making the maximum efforts to improve capacity and skills of the Sub-County officials in order to efficiently play their respective roles during and after project implementation.

66. The training programme conducted during the project implementation period is summarised below.

As of December 31, 2015

Description of Activities	Dates for the Training	Unit	Target	Achievement	Nos. of Participants	Remarks
Sensitization workshop for implementation method of the Project	18th - 19th April 2013	Nos. of Workshop	1	1	32	Participants: SCIOs/SCAO and Directors in 8 counties
Sensitization workshop for agricultural activities	22nd August 2013	Nos. of Workshop	1	1	32	
TOT Program for IWUA Capacity Development Training	17th - 21st February 2014 18th - 19th August 2015	Nos. of Workshop	2	2	16	Participants: SCIOs/SCAO in 8 counties
Feasibility Study, Detailed Design, Construction Supervision and Construction Guidance for IWUA	3rd - 7th March 2014	Nos. of Workshop	1	1	16	
Contract Management	16th - 20th June 2015	Nos. of Workshop	1	1	16	
Lesson Learnt Workshop	14th - 17th december 2015	Nos. of Workshop	1	1	16	
Agricultural development	11th - 14th January 2016	Nos. of Workshop	1	1	16	Participants: SCAO and SCCO in 8 Counties

Source: JICA Team

Environment

67. Environmental Impact Assessment (EIA) Study was conducted by local consultants to identify negative impact for the implementation of projects and mitigation measures. The EIA reports were submitted to NEMA for obtaining NEMA Licenses. NEMA issued licenses with several conditions, which were to be considered to prepare Environmental Management and Monitoring Program (EMMP) for both construction and operation periods.

68. Major items to be monitored during construction period were, WRMA construction permit, project sign board, sanitary facilities, ecological degradation of the river and river bank, soil erosion, health, safety and accidents

69. During the project operation period, water abstraction permit from WRMA, soil erosion, water logging and salinisation, agrochemicals pollution, sanitary facilities, human –wildlife conflicts, water use conflicts are to be monitored.

70. Activities during construction period were monitored by PMT, and contractors generally

followed the requirement specified in EMMP. The EMMP should be continued for the project operation period.

Revision of Guidelines

71. One of the important activities under the Project is to prepare and revise the guidelines and manuals, which have been prepared during the previous project. Some of the manuals were prepared based on the project activities under the Project. The SHIDD Guideline and the IWUA Frameworks have been reviewed and revised by the SCIOs and the SCAOs as well as the PMT members. The guidelines should be finalised taking into consideration devolution and legal frameworks, which are mandatory for implementation of irrigation project, as well as necessary procedure including public comments.

Recommendations

72. In February 2016, a workshop was held to discuss an Exit Strategy for implementation of activities after the completion of the Project. Major items for the implementation are indicated below.

Major Activities in the Exit Strategy

Category	Activities
Engineering	Implementation of the remaining works under Batch 1 & 2 Sites
Capacity Development for IWUA	Continuation of the Trainings for other IWUA members
	Monitoring of IWUA activities, such as amendment of by-law, financial management
	Facilitation to IWUA to prepare O&M Plan
	Provision of field Guidance to System O&M and collection of O&M Fee
	Preparation of Specific O&M Manuals
Agricultural Development	Continuation of the Trainings for other IWUA members, such as SHEP approach and LISA Technology
	Management of Demonstration Farm for extension of irrigated agricultures with water saving technologies
Environment	Facilitation to IWUA to obtain WRMA water abstraction permits
	Conduct of Environmental Audit for the Batch 2 Sites
	Assistance to IWUA to implement EMMP during operation stage
Revision of Guidelines	Conduct of Public comments and workshops
	Finalization and publication of the Guidelines

Source: JICA Team

73. It is recommended that MWI and MOA would make necessary budgetary arrangement to implement the above activity towards sustainable management of the irrigation system and to disseminate the project outputs to other areas.

74. Under 5 schemes of the Batch 1 pilot project sites, namely, Kasokoni, Mdachi, Olopito, Gatitu/Muthaiga, and Tumutumu schemes, and the Batch 2 pilot project sites, the scope of works agreed at the 1st PSC Meeting were not fully completed due to time and budgetary constraints. It is, therefore, recommended to complete the whole scope of the construction works using the resources of the National Government and the County Government.

75. As for schemes partially constructed in the Batch 1 pilot project sites, namely, Kaben, Murachaki and Muungano schemes, it is appreciated that budgetary arrangements followed by

procurements of construction materials have been carried out by the County Governments. It is recommended that the remaining works, such as pipeline system and canals are to be implemented continuously under resources of the Counties with farmers' participation.

76. Major recommendations for each programme are summarised below.

Subject	Recommendations
Construction of Irrigation Facilities	
Construction Supervision	
Legal Requirements to obtain authorisation for NEMA and WRMA	➢ To implement a following up training to obtain the apropriate knowledge for the application process.
Consensus building and the sharing of roles and responsibilities for farmers work	➢ To prepare an action plan by the IWUA so as to explain to the IWUA members their responsibilities during the construction period. ➢ To monitor progress of the IWUA participatory construction works by te IWUA committee members and SCIO.
Promotion of IWUA members' participation in the construction works	➢ To analise the IWUA's contribution rate for the construction works according to their capability, and consequently to corporate the result of analysis into the Guideline.
Wayleave issues	➢ To involve the SCIO for prior explanation of stakeholders in order to solve the wayleave issues. ➢ To obtain consent by IWUA non-members, having their lands along proposed irrigation canals/pipelines, through prior explanation by the SCIO to the land owners. ➢ To conduct walk-through by the IWUA members and the land owner to identify the route and to make consensus for the wayleave issue.
Estimation of Construction Cost	
Conduct of detailed survey during design	➢ To enhance capacities of the SCIO in terms of field investigation required for detailed design works. ➢ To improve capacities of the SCIO for cost estimation. ➢ To strengthen a design review system.
IWUA Capacity Development	
Dissemination activity of capacity building program for IWUA	
Awareness raising for activities and financing to the County	➢ To facilitate the County officials to prepare and submit work plan and budget so that they can continue the activities for farmers.. ➢ To collect necessary information to training budget.
Enhancement of capacity building of practical field activities for farmers	➢ To continue to manage a demonstration farm, utilising a training manual, after completion of irrigation infrastructures.
Upgrading of the training programme	
Upgrading of the training material	➢ To finalise the various manuals produced during the project implementation period.
Follow-up and Monitoring	
Progress monitoring of the Follow-up programme	➢ To conduct field guidance to the IWUA members in system operation and maintenance, monitoring the field activities by the IWUA members. ➢ To conduct the follow-up training programme for enhancing capacity of the IWUA members, which was indentified through the knowledge evaluation as well as the functionality survey.
Agricultural Development	
SHEP approach and LISA	
Absorption / effect of selection of crops and cropping calendar	➢ To conduct the baseline survey to evaluate if the farmers cultivate crop selected during the market survey.
The understanding and the absorption of the transfer technology in farming support activities	➢ To continue the activities in the selected model farmers' group. ➢ To expand participants for the trainings to disseminate the output to the others. ➢ To conduct a follow-up training programme for SHEP approach.
Pilot Demonstration for Irrigated Agriculture	
Dissemination of Water-saving Agricultural Technology	➢ To provide technical guidance by the FEOs to farmers to disseminate the introduced technology.
Environment	
Mitigation Measure against saline irrigation water	
Strengthening of water quality monitoring of irrigation water	➢ To conduct technical guidance to the IWUA members on appropriate farming practice and monitoring of water quality.
WRMA permission for water abstraction	
Promote awareness for the water abstraction permission to WRMA	➢ To raise awareness to the IWUA members for obtaining water abstraction permission, providing technical guidance to construct water storage facilities, which are essential for obtaining the permission.

Source: JICA Team

Kasokoni Irrigation Project (Taveta Sub-County)

Intake Weir before Rehabilitation Works

Main Canal before Rehabilitation Works

Intake Weir after Rehabilitation Works

Main Canal after Rehabilitation Works

Training Program for IWUA Members

Demonstration Farm for water Saving Irrigation Technology

Mdachi Irrigation Project (Ganze Sub-county)

Proposed Intake Weir Site

Meeting with IWUA Members

Completed Intake Weir

Completed Main Canal

Training Program for IWUA Members

Demonstration Farm for water Saving Irrigation Technology

Olopito Irrigation Project (Narok North Sub-county)

Proposed Intake Weir Site

Proposed main Pipeline Route

Completed Intake Weir

Constructed Conveyance Pipeline

Completed IWUA Office

Training Program for IWUA Members

Gatitu/Muthaiga Scheme (Laikipia West Sub-County)

Existing Intake Weir

Construction Works by IWUA Members

Project Sign Board

Training Program for IWUA Members

Current Irrigated Farming

Demonstration Farm for water Saving Irrigation Technology

Kaben Irrigation Scheme (Marakwet East Sub-County)

Signing of MOU

Construction of Stream Crossing

Construction of Stream Crossing

Construction of Stream crossing

Canal Lining Works

Training Program for IWUA Members

Murachaki Scheme (Mbeere North Sub-County)

Sedimentation of Intake Weir

IWUA Office Building

Rehabilitated Intake weir

Training Program for IWUA Members

Training Program for IWUA Members

Training Program for IWUA Members

Tumutumu Irrigation Scheme (Igembe South Sub-County)

Intake Weir Before Rehabilitation Works

Excavation Works by IWUA Members

Intake weir after Rehabilitation works

Construction of Pipeline

Training Program for IWUA Members

Demonstration Farm for water Saving Irrigation Technology

Muungano Irrigation Scheme (Tharaka South Sob-County)

Intake Weir under Construction

Intake weir under Construction

Completed Intake Weir

Completed Office Building

Training Program for IWUA Members

Training Program for IWUA Members

Tuhire Challa Irrigation Project (Taveta Sub-County)

Existing Intake weir

Canal Lining Works

Rehabilitated Secondary canal

Training Program for IWUA members

Training Program for IWUA members

Training Program for IWUA members

Mangudho Irrigation Project (Ganze Sub-county)

Meeting with IWUA Members

Pump House

Reservoir

Pipe Layining Works

Meeting with IWUA Members

Training program for IWUA members

Shulakino Irrigation Project (Narok North Sub-county)

Existing Intake Weir to be rehabilitated

Proposed main Pipeline Route

Rehabilitated Intake Weir

River Crossing

Training Program for IWUA Members

Construction of Pipeline in progress

Kiamariga/Raya Scheme (Laikipia West Sub-County)

Meeting with IWUA members

Excavation Works by IWUA Members

Pipe Laying Works

Training Program for IWUA Members

Training Program for IWUA Members

Training Program for IWUA Members

Kaumbura Irrigation Scheme (Igembe South Sub-County)

Existing Main Canal

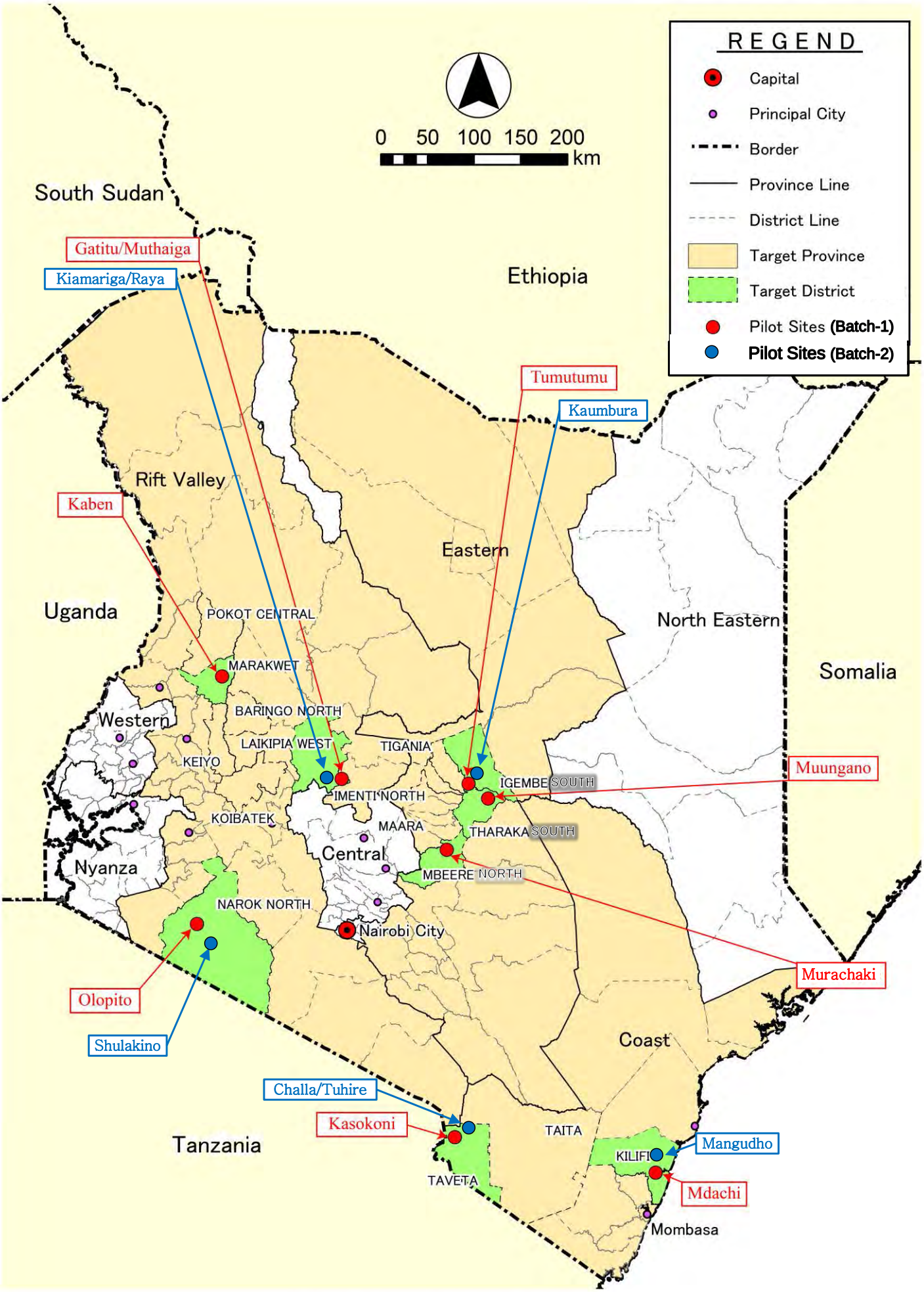
Canal Lining Works by IWUA members

Canal Lining Works by IWUA members

Construction of Intake Weir

Training Program for IWUA Members

Training Program for IWUA Members



Project Location Map

Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project

Final Report

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Attachments

Acronymous

ADB	Africa Development Bank
AEZs	Agro-Ecological Zones
ALDEV	African Land Development Unit
ASALs	Arid and Semi-Arid Lands
ASIP	Agricultural Sector Improvement Programme
CAAC	Catchment Area Advisory Committee
CBOs	Community Based Organizations
CDA	County Director of Agriculture
CDTF	Community Development Trust Fund
CDW	County Director of Water
DAO	District Agricultural Officer
DD	Detailed Design
DFID	Department for International Development
DOHSS	Directorate of Occupational Safety and Health Services
DIU	District Irrigation Unit
DIO	District Irrigation Officer
EA	Environmental Audit
ECLOF	Ecumenical Church Loan Fund
EPHTFCP	Eastern province Horticulture and Traditional Food Crops Project
EIA	Environmental Impact Assessment
EIAS	Environmental Impact Assessment Study
EMCA	Environmental Management Coordination Act
EMMP	Environmental Management & Monitoring Plan
EMoP	Environmental Monitoring Plans
FAO	Food and Agriculture Organization
FEWs	Frontline Extension Workers
FOs	Farmers Organizations
FS	Feasibility Studies
FPEAK	Fresh Producer Exporters Association of Kenya
GDP	Gross Domestic Product
GOK	Government of Kenya
HCDA	Horticultural Crops Development Authority
HQs	Headquarters
ICIPE	International Center of Insect Physiology and Ecology
IDD	Irrigation and Drainage Division
IDWSD	Irrigation, Drainage and Water Storage Department
IPRGI	International Plant Genetic Resource Institute
IWUAs	Irrigation Water Users Associations
IFAD	International Fund for Agricultural Development
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KERRA	Kenya Rural Roads Authority
KENHA	Kenya National Highways Authority
KWS	KWS Kenya Wildlife Service
M&E	Monitoring and Evaluation
MENR	Ministry of Environment and Natural Resources
MFIs	Micro-Finance Institutions
MOA	Ministry of Agriculture
MOALF	Ministry of Agriculture, Livestock and Fisheries
M/M	Minutes of Meeting
MWI	Ministry of Water & Irrigation
NEMA	National Environmental Management Authority

NGOs	Non-Governmental Organizations
NIB	National Irrigation Board
O&M	Operation and Maintenance
PA	Participatory Approach
PAPs	PAPs Project Affected Persons
PDM	Project Design Matrix
PIU	Provincial Irrigation Unit
PM&E	Participatory Monitoring & Evaluation
PMGs	Programme Management Groups
PMT	Project Management Team
PPEs	Personal Protective Equipment
PSC	Project Steering Committee
PR	Project Report
PRSP	Poverty Reduction Strategy Paper
PSCC	Pilot Scheme Coordinating Committee
RDF	Rural Development Fund
SACCOs	Savings and Credit Cooperative Societies
SCAO	Sub-County Agricultural Officer
SCIO	Sub-County Irrigation Officer
SHEP	Smallholder Horticulture Empowerment Project
SHEP UP	Smallholder Horticulture Empowerment and Promotion Unit Project
SHID	Smallholder Irrigation and Drainage
SHIDD	Smallholder Irrigation & Drainage Development
SEA	Strategic Environmental Assessment (SEA)
SIDEMAN-SAL	Sustainable Smallholder Irrigation Development Management in Semi-Arid Lands
SIDP	Smallholder Irrigation and Drainage Programme
SISDO	Smallholder Irrigation Scheme Development Organization
SOPs	Standard Operating Procedures
SSIU	Small Scale Irrigation Unit
UNICEF	United Nation International Children Education Fund
WAB	Water Apportionment Board
WESKAP	Western Kenya District Based Agricultural Development Project
WRM	Water Resources Management
WRMA	Water Resources Management Authority
WRUA	Water River Users Association
WUA	Water Users Association

Exchange Rate

US $ 1.00 = ¥ 110.33

KES 1.00 = ¥ 1.1060

(June, 2016)

Source: http://www.jica.go.jp/announce/manual/form/consul_g/ku57pq00000kzv7m-att/rate_201601.pdf

CHAPTER 1 Introduction

1.1 Introduction

This is the Final Report on the Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project (hereinafter referred to as "the Project"). The Project has been carried out in accordance with the Record of Discussions (R/D) (see Attachment-1) agreed upon between the Government of Republic of Kenya and Japan International Cooperation Agency (JICA) on March 30, 2012.

1.2 Project Background

The area called "the Horn of Africa" which includes the Northern part of Kenya is one of the most vulnerable areas in the region often affected by severe droughts. Due to the shortage of rain in the recent past, some part of this area has been facing the worst and severest drought of the past 60 years. In order to strengthening the resilience against these droughts which occur frequently, an urgent mitigation measure needs to be undertaken.

Approximately, 84% of Kenya land area is arid and semi-arid lands (ASAL). The ASAL are increasingly prone to severe droughts. These areas experiences low, unpredictable and unreliable rainfall which constraints crop and livestock production resulting in recurrent droughts, food insecurity and famine. Irrigation can reduce the vagaries of weather and significantly boost agricultural production and thereby enhance food security, increase farmers' incomes and increase on-farm and off-farm employment opportunities.

Therefore, JICA and Government of Kenya (GOK) conducted a survey, and agreed that the objective of this Project is to strengthen the resilience against drought which occurs frequently through provision of irrigation water by development of smallholder community irrigation projects to enable farmers to grow crops and minimize losses that would otherwise be experienced during the drought. As a result of the series of discussions, the request for the Project was submitted to the Government of Japan (GOJ).

1.3 Scope of the Project

(1) Project Purpose

Resilience against drought and food insecurity is improved through participatory smallholder community irrigation development, management and appropriate farming system.

(2)Outputs

1. Smallholder Community Irrigation facilities are constructed through participation of

IWUA.

2. IWUA capacity is improved for effective Sustainable O&M and appropriate farming systems.
3. Capacity of technical staff is enhanced for participatory irrigation development.
4. SHIDD guideline is improved.

(3)Project Sites and Beneficiaries

13 Pilot Project Sites selected in Semi-Arid Lands of the Country (Coast Province, Eastern Province, and Rift Valley Province). Beneficiaries were identified farmers living in those areas

(4)Project Period

Original: August 2012 – July 2015

Amended: August 2012 – June 2016

(5)Organisation for the Project

Executing Agency: Ministry of Water and Irrigation (MWI)

Implementing and Collaborating Agencies: MOALF and JICA

Project Director: Director Irrigation & Drainage, MWI

Project Coordinator: Deputy Director Irrigation & Drainage, MWI

(6)Implementation Structure

In accordance with the R/D, the Project Organisational Committees, the role and responsibility of each committee are set up as follows:

Table 1.3.1 List of Coordination Committees

Name of Committee	Role and Responsibility
Project Steering Committee (PSC)	The PSC is the highest decision-making organ of the Project. The PSC is responsible for policy direction, approving of project work plans and budgets. The PSC holds regular meetings for the Project twice a year or as the need arises. The PSC develops an operating charter formalizing these roles and responsibilities and those of other Project Committees. The PSC also develops and maintains a set of project "Vision and Goals" and set the tone for cooperation for relevant stakeholder agencies. The PSC also directly is responsible for arranging and securing funding from GOK and JICA for the development and operation of the project. The PSC also ensures they have obtained and secured support/ agreement/ acceptance from key stakeholder Agencies. The PSC is also responsible for communicating on project status and its needs to all stakeholder agencies.
Project Coordinating Committee (PCC)	The PCC is responsible for the technical matters of the Project and is responsible for reviewing work plans, budgets and necessary reports by the PMT and issue appropriate guidance and direction. The PCC holds regular meetings for the Project quarterly or as the need arises.
Project Management Team (PMT)	The PMT is responsible for executing all project activities including, Participant recruitment for scheme level and in-country training, Coordination of scheme-level baseline surveys and field follow-up activities, Coordination of scheme implementation activities, harmonise and compile annual project work plans and budgets, Coordinate revision of SHIDD guideline, Carry out trainings for farmers and staffs, and Preparation of necessary reports such as progress reports and other reports. The PMT holds regular meetings for the Project monthly or as the need arises. The PMT is also responsible for conduct risk assessment and solving issues that cannot be resolved by the PSCC.
Pilot Scheme Coordinating Committee (PSCC)	The PSCC is responsible for implementation of the project activities at scheme level and is responsible for the whole support to WUAs, such as Identify project activities, and Prepare work plans and budgets. The PSCC holds regular meetings for the Project monthly or as the need arises.

Source: JICA Team

1.4 Schemes under the Batch 1 and Batch 2 Pilot Project Sites

The following schemes were selected as a pilot project site under the Batch 1 and Batch 2.

Table 1.4.1 List of Pilot Project Sites under the Batch 1

Name of Scheme	County	Sub-County	Irrigation Area (ha)	No. of IWUA Members
Kasokoni	Taita-Taveta	Taveta	33	44
Mdachi	Kilifi	Ganze	30	82
Olopito	Narok	Narok North	77	82
Gatitu/Muthaiga	Laikipia	Laikipia West	57	252
Tumutumu	Meru	Igembe South	90	450
Kaben	Elgeyo-Marakwet	Marakwet East	362	530
Murachaki	Embu	Mbeere North	172	430
Muungano	Tharaka-Nithi	Tharaka South	167	418

Source: JICA Team

Table 1.4.2 List of Pilot Project Sites under the Batch 2

Name of Scheme	County	Sub-County	Irrigation Area (ha)	No. of IWUA Members
Challa/Tuhire	Taita-Taveta	Taveta	300	700
Mangudho	Kilifi	Ganze	16	40
Shulakino	Narok	Narok North	40	172
Kiamariga/Raya	Laikipia	Laikipia West	60	140
Kaumbura	Meru	Igembe South	200	500

Source: JICA Team

1.5 Work Plan

The Work plan of the Project is as follows.

Table 1.5.1 Work Plan of the Project

Phase	Description of Work
(1) Phase 1 (August 2012 ～ May 2013)	[1-1] Preparation of Work Plan (1) Collection and analysis of related data and information (2) Explanation of the Inception Report [1-2] Study on SIDEMAN Model [1-3]Selection of Batch-1 Pilot Project Sites (1) Field Investigation and Discussion of Selection Criteria of Pilot Project Sites (2) Workshop with Stakeholders to Select the Pilot Project Sites (3) Coordination to establish the Steering Committee [1-4] Implementation and Monitoring of Irrigation Development in the Batch-1 Pilot Projects (1) Start-off Meetings with Farmers (2) Feasibility Study and Detailed Design (3) Preparation of EIA Report (4) Construction of Irrigation Facilities [1-5] Implementation and Monitoring of Agriculture Development the Batch-1 Pilot Projects [1-6]Preparation and Explanation of Progress Report (1)
(2) Phase 2 (July 2013 ～ June 2016)	[2-1]Preparation and Explanation of Interim Report [2-2]Selection of Batch 2 Pilot project sites [2-3] Implementation and Monitoring of Irrigation Development in the Batch 2 Pilot Projects (1) Start-off Meeting with Farmers (2) Feasibility Study and Detailed Design (3) Preparation of EIA Report (4) Construction of Irrigation Facilities [2-4] Implementation and Monitoring of Agriculture Development under the Batch 2 Pilot Projects [2-5] Operation and Maintenance for Pilot projects [2-6] Preparation and Explanation of Progress Report (2) to (4) [2-7] Revision of the SHIDD Guidelines (1) Evaluation of the Pilot Projects (2) Revision of the SHIDD Guideline (3) Workshop /Seminar [2-8] Preparation and Explanation of Draft Final Report [2-9] Preparation of Final Report

Source: JICA Team

1.6 Staff of JICA Team

The JICA Team consists of 11 members listed below.

Table 1.6.1 Members of JICA Team

Expertise	Name
Team Leader/Irrigation facility design & Constructions	Mr. Takuya IGAWA
Deputy Team Leader/Irrigation Planning	Mr. Shinichi HAMADA
Irrigation facility design & Construction 1	Mr. Takashi MISAKI
Irrigation facility design & Construction 2	Mr. Hajime ITO
Construction Management	Mr. Takashi HOTTA
Systematic farming 1	Dr. Terutaka NIIDE
Systematic farming 2	Dr. Michiaki HOSONO
Training planning/Material development	Mr. Haruhiko AOYAMA
Irrigation/Water management Coordination 2/ Construction supervision	Mr. Ryosuke MAKINO
Coordination 1/ Social environmental consideration	Mr. Keita SAITO
Coordination 2/ Construction supervision Coordination 3/Project Monitoring	Ms. Akiko OINUMA

Source: JICA Team

1.7 Counterpart Personnel

The following counter personnel were assigned to the Project.

Table 1.7.1 Members of Counterpart Team

Expertise	Name
Project Coordinator	Eng. Wilfred O. Onchoke
Project Manager	Eng. Richard N. Mbogo
Engineer-In-charge of Construction and O&M	Eng. George W. Kahuro
IWUA Capacity Building and EIA	Mr. Allan C. Abwoga
Agricultural Production/SHEP-UP Approach	Mr. Benson Mureithi

Source: JICA Team

1.8 Meetings

The following meetings were held.

Table 1.8.1 List of Meetings

Meeting	Date
Meeting on the Inception Report	13th September 2012 (see Attachment-2 for the minutes of the meeting)
1st PMT Meeting	18th December 2012
2nd PMT Meeting	04th February 2013
3rd PMT Meeting	16th April 2013
1st PCC Meeting	09th May 2013

Meeting	Date
4th PMT Meeting	11th July 2013
2nd PCC Meeting	09th September 2013
5th PMT Meeting	22nd October 2013
1st PSC Meeting	27th November 2013
6th PMT Meeting	13th January 2014
7th PMT Meeting	26th February 2014
8th PMT Meeting	31st March 2014
9th PMT Meeting	12th May 2014
10th PMT Meeting	31st July 2014
3rd PCC Meeting	19th August 2014
11th PMT Meeting	22nd September 2014
12th PMT Meeting	22nd December 2014
13th PMT Meeting	02nd February 2015
14th PMT Meeting	07th April 2015
2nd PSC Meeting	16th April 2015
15th PMT Meeting	27th July 2015
16th PMT Meeting	16th November 2015
4th PCC Meeting	05th February 2016
3th PSC Meeting	19th May 2016

Source: JICA Team

The minutes of the PSC Meetings are shown in Attachments-3, 4 and 5.

1.9 Change of Implementing Organisation

Since the Devolution changes implementing organisation led to the fact that from January 2014, the Project team had no direct command of the SCIO and the SCAO.

Table 1.9.1 Implementation Organisation

Previous situation as per R/D	Current situation After Devolution
Central Government MWI and MOA PDI/PDA (Provincial Level) DIO/DAO (District Level)	Central Government MOALF/MWI
	Counties CDI/CDA (County Level) SCIO and SCAO (Sub-County Level)

Source: JICA Team

CHAPTER 2 Project Background

2.1 Agricultural Sector in Kenya

2.1.1 Land Resource Base and Rainfall

Kenya has a landmass of 587,000 km2, of which 11,000 km2 is water. Of the remaining 576,000 km2 landmass, only about 16% of high to medium agricultural potential, with the rest being arid and semi-arid lands (ASAL). The high rainfall zone, which receives more than 1,000 mm of annual rainfall, occupies less than 20% of the productive agricultural land and varies approximately 50% of the country's population.

Most of the food and cash crops as well as livestock are produced in this zone under semi-intensive and intensive systems. The medium rainfall zone receives between 750 – 1000 mm of rainfall annually and occupies between 30% - 35% of the country's land area, it is home for about 30% of the population.

Farmers in this zone keep cattle and small stock, and grow drought-tolerant crops. The ASALs, which receive 200-750 mm of rainfall annually, cover 84% of the total area. They are not suited to rainfed agriculture due to low and erratic rainfall, although there is cultivation of some crops.

ASALs carry 80% of the country's livestock and 65% of the wildlife, and are used predominantly as rangelands and game parks. As agriculture expands into more marginal areas and given the increasingly erratic climatic patterns, the country cannot rely on rainfed agriculture and thus, irrigation must of necessity be developed to increase agricultural productivity.

2.1.2 Agriculture

Agriculture is the backbone of the Kenya's economy, directly contributing 26% of the Gross Domestic Product (GDP), 80% of formal employment and 60% of the export earnings. It contributes a further 27% of the GDP through links with the manufacturing, distribution and service-related sectors.

Agriculture is, therefore, central to the realization of national aspiration of poverty reduction, wealth and employment creation. Agriculture is among the priority sectors to be fast-tracked in the realisation of the Vision 2030. Because the cropping and livestock production systems follow the annual rainfall patterns (amount and distribution), which tend to be highly variable and unreliable, the country must embrace irrigation and drainage development to remain comparative in the global and regional areas.

Irrigation will also significantly contribute to the meeting of the demands for national food security as the sophisticated and emerging export market for food, fibre, oil crops, and animal and fisheries products.

2.1.3 Kenya's Irrigation Potential and Development

Kenya has not developed her irrigation and drainage potentials at the necessary rate for agricultural growth to take-off and be sustained. Based on dependable river flows with no water storage, the country has an irrigation potential of 539,000 ha out of which only 110,000 ha (20%) have been developed.

The drainage/flood protection potential is 600,000 ha, of which only 30,000 ha (5%0 have been developed. If water storage facilities (in flowing streams) were to be widely developed, the current irrigation potential could be increased by up to 1.3 million ha. The ASLAs alone have 9.2 million hectares which have the potential for crop production if irrigated.

This irrigable area is equivalent to the total farmland in high and medium potential area in the country. However, the actual irrigated area in the ASALs is negligible. Generally, irrigated land covers only 1.7% of total arable land in the country while drainage and flood protection account for 0.3% of total area under rainfed agriculture. Nevertheless, irrigation directly contributes 3% of total GDP and provides 18% of the value of all agricultural produce.

Furthermore, based on empirical evidence, it has been demonstrated that intensified irrigation can increase agricultural productivity fourfold, and depending on the crops cultivated, income can be increased tenfold.

2.1.4 Agricultural Enterprises in Irrigated Agriculture

The Agriculture Sector Development Strategy (ASDS) envisions strategic agricultural development to be "innovative, commercially-oriented and modern agriculture sector". It has listed that this will require among others, the improvement of water management and irrigation development, as well as the development of Northern Kenya and ASALs.

Currently, irrigation accounts for only 1.7% of the total cultivated area, but accounts for 18% of the value of all agricultural produce, demonstrating the potential of irrigation in increasing agricultural production and productivity. The proportion of crops produced under irrigation has increased steadily over the year, with horticultural produce now contributing 6-% of the value of exported agricultural produce.

However, Kenya's agriculture is dominated by smallholder farmers who accounts for 75% of the total agricultural output, 70% of marketed agricultural produce and 20% of export

produce. Thus, the greatest gains will be made by improving irrigation under smallholder agriculture.

2.2 The Irrigation Policy

The Irrigation Policy seeks to stimulate irrigation and drainage development through targeted technical support, intensified investment in the sector, improved research and extension services, and capacity building for both technical staff and farmer organisations to ensure development and sustainability of the sector. Other important aspects of this policy include; effective co-ordination of the sector, institutional reforms, and the enactment of a comprehensive legal framework for irrigation, drainage and water storage development. During the implementation stage, the national policy will be complemented by other sartorial strategies, institutional and legal frameworks to provide an orderly and rapid development of the irrigation sector and to create an enabling environment for effective stakeholder participation.

The policy Goal, Objectives and Guiding Principles are aligned to Vision 2030, as well as to other sartorial plans and strategies such as SRA, Water Policy, Environmental Management and Coordination Act (EMCA), and have been derived taking account of relevant and emerging issues that affect or are affected by the sector at national, regional and international levels.

Vision

Irrigation, drainage and water storage sustainably creating wealth and food security in Kenya.

Mission

To provide guidance and support for the development and management of irrigation, drainage and water storage in Kenya.

Policy Goal

In line with Vision 2030 on transformation of agriculture, the overall policy goal is to sustainably accelerate development and performance improvement of irrigation, drainage and water storage to contribute to the national aspirations of wealth and employment creation, food security and poverty reduction.

Policy Objectives

1) Expend land under irrigation and drainage by 40,000 ha per year.
2) Increase water harvesting and storage for irrigation and contribute to achieving a national average of 16 m3 water storage per capita up from the current 5.3 m3.
3) Improve the overall performance and service delivery of the sector.
4) Mobilize resources and investments in irrigation and increase Government financial

allocation to irrigation to at least 2% of the annual national budget.

5) Improve sector financing and investments by development partners, private sector and stakeholder contributions.
6) Create an enabling environment for the participation of farmers, water user groups and all stakeholders in the planning, implementation and management of irrigation.
7) Enhance business orientation and commercial farming in irrigated agriculture.
8) Build human resource capacity for irrigated agriculture.
9) Enhance the utilisation of innovation, research, science and technology in irrigation.
10) Promote and adopt a multi-sartorial approach to sustainable irrigation development.
11) Promote, coordinate, manage and regulate activities of stakeholders within the sector.
12) Establish an appropriate institutional, legal, and regulatory framework for the sector.

2.3 Irrigation Sector in Kenya

2.3.1 Categories of Irrigation Schemes in Kenya

Kenya's irrigation sector is categorized into three organisational types: smallholder schemes, centrally managed public schemes and private/commercial irrigation schemes.

The smallholder schemes are owned, developed and managed by individuals or groups of farmers operating as water users of self-help groups. Irrigation is carried out on individual or on group's averages 0.1 – 0.4 ha. There are about 3,000 smallholder irrigation schemes covering a total area of 47,000 ha, which is equivalent to 42% of the total area under irrigation. This works out an average 16 ha per scheme. Over 47% of the population involved in irrigated agriculture work on schemes of the type and category.

They produce the bulk of horticultural produce consumed in urban centres in Kenya, as well as appreciable amounts of export crops, grain staples and tubes. Many smallholder schemes have been developed with the support of government, development partners and Non Governmental Organisation (NGO). The utilize existing water-sources and simple technologies such as weirs built across flowing streams, gravity earthen conveyance canals, portable pump sets and simple drip systems. However, most of these schemes face challenges in terms of O&M, rehabilitation of infrastructure and low productivity due to inadequate support services and input.

The country has seven large-scale publicly funded irrigation schemes, covering a total command area of 18,200 ha and averaging 2,600 ha per scheme. These schemes are managed by the NIB and account for 18% of irrigated land area in Kenya and each tenant farmer is allocated 1.6 - 2.0 ha for the commercial production. Initially, the government developed and managed national schemes with farmers participating as tenants. However,

with effect from 2003, NIB handed over to stakeholder's responsibility for most services, except for the development, O&M and rehabilitation of the major irrigation facilities. The status of most water conveyance and infrastructure in large-scale public irrigation schemes is poor. Lack of adequate agricultural support services have also led to low productivity.

Large-scale private commercial farms cover 45,000 hectares accounting for 40% of irrigated land. They utilize high technology and produce high-value crops for the export market, especially flowers and vegetables. The farms employ a workforce of about 70,000 persons which is 41% of the population directly active in irrigates agriculture.

2.3.2 Expansion of Irrigation and Infrastructure Development

Irrigation development includes physical expansion of irrigated area, rehabilitation of existing ones, improving the productivity of irrigated enterprises, diversification and value addition, all of which require some level of infrastructure development. At current investment rates, the country has been achieving a growth rate of less than 0.5% (5%, equivalent to about 5,000 ha per year of additional irrigation area. This growth rate is very low compared to the target of 40,000 ha per year, needed to meet the target set in Vision 2030. Infrastructure development for irrigation has been mandate of the Government especially for major engineering works. The private sector, including individual farmers and NGOs, have also facilitated infrastructure development, especially for farm-level equipment like pipes and fitting, field canals and farm roads. There is therefore need to modernize irrigation in addition to physical expansion of infrastructure.

2.3.3 Operation and Maintenance

Operations, management and maintenance (O&M) of irrigation is concerned with day-to-day activities as well as problem-solving issues affecting a part or the whole scheme. These services require expertise and finance to enable payment of water use fees, purchasing of spare parts, fuel and other fixtures as well as for hiring labour and experts for specialized activities. Previously, the Government employed many artisans and technicians, and provided spares on public schemes. However, since the late 1980s, the Irrigation Management Transfer (IMT) has been affected in most schemes, to facilitate the gradual turning over of the rights of ownership, authority, and responsibility to operate, maintain and manage irrigation systems from government and/or non-government agencies to farmers through their Irrigation Water Users' Associations (IWUAs). The role of the IWUAs includes managing the completed irrigation development. Farmers as the ultimate users and managers of irrigation water are responsible for proper water application and in-field management. They are also responsible for maintenance of infrastructure within and beyond their boundaries and participate in synchronized cropping calendars. As Government pulls out of O&M, the private sector and other service providers will take over

these services.

2.3.4 Challenges in Irrigation Development

There are many development constraints facing the irrigation sector, which include; (i) inadequate infrastructure development for irrigation, drainage and water storage, (ii) inadequate support services such as access roads, handling facilities, markets, information, extension, training, credit, (iii) low levels of public and private sector investment, (iv) poorly developed channels for participation of irrigators and weak governance by water users'/farmer associations, (v) un-coordinated policy, legal and regulatory framework, (vi) low budgetary allocation for irrigation sector development, (vii) inadequate and un-coordinated research, science and technology, (viii) insecure land tenure, which constrains investment in the sector, and (ix) inadequate strategic focus as compared to rainfed production systems.

Other components that require urgent attention include availability of credit and financial services, output markets as well as agricultural inputs such as seeds, fertilizer, pesticides, feeds, farm machinery, breeding animals, and building materials. Furthermore, incentives such as, zero-rated importation of irrigation equipment and machinery, appropriate government guaranteed credit for capital investment and farm input, are needed for farmers to invest in energy and water-efficient irrigation systems and technologies.

2.4 Organisation

2.4.1 Government Ministries Involved in Irrigation Sector

The overall mandate for irrigation, drainage and water Storage is vested with the Ministry responsible for water affairs in the country. However, a total of 17 Government Ministries currently have some direct or indirect relationship and/or impact on irrigation, drainage and water storage. The Ministries with direct impact on the sector include Ministries responsible for Water, Agriculture, Livestock, Finance, Fisheries and Environment. Other Government Ministries whose functions, rules and regulations affect irrigation include; Ministries responsible for Lands, Planning and National Development, Cooperatives, Trade and Industry, Regional Development, Public Health, Local Government, Public Works, Gender, Youth Affairs and Children and Office of the President.

2.4.2 County Government Involved in Irrigation Sector

After the devolution, the County Government is engaged in implementation of irrigation project.

2.4.3 Farmer Organisations, CBOs and NGOs

Irrigators usually group together into formal and informal organisations such as Irrigation Water Users Associations (IWUAs), cooperatives, farmer groups or self-help groups. These organisations are established at scheme level for operation and management, but some of them engage in development of irrigation. The major challenge with farmer organisation is their low capacity to undertake their mandates. The legal status of some of these organisations is also a problem as many of them are not registered. A number of NGOs, Community Based Organisation (CBO), and civil society groups are also involved in irrigation program. These organisations play a crucial role in capacity building, resource mobilisation and development of smallholder irrigation. However, their activities have remained largely un-coordinated in the rural areas. Their role and activities need to be streamlined for the realisation of added value through their interventions.

2.5 SIDEMAN Project

2.5.1 Project Background

During the period 2000-2003, JICA supported the 'Mini-project' whose objective was to come up with strategies for promotion of sustainable community-based smallholder irrigation development. The mini project was a result of an earlier JICA Study on Irrigation development around the foothills of Mt. Kenya (1997-1998) which identified several weaknesses in Smallholder Irrigation and Drainage Project (SHIDD). The major weaknesses identified at the time were farmers' organisations, lack of clear guidelines and low technical capacity of irrigation and Drainage development (IDD) Staff.

The GOK-JICA Project on Sustainable Smallholder Irrigation development and Management in Central and Southern Kenya (SIDEMAN) were conceptualized to pilot the outputs of the Mini-Project Namely:

- Smallholder irrigation development guidelines
- Framework for Formation and Strengthening irrigation water users associations (IWUAs)
- Training Master Plan for irrigation personnel

Project Goal

The methodology established through the project will be used for other smallholder irrigation scheme development

Project Purpose

Methodology for development of sustainable smallholder irrigation system is verified in selected schemes.

Project Objective

The objective of the SIDEMAN is to verify the applicability of the smallholder irrigation development approaches and strategies towards sustainable farmer-managed smallholder irrigation schemes as outlined in the above three outputs.

2.5.2 Project Components

(1) Strengthening of IWUAs

Farmers in the project pilot schemes were to be trained on-site in the various aspects of irrigation scheme operation, maintenance and management.

(2)Irrigation infrastructure construction/rehabilitation

The project pilot schemes were to be provided with irrigation infrastructure through construction of new infrastructure or rehabilitation of existing one.

Aspects of irrigation scheme operation, maintenance and management.

(3)Training of irrigation farmers

The training program targeted farmers from the pilot schemes and other smallholder irrigation schemes across the country brought together in two week residential courses.

(4)Training of irrigation personnel

Irrigation personnel were to be trained as part of the institutional capacity building to enhance their technical knowledge and skills in the various aspects of irrigation scheme development. The training was to take the form of:

- IDD training course
- Country-focused group training
- Technical exchange visits to third countries
- Counterpart training in Japan

To support the implementation of the components, JICA was provided various equipment such as office and survey equipment, training equipment and vehicles to supplement those availed by the GOK.

2.5.3 Project Duration

The project duration was five years started December 2005 to December 2010.

2.5.4 Project Sites

The project has been working on the pilot projects listed Table 2.5.1.

Table 2.5.1 Pilot Projects List under the SIDEMAN Project

Project Name	District	Area (ha)	No of Farmers
Kiarukungu	Mwea North	120	294
Kianbindu	Mbeere North	160	400
Kyeekolo	Kilungu	10	100
Kisioki	Loitoktok	90	450
Koseka	Narok North	60	67
Kanunka B	Narok North	50	90
Total		490	1401

Source: JICA Team

2.6 SHEP-UP Project

Development of horticulture subsector is notably vital for rapid economic recovery, wealth and employment creation. In Kenya, the potential of the subsector is relatively high. The markets have gradually become more favourable and open to producers than even before. However, 80% of the horticultural crops are produced by smallholder farmers. Farmers are faced with some challenges, e.g.) limited access to markets and inability to market their produce profitably.

Smallholder Horticultural Empowerment Project (SHEP) was a bilateral technical cooperation project between the Governments of Kenya and Japan (Nov.2006- Nov.2009). The implementing organisations were MOA, HCDA and JICA. The project purpose was "to develop capacity of the smallholder horticultural farmer groups supported by the project." The Smallholder Horticulture Empowerment & Promotion (SHEP) Approach refers to specific methods and techniques for empowering smallholder horticulture farmers. The SHEP Approach includes a series of training session for both farmer groups and Frontline Extension Officers (FEOs)/ Group Facilitators.

Success of the previous SHEP was recognized by MOA after the Terminal Evaluation and the SHEP Approach was then confirmed as an efficient and effective approach for small-scale farmers by authorities of MOA. Smallholder Horticulture Empowerment and Promotion (SHEP) Unit was established under the Horticultural Division of the Directorate of Crop Management, to extend the SHEP Approach nationwide. The Smallholder Horticulture Empowerment and Promotion Unit Project (SHEP-UP) was implemented (Mar.2010-Feb.2015).

Overall goal of the project is "Livelihood of horticulture smallholders in implementing districts is improved". The project purpose is "Effective support system for horticulture smallholders

nationwide is established." The prospective outputs of the project are;

1) The SHEP Approach is adopted by the Unit and ready for implementation,
2) Implementation farmer groups' income from horticulture produce is improved,
3) The SHEP Approach is properly replicated by implementing districts based on the Output 2 and
4) Information Management System for the SHEP Approach is established.

*The texts in this section are mainly quoted from the references issued by SHEP UP© Project

CHAPTER 3 Selection of Pilot Project Sites

3.1 General

13 Pilot project sites have been selected in Semi-Arid Land of the eight (8) counties in the former Coast, Eastern, and Rift Valley Provinces, consisting of, 8 pilot project sites in Batch 1, and 5 pilot project sites in Batch 2. The process to select the schemes is described hereinafter.

3.2 Selection of Pilot Project Sites in Batch-1

3.2.1 Candidates for Batch 1 Pilot Project Sites

The candidate schemes and its location in Batch-1 are shown below. 8 Pilot project sites were to be selected out of 15 candidate schemes based on a scoring of the schemes applying selection criteria, which are explained in the Section 3.2.2.

Table 3.2.1 Candidate Schemes for Pilot Project Sites in Batch-1

No.	County	Sub-County	Scheme
1.	Taita-Taveta	Taveta	Kasokoni
2.		Mwatate	Msau
3.	Kilifi	Ganze	Mdachi
4.	Narok	Narok North	Olopito
5.	Laikipia	Laikipia West	Gatitu/Muthaiga
6.	Baringo	Mogotio	Emining
7.	Elgeyo Marakwet	Keiyo North	Kipchuchuku
8.		Marakwet East	Kaben
9.	West Pokot	Pokot Central	Chemosos
10.	Embu	Mbeere North	Murachake
11.	Meru	Imenti North	Gachua
12.		Igembe South	Tumutumu
13.		Tigania East	Igari Antuambugi
14.	Tharaka Nithi	Tharaka South	Muungano
15.			Kiaga

Source: JICA Team

3.2.2 Preparation of Selection Criteria

The candidate pilot project sites were proposed and presented by DIOs at selection workshop in October 2012, keeping them motivated throughout the project period. The pilot project sites are selected based on the agreed selection criteria.

The selection criteria for selection of the pilot project Schemes in Batch-1 were prepared and finalized through discussion among the members of the PPSSC (Pilot Project Scheme Selection Committee).

Indicators in the criteria are, (1) Climate Condition, (2) Land Tenure, (3) Area, (4) Water

Resources, (5) Crop Production, (6) Irrigation Facilities, (7) Organisation in the Scheme, (8) Accessibility, (9) Markets and Market Information, and (10) Environmental Issues. The agreed selection criteria with scoring are indicated below:

Table 3.2.2 Selection Criteria for Selection of the Pilot Project Sites in Batch-1

No.	Category Score	Item
1	2	Climatic Conditions
2	5	Land Tenure
3	10	Area
4	15	Water Resources
5	15	Crop Production
6	10	Irrigation Facilities
7	20	Organization in the Scheme
8	6	Accessibility
9	10	Markets and Market Information
10	7	Environmental Issues
Total	100	

Source: JICA Team

3.2.3 Result of Selection for Pilot Project Sites in Batch-1

The results of selection of the Pilot project sites in Batch-1 are summarised below:

Table 3.2.3 Result of Scoring of Candidate Batch 1 Pilot Project Sites

No.	County	Sub-County	Scheme	Scoring
1.	Taita-Taveta	Taveta	Kasokoni	77
2.		Mwatate	Msau	72
3.	Kilifi	Ganze	Mdachi	62
4.	Narok	Narok North	Olopito	74
5.	Laikipia	Laikipia West	Gatitu/Muthaiga	85
6.	Baringo	Mogotio	Emining	62
7.	Elgeyo Marakwet	Keiyo North	Kipchuchuku	59
8.		Marakwet East	Kaben	78
9.	West Pokot	Pokot Central	Chemosos	61
10.	Embu	Mbeere North	Murachake	87
11.	Meru	Imenti North	Gachua	85
12.		Igembe South	Tumutumu	87
13.		Tigania East	Igari Antuambugi	81
14.	Tharaka Nithi	Thalaka South	Muungano	82
15.			Kiaga	79

Source: JICA Team

The Pilot project sites in Batch-1 were finally selected based on the results of the scoring the candidate schemes taking account of equalisation of the Counties on the scheme selection.

The selected pilot project sites in Batch-1 are shown below:

Table 3.2.4 Selected Pilot Project Sites in Batch-1

No.	Province	County	Sub-County	Scheme
1.	Coast	Taita-Taveta	Taveta	Kasokoni
2.		Kilifi	Ganze	Mdachi
3.	Rift Valley	Narok	Narok North	Olopito
4.		Laikipia	Laikipia West	Gatitu/Muthaiga
5.		Elgeyo Marakwet	Marakwet East	Kaben
6.	Eastern	Embu	Mbeere North	Murachake
7.		Meru	Igembe South	Tumutumu
8.		Tharaka Nithi	Thalaka South	Muungano

Source: JICA Team

3.3 Selection of Batch-2 Pilot Project Sites

3.3.1 Candidates for Batch 2 Pilot Project Sites

Both Batch-1 and Batch-2 schemes were selected in the same Sub-Counties so that capacity of the technical officers at Sub-County level would be enhanced continuously throughout the project period.

The JICA Team conducted a preparatory works, such as preparation of draft questionnaire, and draft selection criteria. Simultaneously, after the discussion at the PMT meeting in December 2013, selection of the candidate schemes has commenced taking into consideration the following aspects.

- Registration status of IWUA/CBO in the schemes,
- Election of committee members as per a by-law,
- Proposed irrigation facilities with length of canals/pipelines to be constructed/rehabilitated,
- Status of WRMA Authorisation for water abstraction

In January 2014, the following candidates and the filled questionnaires were obtained from the relevant SCIOs.

Table 3.3.1 Candidate Schemes for Pilot Project Sites in Batch-2

No.	Sub-County	Scheme
1	Taveta	Tuhire/Challa
2	Taveta	Kimala
3	Taveta	Kimorigo
4	Ganze	Mwangutho
5	Narock North	Shulakino
6	Narock North	Ewaso N'giro
7	Narock North	Muchorui/Muchuha
8	Laikipia West	Munand
9	Laikipia West	Kiamariga/Raya
10	Laikipia West	Kiangoru
11	Igembe South	Kaumbura
12	Igembe South	Mpanguene

Source: JICA Team

3.3.2 Preparation of Selection Criteria

The selection criteria for selection of the Pilot project sites in Batch-2 basically followed that in Batch 1 scheme selection.

The indicators in the criteria are, (1) Climate Condition, (2) Land Tenure, (3) Area, (4) Water Resources, (5) Crop Production, (6) Irrigation Facilities, (7) Organisation in the Scheme, (8) Accessibility, (9) Markets and Market Information, and (10) Environmental Issues.

3.3.3 Result of Selection for Pilot Project Sites in Batch 2

The candidate schemes for the Pilot Project Sites in Batch 2 were scored based on the answers to the Questionnaire, which were sent to the SCIOs.

Table 3.3.2 Result of Scoring in Candidate Batch-2 Pilot Project Sites

County	Sub-County	Scheme	Scoring
Taita-Taveta	Taveta	Challa Tuhire	78
	Taveta	Kimala	71
	Taveta	Kimorigo	78
Kilifi	Ganze	Mangutho	73
Narok	Narock North	Shulakino	78
	Narock North	Ewaso N'giro	46
	Narock North	Muchorui/Muchuha	57
Laikipia	Laikipia West	Munanda	66
	Laikipia West	Kiamariga/Raya	67
	Laikipia West	Kiangoru	66
Meru	Igembe South	Kaumbura	71
	Igembe South	Mpanguene	67

Source: JICA Team

In Taveta Sub-County, Tuhire/Challa scheme was selected as the IWUA in the scheme is activated more than that in Kimorigo scheme. Furthermore, in the scheme, impacts on the rehabilitation of the irrigation infrastructures were highly expected.

The Pilot project sites in Batch 2 were finally selected as shown below.

Table 3.3.3 Selected Pilot Project Sites in Batch-2

County	Sub-County	Scheme	Proposed Irrigation Area (ha)	Number of Beneficiaries
Taita-Taveta	Taveta	Challa Tuhire	300	700
Kilifi	Ganze	Mangutho	16	40
Narok	Narock North	Shulakino	40	172
Laikipia	Laikipia West	Kiamariga/Raya	60	140
Meru	Igembe South	Kaumbura	200	500

Source: JICA Team

3.4 Start off Meeting

The purpose of a start-off meeting held in both Batch 1 and Batch 2 pilot project sites is 1) to explain the activities and schedule of the Project for construction/rehabilitation of irrigation facilities and improvement of farming practice and 2) to clarify roles and responsibilities of the

Project, Ministry of Irrigation, Ministry of Agriculture, and IWUA.

At the Meetings, the following subjects were explained to the IWUA members,

- Introduction of the SIDEMAN-SAL Project,
- Output of the Project,
- Project Period and Schedule,
- Program for Irrigation Development,
- Construction and Rehabilitation works by IWUA,
- Training program for i) IWUA capacity building; ii) construction/ irrigation system O&M; iii) farming,
- Establishment of Pilot scheme Coordinating Committee (PSCC),
- Coordination with the SCIO and the SCAO, the EIA Consultants, hydrologist for the implementation of Feasibility Study (F/S) and Detailed Design (D/D)
- Community response to EIA public hearing to be conducted by the EIA consultant,
- Implementation and Monitoring of Agricultural Development using SHEP Method,
- Roles of the SCAO and the SCIO,
- Roles of IWUA (especially during farmers' participatory construction stage),
- Environmental Management and EIA,
- Application of "Authorisation to Construct"/ "Water Permit" to WRMA by initiative of IWUA, and
- Water Storage Facility issue with WRMA (Construction of Storage by IWUA)

After the Meetings, field visits at the intake weir/ water source sites were conducted so as for the SCIO with his staffs to commence the topographic survey at the sites. The area for the topographic survey was confirmed at presence of the SCIO and members of the IWUA, and directed by the JICA Team to EIA consultants/ hydrologist and local consultants for feasibility study and detailed design (Batch 1 Pilot Project Sites only).

CHAPTER 4 Feasibility Study and Detailed Design for Pilot project Sites

4.1 General

As the implementation of the Batch 1 pilot project sites was to be fast-tracked, feasibility study and detailed design were outsourced to local consultant. During the study period, transfer of technology for the study was expected to the SCIOs and the SCAOs so that they would carry out the study for the Batch 2 pilot project sites.

4.2 Procedure of Study and Design

4.2.1 Feasibility Study

Field investigation was carried out by local consultants. Items for investigation shown below were discussed and finalised among the PMT members.

- Number of Households and Population
- Topography, Soil, Land Use
- Climate and Water Resource
- Present condition of Irrigation Infrastructures, if any
- Rural Infrastructures, such as rural road, water supply
- Agriculture, such as cultivated crops, farming practice, farm gate price, and marketing
- Access to Market
- Irrigation Water Users' Association, such as number of IWUA members, activities, financial status
- Government Organizations, Staffing and equipment in DIO (SCIO)'s Office and DAO (SCAO)'s Office
- Gender Issue
- Field Investigation to identify needs of rehabilitation/construction of irrigation facilities with prioritization of the work,
- Topographic survey with cross section of river at the head works, and levelling along main canal/pipelines according to the standard of survey

Hydrological study was also outsourced to a registered hydrologist, covering the following study items.

- Comprehensive drainage network analysis,
- Historical analysis of the hydrological trends in the river course,
- Field measurements of the current hydrological status of the river course,
- Comprehensive analysis of community livelihood systems and water demand patterns,
- Assess the hydrological viability and community acceptability of the proposed project.

The Feasibility Study Report was prepared on the basis of the collected data and information and consequent analysis, and submitted to MWI. The contents of the feasibility study report are indicated below.

- Present condition of the schemes
- Agriculture Development Plan
- Irrigation Development Plan
- Assessment of IWUA and Strengthening Plan of IWUA
- Operation and Maintenance Plan
- Preliminary Cost Estimate
- Economic/Financial Evaluation

4.2.2 Detailed Design

Following the results of the Feasibility Study, the Detailed Design was conducted by the Local Consultants, including the following aspects.

- Additional field investigation
- Design and cost estimate of the facilities
- Preparation of the Detailed Design Report in consultation with MOALF, including longitudinal sections of the main canals/pipelines, plan of major structures, work quantity calculation sheets, breakdown of the cost, implementation plan and schedule.
- Preparation of draft tender documents for outsourced contract and farmers' work with IWUAs' contribution portion

4.3 Present Condition under Pilot Project Sites

4.3.1 Agriculture

(1) Crops cultivated

Crops presently cultivated in the Schemes are outlined below.

Table 4.3.1 Crops Presently Cultivated in Batch 1 Pilot Project Sites

Crop/ Scheme	Kasokoni	Mdachi	Olopito	Gatitu Muthaiga	Kaben	Murachake	Tumutumu	Muungano
Maize	○	○	○	○	○	○	○	○
Beans	○	○		○		○	○	○
Tomato, Onion	○		○	○			○	
Banana	○				○		○	○
Greengram, Cassava		○			○			
Cawpea		○				○		
French bean			○	○				
Irish potato			○					
Cabbage				○				
Mango					○			
Sweet potato, Sorghum						○		
Water melon								○

Source: JICA Team

Table 4.3.2 Crops Presently Cultivated in Batch 2 Pilot Project Sites

Crop \ Scheme	Tuhire Challa	Mangudho	Shulakino	Kiamariga Raya	Kaumbura
Tomato	○	○	○	○	
Maize, Beans	○		○	○	○
Onion, Banana	○	○		○	
Green gram, Cowpea	○	○			○
Kale	○	○	○		
Brinjals	○		○		
Pigeon pea	○				○
Cassava, Oranges		○		○	
Cabbage, Sweet potato, Water melon, Garden Pea, Capsicum			○	○	
Sorghum				○	○
Rice, Okra, Karella	○				
Mango, Cashew nut, Coconuts, Tangerine, Pawpaw, Passion fruits, ABEC (Chillies)		○			
French bean, Irish potato, Potato, Wheat, Barley, Baby Corn, Courgette, Spinach, Chilli, Coriander, Snow peas, Lettuce, Cucumber, Carrots			○		
Sweet pepper, Finger millet, Field beans, Yam				○	
Bulrush, Millet, Dolichos					○

Source: JICA Team

(2)Crop Cultivation

Share of main crop planted area under the Batch 1 pilot project sites in 2013 is shown in Table 4.3.3. According to the table, many varieties of crops are cultivated in the schemes. So far the most wide-spread crops are maize and beans; sharing 38 % and 32 % of total planted area, respectively. They usually cultivate the crops in rainfed and mixed cropping field. Vegetables and fruits (banana) are cultivated mainly with irrigation. Rainfed agriculture is dominant in the schemes, sharing about 80 % of total crop area.

Table 4.3.3 Crop Cultivation in Batch 1 Pilot Project Sites

(Unit : %)

	Maiz	Beans	Other Cereals	Veg	Fruits	Others	Total area (Acre)
Mdachi	25	50	-	-	-	25	24
Olopito	60	12	-	25	-	3	293
G/Muthaiga	29	29	-	42	-	-	209
Tumtum	33	33	20	14	-	-	500
Kasokoni	19	28	-	34	19	-	113
Kaben	46	16	-	-	14	23	170
Murachake	33	33	20	-	-	14	977
Muungano	44	44	-	2	9	-	540
Total	38	32	10	15	3	2	2,826

Source: FS Study by JICA Team

Basic agriculture information by each scheme; soil physical character and cropping system, are summarised in Table 4.3.4.

Table 4.3.4 Soil Characters, Rainfed Cropping System and Existing and Proposed Irrigation Method

	Mdachi	Olopito	G/Muthaiga	Tumtum	Kasokoni	Kaben	Murachake	Muungano
1) Representative Soil Physical Character								
Soil Texture	Coarce	MC to M	M to MF	MC	MF to F	Medium	MF to F	MC
Drainage	Well	Moderate	Well	Moderate	M to P	Moderate	M toP	Moderate
2) Rainfed Cultivation								
Alley Cropping				○			○	○
Mixed Cropping	○	○	○		○		○	
Monocropping	○							

Soil Texture : MC: Moderately coarce, M: Medium, MF: Moderately fine, F: Fine
Drainage: M:Moderate, P: poor
Source: JICA Team

(3) Rainfed Crop Cultivation

Maize, other cereals and beans are commonly cultivated in rainfed condition in the schemes. Production, area and yield of rainfed crop are shown in Table 4.3.5 and their average yield in Kenya are shown in Table 4.3.1.

Table 4.3.5 Rainfed Crop Cultivation

	Maize			Other Cereals			Beans		
	Area	Pro.	Yield	Area	Pro.	Yield	Area	Pro.	Yield
	Acre	Ton	T/A	Acre	Ton	T/A	Acre	Ton	T/A
Mdachi	6	4	0.7	–	–	–	12	3	0.3
Olopito	175	158	0.9	–	–	–	35	49	1.4
G/Muthaiga	60	60	1.0	–	–	–	60	12	0.2
Tumtum	167	83	0.5	100	40	0.4	167	33	0.2
Kasokoni	21	9	0.4	–	–	–	32	6	0.2
Kaben	79	40	0.5	–	–	–	27	3	0.1
Murachake	319	127	0.4	191	70	0.4	319	64	0.2
Muungano	240	96	0.4	–	–	–	240	72	0.3

Source: FS Study by JICA Team

Table 4.3.6 Average Yield (2012) in Kenya

Maize	Sorghum	Bean	Tomato
0.76 t/a	0.3 t/a	0.2 t/a	8.6 t/a

Source: Economic Review of Agriculture 2013

Yield of maize in Mdachi, Olopito and Gatitu/Muthaiga schemes is almost same or higher than that in the national average. However, the yield of maize cultivated with alley cropping system corresponds twice of the yield grown by the mono-cropping. Therefore, the yield of Tumutumu, Murachaki and Muungano schemes is also higher than the national average. Only Kaben and Kasokoni scheme are lower than the national average. Yield of other rainfed crops also shows higher than the national average. Generally, it can be said that productivity of rainfed crop in the schemes is higher than that in the national average.

(4)Production Qualities

Much of vegetable and fruits products are lost mainly due to low quality. These can not be sold because middlemen hardly buy them. As shown Figure 4.3.1, much product has been disposed or feed livestock due to low quality in the schemes. To improve food security and income for farmers, it should effectively utilise the low-quality products that are disposed.

Countermeasures for the problem are:

- To improve quality of vegetable products,
- To process the low quality products for using the products effectively, and
- To enhance quality of products, improving seed, pest management and crop cultivation technology are necessary.

Food processing has been necessary as having the potential to increase income and secure food security through improved incomes, employment and food availability for long time. It has other benefits such as the preservation or temporary storage of food for self consumption because most of the products are seasonally.

		
Disposed tomato	Cabbage left in the field	Feeding for cow

Source: JICA Team

Figure 4.3.1 Disposed Vegetables

4.3.2 Irrigation Practice

(1) Irrigated Crop Cultivation

Vegetables are mostly grown in irrigated field of the schemes. Area, production and yield are shown in Table 4.3.7. Tomato yield of all schemes is much lower than that of the national average.

The average yield of onion is about 15 tons per ha which equivalent to 6 tons per acre. The yield of the schemes except Gatitu/Muthaiga scheme is also much lower than that of the national average. Only the yield of Gatitu/Muthaiga shows almost same level of the average.

Table 4.3.7 Irrigated Crop Production

	Tomato			Onion		
	Area	Pro.	Yield	Area	Pro.	Yield
	Acre	Ton	T/A	Acre	Ton	T/A
Mdachi	–	–	–	–	–	–
Olopito	45	351	7.8	5	9	1.8
G/Muthaiga	30	95	3.2	15	99	6.6
Tumtum	33	164	4.9	33	137	4.1
Kasokoni	23	157	6.7	15	38	2.5
Kaben	–	–	–	–	–	–
Murachake	–	–	–	–	–	–
Muungano	–	–	–	–	–	–

Source: FS Study by JICA Team

(2) Irrigation Method

There are three types of irrigation method applied in the schemes; namely, basin, furrow and spraying water, as shown in Table 4.3.8 and Figure 4.3.2.

Table 4.3.8 Existing Irrigation Method

Type of irrigation	Mdachi	Olopito	G/Muthaiga	Tumtum	Kasokoni	Kaben	Murachake	Muungano
Basin	O	O	O		O		O	
Fullow+Basin		O	O		O	O	O	
Other				O		O		O

Source: JICA Team

Basin Irrigation
(Olopito)

Farrow Irrigation
(Gatitu/Muthaiga)

Other
(Tumutumu)

Source : JICA Team

Figure 4.3.2 Irrigation Method in the Schemes

Under furrow and basin irrigation methods, crops tend to be damaged by water stress. Water is very essential for crop growth but excessive irrigation of field may leads to water logging of soil. Water logging should damages the crop and reduces the quantity and quality of the produce because excess water pushes out air in the soil, which is essential for crop growth.

Main damages of water logging are as follows:

1) Inhibits the process of germination of seeds and then seed fail to germinate.
2) Unable to absorb nutrient from soil because roots does not grow properly.
3) Increases the amount of salt on the surface of soil due to evaporation.

Typical symptoms of water logging are patchy germination, uneven crop growth and yellowish leaf etc. As shown in Figure 4.3.3, these symptoms can be commonly found in almost all Batch 1 irrigated field. Therefore, main cause of low productivity of irrigated crops in the schemes is root rotting due to excess irrigation.

Generally, most of the horticultural crops prefer well drained soils and are greatly impacted its productivity by soil drainage. They are very sensitive to poor drainage soils. In the case of Kasokoni scheme, the soils are characterised into very poor drainage because it composes very fine soil texture consisting mainly clay. Therefore, the low productivity of crops, such tomato, and maize, under both rainfed and irrigated is caused by not only water logging but also inappropriate crop selection according to soil physical character. In this context, it is important to select the right crop as per the given soil conditions.

Excess irrigation is one of the main causes of salt accumulations in the field. As long as the current water management in Kasokoni scheme is concerned, as a plot-to-plot irrigation is practiced, the interval of irrigation is about 20 days. Because of the long interval of irrigation, the farmers in the area tend to supply much water at once. Salts can be transported to the soil surface by capillary transport from salt laden water and then be accumulated due to evaporation. As soil salinity increases, it induces soil degradation and affects crop growth. In case of Mdachi scheme, irrigation water is saline and the symptoms damaged by excess irrigation were observed in the irrigated field. Excessive watering with high-salt-containing water is one of the most common ways of causing a salt accumulation in soil. To avoid the damage, irrigation with appropriate water amount and interval is highly required.

		
Maize(Murachaki)	Tomato(Kasokoni)	KTV(Olopito)

Source: JICA Team

Figure 4.3.3 Irrigated Cultivation in the Pilot Project Sites

4.3.3 Irrigation Infrastructure

(1) Batch 1 Pilot Project Sites

Existing irrigation facilities in Batch 1 pilot project sites are outlined below.

Table 4.3.9 Existing Irrigation Facilities in Batch 1 Pilot Project Sites

Scheme	Facilities
Kasokoni	- Water abstraction works (diversions, intake head works, etc.) - Main canal and structures - Secondary canals - In-field irrigation system (canals and drains) and related structures - Drainage system
Mdachi	- None
Olopito	- None
Gatitu Muthaiga	- Intake weir - Canals for Gatitu and Muthaiga
Kaben	- Water abstraction point - Main canal and structures; - Secondary canals - In-field irrigation system (canals and drains) and related structures
Murachaki	- Intake weir - Part of conveyance pipe
Tumutumu	- Diversion weir - Intake box
Muungano	- Portable pumps

Source: JICA Team

In Kasokoni and Kaben schemes, the irrigation facilities are to be rehabilitated under the Project. As intake weir in Gatitu/Muthaiga scheme exists, construction of pipeline system is requested by the farmers in the scheme. In some schemes, farmers cultivates by use of personal portable pumps.

(2)Batch 2 Pilot Project Sites

Existing irrigation facilities in the Batch 2 pilot project sites are described below.

Table 4.3.10 Existing Irrigation Facilities in Batch 2 Pilot Project Sites

Scheme	Facilities
Tuhire Challa	- Weir including intake structure - Box culvert channel - Conveyance canal - Main canal - Road crossing in main canal - Branch canal & division boxes - Secondary canals & offtakes
Mangudho	- Pump house - Diesel engine driven water pump - Main Line - Main water supply pipeline – 4" PVC – 800m long with 3 division boxes - 3" pipeline - 8 HP portable, diesel engine water pump - Drip irrigation tank – 10,000 lt - 1 acre drip kit
Shulakino	- Weir with intake gate and scouring gate - Main pipe line for right bank - Improvised water way for left bank made by a farmer
Kiamariga Raya	- Weir with two intake chambers and wing wall - Pipe lines for Kiamariga and Raya with 29 hydrants and 1 washout
Kaumbura	- Earth main canal

Source: JICA Team

While farmers in the Batch 2 pilot project site have experience for irrigated agriculture, facilities in the schemes are to be rehabilitated or improved as most of them are deteriorated.

4.3.4 Irrigation Water Users' Association (IWUA)

Self-Help Groups (SHGs) were established under al the Batch-1 and Batch 2 pilot project sites guided by GOK. The present condition of the organizations is summarised below.

Table 4.3.11 Present Condition of IWUA in Batch 1 Pilot Project Sites

Name of Scheme	Status of Registration of IWUA	Selection of IWUA Committee Members	By-law		
			Available	Status of by-law	Understanding of by-law among the members
Kasokoni	Registered as SHG	Elected with a 1-year term	Yes	Amended	Not all members understand the by-laws
Mdachi	Registered as SHG	Elected but the term is not specified in the by-law	Yes	Under process of amending	Few members understand the but-laws
Olopito	Registered as SHG	Elected with a 1-year term	Yes	Under process of amending	All members understand the by-laws as they are involved in the revision of it
Gatitu/Muthaiga	Registered as SHG	Elected with a 1-year term	Yes	Amended	Members are not aware of by-law
Kaben	Registered as SHG	Elected but the term is not specified in the by-law	Yes	Amended	the amendment of the by-law, all members understand it
Murachaki	Registered as SHG	Elected but the term is not specified in the by-law	Yes	Under process of amending	Not all members understand the by-laws
Tumutumu	Registered as SHG	Elected but the term is not specified in the by-law	Yes	Under process of amending	Not understand the by-law except the committee members
Muungano	Registered as SHG	Elected with a 3-years term	Yes	Under process of amending	All members understand the by-law

Name of Scheme	Regular Meeting			Financial Management		
	Frequency	Rate of attendance (%)	Availability of minutes of meeting	Bank account	Funds available	Collection of O&M Fee
Kasokoni	Every week	Nearly 100%	Available	Opened	Ksh 100,000	Water fee for Ksh 10 per hour
Mdachi	Every week	Less than 50%	Available	Opened	Ksh 7,000	Ksh 20 per week per member
Olopito	Every month	50%-80%	Available	Opened	Ksh 6,000	Ksh 50 per member per week
Gatitu/Muthaiga	Every month	Nearly 80%	Available	Opened	Ksh 20,000	Ksh 50 per member per week
Kaben	Every week	Nearly 95%	Available	Opened	None	Ksh 1,200 per member per year
Murachaki	Bi-weekly	Nearly 100%	Available	Opened	None	Collected when required
Tumutumu	Every month	Nearly 80%	Available	Opened	Ksh 250,000	Collected when required
Muungano	Every month	Nearly 50%	Available	Opened	Ksh 300,000	Ksh 100 per month

Source: JICA Team

Table 4.3.12 Present Condition of IWUA in Batch 2 Pilot Project Sites

Name of Scheme	Status of Registration of IWUA	Selection of IWUA Committee Members	By-law		
			Available	Status of by-law	Understanding of by-law among the members
Tuhire Challa	Registered as SHG	Elected (tenure 3 years)	Available	Generally okay but reviewing and addition of some important clauses necessary	Newly revised and yet to be passed for lack of quorum
Mangudho	Registered as SHG	Elected	Yes	Well formulated with the help of SIDEMAN-SAL guideline and SCSDO	Not yet operationalised as they are still new
Shulakino	Registered as SHG	Appointed as per family	No	Formulation in progress but following SIDMEMAN-SAL formulation guideline	N/A
Kiamariga/Raya	Registered as SHG	Election	No	Formulation of Bylaw in progress	N/A
Kaumbura	Registered as SHG	Elected (Tenure 3years)	Available	Newly constituted as at December 2014	Not yet operationalised

Name of Scheme	Regular Meeting			Financial Management		
	Frequency	Rate of attendance (%)	Availability of minutes of meeting	Bank account	Funds available	Collection of O&M Fee
Tuhire Challa	Annually	About 50% - 74% and other times less	Available	Opened	Ksh.180,000	Ksh.1,100 per year for WRMA and O&M
Mangudho	Weekly	60-75%	Available	Newly opened	Ksh.10,000	Monthly Ksh.50 per member
Shulakino	Meets when need arises	About 50%	Available	Opened	Ksh.5,000	Initially charged Ksh.20/- per member. Now in the process of setting the O&M fee
Kiamariga/Raya	Monthly (3rd Saturday of the month)	38% on average	Available	Opened	TBC	Ksh.500 per month per member and tenants Ksh.3,000 per season previously
Kaumbura	No particular period or date set. Meets when need arises	About 50%	Available	Opened	Ksh.35,000	Fees charged when need arises between Ksh.2,000 – 3,000

Source: JICA Team

The IWUAs in the Project Area are featured as shown below

- All the IWUAs in Batch 1 pilot project sites are registered as a self-help group (SHG).
- Although by-law is available for most of the IWUAs, understanding of the by-law is not sufficient.
- Election of committee members are held, some IWUA do not follow its regulation for frequency of election
- Water management rules is not regularised for the IWUAs
- All the IWUA open their bank accounts for financial management, but O&M fees are not collected regularly.
- IWUAs under existing irrigation schemes conduct maintenance activities according to their needs without firm maintenance plan.

4.4 Summary of Feasibility Study and Detailed Design

4.4.1 Agricultural Development Plan

Based on collected agro-economical data (obtained/ rendered) from regional agricultural service stations, national agronomical census and the interviews with regional agricultural service officials, local farmers and relating personnel, the proposed crops were selected as shown below.

Table 4.4.1 Proposed Crops in Batch 1 Pilot Project Sites

Crop \ Scheme	Kasokoni	Mdachi	Olopito	Gatitu/Muthaiga	Kaben	Murachake	Tumutumu	Muungano
Maize	○	○	○	○	○	○	○	○
Beans*	○	○		○	○	○	○	○
Tomato	○	○	○	○	○	○	○	○
Onion	○		○		○	○	○	○
French bean	○		○	○				
Cabbage				○				
Kale		○	○					
Okra		○						
Amaranth		○						
Ground nut						○	○	
Sweet potato					○			
Irish potato			○					
Mango					○			
Banana	○					○	○	○

*Beans including Green gram for intercropping

Source: JICA Team

Table 4.4.2 Proposed Crops in Batch 2 Pilot Project Sites

Crop/ Scheme	Challa/Tuhire	Mangudho	Shulakino	Kiamariga/Raya	Kaumbura
Maize	○		○	○	○
Beans*	○		○		
Tomato	○	○	○	○	○
Onion	○	○	○	○	○
Cabbage			○	○	
Water melon		○			○
Banana	○				
Green maize		○			
Amaranth		○			
Capsicum			○	○	
Garlic				○	
Pawpaw					○

*Beans including Green gram for intercropping

Source: JICA Team

4.4.2 Irrigation Development Plan

In the detailed design, irrigation facilities to be constructed/rehabilitated in each scheme were proposed as summarised below. Scope of construction works under the Project was discussed and it was agreed that the final scope of the construction works would be decided taking into consideration available fund and time frame.

Table 4.4.3 Proposed Irrigation Facilities in Batch 1 Pilot Project Sites

		Kasokoni	Mdachi	Olopito	Gatitu Muthaiga	Kaben	Murachaki	Tumutumu	Muungano
Intake Works									
New Construction/ Rehabilitation (Rehab)/ NA		Rehab	New	New	NA (Existing)	New	Rehab	Rehab	New
Weir Length	(m)	15.6	16.0	16.0		16.0	20.0	8.0	24.0
Weir Height	(m)	2.2	1.7	1.5		1.75	1.50	1.20	1.00
Type of Irrigation Network		Open Canal	Open Canal	Pipe Lines	Pipe Lines	Open Canal	Pipe Lines	Pipe Lines	Pipe Lines
		Main	Main	Main	Main	Conveyance	Conveyance	Conveyance	Main
Number of Lines	(Nos)	1	1	1	2	1	1	1	2
Total Length	(m)	1,886	458	3,646	9,065	13,000	2,125	1,271	12,613
Related Structures	(Nos)	39	5	26	75	36	13	11	90
		Feeder	Sub Branch	Sub-main	Feeder	Main	Main	Main	Distribution
Number of Lines	(Nos)	20	2	5	25	1	1	3	224
Total Length	(m)	5,546	1,231	2,943	8,738	5,853	10,875	11,547	12,613
Related Structures	(Nos)	192	19	36	149	22	70	80	418
			Tertiary	Distribution		Feeder	Sub-main	Sub-main	
Number of Lines	(Nos)		10	3		11	19	3	
Total Length	(m)		2,548	564		6,773	13,000	11,191	
Related Structures	(Nos)		108	6		65	213	67	
				Feeder			Feeder	Feeder	
Number of Lines	(Nos)			5			46	100	
Total Length	(m)			6,455			29,667	56,805	
Related Structures	(Nos)			5			192	475	

NA: Not Applicable

Source: JICA Team

Except Gatitu/Muthaiga scheme, 4 Intake Weirs were proposed to be newly constructed while 3 Intake Weirs were to be rehabilitated. Under the Kasokoni and Kaben Schemes, rehabilitation of open irrigation canals was proposed while construction of new canal system was proposed under Mdachi Scheme. Under 5 schemes, construction of pipeline irrigation system was proposed. As for pipeline system, based on topographic condition in the commanding area, introduction of sprinkler system was considered.

Table 4.4.4 Proposed Irrigation Facilities in Batch 2 Pilot Project Sites

		Tuhire Challa	Mangudho	Shulakino	Kiamariga Raya	Kaumbura
Intake Works						
New Construction/ Rehabilitation (Rehab)/ NA		Rehab	New	Rehab	Rehab	New
Weir Length	(m)	12.7	40.0	11.3	4.5	10.0
Weir Height	(m)	1.0	1.5	3.0	1.0	1.50
Type of Irrigation Network		Open Canal	Pump Feed Pipe Lines	Pipe Lines	Pipe Lines	Open Canal
		Conveyance	Main	Main	Main	Main
Number of Lines	(Nos)	1	2	2	2	1
Total Length	(m)	1,083	1,977	2,795	3,900	3,190
Related Structures	(Nos)	2	10	25	40	4
		Branch	Link		Secondary	Secondary
Number of Lines	(Nos)	1	1		8	8
Total Length	(m)	745	100		3,561	3,015
Related Structures	(Nos)	3	0		8	60
		Secondary	Submain			Terriary
Number of Lines	(Nos)	5	7			60
Total Length	(m)	14,902	923			6,000
Related Structures	(Nos)	175	9			120
			Distribution			
Number of Lines	(Nos)		10			
Total Length	(m)		740			
Related Structures	(Nos)		10			

NA: Not Applicable

Source: JICA Team

Under the Project, only Mangudho scheme is featured by pump irrigation system accompanied with pipeline system while the others are under gravity irrigation system, with open channel/pipelines. Farmers in Tuhire/Challa and Kaumbura schemes requested to provide canal lining works in the main system. In Kiamariga/Raya scheme, pipeline system was proposed to be extended for expansion of its commanding area.

4.5 Challenges and Lesson Leant

- Although the transfer of technology was intended to the SCIO and the SCAO during conducting the feasibility study and detailed design, they pointed out that the outputs were not sufficient. The implementation procedure and organisation to conduct study and

design are to be re-considered in the future project, aiming at strengthening capacity of the officers for the activities.

- Specially, as for the hydrological study to evaluate potential water resource, as per regulation of GOK, the work needs to be outsourced to WRMA-registered hydrologist. Thus, in view of the technology transfer, survey procedure for the SCIO to collaborate with the hydrologist would be highly required so that the SCIO can gain the knowledge hydrological analysis, such as water balance study to decide commanding area and flood analysis.

- To overcome the above-mentioned shortcomings, a workshop was held in March 2014 to share technology and experience for the feasibility study and the detailed design. The officers appreciated that practical knowledge of the study and design was enhanced during the workshop, resulting in smooth implementation of the study and design under the Batch 2 pilot project sites. They mentioned that the knowledge was estimation of crop water requirement using FAO CROPWAT and calculation of crop budget.

- While the field officers appreciated that the technology of transfer through conducting the study and design of the Batch 2 pilot project site was relevant, the project implementation schedule to construct the Batch 1 pilot project sites and study in the Batch 2 pilot project sites simultaneously were heavy burden to them. They recommended that special consideration would be made in terms of preparation of the overall project implementation schemes in order to eliminate work load for the officers.

- The SCIOs pointed out that process of technical analysis including survey and levelling should have been strengthened during the study although survey equipment and AUTO CAD software were provided by the Project.

CHAPTER 5 Basic Approach of Implementation for Pilot Projects

5.1 Basic Approach for Project Implementation

The Record of Discussion (R/D) in the Project specifies the purpose and the outputs of the Project as described below.

Project Purpose

Resilience against drought and food insecurity is improved through participatory smallholder community irrigation development, management and appropriate farming system.

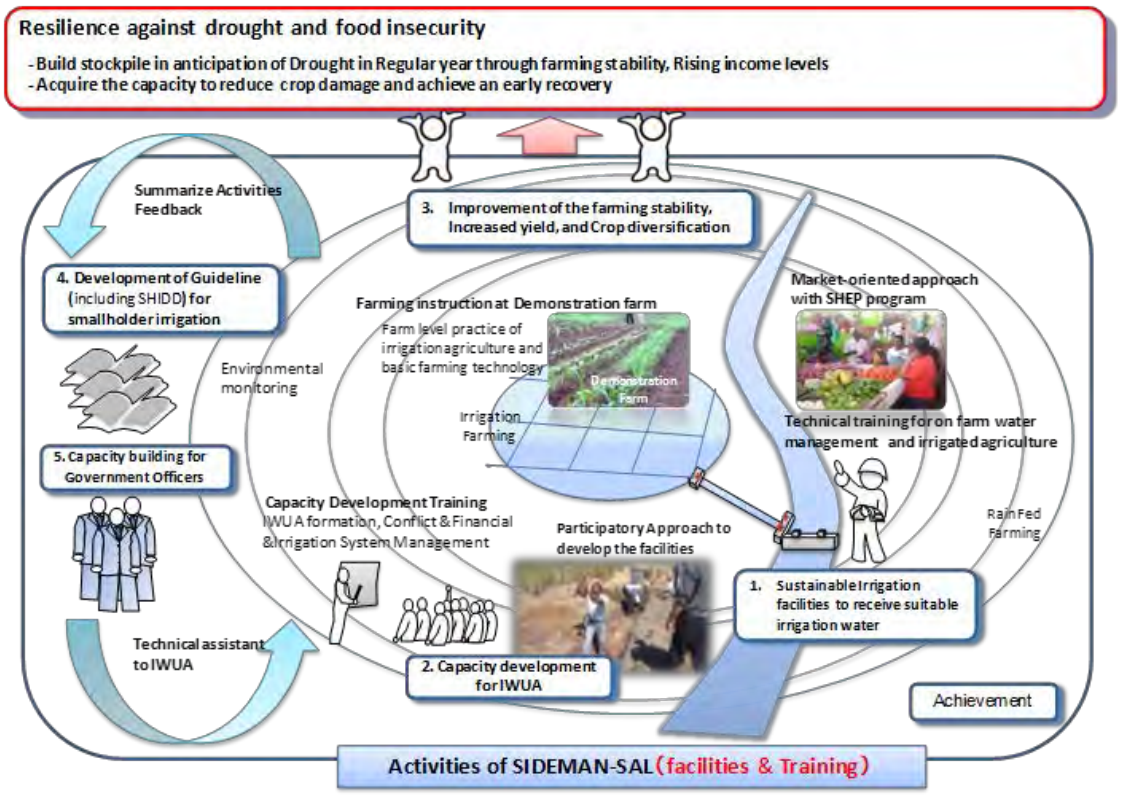
Outputs

- Smallholder Community Irrigation facilities are constructed through participation of IWUA.
- IWUA capacity is improved for effective Sustainable O&M and appropriate farming systems.
- Capacity of technical staff is enhanced for participatory irrigation development.
- SHIDD guideline is improved.

To achieve the above, under the Project, the term of "Resilience against drought and food insecurity" was defined as follows, on which the activities based on the findings obtained in the process of implementing the Project would be developed and reorganised.

Improvement of resilience against drought and food insecurity

Farmers will improve farm income and acquire the stable farming system through stable production of crops, increase of yield, and crop diversification brought by stable irrigation water supply and improvement of farming technology. Those activities, during normal season, enable the farmers to stock foods and enhance their capacity to reduce crop damage and achieve an early recovery against series of drought.



Source: JICA Team

Figure 5.1.1 Outline of SIDEMAN-SAL Achievements and Activities

The major activities of the Project are outlined in Table 5.1.1.

Table 5.1.1 Major Achievements and Activities of SIDEMAN-SAL Project

Outputs	Activities
Sustainable Irrigation facilities to receive suitable irrigation water	Participatory Approach to develop the facilities cooperated with the Government officials
Capacity development for IWUA	Capacity Development Training for IWUA IWUA formation, Conflict & Financial &Irrigation System Management
Improvement of the farming stability, Increased yield, and Crop diversification	Farming instruction at Demonstration farm Market-oriented approach with SHEP programme Technical training for on farm water management and irrigated agriculture
Development of Guideline (including SHIDD) for smallholder irrigation	A result of the above activities
Capacity building for Government Officials	A result of the above activities

* Environmental Monitoring is implemented together with above activities

Source: JICA Team

5.2 Project Component for Implementation

As mentioned in Section 5.1, based on problems identified from present condition, the major activities (components) of the project were determined as illustrated below.

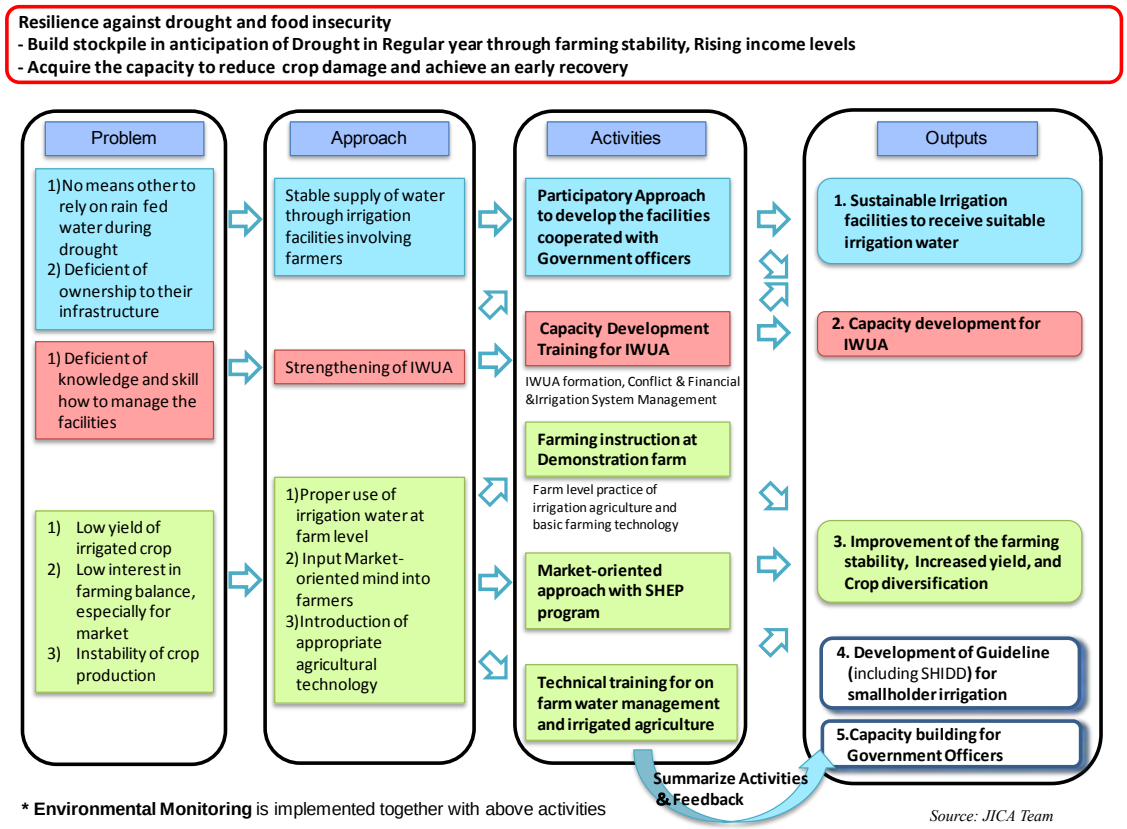


Figure 5.2.1 Flow from Problem Identification to Major Activities/Achievement of the Project

5.2.1 Irrigation Facilities Construction Component

(1) Problem Identification

Based on the study result and observation, the following problems were identified for irrigation facility construction.

1) No means other than rely on rain water

As farmers in the project area highly rely on rainfed farming system, their production is highly affected by erratic rainfall and climate condition. Especially, during drought period, it is not possible at all for farmers to grow crops, and farmers are relegated to the difficult situation.

2) Deficient of ownership to their facilities

If irrigation schemes are developed by the Government or other donors/NGOs without proper involvement and participation of farmers, it should be difficult for the farmers to have their ownership to ensure sustainable irrigation management because they recognise the system as "Given one" and tend to rely on the external source even during operation and maintenance period of the schemes.

(2)Basic Approach

The following basic approaches were set to overcome the main problems.

- Supply stable irrigation water that less susceptible to changes in the weather with irrigation facility.
- Develop mechanism to involve the farmers during the project planning, design, implementation and operation and maintenance.

(3)Activities

1) Participatory approach to develop the facilities cooperated with Government Officials

Under the Project, the construction works should be carried out by IWUA so that they can sustainably manage the completed irrigation facilities by their resources as much as possible. Thus, the maximum efforts were put to motivate and encourage the IWUA members to participate in the construction works with appropriate facilitation to the leaders and members of the IWUAs. The works to be undertaken by the IWUA were determined taking into consideration total cost, period of the construction works as well as capabilities of the IWUA's members for the works through series of discussion with them. Meanwhile, parts of the works were outsourced by private contractors in such case that it was technically difficult for the IWUA members to carry out the works.

Major activities of the irrigation development are summarised below. The detail of the activities is described in Chapter 6.

Table 5.2.1 Activities of Irrigation Facilities Construction Component

Category	Major Activities
Pre-construction activities	Discussion with IWUA members and signing of MOU for the Construction Works WRMA Authorization Way leave Application
Construction of Irrigation Facilities by IWUA members	Pre-construction Guidance to the IWUA members Technical Guidance to the IWUA
Construction of Irrigation Facilities by private contractors	Preparation of Tender Documents Tendering Construction Supervision and Contract Management

Source: JICA Team

5.2.2 IWUA Capacity Development Component

(1) Problem Identification

Through the field study and interview with the IWUA members in the Pilot Project Sites, the following problems were revealed.

- In the project area, the IWUAs have been struggling with group cohesion, writing and updating their membership register as they were unable to identify their members correctly. Some IWUAs did not have by-laws and even those who had were not related to an IWUA but just any self-help group. Most of the groups were not aware of what an IWUA was and its formation process.

- The main challenges that the groups were experiencing were lack of regular elections as the by-laws were silent as to tenure of office for the leaders, improper mode of holding elections, weak and unskilled leadership (some IWUAs had leaders who could not read and write), lack of gender representation in IWUA leadership, lack of defined roles of each leader. Some groups were experiencing conflicts relating to leadership and accountability of the leaders.

- As for financial management, the IWUAs were not clear as to the various contributions by the members. They were also weak in maintaining financial records with mostly only maintaining a receipt book. The chairman of the IWUA was mainly the one with custody of IWUA funds. The groups were working without budgets and most of them did not have any money for IWUA affairs.

- For the IWUAs who were already irrigating, most of them were unaware of crop water requirements and the amount of water required for irrigating a crop during various crop stages. The IWUA members were not aware of the various soil types and their demand for irrigation water. They should be trained on the various water application technologies relating to the design of their irrigation system. Most of the farmers were did not perceive importance of conducting market survey and preparing a cropping calendar, post-harvest handling and processing.

- Even the IWUAs that were already irrigating did not notice importance of preparing plans for cropping, system operation and maintenance. The IWUAs did not have written irrigation schedules, and did not understand water management, calculation of O&M fee, having challenges accepting the WRMA charges for water services.

(2)Basic Approach

The following basic approach was given priority to sort out the main problems

- Strengthening of IWUA capacity to deliver proper knowledge and skill to handle the irrigation facilities through training and practice on site
- Introduction of proper irrigation water management and system management system in order to distribute the irrigation water timely and equally among each IWUA member.

(3)Activities

As mentioned in the Section 5.2.1, by adopting SIDEMAN organizational structure, the Project was expected to enhance knowledge, skills and experience of the farmers for increased their participation, ownership and overall management of the irrigation schemes.

The following factors were taken into consideration towards sustainable management of the irrigation facilities by the IWUAs through the Training Needs Assessment under SIDEMAN project,

- Motivation and ownership for Farmers,
- Organizational strengthening for the IWUA,
- Financial management, and
- Operation and maintenance (O&M) of the facilities, and collection of O&M fee.

The Project attempted to establish mechanism to sustain or enhance the above mentioned factors through the following training programmes.

1) Community mobilisation and IWUA formation

Training programme for community mobilisation and IWUA formation helped the IWUAs in training them on group dynamics and group cohesion. It was expected that they were able to register their membership as well as formulate proper by-laws relating to an IWUA and to develop an IWUA organizational structure

2) Leadership and conflict management

Training programme for leadership and conflict management is important as the IWUAs should give basic knowledge on characteristics of various leaders to enable them elect right leaders, elections (mode of conducting them and tenure of office), role delineation of the various office bearers and importance of leaders' accountability. Conflict management was also covered in the training programme. The IWUAs were able to incorporate these leadership policies in their by-laws.

3) Record keeping and financial management

During training programme for record keeping and financial management, the IWUA members were taught on basic book keeping and importance of maintaining records. At the training programme, the role of the treasurer as the custodian of funds was stressed.

The IWUAs should maintain bank accounts and set up expenditure limits for the management committee. Various financial records are to be opened including petty cash book, cash book, income and expenditure book and a file to keep the various IWUA records. The groups were sensitised on importance of auditing their books and regular contributions by the IWUA members

4) On-farm water management and practical irrigated agriculture

Under training programme for on-farm water management and practical irrigated agriculture, the IWUA members were expected to obtain practical training on various water application technologies respective to independent schemes, identification of soil types, irrigation application and how to test if one had irrigated enough, group work to discuss market survey and prepare a cropping calendar, and they were involved in post-harvest processing.

5) Irrigation system management

Training programme for irrigation system management enabled the IWUA members to change their attitude towards collection of O&M fee and WRMA charges, the importance to calculate irrigation water requirement before deciding on water distribution plan. The farmers were also trained on how to manage the scheme during the dry seasons and the importance of recording system performance, importance of O&M and monitoring and evaluation (M&E).

Major activities of the capacity development to the IWUA members are summarised below. The detail of the activities is described in Chapter 7.

Table 5.2.2 Activities of IWUA Capacity Development Component

Category	Major Activities
Improvement of IWUA capacities for O & M	Participatory Approach to develop the facilities
Organizational Strengthening	Sensitization programme for IWUA activities Training of Leadership and Conflict Management Training for Financial Management
Strengthening of capacity for on-farm water management and Operation and Maintenance (O&M)	On-farm level water management Basic knowledge of irrigated agronomy Irrigation planning and scheduling Water distribution and monitoring System operation & maintenance activities Preparation of Maintenance plan and budget Collection of O&M Fee

Source: JICA Team

5.2.3 Agriculture Development Component

(1) Problem Identification

Major problems in agriculture observed during the field study were described below.

1) Low yield of irrigated crop

In the project area, vegetables are cultivated mainly with irrigation. However, the yields are much lower than that of national average. The main causes are as follows:

- Large quantity of water is applied at the time of irrigation because irrigation interval is too long to grow vegetables adequately. It also induces their poor growth because of root rotting.
- Unsuitable crops for soil are cultivated in some schemes. Especially growing vegetables with over irrigation under clayey soils are severely damaged because most of them prefer well drained soils.

2) Unstable irrigation water supply due to climate change

While frequency of drought depends on by each pilot project site, droughts incidence in the former Eastern Province (Tumutumu, Murachaki, Muungano schemes), and the former Costal Province (Mdachi and Kasokoni schemes) are more frequent than the others.

The most immediate damage of drought is a fall in crop production for both rainfed and irrigated cultivation. According to survey of the drought damage occurred in 2014, the damage of irrigated crops was much lower than that of rainfed. However, the irrigated crop also received a lot of influence of drought even due to decline of the river water flow.

To mitigate damages of the drought, introduction of water saving techniques is necessary. Furthermore, many people used the wild animals and plants as food source during drought. In this context, it is very important to protect natural environment surrounding residence as food source during drought.

3) Low interest in farming balance, especially for market

Farmers pay little attention to what the market is looking for. At the same time, they have little interest in price of agricultural products as well as inputs.

4) Low quality of vegetables

There are much vegetable products that are unable to sale due to low quality, and most of them are not used effectively. The low quality products may be caused by the

followings.

- Water stress from either too little or too much irrigation water,
- Un-optimum planting density, and
- Damages of insects, diseases, and weeds.

It is necessary, therefore, to improve the factors listed above in order to reduce the low quality products. Furthermore, introduction of processing technologies is vital to use them effectively.

5)Instability of crop production

The Project area is located in the semi-arid area and affected by climate change. Especially drought has frequently taken place and has given a great deal of damage because rainfed cultivation is dominant in the Batch 1 pilot project sites. Therefore, rainfed crop production is largely fluctuated by the climate event.

(2)Basic Approach

The following basic approach was adopted to solve the main problems, such as

1) Effective use of irrigation water at farm level

To utilise the limited water resources effectively, proper irrigation method is proposed to be extended to improve the land and water productivity, and to expand irrigation area as much as possible through saving water. Thus, it is to be highlighted to demonstrate how to use the irrigation water to improve the crop productivity at farm level under limited water resources.

2) Awareness raising of market-oriented agriculture to farmers

Awareness raising programme was introduced to the farmers in terms of market-oriented agriculture.

3) Extension of cultivation technology based on proper irrigation water management

Appropriate cropping technology based on proper irrigation water amount was proposed and expanded to the IWUA members to improve yield and quality of products. Those improvements were intended to ensure increase of farm income and food security.

4) Effective use of agriculture products

Much of the products are unable to be sold to market, and discarded due to low quality. The quality of the products should be improved expanding appropriate crop cultivation technology. The effective use of the products also is essential for food security and

increasing income. Therefore, appropriate processing technique is introduced and expanded to farmers.

5) Stable production of rainfed cultivation

Although the Project intends to expand irrigation area, rainfed crop cultivation continues to play important role in terms of food security in the project area because irrigated land is limited due to available manpower and water resources. Thus, to stabilise the food crops production under rainfed condition, drought resilient cropping systems was proposed and extended in the study.

6) Promotion of crop diversification

In the project area, promotion of crop diversification was expected for the farmers to obtain alternative opportunity for farming income, mitigating risk against draught.

(3)Activities

The following activities were a specific plan to develop the basic policy.

1) Farming instruction at demonstration farm

In order to extend the technology, demonstration pilot farms were effectively used as a demonstration farm or field school. Participants in the farms consist of not only SHEP members but also all IWUA members. The participants managed their own field themselves; the maximum field area was 10mX10m per participant. A field day was held during the pilot farm to extend the technology. To implement it, many farmers are invited to the pilot farm, not only inside but also outside of the scheme. The participants of the pilot farms and the agriculture officers in the Counties explained their applied technology to the farmers.

Farm level practice of irrigation agriculture and basic farming technology was implemented on the site. Activities carried out in three steps are described below.

a) Pre-Pilot farm
b) Pilot farm (using irrigation facilities prior to completion)
c) Demonstration farm (using irrigation facilities after completion)

2) Market-oriented approach with SHEP programme

The SHEP approach was introduced, aiming at inducing farmers' awareness of the market-oriented farming management. It referrers to specific methods and techniques for empowering stallholder horticulture farmers, and it includes a series of training session for farmers, which were mainly focusing on farmer's capacity of the followings;

- Identifying the present cost and benefit in their farm production,
- Understanding the market condition, and
- Extending horticulture cultivation technology.

Under the two Sub-Counties in the project area of the SHEP-UP Project, the original SHEP approach, comprising the Sensitization Workshop, the Baseline Survey, the Stakeholder Forum (FABLIST Forum), Joint Extension Staff and Farmers Dual Gender Training (JEF2G), Group Activities Facilitators Training for Farmer Demand Driven Extension (FT-FADDE) and In-Field Trainings, contributed to realise the market-oriented faming by beneficiaries, changing their mindsets and behaviours. Furthermore, special attention was drawn so that series of activities with the SHEP approach motivated the farmers throughout the project period.

Meanwhile, in the remaining six Sub-Counties in the Project area, core-components of the SHEP Approach, namely, 1) Baseline Survey, 2) Market Condition Survey and 3) Preparation of Crop Planning Calendars, and Record Keeping Management, were introduced.

3) Technical training for on farm water management and irrigated agriculture

Unit 4 IWUA Training Programme was carried out to extend the irrigated agriculture technology. The following training sessions were included in the Unit 4 training programme for the IWUA members to improve the existing problems.

1) The proposed irrigation technology.
2) Appropriate crop cultivation techniques.
3) Simple processing methods.

4) Introduction of the LISA technology

Introduction of the Low Input Sustainable Agriculture (LISA) technologies is mainly to stabilise rainfed crop production to ensure sustainable food security for farmer. The technologies consist of the followings;

1) Kenyan traditional vegetables

Kenya traditional vegetable programme is expected to contribute to the improvement in the livelihood and nutrition status of the farmers in the project area because they contain much vitamins and minerals. As they can be grown in a short period and under unfertile soil, as they are suitable for the area.

2) The push-pull technology

The push-pull technology is an effective method to stabilise maize yield by controlling stem borers and suppression of striga weeds. It is a simple cropping strategy, whereby farmers use Nepier grass and desmodium legume intercrop as repellent "push" plants

and trap "pull" plants. The technology is also expected to provide fodder for livestock and improve the fertility of the soil.

Major activities of the agricultural development are summarised below. The detail of the activities is described in Chapter 8.

Table 5.2.3 Activities of Agriculture Development Component

Category	Major Activities
1) Farming instruction at Demonstration farm	Establishment of Demo Pilot Plots a) Pre-Pilot farm b) Pilot farm (using irrigation facilities prior to completion) c) Demonstration farm (using irrigation facilities after completion)
2) Market-oriented approach with SHEP programme	Sensitization Programme Training programme in SHEP Area Implementation of activities as per the SHEP Programme Training in Non-SHEP Area Baseline survey Market survey and preparation of cropping calendar Record keeping Workshop on Resilience
3) Technical training for on farm water management and irrigated agriculture	On farm water management and irrigated agriculture training ** this activity is implemented in conjunction with Capacity Development of IWUA*

Source: JICA Team

5.2.4 Staff Capacity Development Component

During the whole Project implementation period, namely, planning and implementation of construction of irrigation facilities, operation and maintenance, and agricultural farming, the Project has been carried out a capacity building programme for the Sub-County officials, making the maximum efforts to improve their skills and capacities of the officers in order to efficiently play their respective roles during and after the project implementation (See further information in Chapter 9).

Table 5.2.4 Activities of Staff Capacity Development Component

Output	Major Activities
Enhancement of Capacity of Officers	Conduct of Needs Assessment for the Programme Preparation of Training Programme Implementation of Training Programme

Source: JICA Team

5.2.5 Environmental Component

As per recommendation by NEMA, an Environmental Monitoring and Management Plan (EMMP) was prepared, and activities indicated in the plan should be implemented. The Project assisted the IWUAs to prepare EMMP and action plan for each pilot project site so that the entire stakeholders, including the IWUA members, could continue the activities under the guidance of the officers concerned (see detail in Chapter 10).

5.2.6 Revision of Guidelines

All the implementation processes such as Planning, Feasibility Study (F/S), Detailed Design (D/D), Construction Supervision, and O&M for the irrigation facilities shall be documented as lessons learnt. At the final stage of the Project, lessons learnt obtained from the project activities should be reflected into the SHIDD Guideline for the revision (se detail on Chapter 11).

5.3 Improving Resilience

Measures implemented in the Project to improve resilience against drought and their expected effects are as follows.

(1)Irrigated Crop Production

1. Thanks to expansion of irrigated area by the construction of irrigation facilities, many farmers will be able to enjoy stable crop production even during drought.
2. Thanks to implement training on water management and distribution system of irrigation water, farmers can maintain and manage irrigation facilities.
3. Because of implementation of training on water saving cultivation implemented by the pilot farm, IWUA can appropriately distribute irrigation water to farm.
4. Due to improvement of excess irrigation by expanding the water saving cultivation technology, increasing in crop productivity and expansion of irrigated area can be achieved.
5. Thanks to introduction of SHEP methodology and on-farm water management and farming training by SIDEMAN-SAL, farmers can select appropriate crops which are marketable and suitable for soils in their farm.
6. Due to training on crop rotation in unit four, the crop production can be stabilised to mitigate the injury of continuous cropping.

7. The impact on the sharp fluctuations in market prices can be alleviated due to the diversification by crop rotation.
8. Through processing sub-standard or unmarketable product, food can preserve and supply throughout the year.

(2) Rainfed Crop Cultivation

1) Push-Pull

1. Rainfed crop productivity in normal year can be stabilised, which allows storing food for drought year.
2. Thanks to the storing, farmers can be suppressed food spending by food stockpile during drought because grain prices are soaring.
3. Production of pastures can allows to improve livestock productivity in normal year and to alleviate feed shortage for livestock in drought year.

2) Kenyan Traditional Vegetables (KTV)

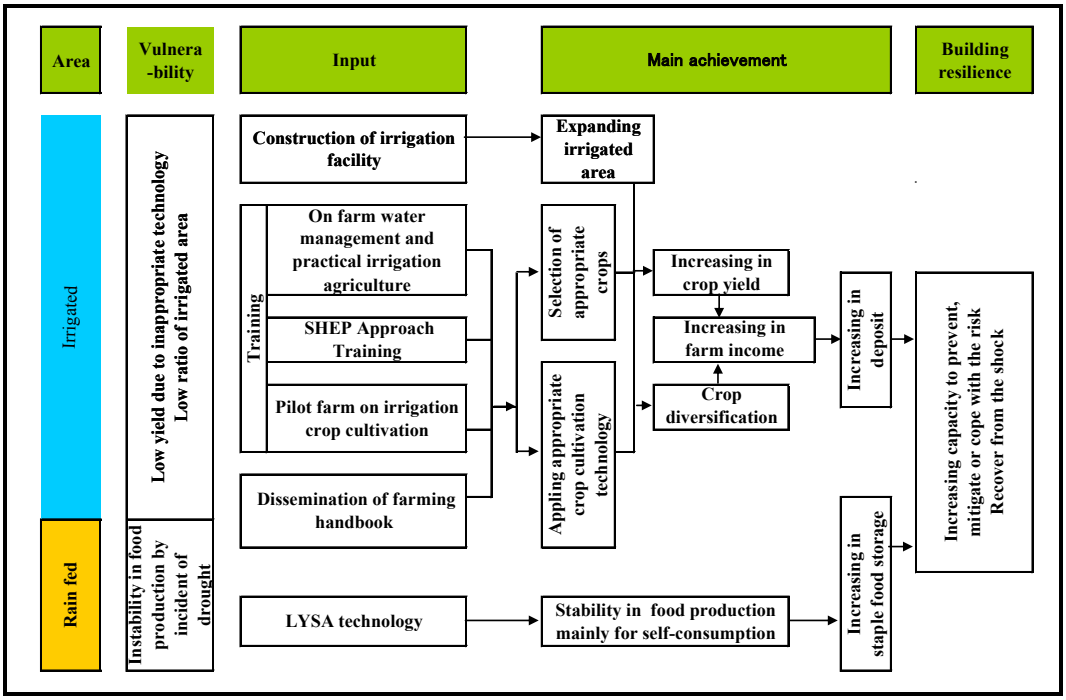
1. KTV is important also as an income source to cultivate in semiarid region. .
2. Farmers health can be maintained by ingesting them because they are nutrient rich food to prevent anemia which is the most popular disease in Kenya.

5.4 Expected Effect to Improve Resilience

As a result of implementation of the activities mentioned above, the following effects to improve resilience against drought are expected.

- Thanks to expanding irrigation area, many farmers can enjoy getting high profit stably and the stable profit can allows saving money. The money can be used buying food to mitigate food shortage during drought and can be invested in agriculture activates to recover the damage.
- More farmers can receive the benefit of irrigation due to the expanding of water saving cropping techniques.
- LISA is a sustainable method of farming that stabilises food production for self-consumption. It improves the livelihood of farm family through the contribution to food security and reduction of household spending.
- Introduction of processing techniques can be stored food for longer. The food is available for drought to alleviate food shortage. And it is also possible to obtain cash income by selling in a rural market.

Strategies to improve resilience against drought in SIDWMAN SAL Project are summarised in Figure 5.4.1.



Source: JICA Team

Figure 5.4.1 Concept of Agriculture Development for Improving Resilience

CHAPTER 6 Irrigation Facilities Construction Component

6.1 General

According to the SHIDD Guidelines, the construction of the irrigation facilities bas been basically carried out with farmers' participation. Through the construction works, special attention was paid to strengthen capacities of the farmers and the IWUAs for organisational strengthening and operation and maintenance of the facilities.

As described in the Chapter 5, in the Project, the construction works of the irrigation facilities were conducted by the IWUAs and private contractors. Before the commencement of the construction works, necessary arrangements, such as the approval of NEMA and WRMA, application of the Way leave, and signing of a Memorandum of Understanding (MOU), were made by the SCIO under the assistance of the PMT.

The construction works of the irrigation canals and pipelines were basically undertaken by the IWUA under the technical guidance of the SCIOs and the PMT so as to enhance capacities of the IWUA members towards sustainable management of the irrigation schemes. After the tendering process, a private contractor was awarded for the construction works of major irrigation facilities, such as "intake weirs" and some of "conveyance/ main pipelines". As a field representative of works, the SCIO attached to each scheme was responsible for the supervision of the construction works.

6.2 Activities before Construction Works

6.2.1 Signing of the MOU

(1) General

After completion of the detailed design, a meeting was held to obtain concurrence of the IWUA members on the development plan. The SCIO as well as other government officials concerned attended the meeting. The amount of the farmers' contribution as well as schedule of the construction works was also discussed and agreed. The MOU was signed among three (3) parties, namely, i) National Government of Kenya - JICA represented by the Ministry and JICA Mission representative, ii) IWUA in each scheme, iii) County Government concerned (SCIO, or other county officials). The MOU covers the following items:

- Scope of the IWUA's works and Contractor's works,
- Amount of the farmers' contribution,
- Schedule of construction works,
- Farmers' obligation to the construction works,

- Obligation of the National Government and JICA to the construction works,
- Obligation of the County Government to the construction works,
- Quality control, and
- Safety control.

(2)Purpose of MOU

The Purpose of the MOU was,

- To provide for the establishment of the smallholder community based irrigation scheme for horticultural production,
- To provide for the participation of all the parties to the agreement in the survey/ investigations, design and implementation of the irrigation scheme construction,
- To provide for the strengthening of the IWUA for effective operation and maintenance (O&M) of the scheme, and
- To provide for the strengthening of extension, training and support services to the irrigation scheme.

(3)Role and Responsibilities of the Project

JICA and/ or the National Government fund shall supply:

- Materials for pipelines such as pipes and accessories, cement, fine and coarse aggregates,
- Skilled labour such as mason, pipe fitter, for the construction works, and
- Equipment and labour for excavation of soft rock/ hard rock layers.

(4)Role and Responsibility of IWUA

The IWUA members were requested to contribute to:

- Unskilled labour for simple excavation, simple backfilling with compaction, mixing and pouring of concrete with guidance of skilled mason,
- Transportation and arrangement of construction materials from storage to working site,
- Assistance in i) pipe laying and fitting works, ii) canal lining, related structure construction, and
- Construction of water storage as per the WRMA requirement.

(5)Role and Responsibilities of the County Government

The County Government shall:

- Assist the farmers groups and schemes committee when they require support to enforce their regulation in solving of disputes during irrigation scheme planning, design, implementation operation and maintenance phases, and
- Collaborate with the Ministry and other institutions to implement the irrigation scheme

successfully.

6.2.2 Pre-construction Guidance to IWUA

After the MOU has been signed among the three (3) parties, a pre-construction guidance to the IWUA members was conducted by the PMT members so that they could understand clearly what would be done in the construction together with quality and safety management, how much labour contribution was required to each IWUA member family along the time frame of the construction works.

6.2.3 Implementing Organisation for IWUA Works

For smooth implementation of the construction works, the PMT proposed the IWUA to organise the following sub-committees.

- Overall Management,
- Material Management,
- Labour Management, and
- Technical and Quality Management

6.2.4 Authorisation by WRMA

(1)General (The Water Act 2002 & WRMA)

The organisation (Water user) to operate the irrigation project shall obtain “Water Right Permission” from “Water Resources Management Authority” (hereinafter referred to as “WRMA”) formed by “The Water Act 2002”. Here's an outline of “The Water Act 2002” and ”WRMA”.

The Water Act 2002 went into effect to provide for 1) improved management, conservation, use and control of water resources, 2) acquisition and regulation of rights to use water, 3) management of water supply and sewerage services and 4) ensuring public participation in Water Resource Management through CAACs &WRUAs. The act is buttressed by various subsidiary legislations such as the “Water Resources Management Rules (2007)” which has been promulgated and gazetted as to enable provisions of that. The act gives the clear legal definition of “Water Right Permission” as shown below.

“Every water resource is hereby vested in the state, subject to any right of user granted or under this act or any other written law and any person intending or undertaking any water activity defined in the Act including the activities listed in WRMA rules 07 fifth schedule (Pg 1698) shall obtain approval from the Authority for:

- Temporary abstraction for construction,
- Diversion of water from a water course,
- Abstraction from surface water, and

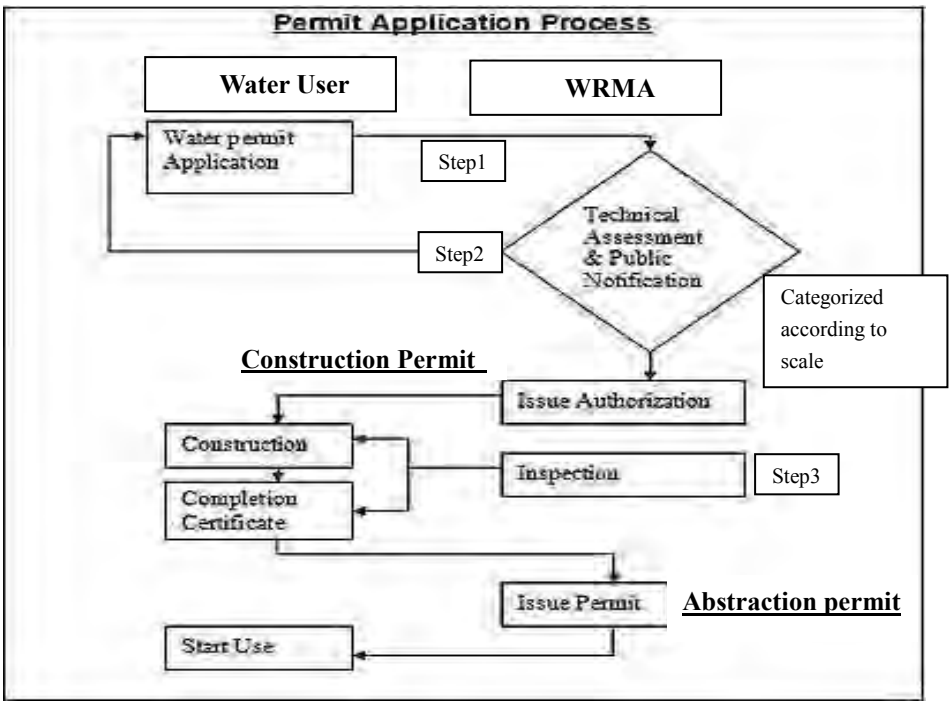
- Diversion of a water course among others

Meanwhile, WRMA was established as an implementation organisation to carry out the activities described above in the act No.8140, 14th November 2003. WRMA's principal mandate is to work as the lead agency to the management of water resources in the whole country. The specific responsibilities are shown as below:

- Water allocation and apportionment,
- Monitoring and assessment of water resources,
- Gathering and publishing information on water resources,
- Receiving and determining applications for permits of water use,
- Regulation and protection of water quality,
- Management and protection of water catchments,
- Water conservation and control,
- Determine and collect water use charges,
- Coordination with other bodies for better water management, and
- Advising the minister with respect to water resources management.

(2)Application Process of Water Right Permission

The process to obtain "Water Right Permission" is described hereinafter. Under the process, each scheme is categorised from A to D. Permit fees of Construction and Abstraction is shown below.



Source : WWW.WRMA or.ke

Figure 6.2.1 Permit Application Detail Process 1(Class A-D)

Step 1 - Application received at the WRMA Sub Regional Office (SRO) with all the documents

Step 2.1 - Submission to Regional office for Technical assessment and approval in case of Category A & B and then returned to SRO for printing of authorisation/permit for issuance to the applicant

Step 2.2 - Category C & D applications are advertised after the technical assessment, forwarded to CAAC for approval in case of category C and for recommendations in case of category D

Step 3 - Forwarded to HQs for approval after "step 2" and Issue the Authorisation/permission

[Notes]

The construction permit period is effective in 24 month.

There sometime is difference in quantity of water between "Construction Permit" and "Abstraction permit".

Table 6.2.1 Category of Water Resource Use Activities

Category	**Definition**
A	Water use activity deemed by virtue of its scale to have a low risk of impacting the water resource
B	Water use activity deemed by virtue of its scale to have the potential to make a significant impact on
C	Water use activity deemed by virtue of its scale to have a significant impact on the water resource
D	Water use activity which involves either two different catchment areas ,or is ~~of~~ a large scale or complexity and which is deemed by virtue of its scale to have a measurable impact on the water resource

Source : WRMA office MWEA

Table 6.2.2 WRMA Construction Permit Fees

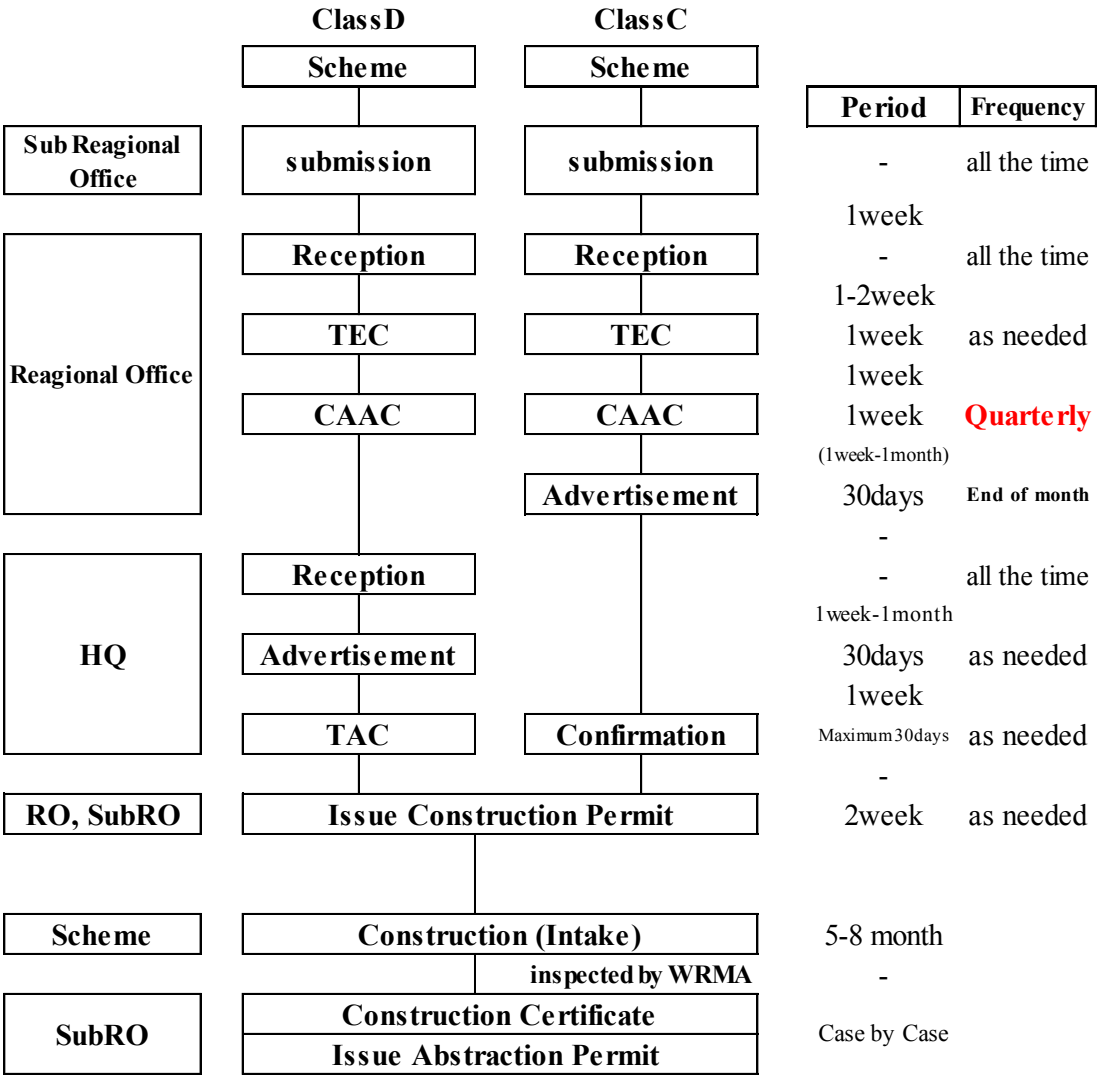
Application	**Assessment of application (Ksh)**	**Issuance or renewal of permit for 5 years (Ksh)**
Category A	1,000	Nil
Category B	5,000	7,500
Category C	20,000	25,000
Category D	40,000	50,000

Source : WRMA office MWEA

Table 6.2.3 WRMA Abstraction Permit Fees

First 300 m^3/day	50 cents / m^3
Over 300 m^3/day	70 cents / m^3

Source : WRMA office MWEA



*1 RO: Regional Office

Source: WRMA office MWEA

*2 Advertisement can be done after reception to RO. But usually they cannot because RO doesn't have money.

Figure 6.2.2 Permit Application Detail Process 2(Class C, D)

(3)Present condition of Application

"The Water Resources allocation thresholds for classification of permit, First Edition, October 2007" by WRMA specifies that the application of each scheme is classified in Class D.

Table 6.2.4 Threshold of WRMA Category and Water Abstraction Amount (Batch 1 Pilot Project Sites)

Scheme	Water Abstraction Amount (m^3/day)		Threshold of WRMA Categoly*2				Remarks
	Actual application	Recommended*1	A	B	C	D	
Olopito	To be clarified	29,968	0-20	20 - 500	500 - 1,000	1,000<	Rift valley catchment, Sikinder River,2KA
Kaben	19,500	25,920	0-20	20 - 500	500 - 1,000	1,000<	Rift valley catchment
Kasokoni	To be clarified	3,888	0-2	2 - 1,000	1,000 - 2,000	2,000<	Athi catchment, Upper Lumi River,Middle zone
Gatitu/Muthaiga*3	1,500	8,640	0-50	50 - 500	500 - 5,000	5,000<	Ewaso Ng'iro north catchment
Tumutumu	10,368	10,368	0-100	100 - 500	500 - 2,500	2,500<	Tana catchment, Ura-Tharaka River,4FC
Mungano*3	5,708	14,342	0-100	100 - 500	500 - 2,500	2,500<	Tana catchment, Thanantu River,4FA
Murachaki	21,150	21,150	0-100	100 - 500	500 - 2,500	2,500<	Tana catchment, Thanantu River,4FB
Mdachi	To be clarified	5,098	0-10	10 - 500	500 - 5,000	5,000<	Athi catchment, Coastal zone, Sabaki River

*1 Required Daily peak amount of irrigation water in the year

*2 Water Resources Management Authority Water resources allocation thresholds for classification of permit First edition October 2007

*3 JICA team recommended to change the application amount.

Source: WRMA office MWEA

Table 6.2.5 Threshold of WRMA Category and Water Abstraction Amount (Batch 2 Pilot Project Sites)

Scheme	Water Abstraction Amount (m^3/day)		Threshold of WRMA Category*2				Remarks
	Actual application	Recommended*1	A	B	C	D	
Shulakino			0-20	20 - 500	500 - 1,000	1,000<	Rift valley catchment, Engare ngossor River,2KA
Challa Tuhire	8,763	8,763	0-20	2 - 1,000	1,000 - 2,000	2,000<	Athi catchment, Upper Lumi River,Middle zone
Kiamariga/Raya	7,171	7,171	0-50	50 - 500	500 - 5,000	5,000<	Ewaso Ng'iro north catchment
Kaumbura	20,909	20,909	0-100	100 - 500	500 - 2,500	2,500<	Tana catchment, Ura-Tharaka River,4FC
Mangudho	789	789	0-10	10 - 500	500 - 5,000	5,000<	Athi catchment, Coastal zone, Sabaki River

*1 Required Daily peak amount of irrigation water in the year

*2 Water Resources Management Authority Water resources allocation thresholds for classification of permit First edition October 2007

*3 JICA team recommended to change the application amount.

Source: WRMA office MWEA

(4)Water Storage for Authorisation

Based on the Water Act 2007, water storage for supplying irrigation water during dry season is required. There has been series of discussion between the Project and WRMA to deal with the issues on the water storage indicated below.

- The Project basically agreed with WRMA to allow the Project with adoption of storage with block basis, and/ or storage with farm plot basis;
- The Project proposed to WRMA that the schemes would provide storage to supply water to 10% of total irrigable area during the dry season (90 days).
- At the time of the signing of the MOU, the Project assisted the SCIO and explaining the IWUA importance of adoption of the storage, and the location and the number of storage would be discussed on block basis/ plot basis.
- The design layout, typical design as well as installation schedule of the said storage

shall be prepared and submitted/ explained to WRMA, within three months after the MOU, so that WRMA could issue the "Abstraction Permit" at the time of completion of the intake weir.

- The storages shall be installed based on the above submitted schedule before the completion of the farmers' construction works.

6.2.5 Land Acquisition Plan

Though any resettlement is not required in all the pilot project sites since the scale of the projects is quite small, the following procedures are required to commence the construction works for way leave acquisitions and permission for crossing road:

- Consents from land owners out of the scheme,
- Consents from farmers within the schemes, and
- Permission for road crossing of pipelines.

6.3 Implementation Procedure of Construction Works

The Construction works were undertaken by the IWUAs and private contractors if the IWUAs are in difficulty to conduct the particular works technically.

6.3.1 Construction Work by IWUA

(1) Implementation Method

The SCIOs were responsible for the implementation of the construction works by the IWUAs. The PMT provided the IWUA with necessary materials, equipment with operators, skilled labour, if required while the IWUA contributed unskilled labours for common excavation, backfilling with compaction, and transportation of construction materials, and local materials available to the Project.

(2)Pre-construction Guidance to IWUA's Members

Before the commencement of the work, the IWUA members were guided on how to manage the rehabilitation/construction works smoothly and efficiently. Several formats were developed for the construction management including attendance of farmers to the rehabilitation/construction works.

(3)Mobilisation of Construction Works

The PSCC members assisted the IWUA to set up the rehabilitation/construction works at the work site.

(4)Technical Guidance to Farmers

The SCIOs assisted by the PMT provided the IWUA members with necessary technical

guidance, covering records keeping for attendance of labours, use of materials, daily activities, and cash books and so on. The guidance was expected to enhance capacity building of the IWUA for future maintenance of the irrigation scheme.

(5)Monitoring for Construction Work by Contractors

The IWUA members visited the site of contractors' works so as for them to obtain knowledge of required quality of the works.

(6)Joint Inspection

The SCIOs in collaboration with the PMT conducted a joint inspection to provide necessary guidance to the IWUA Chairman.

(7)Measurement of Work Performance

Under guidance of the PMT, the SCIOs checked performance of the works periodically. The activities was supported by the PMT.

(8)Final Inspection

Final inspection was conducted by the members of the PSCC to check whether the work has been done appropriately according to the contract agreement. Outstanding works to be done were identified through the inspection for the completion of the work.

(9)Preparation of Handing-over Documents

The PMT prepared a Handing-over Document of the completed facilities in collaboration with the SCIOs.

6.3.2 Construction Works by Contractors

The Construction works undertaken by the private contractors were conducted except Gatitu-Muthaiga scheme. The works mainly covered the construction of the intake weirs and the conveyance/ main pipelines and related structures, which were rather difficult to conduct the works by IWUAs in technically and/ or in the time frame.

(1)Organisation for Implementation

Role of each organisation for the construction works undertaken by private contractors was set as follows.

The Employer	:	SIDEMAN-SAL Project, Project Manager/Team Leader of JICA Team
Field Representative	:	SCIO (Appointed by the Project Manager, Assisted by the PMT)

(2) Preparation of Bid Documents

The PMT prepared a draft Bid Document then submitted it to the Employer for authorisation. The document adopted the sample tender documents published by the Public Procurement Oversight Authority (PPOA).

(3)Bidding

The Employer conducted the tendering process, including the tender advertisement, pre-tender meeting together with site visit, tender opening and the tender evaluation.

(4)Signing Agreement

Contract agreements were signed between the Employer and the Contractor.

(5)Mobilisation

The PMT assisted the SCIOs to supervise mobilisation of the Contractors.

(6)Coordination Meeting with Farmers

Before the commencement of the construction works by the Contractor, the PMT assisted the SCIO to hold a meeting with the farmers to explain the works.

(7)Construction Supervision

The PMT assisted the SCIO to supervise the works including quality control and safety management based on the procedures discussed and consent among the PMT.

(8)Social/ Environmental Management

As per the recommendation by NEMA, the PMT assisted the SCIO and gave guidance and monitoring over the contractors' works to avoid/ mitigate negative impacts to the social/ environmental aspects, such as, water pollution/ water resource degradation; resource conflicts such as water resources, conflict of interest; diseases such as HIV/AIDS, Malaria, Bilharzia. The detail of the plan is described in Chapter 10.

(9)Interim Payment to Contractors

The PMT assisted the SCIOs to carry out measurement of achieved work quantities and to check the statement submitted by the Contractors.

(10)Regular Site Meeting for Progress Monitoring

A Progress Review Site Meeting was organised every month to monitor the progress of the works. The Employer, the SCIO, and the Contractors as well as the IWUA committee members participated in the meeting.

(11)Final Inspection

Final inspection was conducted at the presence of the SCIO, the Employer, and of the IWUA committee members, together with the Contractor, so as to confirm if the work was done properly according to the contract agreement. The list of outstanding works to be rectified during defect liability period was prepared to conclude the work successfully.

(12)Issuance of Completion Certificate

The Employer issued a Certificate of Completion.

(13)Preparation of Handing-over Documents

The Employer prepared a Handing over Documents including O&M manuals and submitted it to the SCIOs so that the completed facilities can be handed over to the IWUA.

6.3.3 Scope of Works

The scope of the construction works for each site is presented below.

Table 6.3.1 Scope of Construction Works under the Batch 1 Pilot Project Sites

Name of Sites	IWUA Works	Contractors' Works
Kasokoni	Rehabilitation of Main Canal	Rehabilitation of Intake Weir Construction of Flood Protection Dike Construction of Building for O&M
Olopito	Construction of Main, Sub-Main, Distribution and Feeder Pipelines	Construction of Intake Weir Construction of Conveyance Pipeline Construction of Structures in the Main Pipeline Construction of Gully Crossing and Stream Crossing Construction of Building for O&M
Tumutumu	Construction of Main, Sub-Main and Feeder Pipelines	Improvement of the Intake Weir Construction of Conveyance Pipeline Construction of Building for O&M
Gatitu/Muthaiga	Construction of Main and Feeder Pipeline	-
Mdachi	Construction of Main, Secondary and Tertiary Canals	Construction of Intake Weir Construction of Building for O&M
Murachaki	-	Improvement of Intake Weir Construction of Building for O&M
Muungano	-	Construction of Intake Weir Construction of Building for O&M
Kaben	Construction of Structures in the Conveyance Canal	Construction/ Improvement of critical Structures along the Conveyance Canal

Source: JICA Team

Table 6.3.2 Scope of Construction Works under the Batch 2 Pilot Project Sites

Name of Sites	IWUA Works	Contractors' Works
Tuhire/Challa Harambee	Rehabilitation of Secondary Canals	None
Mangudho	Construction of Pipeline System	Construction of Pump House and reservoir
Shulakino	Construction of Pipeline System	Rehabilitation of Intake Weir
Kiamariga/Raya	Rehabilitation/Extension of Pipeline System	None
Kaumbura	Rehabilitation of Irrigation Canals	None

Source: JICA Team

6.4 Achievement of Activities

6.4.1 Signing of the MOU

(1) Briefing of the MOU

In prior to the signing of the MOU, the MOU was briefed for each pilot project site. Explanation and discussion made at the meetings were shown below.

Table 6.4.1 Explanation under the MOU Briefing

	Item	Description	Results of Discussion
1	Briefing of main text of the MOU	Briefing of the clauses and responsibilities of the Ministry, the IWUA, and the County Government	The participants basically agreed with the draft MOU, and they would hold a general meeting to discuss the issue.
		Necessity to install the water storage as per the regulation by WRMA with type and storage capacity of the facility.	The participants basically accept the requirement. Meanwhile, necessary assistance by the Project was proposed in terms of technical and financial aspects.
		Signatories in the MOU	The signatories in the MOU were to be discussed with a representative of the Counties.
2	Briefing of the Attachment	Results of detailed design and cost estimate, scope and construction cost of contractor's work and IWUA works, and contribution of the IWUA.	Basic understanding has been obtained
3	Role and Responsibility of IWUA during the construction	Explanation of Construction sub-committees, such as overall and management, material management, labour management, and technical and quality control, with their functions. Establishment of Irrigation block and its leader for the construction works	Basic understanding has been obtained It was agreed that the IWUA would prepare the irrigation blocks and their representative by the signing of the MOU.
4	Social issue related to the IWUA construction works	Outline of social issues to be solved during the construction period and operation periods.	The outstanding issues, including wayleave, WRMA Authorisation for construction, land issue, were understood by the participants for further actions.

	Item	Description	Results of Discussion
5	Way Forward	Identification of the outstanding issue to sign the MOU, such as concurrence of the clause in the MOU, revision of the clauses in the MOU, if any, selection of block leaders and members of the sub-committee, and preparation of basic plan for provision of the storage required by WRMA.	

Source: JICA Team

(2) Signing of the MOU

The MOU were signed as shown in the following table.

Table 6.4.2 Date of the MOU Signing

	Scheme	Date
1	Olopito	28th January 2014
2	Gatitu/Muthaiga	29th January 2014
3	Kasokoni	6th February 2014
4	Tumutumu	14th February 2014
5	Mdachi	29th April 2014
6	Kaben	24th July 2014
7	Tuhire/Challa Harambee	29th April 2015
8	Mangudho	29th April 2015
9	Shulakino	14th May 2015
10	Kiamariga/Raya	07th May 2015
11	Kaumbura	07th May 2015

Source: JICA Team

In prior to the signing the MOU, the PMT made a discussion with the SCIO, and the IWUA committee members so that the contents of the MOU with decision of signatories from the County Government were confirmed, focusing on the role and responsibility of the Project, the IWUA, and the County Government, and the scope of the IWUA works and the contractor's works.

The signing of the MOU was conducted with over 70% participation of each IWUA member. The contents of the MOU were finally confirmed to the participants, and after an agreement in the document, the MOU was signed by the representatives of the Project, the IWUA, the County Government, as well as the JICA Mission.

After the signing of the MOU, the Project again confirmed that the basic plan on provision of WRMA storage would be prepared within 3 months after the signing of the MOU. In Gatitu/Muthaiga scheme, the necessity of fund raising for the application to water abstraction was stressed.

The SCIO and the SCAO in each scheme had important roles for facilitation and coordination among the stakeholders so that the process could be made properly.

6.4.2 Procurement of Construction Tools and Materials for the IWUA Works

The PMT commenced necessary arrangement to select candidate suppliers and request quotations for the construction tools and materials. The suppliers were short-listed through the information obtained from each SCIO, based on the "Pre-qualified List of Suppliers", as the long-list, issued by Sub-County administration for the Fiscal Year 2013/14. The request of the quotation has been distributed to the suppliers through the SCIOs concerned.

As per the signed MOU, the Project procured tools for the IWUA construction works, such as mattocks, fork jembes, two wheel barrows, shovels and so on. The quotations obtained from suppliers were evaluated by the PMT and a purchased order was sent to a supplier with the lowest price quotation. At the time of the delivery of the site, the IWUA members and the SCIO checked the quantities and quality of the tool so that the IWUA members could proceed the construction works smoothly.

Likewise, the quotations for the construction materials were evaluated by the PMT and the lowest evaluated suppliers were called for a negotiation meeting to discuss the contract amount and schedule of the delivery. After the negotiation, a contract agreement was signed between the PMT and the supplier.

After the signing of the contract agreement, the PMT assisted to prepare delivery note and guidance on how to check quality of the delivered construction materials, which was critical matters to ensure quality of the construction works.

Based on the delivery note signed by the IWUA Committee Members and the SCIO, necessary arrangement of the payment to the supplier is being made.

6.4.3 Procurement of Skilled Labour

For the construction works, which were beyond capacities of the IWUA members, the PMT deployed skilled labours, such as masons and pipe fitters.

6.4.4 Technical Guidance for IWUA Works

After setting out of canal/pipeline route on the ground as per the design, the SCIOs instructed the IWUA members the excavation depth for each point along the canals/pipelines.

6.4.5 Monitoring of IWUA Works

After the commencement of the construction works by the IWUA, the PMT has been conducting monitoring and technical guidance of the works.

At the initial stage of the construction works, low participation in the IWUA construction works and subsequent low progress of the excavation works were observed in several schemes. This was because the agreement specified into the MOU, the number of days per week to participate in the construction works, was not shared properly among the IWUA members. Thus, the PMT advised the chairman of the IWUA to hold a general meeting to explain the obligation of the members. Further, the IWUA members were suggested to prepare an action plan on how to expedite the construction works.

In connection with the construction materials, the PMT made technical advice the IWUA members to set up storage facilities so as to keep the material good condition. As per the advice, the IWUA made necessary action to decide location of the storage facilities, taking into consideration access to the working site and security condition, under the guidance of the SCIO. Further, method to check quality of the construction materials was conducted.

After the excavation works, elevation of the pipe invert level was checked so that the excavation works was made properly as per the design. The PMT made technical guidance for methodology to check the elevation.

Whenever, there was conflict among the IWUA members caused by the construction works, the PMT suggested the IWUA committee members and the SCIO and the SCAO to sort it out.

6.4.6 Procurement of Civil Works

The major civil works under the Project were procured by bidding or submission of quotation. At the pre-bid meeting, clarification to the tender document was made and the visit to the construction site was organised.

After opening of the bids, technical and financial evaluations were conducted. The lowest evaluated bidder was selected and approved by the evaluation committee. The evaluated bidder was called for the pre-contract negotiation meeting, and after the meeting contract award was made.

6.4.7 Quality Control Management

In order to maintain the quality of the contractor's construction works, quality control management guidance material, together with "acceptance of site delivery of construction materials", has been prepared, and guidance to the SCIO has been conducted occasionally when the PMT members made site follow up visit. The guidance material mainly consists of

such topics and contents, as Work Stages, Inspection Methods, Reference/ Inspection Items.

Table 6.4.3 Topics and Contents of Quality Control Guidance Material

Work Stages & Topics	Inspection Methods	Reference Specification / Inspection Items
1. Concrete Strength Test 1.1 Trial Mix test 1.2 Mix proportion 1.3 Random cube test 1.4 Inspection	-The Contractor Carried out at specified/ approved laboratory - The Contractor submit test results to SCIO. - SCIO examined & submitted the test results to PMT	Specifications in Tender Docs: "3.10 Trial Mix test" "3.11 Mix proportion" "3.11 Testing of Concrete" "3.12 Failure to Comply with Specified Requirements"
2. Material loaded 2.1 Submission of the Specification documents of materials 2.2 Cement 2.3 Fine Aggregates 2.4 Coarse Aggregates 2.5 Steel Reinforcement 2.6 Pipe	・Inspection: Spec. Documents, KEBS mark ・Document: Guarantee certificate ・Visual: Deformed, flaw, cracked or chipped pipe shall be rejected ・Squeezing: Adhesiveness	"1.27 Material of the Works" "3. Concrete (3.1 to 3.5)" "3.2 Cement" "3.6 Aggregates for Concrete" "3.31 Steel Reinforcement" "5. Pipework" - Acceptance of Site Delivery of Construction Materials
3. Construction Site 3.1 Overall 3.2 Concrete structure 3.2.1 Excavation 3.2.2 Formwork 3.2.3 Steel Reinforcement & cover 3.2.4 Placing concrete 3.2.1 Curing	・Inspection: Confirm - rock w/ specified thickness; or - soil layer w/ specified bearing capacity & thickness ・Measurement: formwork inner dimension. - Application of release oil to inner formwork surface ・Inspection: Cover between concrete surface & steel reinforcement surface: 50mm. Spacer blocks. ・Inspection: as shown below ・Cleaning of the formwork; ・ Placing concrete Stable Position ・ Placing surface=horizontal w/ single layer (40~50 cm); ・Distance between placing surface & delivery casing: less than 1.5m.	"1. General" "3.32 Cover to Reinforcement" 3.33 Formwork", "3.20 Dimension of Concrete Pours and programme of Placing" "3.23 Compaction of concrete", "3.22 Distribution and Spreading of Concrete", "3.21 Transport and Deposition of Concrete" "3.31 Steel Reinforcement" "3.30 Curing and Protection" & "3.24 Protection of Concrete"
3.3 Pipeline 3.3.1 Excavation Stage 3.3.2 Placing pipe 3.3.3 Backfill 3.3.4 Running test for Approval/ Acceptance	・Inspection: trench bottom well compacted with smooth, flat surface (avoid uneven pipe sinking) and not angulated (avoid damages to pipes) ・Measurement: Excavation depth and width after compaction ・Visual: Removal of stones > 25 mm dia. / clay lumps. 75 mm. ・Backfill with proper excavated materials other than stone/ soft materials ・Inspect: Backfilling materials/ soil well compacted ・Running Test (Pressure Test): BS 8010. No leakage allowed	"5.7 Laying Pipes in Trenches and Headings" "5.8 Pipe Laid on Natural Ground" "5.9 Pipe laid on Granular Bedding" "5.18 Pressure Testing of Pipeline"

Source: JICA Team

Together with the above quality control material, forms of "Request of Inspection/ Approval" from the Contractor to the SCIO, "Daily Report for Contractor's Works/ Farmers' Works",

"Joint Inspection of Contractor's Work/ Farmers' Works with photo documents" have been prepared for daily and event/ stage basis quality control material, together with instruction and photo documentation as regular recording of evidences.

6.4.8 Safety Control Management

In parallel with the quality control management, "safety control management guidance material, including environmental protection" has also been prepared to comply with the regulations, such as, the Circular Ref: KA/17/A/2(4) from Factories Inspectorate, Ministry of Labour, notices No. 79 gazette in the Kenya Gazette No. 56 (Legislative Supplement No. 38) in respect of the appointment of Safety Supervisors on Building and Works of Project Management of Construction.

- The Occupational Safety and Health Act (OSHA) of 2007.
- The Contractor shall at all times comply with any accident prevention regulations and any safety regulations peculiar to the various trades employed on the Works, and any safety regulations published by the Government

The guidance materials mainly consist of the following topics and contents as tabulated below, attached with a "checklist":

Table 6.4.4 Topics and Contents of Safety Control Guidance Material

Obligation of the Contractor	Remarks
・Appointment of Safety Officer <Safety Management Aspect> ・Precautions against risks of the labour accident and the accident of general public accident. ・Promptly reporting the accidents ・Safety education and safety instructions to the employee ・Submission of certificate of training of OSHA ・Installation of the fuel storage tank in accordance with the laws and security regulations ・Employment competent watchmen ・Fence, Lighting <Environment Management Aspect> ・Soil conservation measures ・Dust abatement measures ・Noise control measures ・Sanitation ・First Aid and Medical Services ・HIV/AIDS Awareness ・Pollution ・Restoration of Drains, Streams, Canals etc. ・Site clearance	- Safety Management ・In the case that there are any accidents/incidents take place, regardless scale of the accidents/ incidents, the Contractor should report them immediately to the SCIO so that he can inform it to the Project Manager/JICA immediately - Labour accident ・Fall, Vehicle-related, Slope failure - Guidance method: SCIO ・ Checks the Safety management plan submitted by the Contractor before construction starts, and advice as necessary ・ Advices as necessary at the regular inspection of the Site ・ Holds "Regular joint meeting" among the Contractor and SCIO, safety management is reviewed based on "Checklist "and provides effective instructions

Source : JICA Team

6.4.9 Achievement of Construction Works

The achievement of the construction of the irrigation facilities is summarised below.

Table 6.4.5 Achievement of Construction Works (as of April 2016)

Scheme	Facilities	Canals/Pipelines	Length			Remaining work Detail
			Full Scope	JICA Fund	Remaining	
	Nos		M	m	m	
Batch-1						
Kasokoni	1	Main Canal	1,886	1,886	0	(1) Excavation of drainage canal
	(Intake Works)					(2) Rock excavation of drainage canal
Mdachi	1	Main Canal	458	458	0	(1) Construction of secondary canal
	(Intake Works)	Secondary canal	1,231	0	1,231	(2) In-field system
		Tertiary canal	2,556	0	2,556	
Olopito	1	Main line	3,646	3,511	135	(1) Rock excavation downstream of main pipeline
	(Intake Works)	Sub main line	2,941	311	2,630	(2) Sub-main Downstream
		Distribution line	564	0	564	(3) In-field
		Feeder line	6,431	673	5,758	
Gatitu Muthaiga		Main line	9,105	5,996	3,109	(1) Material and labour cost for construction of chambers and crossing (downstream):
						(2) Feeder pipelines downstream
		Feeder line	8,736	3,930	4,806	(3) In-field system downstream
Kaben	7	Critical Sections				
	(Critical Sections)					
Murachaki	1	Intake Works				
	(Intake Works)					
Tumutumu	1	Conveyance line	1,271	1,271	0	(1) Main and Sub-main: Material and labour cost for construction of chambers and crossing (downstream)
	(Intake Works)	Main line	11,547	9,153	2,394	(2) Construction of Main and Sub-main pipelines downstream
		Sub main line	11,412	4,457	6,955	(3) Distribution and In-field system downstream
		Distribution line	54,983	15,294	39,689	
Muungano	1	Intake Works				
	(Intake Works)					
Batch-2						
Tuhire Challa		Secondary Line	2,750	1,375	1,375	(1) Lining works for secondary canals
						(2) Construction of road crossing
Mangudho	2	Rising Main Line	738	738	0	
	(Pump House, Reservoir)					
Shulakino	1 (SB)	Main Pipe Line	1,745	1,729	16	
		Distribution	475	0	475	
Kiamariga Raya		Kiamariga Main	2,440	2,440	0	(1) Construction of Distribution Pipelines in Kiamariga
		Kiamariga Distribution	1,901	0	1,901	(2) Rehabilitation of intake weir
		Raya Main	1,460	0	1,460	(3) Rehabilitation of Raya pipeline system
		Raya Distribution	1,660	0	1,660	
Kaumbura		Main Line	2,360	1,000	1,360	(1) Lining works on the main canal

Source : JICA Team

6.4.10 Progress of WRMA Authorisation

The progress of the WRMA authorisation for each scheme is summarised below.

Table 6.4.6 Status of each Irrigation Schemes Authorisation and Abstraction Permit

Scheme	WRMA Authorisation	WRMA Abstraction
Olopito	Obtained	Not applied
Gatitu Muthaiga	Reapplied	Not applied
Kaben	Obtained	Not applied
Mdachi	Obtained	Not applied
Tumutumu	Obtained	Not applied
Murachaki	Obtained	Not applied
Muungano	Obtained	Not applied
Kasokoni	Obtained for less of water	Not applied
Challa-Tuhire	Obtained	Obtained
Mangudho	Not obtained	Not applied
Kiamariga-Raya	Not applied	Not applied
Kaumbura	Not obtained	Not applied
Shulakino	Not obtained	Not applied

Source: JICA Team

The application for the WRMA abstraction permit has not been done yet because the IWUA members have not raised the application fees yet which range from Ksh 25,000 to Ksh 50,000 per scheme.

Further, Kasokoni scheme were allocated 125m3/day while the scheme requirement is 3,888m3/day. Thus, they are required to upgrade the application from class C to class D.

6.5 Impacts of Activities

6.5.1 Impact of the Construction Works

(1) Compliance to Legal and Statutory Obligations

The project implementation has strictly followed all legal and statutory obligations as a precondition for construction activities. i.e. Hydrological Report, Water Permits, EIA and NEMA licenses.

(2)Process of Participatory Approach

Before the construction works commenced, at the signing of the MOU, the IWUAs have been sensitised reasonably well in respect of what was expected for them towards the implementation of the project activities.

Even during the construction period, several discussions with the IWUA members have been carried out to solve the following issues.

- Land acquisition for the flood dykes (Muungano)
- Necessity of flood protection dyke (Kasokoni)

- Deviation of route of pipelines (Gatitu/Muthaiga, Mangudho)

During the process of discussion and agreement, management capacities of the IWUA have been strengthened. Further, the PSCC meetings were well functioned as a coordinating body for the project implementation.

The IWUA members in Tumutumu scheme appreciated dedicated technical guidance and follow-up by the SCIO and the SCAO with the PMT members so that they can conduct the construction works smoothly. They added that the continuous supports should lead to build confidence between the Project and the beneficiaries.

(3)Progress of IWUA Works

Among the Batch 1 pilot project sites, Olopito scheme had critical challenges in farmers' participation as they experienced difficulties to meet their obligations as agreed in the signed MOU (see section 6.5.2)..

(4)Increase of the Construction Costs under the Batch 1 Sites

During the project implementation, several challenges were realised in the construction works under each Batch 1 pilot project site, which were unforeseeable during the survey and design period. Thus, the revision of the design obliged the Project to make series of variation orders, resulting in increase of the construction cost. Moreover, it was observed that agreed contract agreements for the material procurement exceeded the project budgets due to difficulty to avail the construction materials as well as price escalation.

(5)Process of Variation

Although, at the initial stage of the construction works, some SCIOs were not accustomed to process of variation order, they have obtained knowledge and know-how of the process of the order, with estimation of work quantities and costs and submission of necessary document to the PMT for approval.

(6)Inspection

The SCIOs could conduct inspection for not only quantity and quality of completed structures but also process of the construction works, such as check of form works before concreting works, arrangement of reinforcement bar, and quality of concrete, and so on.

(7)Schedule Management

Under the canal/pipeline construction works, proper schedule management was required taking into consideration procurement of the construction materials and the skilled labours, such as masons and pipe fitters. The SCIOs, who were guided by the PMT during the

construction works during Batch 1, could proceed appropriate management under the construction works in the Batch 2 pilot project sites. It can be said that capacities of the SCIOs were enhanced through the proper construction management.

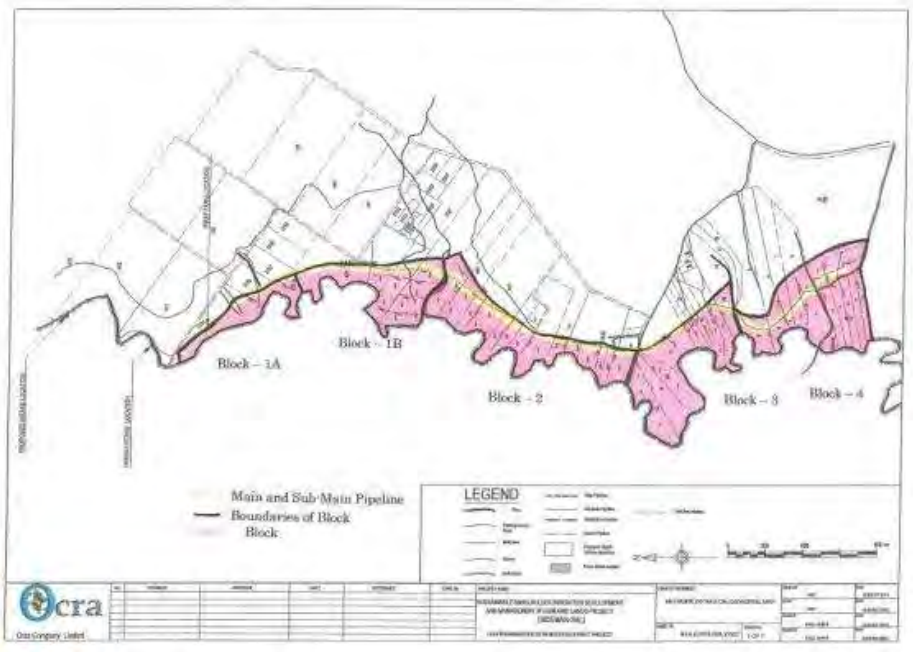
(8)Setting out and survey works

The SCIOs understood importance of maintenance of survey records, especially bench marks, through setting out of canal/pipeline routes and verification after excavation works by the IWUA members.

6.5.2 Intervention by the Project (Community Mobilisation Activity) to Improve the Progress of IWUA Works in Olopito Scheme

(1) Background

This section describes an intervention by the Project called "Olopito community mobilisation activity" implemented from 24th to 28th November 2014 so as to identify backgrounds of low progress of the IWUA construction works and to decide actions to improve the progress of the works.



Source: JICA Team

Figure 6.5.1 Layout of Olopito Scheme

As per the signed MOU, the IWUA members were tasked to conduct excavation works for the 5.7 km long main pipeline. However due to the following reasons, the work progress was far from the expected schedule.

1. Food Shortage because of Drought

Drought had occurred in 2014 and some IWUA members could not have cultivated crops. So, some members have gone out to seek works and had difficulty to participate in the excavation works.

2. Inadequate Workers in Olopito Scheme

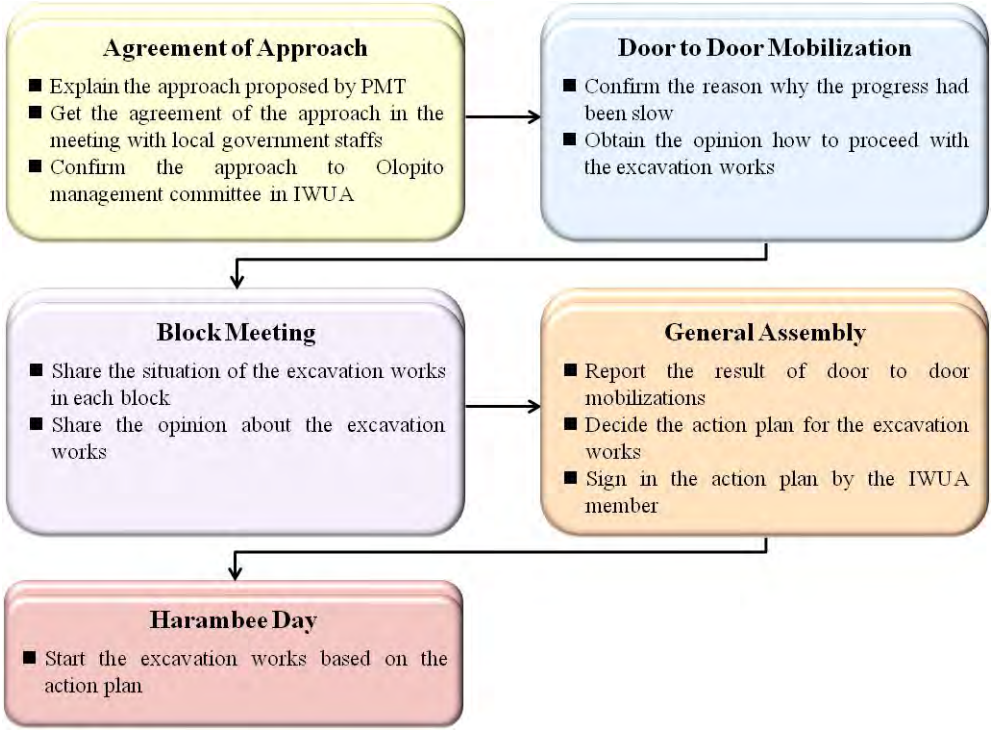
As the number of IWUA members had been more women than men and some members had been not interested in agriculture because of pastoralists, enough manpower for the excavation works has not been ensured.

3. Misunderstanding on the SIDEMAN-SAL Project

A sign board about construction of water distribution system financed by JICA was erected near the scheme. Thus, some of the IWUA members have misunderstood that the objective of the Project was to construct water distribution system with the project contribution and did not attend the meeting.

(2)Flow of Olopito Community Mobilisation

To overcome the challenges, the Project commenced to re-mobilise the IWUA members in the following procedure.



Source: JICA Team

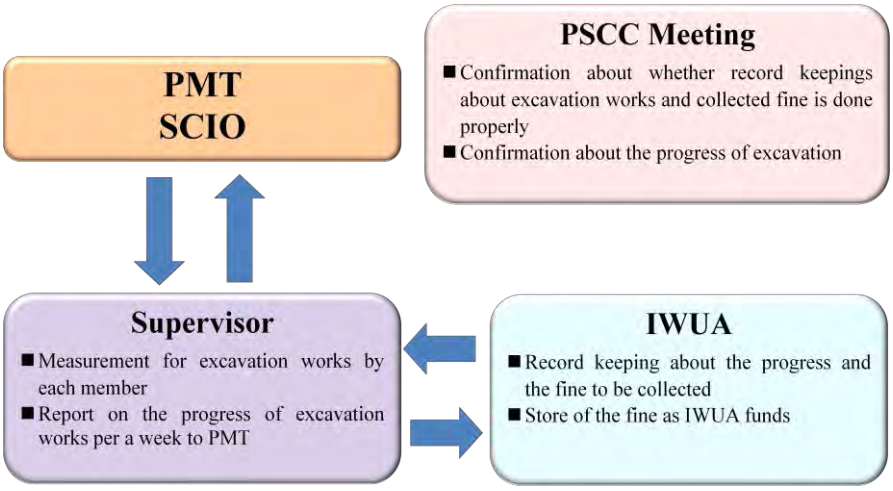
Figure 6.5.2 Flow of Community Mobilisation

(3)Action Plan prepared by IWUA

After several discussions with the IWUA members, an Action Plan was prepared and agreed at the IWUA general assembly, indicating,

- Each IWUA member has to excavate 74 m. If members who cannot participate in excavation works, they have to ask the Block Leaders to hire workers.
- Each IWUA member has to excavate 12 m per a week under the monitoring by the Block Leaders
- If IWUA member fail to excavate the required works, fine with a sum of Ksh 1,000 should be imposed, among which Ksh. 700 Ksh was to be used for employment of persons who excavated, and Ksh. 300 for savings as the IWUA fund.

The implementation of the action plan has been monitored by the field staff as well as the PSCC members as shown below.

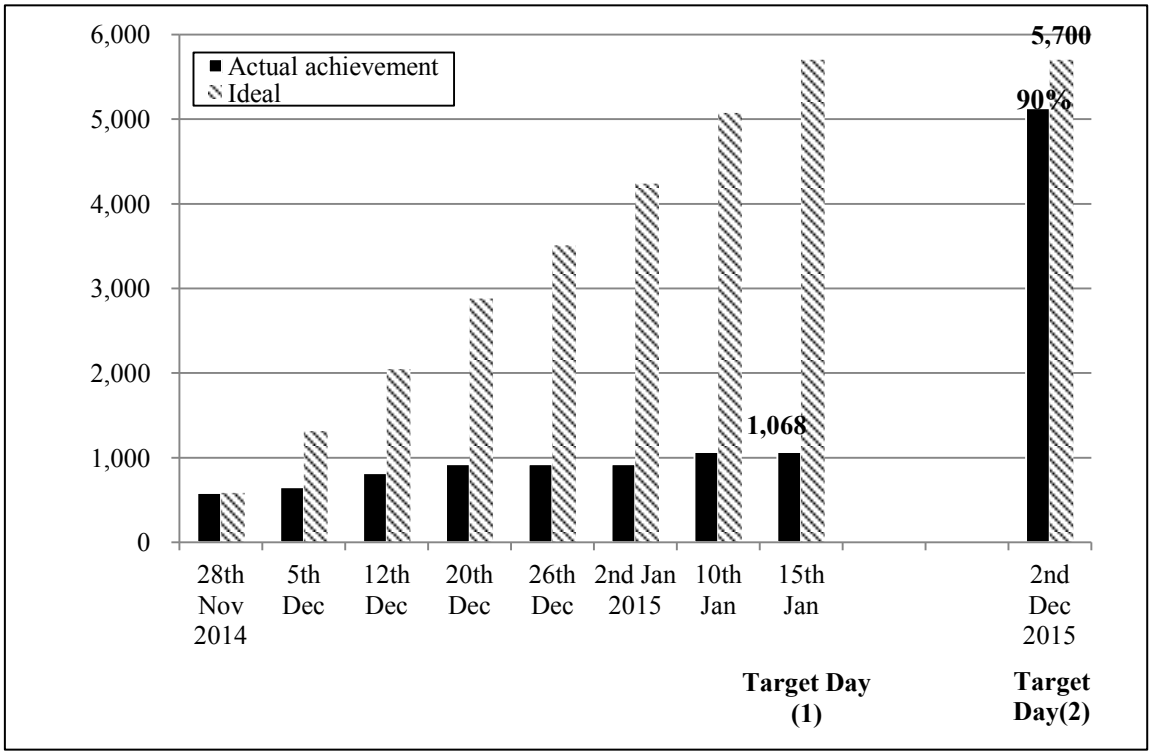


Source: JICA Team

Figure 6.5.3 Monitoring Flow of Community Mobilisation

(4)Work Progress after Re-mobilisation

After the re-mobilisation activities initiated by the Project, the progress was gradually improved and finally the progress as of end of December 2015 reached 90% as shown below.



Source: JICA Team

Figure 6.5.4 Progress of IWUA Works

(5) Impact of re-mobilisation

Before re-mobilisation

The farmers have been meeting all of them together and excavation without dividing the area among farmers, others never used to attend the communal work while others attended but really did nothing and were exploiting others.

After re-mobilisation

The farmers were able to do the followings:

1. Sub-divide the conveyance to be excavated among the members and to be costed it. Therefore every member was expected to excavate or contribute Ksh. 700 per pipe excavated
2. Stiff penalties were set for those who do not excavate of contribute money for excavation and the chief was in place to assist in the penalties enforcement
3. The farmers also resolved to start excavating from Block 1 and continue excavating and that is the reason they have been able to have good progress
4. The few farmers who were committed to excavation decided to continue excavating irrespective of those inactive members for the sake of completion of the Project and

based on mobilisation

5. Mobilisation made farmers' feel and own the Project. It helped them to visit the intake and to see the project is real and therefore they were motivated
6. Mindsets of the IWUA members was changing from "group to individual" to "individual to group"

6.6 Challenges and Lessons Learnt

Challenges and lessons leant through the construction of the irrigation facilities are summarised below.

6.6.1 Construction Supervision

(1) Legal Requirement for Authorisation

Delay of NEMA approval and WRMA Authorisation for construction resulted in delay of commencement of the construction works for the intake weirs. It took more than 45 days, which was officially needed for the NEMA approval. Thus, practical scheduling is required for the planning and scheduling of the implementation of irrigation development.

Further, there were cases that the documents were not accepted by the authorities due to lack of proper information. Thus, the officers, such as the SCIO and the SCAO, are recommended to be trained so that they are able to support the IWUAs to prepare the documents for the approval/authorisation.

(2)Progress of Construction Works

Responsibility of IWUA for Participatory Works

In some schemes, from the signing of the MOU, it took times to commence the IWUA works. One of reasons for the delay was that the responsibilities of the farmers' works were not shared properly among the farmers despite their agreements in the signed MOU.

In order to commence the IWUA works, early facilitation and coordination by the SCIOs and the SCAOs guided by the PMT should have been needed, and action plans to implement the works should be prepared after the signing of the MOU for raising farmers' awareness for the construction works.

In future project implementation under farmers' participation, it is recommend that the County officials are expected to guide the IWUA to prepare the action plan for the construction works, and to support the IWUA committee members to conduct house to house visit so that the IWUA members can mobilise themselves for commencement of the construction works early.

Promotion of Participation in the IWUA construction Works

In some schemes, participation of farmers in the construction works was low because they were obliged to work out of village due to serious draught damage, and subsequently the situation has led to delay of the progress of the works.

As observed in Olopito scheme, the contribution to the Project specified in the MOU was likely to be burdened heavily to the IWUA members, who had little experience for agriculture and irrigation practices. The facts suggested that the contribution portion for the farmers' participatory works should be reviewed and decided taking into consideration their experiences to agriculture and local culture in the area.

It is recommended, therefore, that the farmers' contribution rate to the Project would be reviewed and the results would be incorporated into the SHIID Guideline so as to carry out irrigation development smoothly with participatory approach. Furthermore, it is worth while introducing "Food for Works" for applying the approach to poverty area.

Wayleave

As for the Wayleave, the following issues were observed in the schemes during the construction works.

Muungano: Dispute with land owner, having their lands at the intake weir site and along the flood protection dyke.

Gatitu/Muthaiga: Route diversion due to opposition by land owners, whose lands the pipeline passes.

Mangudho: Route diversion due to opposition by land owners, whose lands the pipeline passes.

Mdachi : Discussion and agreement with land owners, having their lands at soil borrowed area for construction works of the flood protection dyke.

While solution of the above at the PSCC Meetings led by the SCIOs and the SCAOs contributed to enhance management capacities of the IWUAs in terms of conflict management, it was also facts that the issues interrupted the construction activities, resulting in delay of the works.

Generally, the issues of Wayleave should be discussed and solved among the IWUA members. However, intervention by the officers would be effective for solving the issue early, discussing the issues at the PSCC meeting.

Special attention and consideration are required to settle the Wayleave issues with

non-member of IWUAs, having their lands out of command area, where conveyance pipeline/canal passes through. Other issues were how to communicate with land owners, who agreed with the Wayleave at the MOU signing but started to oppose to the construction works after commencement of the construction works. They got realised that their land were affected by the Project activities just after commencement of the construction works.

Thus, the following actions are recommended to mitigate risks for the Wayleave.

- The SCIOs and the SCAOs are expected to lead the matters before commencement of the construction works at the PSCC Meetings
- At leadership training for IWUA strengthening programme, the issues are to be raised to the IWUA committee members to share importance to attend the issues early for smooth implementation of the construction activities.
- Sensitisation programme for non-members of the IWUAs is required so as to obtain their Wayleave agreement early.
- To eliminate dispute and arguments, farmers, having their land at the proposed pipelines/canal route, are expected to attend setting out of the route.

Decision Making on Design Variation

Under Kaben and Tumutumu schemes, lengthy discussion and subsequent delay of decision making for design variation affected the progress of the construction works. This is because the there was insufficient understanding on process of issuance of variation order between the PMT members and the SCIO. Thus, necessary information on the issuance of variation order as well as procedure for approving the order should be shared among the stakeholders, conducting necessary follow-up training programme for them.

Coordination between Contractors' Works and IWUA Work

As the construction works have been conducted simultaneously by the IWUA members, the skilled labours, and the private contractors, complexity of work procedure caused insufficiency of the works and consequent delay of progress of the works as described below.

- In Gatitu/Muthaiga scheme, construction works of chambers at the Main Pipelines were divided into 3 groups, namely, 1) the IWUA members for earth excavation works, 2) construction of foundation and block works by mason, and 3) connection of pipes by a pipe fitter. Due to delay of the excavation works by the IWUA members, the mason and the pipe fitter are idled.
- The main pipeline under Olopito scheme has been constructed by IWUA members, a

pipe filter, and the Contractor, who were engaged in pipe trench excavation works, pipe laying and fitting works, and construction of chambers at the pipeline, respectively. The complex work division at the construction site affected the work progress, due to low progress excavation works by the IWUA members.

- Although the IWUA members under Tumutumu scheme recorded remarkable progress and achievement for the excavation works for the pipelines, they are de-motivated by delay of delivery of pipes.

The above-mentioned challenges were caused by complex work division among the working groups that should result in delay of the construction works. Thus, material procurement plan for the IWUA works should have been taken carefully to optimise the work schedule. In order to optimise the IWUA work procedure and progress, scope of each worker should be re-arranged, accordingly.

For smooth implementation of the farmers' participatory works in future, taking into consideration capacities and experiences of farmers, scope of the works for IWUA, skilled labours, and private contractor should be planned and decided carefully. It is further recommended that the follow-up training on progress monitoring and procurement plan is conducted to the SCIOs and the SCAOs.

6.6.2 Construction Cost

Accuracy of Construction Cost at Project Formation Stage

As mentioned in the following table, under the Batch 1 pilot project sites, the project construction cost has exceeded original estimates due to larger project scope compared with preliminary study during the project appraisal period.

Table 6.6.1 Comparison of Length of Pipes/Canal for the Schemes

Unit : km

Scheme	Appraisal Period	Detailed Design in 2013	Remarks
Kasokoni	1.5	7.3	Open Channel
Mdachi	3.0	4.0	Open Channel
Olopito	4.0	14.0	Pipelines
Gatitu/Muthaiga	4.7	16.0	Pipelines
Kaben	11.0	25.0	Open Channel
Murachaki	13.0	55.0	Pipelines
Tumutumu	24.0	50.0	Pipelines
Muungano	19.0	24.0	Pipelines
Total	80.2	195.3	

Source: JICA Team

The change of the scope resulted in increase of the construction cost as summarised below.

Table 6.6.2 Comparison of the Construction Cost

Unit Ksh Million

Scheme	Appraisal Period	Detailed Design in 2013	Items for Construction/ Rehabilitation Works
Kasokoni	8.0	23.1	Intake Weir, Main Canal
Mdachi	7.0	16.7	Intake Weir, Main/Sec Canals, In-field
Olopito	13.0	33.9	Intake Weir, Pipeline, In-field
Gatitu/Muthaiga	27.3	19.7	Pipeline, In-field
Kaben	37.9	99.6	Intake Weir, Conveyance/Main/Sec Canals
Murachaki	70.7	99.5	Intake Weir, Main/Sec Pipeline, In-field
Tumutumu	46.3	71.1	Intake Weir, Main/Sec Pipeline, In-field
Muungano	55.6	68.4	Intake Weir, Main/Sec Pipeline, In-field
Total	265.8	432.0	

Source: JICA Team

The increase of the construction cost has resulted in funds shortage, and at the PSC Meeting it was decided to change the scope of works in the Batch 1 pilot project sites: 5 schemes with full scope from the selected 8, and the remaining 3 with partially development; only the intake works and an IWUA office under Murachaki and Muungano schemes and rehabilitation of the conveyance canal for Kaben scheme.

The above-mentioned fact suggested that, from project formation/appraisal stage, the construction cost for each irrigation scheme should have been estimated correctly by the County officials, supported by MWI.

It is, therefore, recommended that the results of the feasibility study and the detailed design conducted under the Project are fully utilised for future planning and design to ensure accuracy of the construction cost.

Detailed Survey during Design Stage

During the project implementation period, several challenges were realised in the construction works under each Batch 1 pilot project sites, which were not predicted during the survey and design period. Thus, the revision of the design obliged the Project to make a series of variation orders, resulting in increase of the construction cost. Moreover, it was observed that agreed contract agreements for the material procurement have exceeded the project budgets due to difficulty to avail the construction materials/ price variations. The following table details the extra works per each scheme.

Table 6.6.3 Major Factors for Construction Cost Increase

Scheme	Major factors for construction cost increase
Kasokoni	- Design revision of wing wall of the intake weir after the flood damage - Additional Handrail at the intake weir - Addition of stop logs for scoring gate of the intake weir - Additional works for the rock excavation works conducted by the contractor
Mdachi	- Supplementary drilling works to identify the foundation condition at the intake weir - Design revision of the intake weir, such as provision of the wooden piles and wing walls for the stability of the structure - Design revision of the flood protection dyke including additional cost for arrangement of borrowed filling materials - Bund rising of the flood protection dyke, which is being discussed under the PMT as an additional works.
Olopito	- The contract amount for the Contractor exceeded the engineering estimate - Increase of concrete volumes at the intake weir after identification of foundation condition at the site, consisting of wing walls, weir body and apron - Extension of the wing walls against possible flood - Increase of rock excavation along the conveyance pipeline as well as the main pipeline - Provision of additional structures on the pipelines, such as an additional gully crossing
Gatitu/Muthaiga	- Increase of quantity for rock excavation along the main pipelines
Tumutumu	- Increase of procurement and fitting cost of steel pipes, after the lengthy discussion between the PMT and the contractors, despite seeking several alternatives to save the cost. - Increase of quantities for rock excavation works along the conveyance and the main/sub-main pipelines - High cost for the procurement of the construction materials, which were more expensive than those under the engineering estimate, due to difficulty to avail the materials, such as gravels and sands with further distance than expected.
Kaben	- Design revision for each structure to suit the site condition, especially under the Crossing No.5, stream crossing structure. - Design revision for the crossing No.4 - Price variation of the steel pipes for the additional structures, the Crossing No. 6.
Murachaki	- Additional works, such as provision of gabion, hand rail and so on - Price variation for the valves after the lengthy discussion with the Contractor
Muungano	- Provision of extra wing walls against the floods

Source: JICA Team

To minimise the above-mentioned cost variation in future, the following measurements are required.

- During detail design period, marketing survey for construction materials should be conducted taking into consideration local condition of each irrigation scheme,
- Construction items, that are beyond capacity of the IWUA, i.e. rock excavation works, are to be estimated properly, and
- Contingency of construction cost is to be properly included taking into consideration unforeseeable condition.

Furthermore, in order to conduct the study and the design considering the above, it is recommended that a follow-up training for SCIO and the SCAO be conducted by the National Government to strengthen their capacities for the works, and review of the design outputs.

CHAPTER 7 IWUA Capacity Development Component

7.1 Project Activities

7.1.1 General

To improve resilience against drought and food insecurity, main issues to strengthen IWUAs' capacities were identified as follows:

1) To obtain necessary knowledge and skill on how to manage the irrigation facilities
2) To strengthen capacities for management of IWUA.

For management of irrigation schemes, organisational strengthening of the IWUA is a key issue for proper operation and maintenance including water management. Therefore, the Project put high priority to strengthen IWUA, to deliver proper knowledge and skill for handling the irrigation facilities with training and practice on site so that the IWUA can obtain self-sustaining management ability.

7.1.2 Selection of Training Programme

To achieve the target, the contents of the training programme were basically selected from previous project, namely, the SIDEMAN Project, because it was well assessed and fits for Kenya's smallholder farmers. However, under SIDEMAN Project, the following challenges were revealed during conducting the training programmes:

1. SCIOs involving the training programmes felt 1) the number of training programmes was too many, 2) taking too much time, and 3) some contents of training programme were overlapped.
2. 5-days training fatigue by farmers due to the long duration.
3. As the trainings programme were held without break-time, the attendance of the farmers was diminishing as days went by.

Thus, taking into consideration the above and time constraint under the Project, the major activities of the capacity development for IWUA were reorganised into five (5) Units with induction training, being classified into three aspects, namely, 1) strengthening of IWUA organisation, 2) Water management, and 3) Operation and Maintenance.

Especially, the Project fully reviewed and developed training programmes for "On Farm Water Management and Practical Irrigated Agriculture (Unit 4)" and "Irrigation System Management (Unit 5)".

Table 7.1.1 Comparison between SIDEMAN and SIDEMAN-SAL Training Programme

SIDEMAN		**SIDEMAN-SAL**
1. Community Mobilisation (Scheme orientation).	8. Development of leadership skills	Unit 1 Community Mobilisation & IWUA Formation (Partial reviewed and developed)
2. IWUA formation and Management.	9. On farm water management	Unit 2 Leadership and Conflict Management (Partial reviewed and developed)
3. Basic leadership	10. Irrigation agronomy	Unit 3 Financial Management & Record Keeping (Partial reviewed and developed)
4. Scheme operation and maintenance.	11. Marketing of Irrigated produce	Unit 4 On Farm Water Management and Practical Irrigated Agriculture (fully reviewed and developed)
5. Financial Management	12.Access and utilisation of credit	Unit 5 : Irrigation System Management (fully reviewed and developed)
6. IWUA monitoring and reporting.	13. Environmental issues.	
7. Cross cutting issues such as gender and HIV-AIDs.		

Source : JICA Team

Table 7.1.2 Identified Training Activities for SIDEMAN-SAL

Activity		**Objective**	**Training Programme**
Preparation	Induction Farmers Training (5days)	Induct farmers to the SIDEMAN-SAL project and train them on the basic skills required for irrigation	1. Briefing on the Project; 2. Basic knowledge on irrigation & irrigation technologies; irrigation system management; 3. Market-oriented farming; 4. Environmental management
	IDD staffs induction workshop	1. Discuss the roles of IDD staff in SIDEMAN-SAL project implementation; 2. Prepare a financial budget; 3. Cost sharing agreement with the farmers; project management including construction supervision; 4. Agreement of IWUA Capacity building programme	1. Roles of IDD staff in SIDEMAN-SAL, Budget planning, Management(supervision); Proposed detailed training programmed; 2. Cost sharing agreement during construction and capacity building; 3. Capacity building programme
Organisational Strengthening	Unit 1 Community Mobilisation & IWUA Formation (3 days)	Farmers re able to 1. Make Action plan 2. Understand IWUA organisation	1. Scheme Design (Concept of irrigation, scheme's layout and infrastructure expense for O&M, Stages of a project) 2. Implementation Activities during scheme development and the roles of each stakeholder 3. Ownership and Farmers' Participation in construction works 4. Group dynamics (Group Definition Formation, and Progress Stage) 5. Legal requirement for irrigation water use 6. Training for making action plan
	Unit 2 Leadership and Conflict Management (2 days)	Farmers are able to explain ideal IWUA, good leader, team work, and ability for how to resolve the conflict.	1. IWUA organisational structure (objectives, roles and functions 2. Leadership (Qualities, Styles, Facilitation) 3. Conflict and its Resolution
	Unit 3 Financial Management & Record Keeping (2 days)	Farmers are able to be equipped to understand the importance of book keeping, the different financial records, budgeting as well as the auditing process	1. IWUA income and Expenditure 2. Financial Management (Records, Report, Audit)

Activity		**Objective**	**Training Programme**
Strengthening of capacity for water management	Unit 4 On Farm Water Management and Practical Irrigated Agriculture (3 days+1day field practice)	Farmers are able to 1. Describe systems of water conveyance, distribution and application and prepare water application schedules for given crops. 2. Understand basic irrigated agriculture	1. Plant, Soil and Water relationships 2. Crop water requirements 3. Formulation of Cropping Calendar and Pattern 4. Irrigation systems and water application technologies 5. Crop management under irrigation 6. Irrigation agronomy 7. Post -harvest Handling and processing 8. Field practical's in the scheme
Strengthening of capacity for Operation and Maintenance (O&M)	Unit 5 : Irrigation System Management (3 days+1day field visit)	Farmers are able to prepare an operations and maintenance plan for their irrigation system	1. Organisational Set-up 2. Irrigation System Operation and Maintenance 3. O&M Costs Management 4. Gender and Cross Cutting Issues 5. Action Plan 6. Field Visit to the neighbourhood successful irrigation scheme
Complemented training for SCIOs and SCAOs	TOT for the SCIOs and SCAOs (5days) *Executed before Unit2 training*	The SCIOs and the SCAOs are able to acquire training knowledge to cover Unit2 to 5 independently.	1. IWUA capacity building framework 2. Training Cycle 3. Adult Learning Theories & Principles 4. Training Programme Preparation 5. Training Delivery 6. Training Evaluation 7. Training Reporting & Follow-up 8. Training Budgeting & Logistics
	TOT for the SCIOs and SCAOs(Workshop) (2days) *Executed before Unit5 training*	The SCIOs and the SCAOs are able to acquire implementation ability for Unit5 training	1. Discussions of the contents of the unit 5. 2. Development of the training content as a manual.

Source : JICA Team

7.1.3 Outline of Training Approach and Performance Evaluation

(1) Training Approach

In each training unit, basic training approach is adopted as shown in Figure 7.1.1.

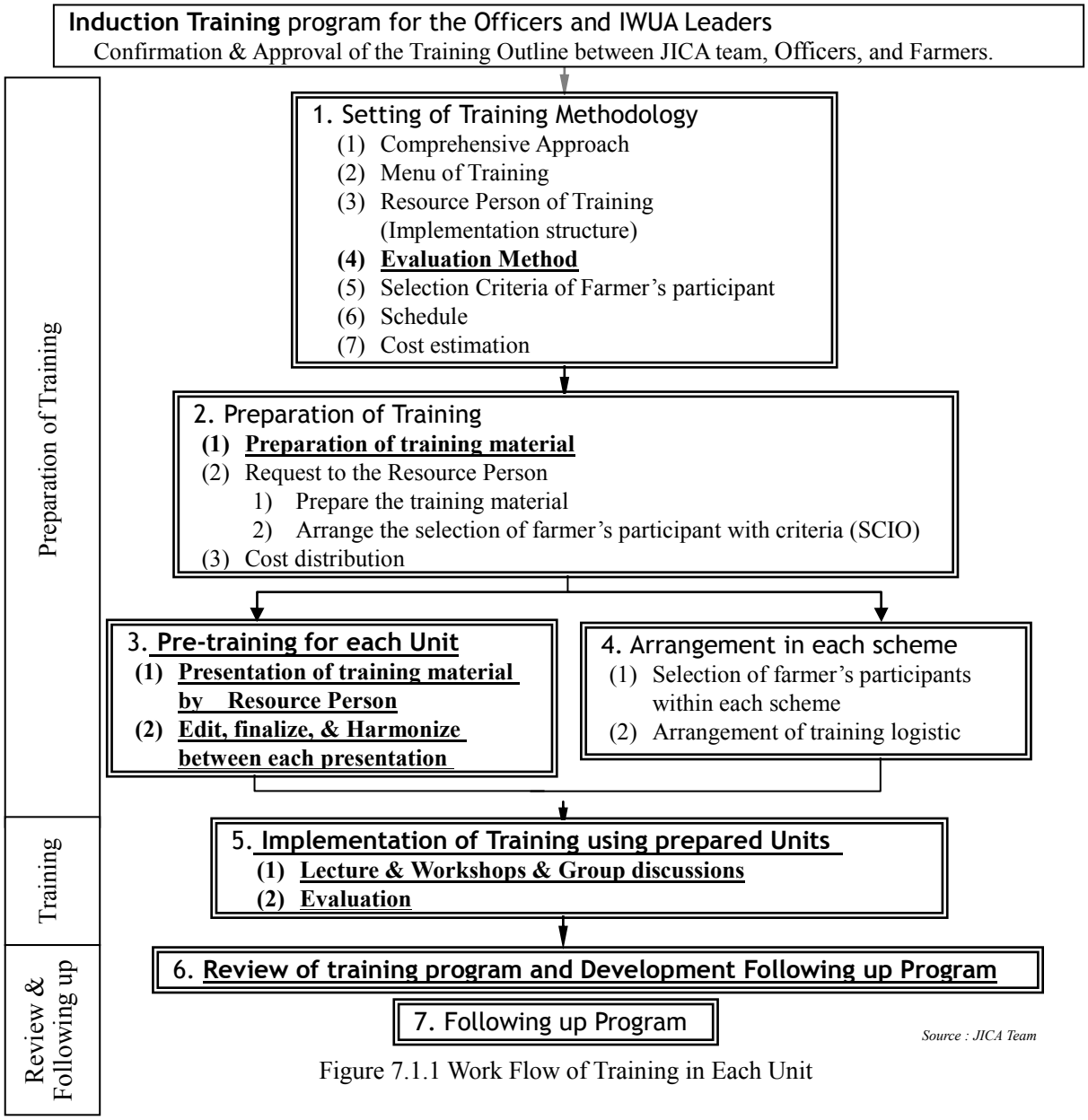


Figure 7.1.1 Work Flow of Training in Each Unit

The underlined items are newly introduced activities in the Project, which are indicated in the following table.

Table 7.1.3 Points of Improvement for IWUA Capacity Building under the Project

Activity in the flow chart	Improvement	Reason
1. Setting of Training Methodology (4) Evaluation Method	Implement the Knowledge Evaluation test of each lecture in each training unit.	Focus on the points which were good or needed to follow-up in each lecture (Challenge of SIDEMAN)
2. Preparation of Training (4) Preparation of training material	After re-verification of basic policy and direction of the training, the project organisation the objects, lectures to achieve it. Then, proposal of specific implementation method of lectures was considered. The procedure was repeated several times, and developed to training manual. (Units 4 and 5) Through the above-mentioned process, the counterparts raised their awareness that "We have created new training material in their own hands", and it also enhanced ownership to the training materials.	There was a need to develop new training materials. Because some training materials did not include necessary training and described only at a superficial level during SIDEMAN.
3. Pre-training for each Unit	The Project allows the SCIOs and the SCAOs to run the training programme by themselves with TOT. (How to implement the training programme, to prepare training materials, and to arrange budget.)	In order to ensure the implementation of the training programme by the officials after the end of the Project.
5. Implementation of Training using prepared Units	Incorporate field work and lecture into the training programme (Units 4 and 5) and set training period within three days.	In order to 1. Improve participation rate in the training programmes. 2. Improve to concentrate on the training programmes.
6. Review of training programme and Development Following up Programme	Analysis of the Knowledge Evaluation test and implementation of the follow-up training programme.	Support the weakness and follow up it.

Source : JICA Team

(2) Performance Evaluation

As indicated in Table 7.1.4, under the Project, three (3) methods were adopted to evaluate the IWUA training programme, among which Pre- and Post-Knowledge Evaluation (test) was fully developed under the Project.

Table 7.1.4 Performance Evaluation for Capacity Building Programme

Tool	Purpose
Course evaluation	➢ Understand how participants react to the training programme. If participants do not react favourably, they probably may not be motivated to learn.
Pre and Post Knowledge Evaluation (test)	➢ Determine the impact of the training(Knowledge gained) ➢ Determine areas of weakness in understanding for further intervention (Fully developed under the Project)
Pre and Post IWUA functionality survey	➢ Mark baseline information on the functionality status of the schemes ➢ Determine the level of performance of the schemes and predict the future prospects of the scheme (sustainability).

Source : JICA Team

While the Knowledge Evaluation and the Course Evaluation were implemented before /after each training programme, the Functionality Survey for IWUA was carried out twice; before commencement of the 1st training programme, and after completion of the last training programme.

1)Course evaluation

The Course Evaluation was conducted with a form of an evaluation questionnaire. A simple rating scale was used (good, fair, and bad). And the questionnaire also has space to write free message on what they felt through the training programme. Each question also gave the participants an opportunity to state ways to improve the various areas in question

Some of the questions that were asked include:

- Contents: Was the content appropriate?
- Materials: Were the materials useful?
- Teaching method: Was the teaching method appropriate?
- Trainer/Facilitator: Was the trainer/facilitator effective
- Motivation to learn: Were you motivated to learn the contents?
- Programme relevance: Was the programme relevant to your needs?
- Level of understanding: Did you understand the contents?
- Time: Was the time and length of programme appropriate?

2)Pre and Post Knowledge Evaluation

The Knowledge Evaluation tests have been developed during the Pre-training meetings, and every facilitator contributed to prepare questions from the subject area they were trained on. The tests were composed of total 20- 25 questions and administered in each of the trainings. The test style is multiple choice questions for ease of administration and analysis. The contents of questionnaires in each training unit are summarised below.

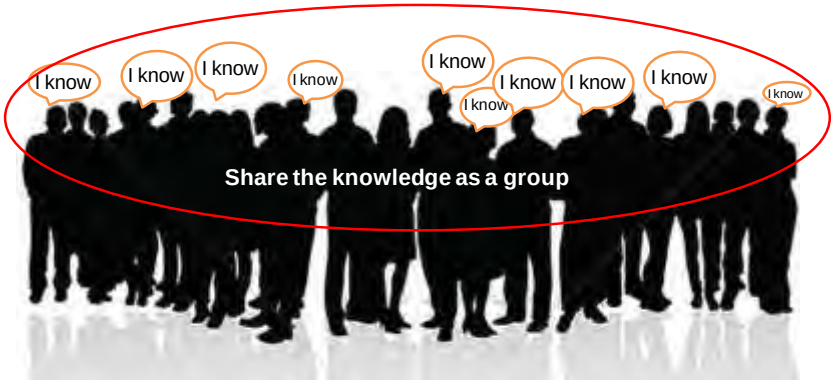
Table 7.1.5 Summary of Knowledge Evaluation Test in Each Training Unit

Unit1	Community Mobilisation & IWUA Formation
1. Scheme Design	Activities of the Project
2. Implementation Activities during scheme development and the roles of each stakeholder	Facilities to be built in the scheme
	What is needed in order to sustainable development of irrigation scheme
	Overview of leadership
	Overview of the developmental stage of irrigation scheme and O＆M method
3. Ownership and Farmers' Participation in Construction Works	Farmers' obligations in participatory construction works and the content of Memorandum of Understanding within stakeholders
4. Group Definition Formation, and Progress Stage	Function, structure, role, significance, and registration method of IWUA.
	Preparation method for IWUA "By law" and how to make agreement of that
5. Legal requirement for irrigation water use	Role of WRMA and contents of the water rights and penalties
	Role of WRUA
	Meaning of the payment of water fee
6. Training for making action plan	factor and importance of the action plan for implementing the activities
Unit2	Leadership and Conflict Management
1. IWUA organisational structure related to leadership (Including review of Unit1)	Part of the IWUA management structure
	Operating structure of IWUA, Decision-making process
	Feature of success group
2. Leadership (Qualities, Styles, Facilitation)	Principle and technique of leadership
	How overcome challenges as a leader
	Challenges, leader resolves in irrigated agriculture
	Matters, leader planning
	Important matters on the leader to hold the team work
3. Conflict and its Resolution	What is good as a reward to be given to members from leader
	Who take initiative to resolve conflict
	Style of conflict resolution and reason of conflict
	Process of conflict resolution
	Matters that might interfere with the achievement of IWUA's objectives
	Problems that unresolved disputes may bring
Unit3	Financial Management & Record Keeping
1. IWUA income and Expenditure	Documents to be stored in IWUAs
	Classification of assets and liabilities of IWUA
	Management system of finance
	Appropriate method to stock the money collected from IWUA members
2. Financial Management (Records, Report, Audit)	Merit of writing accounting book How to describe/keep accounting book, Rules for making accounting book

	Important matters in order to ensure transparency
	Department to manage the assets of IWUA
	Rules of finance management and relevance to by law
	Activities associated with the financial management
	Keeping place of receipts
	Structure of IWUA budget and benefits to make it
	Overview of audit
Unit4	On Farm Water Management and Practical Irrigated Agriculture
1. Plant, Soil and Water relationships	Essential factors of plant growth
	Importance of root growth related to the yield of the crop
	Soil texture and irrigation agronomy
	Timing of irrigation
	Suitable soil texture for general vegetable crop
2. Crop water requirements	Time there is no need irrigation
3. Formulation of Cropping Calendar and Pattern	Types and features of the irrigation system at field level
4. Irrigation systems and water application technologies	Cropping Calendar and Crop selection
5. Crop management under irrigation	Importance of crop rotation
6. Irrigation agronomy	How to make Seedbed, Replanted time, Fertilisation application method
	timing of pesticide
7. Post-harvest handling and processing	Harvesting Season
	Method to reduce the after harvesting and to promote the value
Unit5	Irrigation System Management
1. Organisational Set-up for O＆M	Purpose, factors, and operation plan of the irrigation system
	Problem and Merit that occurs whether the irrigation system management is sufficient or not.
	The most important matters and organisational structure to continue the irrigation system
	Important information to make the water distribution plan
	Necessary information in order to ensure the sustainability of the irrigation system
2. Operation and Maintenance for Irrigation System	Activities in order to improve the irrigation efficiency
3. O&M Costs Management	Significance of the maintenance costs
	Who has responsible for maintenance costs
	Significance of monitoring the maintenance cost
4. Gender and Cross Cutting Issues	Definition and significance of Gender

Source : JICA Team

Furthermore, it was intended to evaluate the scores as a group rather than an individual farmer because farmers usually share the knowledge in the schemes. If more than 50% of the group members know the correct knowledge, the knowledge is expected to be extended to in the area.



Source : JICA Team

Figure 7.1.2 The Basic Idea of Criteria (50% is Watershed)

Therefore the criteria which highlight the feature of their understanding were set up as follows.

Table 7.1.6 Evaluation and Criteria for Knowledge Evaluation Tests

Evaluation	Criteria
Training impact (Farmers understand well) → Knowledge gained	**Score more than 50%** **(Post training)**
Remaining issues (Farmers still didn't understand well) → Recommendations to improve future trainings	**Score less than 50%** **(Post training)**

Source : JICA Team

3)Pre and Post IWUA functionality survey

The IWUA Functionality Surveys were carried out twice. While the first survey was conducted before commencement of the 1st training programme to develop a baseline, the second survey was carried out after completion of the last training programme to determine the impact of the capacity building programme.

The IWUA Functionality Survey took into consideration various aspects of the IWUA that measures performance. The main criteria areas include:

1. Operations and Maintenance Activities achievement (40)
   1) Presence or Absence of Plan (cropping calendar, water distribution, O&M, and water users fee collection)
   2) Whether Actual activities carried out along the plan or not
   3) Yield(increase and decrease), Management track record, Collection status of the maintenance costs
2. Organisational performance (40)
   1) Official status of IWUA, Participation percentage of the various meetings,

2) Presence or Absence of various records,
3) Implementation of election, Performance of conflict resolution

3. Financial performance (20)
1) Presence or Absence of financial planning, bank account
2) Payment status of the bank account,
3) Collection status of the water fees and fines, Proper use the money to the O&M
4) Balance soundness of the IWUA payment

4. Additional indicators covering social welfare activities of the IWUA and networking (10)
1) Presence or Absence of Bank function, Market support, Rental equipment and livelihood support through IWUA
2) Presence or Absence of IWUA office
3) Cooperation with other organisations
4) Presence or Absence of participation of young people and women to the committee
5) Presence or Absence of contribution work of IWUA leader with free of charge

SUM: 110 point

7.2 Achievements and Results

7.2.1 Accomplished Activities and Project Output

All of the activities in the IWUA training programmes were implemented from Mar 2013 to Dec 2015. The results of the training programme were reviewed and incorporated into manuals and booklets as shown in Table 7.2.3. Those achievements per each unit are described below.

Table 7.2.1 Accomplished Activities of Capacity Building Programme

Scheme	Accomplished activities
Batch1 Pilot Project Sites 1) Kasokoni 2) Mdachi 3) Olopito 4) Gatitu/Muthaiga 5) Kaben 6) Murachaki 7) Tumutumu 8) Muungano*	1) Induction Training 2) Unit1 IWUA Framework 3) Unit2 Leadership & Conflict Management 4) Unit3 Finance management 5) Unit4 On farm water management & Irrigated Agriculture 6) Unit5 Irrigation System Management 7) Functional Survey Evaluation for Training)
Batch2 Pilot Project Sites 1) Tuhire/Challa Harambee 2) Mangudho 3) Shulakino 4) Kiamariga/Raya 5) Kaumbura	

*Units 4 & 5 have not conducted in Muungano scheme as construction of the pipeline system is out of the project scope.

Source : JICA Team

Table 7.2.2 Accomplished Dates of Each Activity for Capacity Building Programme

Scheme	Induction Training	Functionality Survey		Unit1	TOT for Unit2-5	Unit2	Unit3	Unit4	TOT for Unit5	Unit5
		Before	After							
Batch 1										
Kasokoni	18th - 22th Mar 2013 (farmers) 18th -19th Apr 2013 (officers)	2nd Aug 2013	25th Nov 2015	5th -7th Aug 2013	17th - 21st Feb 2014	8th -9th Apr 2014	5th -7th Aug 2014	18th -21st May 2015	19th - 20st Aug 2015	3th -6th May 2015
Mdachi		10th Oct 2013	8th Dec 2015	29th - 31st Oct 2013		25th - 26th Mar 2014	19th - 21th Aug 2014	20th -23rd Apr 2015		29th Sep - 2nd Oct 2015
Olopito		20th Aug 2013	4th Dec 2015	21st - 23rd Aug 2013		2nd - 3rd Apr 2014	12th - 14th Aug 2014	25th -28th May 2015		29th Sep - 2nd Oct 2015
Gatitu/Muthaiga		3rd Sep 2013	1st Dec 2015	4th -6th Sep 2013		25th - 26th Mar 2014	9th - 11th Sep 2014	18th -21th May 2015		6th - 9th Oct 2015
Kaben		28th Nov 2013	24th Nov 2015	3rd - 5th Dec 2013		25th - 26th Apr 2014	26th - 28th Aug 2014	11th -14th May 2015		22nd - 25th Sep 2015
Murachaki		19th Nov 2013	8th Dec 2015	29th Nov - 1st Dec 2013		25th - 26th Apr 2014	3rd - 5th Sep 2014	20th -23th Jul 2015		27th - 30th Oct 2015
Tumutumu		27th Sep 2013	18th Nov 2015	1st - 3rd Oct 2013		9th - 10th Apr 2014	9th - 11th Sep 2014	11th -14th May 2015		22nd - 25th Sep 2015
Muungano		12th Nov 2013	9th Dec 2015	13th - 15th Nov 2013		28th - 29th Apr 2014	26th - 28th Aug 2014			
Batch 2										
Tuhire / Challa		16th Sep 2014	26th Nov 2015	17th - 19th Sep 2014		9th - 10th Dec 2014	20th -22nd Jan 2015	8th -11th Jun 2015		15th - 18th Sep 2015
Mangudho		9th Sep 2014	9th Dec 2015	10th - 12th Sep 2014		3rd - 4th Dec 2014	27th -29th Jan 2015	25th -28th May 2015		10th - 13th Nov 2015
Shulakino		3rd Nov 2014	3rd Dec 2015	4th - 6th Nov 2014		14th - 15th Jan 2015	10th -12th Feb 2015	16th -19th Jun 2015		3rd - 6th Nov 2015
Kiamariga/Raya		7th Oct 2014	2nd Dec 2015	8th - 10th Oct 2014		2nd - 3rd Dec 2014	27th -29th Jan 2015	8th -11th Jun 2015		13th - 16th Oct 2015
Kaumbura		30th Sep 2014	19th Nov 2015	1st - 3rd Oct 2014		12th - 13th Nov 2014	16th -18th May 2014	15th -18th Jun 2015		6th - 9th Oct 2015

Source : JICA Team

Table 7.2.3 Output of Capacity Building Programme

S/NO	MANUAL TITLE	REMARKS
Reviewed under SIDEMAN-SAL (Developed under SIDEMAN)		
1	Community Mobilisation	- Reviewed in Embu_2014 - Quotation for finalisation from AIC available
2	IWUA formation	
3	Basic leadership	
4	System Management	- Reviewed by PMT and the SCIO, SCAO - Reflect and improved into Manual No.9
5	Financial Management	- Reviewed by PMT - Reflect and improved in Unit 3 training
6	Monitoring	- Reviewed by PMT and the SCIO and the SCAO - Reflect and improved into No.9
7	Gender	Reviewed by PMT
Newly developed manuals under SIDEMAN-SAL		
8	On-farm water management and irrigated Agriculture	Completed (Draft)
9	Operations & Maintenance manual	
Newly developed booklets under SIDEMAN-SAL for Farmers		
10	IWUA constitution	Completed (Draft)
11	IWUA record keeping and financial management	
12	Water Act 2002 (WRMA)	
13	On-farm effective water management	
Newly developed material under SIDEMAN-SAL for Farmers		
14	Training material from unit1 to unit5	Completed

Source : JICA Team

7.2.2 Results and Impact

(1) Reaction: Course Evaluation and Lesson Learnt Workshop

At the Course Evaluation, positive and negative reactions were observed from the participants. The reactions with view of the government officials at the lessons-learnt workshop are summarised below.

Table 7.2.4 Summary of Course Evaluation

Item		Positive Views	Negative Vies
Facilitation	Pre-training	1. Very effective, relevant. It harmonised the tone of the trainings 2. The facilitators were able to work together as a team 3. Ensure the materials presented met the objectives for the training 4. It gives direction. 5. Notice before 2 week for preparation ensured that most of the training materials were ready 6. Training style should be changed based on content. For example Unit 4 is pre-trainings, Unit2,3 Unit 5 TOT style	1. The SCIO does not prepare the materials. 2. Facilitators drop out after pre-training meeting. 3. Presentation materials were not ready during the pre-training meeting. 4. Training materials were shared between Sub-County officials.
	Training Material	1. Good, high quality, Simplified, prepared in simple language and localised which made it easy for the farmers to understand. 2. The programme was very relevant. 3. The outputs of the workshops showed great understanding of the concepts that we taught.	1. The training materials should have more pictorials. 2. Handouts were not available during the training. 3. Handouts should be translated to Kiswahili. 4. Technical terms beyond farmers' comprehension were used.
	Facilitator	1. On time, very participatory and helpful 2. Good, effective and interesting 3. An interpreter enhanced farmers' understanding	1. Some presentations were too long 2. Low voice 3. The level of preparation by the Sub-County team for the practical sessions was not so good 4. Too much involvement by PMT
	Farmers	1. Very committed to the training and demonstrated a lot of enthusiasm 2. Most of the participants could read and write 4. The participants who could read and write, irrespective of their age were so attentive all through the training 5. Very organised, participatory and timely with regards to meals organisation thereby ensuring that all Post noon sessions were not delayed 6. Motivated as they have learnt different and better methods 7. The IWUA leaders were all present at the training 8. IWUAs are utilizing the knowledge e.g. bylaw formulation, change of leadership, maintaining records, communal work	1. Some Farmer was not punctual and the schedule is rushed. 2. Too short that farmers had no opportunity to grasp the ideas well 3. Only a very small percentage of the IWUA leadership attended the training 4. The participants' High illiteracy levels 5. Most of the farmers have to attend to their livestock Pre the training 6. Some farmers were came late and inconsistent in attending the training 7. Poor gender representation among the participants
Schedule	Date	1. Farmers was able to plan to attend the 3 day training because of being informed early enough	1. Some farmer didn't attend the training. Because it coincided with Market day.
	Time schedule	1. Well organised and run effectively 2. The trainings started on time 3. Time management throughout the training period was very good	1. Time management needs improvement 2. Sessions should be a maximum of 1.5 hours 3. Time was inadequate for farmers to grasp all the knowledge

Item		Positive Views	Negative Vies
Venue	Equipment	1. The training venue was very convenient and satisfactory although it lacked tables so the farmers had to write on their laps 2. Training using projector was good and enhanced participants understanding	1. Not conducive due to interruptions from the children in the primary school 2. Lacked electricity, tables, Toilet 3. Seats were very uncomfortable
	Location	-	1. Not central for all farmers some farmer had trouble to come every day.
	Meal subsidy	-	1. When it was not clearly mentioned, it makes the confusion within the scheme

Source : JICA Team

(2) Learning: Pre and Post Knowledge Evaluation (test)

The average score of Pre and Post the training was 64% and 71%, respectively (100% is full marks), being improved by 7 points after the training programme. In general, while the scores were generally improved, in several training programmes, the scores at the post training have dropped. It is supposed that persons, who took the pre training eveluation, did not attend the post training evaluation. And in some cases, it was due to decline of concentration of the participants due to fatigue after the training programme.

The Project should review the test results with improvement of the methodology of the test of how the test be conducted, in consultation with the IWUA committee members. Also in future, a follow-up programme would be made to complement individual weaknesses identified from the test results together with observations by the government officials (Refer to the table below, as well as, Sector report for details)

The results of knowledge evaluation per unit and each scheme are as follows.

Table 7.2.5 Summary of Knowledge Evaluation Results

Unit	Pre Training	Post Training	Difference
Unit 1	66%	74%	7%
Unit 2	60%	68%	8%
Unit 3	62%	71%	9%
Unit 4	63%	67%	4%
Unit 5	68%	75%	6%
All Trainings	**64%**	**71%**	**7%**

*There is a slight difference between the scheme questionnaires; however these are compared in the same row.

Source: JICA Team

Table 7.2.6 Summary of Knowledge Evaluation Results at Each Scheme Level

Batch	Scheme	Unit 1			Unit 2			Unit 3		
		Pre	Post	Dif	Pre	Post	Dif	Pre	Post	Dif
Batch 1	Kaben	73%	75%	2%	57%	63%	6%	60%	63%	3%
	Olopito	60%	65%	5%	60%	46%	-14%	-	-	-
	Gatitu-Muthaiga	74%	81%	7%	52%	72%	20%	68%	70%	2%
	Tumutumu	67%	71%	4%	34%	76%	42%	-	-	-
	Muungano	76%	84%	8%	68%	70%	2%	53%	73%	20%
	Murachaki	57%	74%	17%	56%	51%	-5%	60%	69%	9%
	Kasokoni	63%	72%	9%	58%	64%	6%	-	-	-
	Mdachi	67%	72%	5%	79%	85%	6%	76%	82%	6%
Batch 2	Mangudho	62%	71%	9%	75%	79%	4%	78%	79%	1%
	Tuhire Challa	72%	79%	7%	60%	71%	11%		69%	
	Kiamariga Raya	70%	79%	9%	-	-	-	46%	60%	14%
	Shulakino	63%	67%	4%	58%	73%	15%	58%	73%	15%
	Kaumbura	60%	68%	8%	62%	67%	5%	57%	69%	12%
All scheme		**66%**	**74%**	**7%**	**60%**	**68%**	**8%**	**62%**	**71%**	**9%**

Batch	Scheme	Unit 4			Unit 5		
		Pre	Post	Dif	Pre	Post	Dif
Batch 1	Kaben	61%	69%	8%	63%	76%	13%
	Olopito	70%	68%	-2%	77%	78%	1%
	Gatitu-Muthaiga	71%	78%	7%	65%	78%	13%
	Tumutumu	52%	59%	7%	59%	73%	14%
	Muungano	-	-	-	-	-	-
	Murachaki	66%	72%	6%	73%	78%	5%
	Kasokoni	60%	55%	-5%	82%	73%	-9%
	Mdachi	66%	72%	6%	63%	76%	13%
Batch 2	Mangudho	73%	65%	-8%	77%	73%	-4%
	Tuhire Challa	64%	78%	6%	72%	79%	7%
	Kiamariga Raya	64%	60%	-4%	64%	66%	2%
	Shulakino	56%	65%	9%	61%	73%	12%
	Kaumbura	53%	64%	11%	62%	70%	8%
All scheme		**63%**	**67%**	**4%**	**68%**	**75%**	**6%**

Source: JICA Team

In Table 7.2.7, impacts of the trainings (Farmers understand well) and remaining issues (Outstanding points to be improved) are summarised. In the table, un-shaded and underlined items show that participants have obtained specific knowledge in the items (understanding level is over 50%). In particular, underlined items indicated that farmers' understanding in the items was below 50% before the training, but it exceeded 50% after the training programme. This result suggested that, in the items, the participants gained knowledge what the Project intended to deliver.

On the other hand, the shaded items indicated that understanding level was below 50% even after the training programme. The main reason is that content of questionnaire or answer choice may confuse the respondents. Those matters should be reviewed and reflected into the follow-up programmes as well as revision of the questionnaires in the

future.

Table 7.2.7 Summary of the Area of Training Impacts and Remaining Issues

Unit1	Community Mobilisation & IWUA Formation
1. Scheme Design	Activities of the Project
2. Implementation Activities during scheme development and the roles of each stakeholder	Facilities to be built in the scheme
	What is needed in order to sustainable development of irrigation scheme
	Overview of leadership
	Overview of the developmental stage of irrigation scheme and O＆M method
3. Ownership and Farmers' Participation in Construction Works	Farmers' obligations in participatory construction works and the content of Memorandum of Understanding within stakeholders
4. Group Definition Formation, and Progress Stage	**Function, structure, role, significance, and registration method of IWUA.**
	Preparation method for IWUA "By law" and how to make agreement of that
5. Legal requirement for irrigation water use	Role of WRMA and contents of the water rights and penalties
	Role of WRUA
6. Training for making action plan	**Meaning of the payment of water fee**
	factor and importance of the action plan for implementing the activities
Unit2	Leadership and Conflict Management
1. IWUA organisational structure related to leadership (Including review of Unit1)	Part of the IWUA management structure
	Operating structure of IWUA, Decision-making process
	Feature of success group
2. Leadership (Qualities, Styles, Facilitation)	Principle and technique of leadership
	How overcome challenges as a leader
	Challenges, leader resolves in irrigated agriculture
	Matters, leader planning
	Important matters on the leader to hold the team work
3. Conflict and its Resolution	**What is good as a reward to be given to members from leader**
	Who take initiative to resolve conflict
	Style of conflict resolution and reason of conflict
	Process of conflict resolution
	Matters that might interfere with the achievement of IWUA's objectives
	Problems that unresolved disputes may bring
Unit3	Financial Management & Record Keeping
1. IWUA income and Expenditure	Documents to be stored in IWUAs
	Classification of assets and liabilities of IWUA
	Management system of finance
	Appropriate method to stock the money collected from IWUA members
2. Financial Management (Records, Report, Audit)	Merit of writing accounting book How to describe/keep accounting book, Rules for making accounting book Important matters in order to ensure transparency
	Department to manage the assets of IWUA
	Rules of finance management and relevance to by law
	Activities associated with the financial management
	Keeping place of receipts
	Structure of IWUA budget and benefits to make it
	Overview of audit

Unit4	On Farm Water Management and Practical Irrigated Agriculture
1. Plant, Soil and Water relationships	Essential factors of plant growth
	Importance of root growth related to the yield of the crop
	Soil texture and irrigation agronomy
	Timing of irrigation
	Suitable soil texture for general vegetable crop
2. Crop water requirements	Time there is no need irrigation
3. Formulation of Cropping Calendar and Pattern	Types and features of the irrigation system at field level
4. Irrigation systems and water application technologies	Cropping Calendar and Crop selection
5. Crop management under irrigation	Importance of crop rotation
6. Irrigation agronomy	**How to make Seedbed, Replanted time, Fertilisation application method**
	timing of pesticide
7. Post-harvest handling and processing	Harvesting Season
	Method to reduce the after harvesting and to promote the value
Unit5	Irrigation System Management
1. Organisational Set-up for O＆M	Purpose, factors, and operation plan of the irrigation system
	Problem and Merit that occurs whether the irrigation system management is sufficient or not.
	The most important matters and organisational structure to continue the irrigation system
	Important information to make the water distribution plan
	Necessary information in order to ensure the sustainability of the irrigation system
2. Operation and Maintenance for Irrigation System	Activities in order to improve the irrigation efficiency
3. O&M Costs Management	Significance of the maintenance costs
	Who has responsible for maintenance costs
	Significance of monitoring the maintenance cost
4. Gender and Cross Cutting Issues	Definition and significance of Gender

Source : JICA Team

(3)Performance: IWUA Functionality Survey

As mentioned in the previous section, the "Knowledge Evaluation results" indicated that all of the schemes acquired the necessary knowledge for sustainable irrigation system management. However, the improvement of their knowledge did not lead to that in the functionality survey. According to the results of the Functionality Survey, the IWUAs are categorised into three groups, namely, the first group with the same or dropping scores even after the training programmes, the second group having increasing scores after the training programmes, and third groups recording remarkable increasing scores after the training programmes.

The first group, like Kasokoni scheme, needs further organisational strengthening even

though amendment of the by-laws has been made. The IWUAs in the second group were featured by improving skills for the financial management while those in the third group improved capacity of operation and maintenance as well as financial management. The IWUAs in the Batch 2 pilot project sites belonging to the third group are accustomed to irrigation system management and irrigated farming practice.

Table 7.2.8 Summary of Functionality Survey Results

Group	Scheme		1. O&M	2. Organisation	3.Finance	4.Additional	Score
Same score or slightly Decline	Kasokoni	Pre	28.0	23.5	9.5	3.0	**64.0**
		Post	28.5	17.5	9.5	2.5	**58.0**
	Mdachi	Pre	8.0	19.5	4.5	2.0	**34.0**
		Post	7.5	18.5	6.5	3.0	**35.5**
	Olopito	Pre	**7.5**	23.0	**5.0**	2.0	**37.5**
		Post	**11.0**	13.8	**8.5**	3.0	**36.3**
Increase	Tuhire Challa	Pre	23.5	20.5	**9.5**	**1.0**	**54.5**
		Post	19.5	22.5	**13.0**	**6.0**	**61.0**
	Kaben	Pre	9.5	22.5	**3.0**	3.5	**38.5**
		Post	7.5	23.5	**10.0**	1.5	**42.5**
	Murachaki	Pre	**7.5**	24.0	**4.5**	4.0	**40.0**
		Post	**12.0**	22.0	**11.5**	3.0	**48.5**
Remarkable Increase	Gatitu/Muthaiga	Pre	**9.0**	21.5	**4.5**	2.0	**37.0**
		Post	**14.5**	22.5	**10.5**	1.5	**49.0**
	Tumutumu	Pre	**7.5**	19.3	**5.5**	3.0	**35.3**
		Post	**13.5**	18.0	**11.5**	3.0	**46.0**
	Muungano	Pre	**7.5**	26.0	**5.0**	3.0	**41.5**
		Post	**15.5**	26.0	**13.0**	3.5	**58.0**
	Kiamariga/ Raya	Pre	**21.0**	24.0	11.5	2.0	**58.5**
		Post	**31.0**	20.0	13.5	1.5	**66.0**
	Mangudho	Pre	**10.5**	**5.5**	**3.5**	3.0	**22.5**
		Post	**22.5**	**21.0**	**11.5**	3.0	**58.0**
	Shulakino	Pre	**13.5**	17.5	**5.5**	3.0	**39.5**
		Post	**22.5**	18.0	**10.0**	3.5	**54.0**
	Kaumbura	Pre	**26.5**	**24.0**	11.0	3.0	**64.5**
		Post	**33.0**	**28.5**	12.0	3.0	**76.5**

Underlined Figure: increase field after training

Hatching Figure : decrease field after training

Source: JICA Team

*Irrigation operation does not start in any scheme as of 11th Dec 2015 except Gatitu-Muthaiga, Kasokoni, Tuhire Challa, and Kiamariga Raya

7.3 Lessons Learnt and Recommendation

7.3.1 Validity of the Training Programme from Viewpoint of Improvement of Resilience

(1) Evaluation of the Validity of the Training Programme

The results of the Knowledge Evaluation Test showed that, almost all of the IWUAs in the schemes exceeded 50% of correct answer rate. Also, as results of the functionality survey, the IWUAs in 10 schemes out of 13 have improved the financial management and maintenance capacities. The facts suggested that the IWUA members obtained necessary knowledge through adopted training programmes to manage their irrigation schemes towards improvement of resilience.

In addition, through the Course Evaluation and the Lessons-Learn workshop, there were several opinions and remarks, mentioning that the training programmes conducted in the Project were viable from the following viewpoints,

1) IWUA members have applied the learned knowledge to IWUA's management, consisting of formulation of by-laws, leadership, record keeping, and collective work and so on,

2) The contents of the training programme were well organised, and it proceed effectively, and

3) Series of lectures in training programme were inter-related and relevant.

It should be noted that capacity building training programme was implemented to achieve the participatory construction works and establish basic IWUA organisation capacity mainly by in house lecture training style because of time constraints. Then it is necessary for continued provision of guidance for officers to implement actual field activities, such as operation and maintenance as well as water-saving irrigated farming with market-oriented crop selection with SHEP approach.

Awareness and attitude of the participants were enhanced as indicated in the results of the IWUA Functionality Survey because of the following reasons:

1) Training contents were reasonable and met requirement of the participants (Satisfaction rate of the farmers was high)

2) Shorter training period activated the participants without boring for the training programme, and

3) As the training programmes and the construction works of the irrigation facilities have been carried out simultaneously, the participants were highly motivated by the

project activities, expecting irrigated farming.

Particularly, under the current training programmes, the synergistic effect of the farmers' participatory work was also significant. Typical success case in Olopito irrigation scheme is described in Chapter 6.5.2.

On the other hand, since the project activities, such as capacity development programme including SHEP programme, and construction supervision, have been conducted simultaneously, it had resulted in heavy burden for the SCIOs and the SCAOs and subsequently, the PMT members were obliged to backstop their activities. Thus, in the case that Sub-County officials would implement those activities simultaneously in future project, the training programme should be optimised taking into consideration the capacity of the officials as well as human resources.

(2)Verification of the Training Programme from Viewpoint of the PDCA Cycle

The training programme was verified from the viewpoint of PDCA (Plan-Do-Check-Action) cycle. It is remarked that, the adopted/improved programme enabled the PDCA cycle to turn correctly (see Figure 7.3.1), and it led to obtain necessary knowledge to the IWUA members and the Government officials for improving resilience, such as ownership for training material, self-reliance, and improvement of training programme.

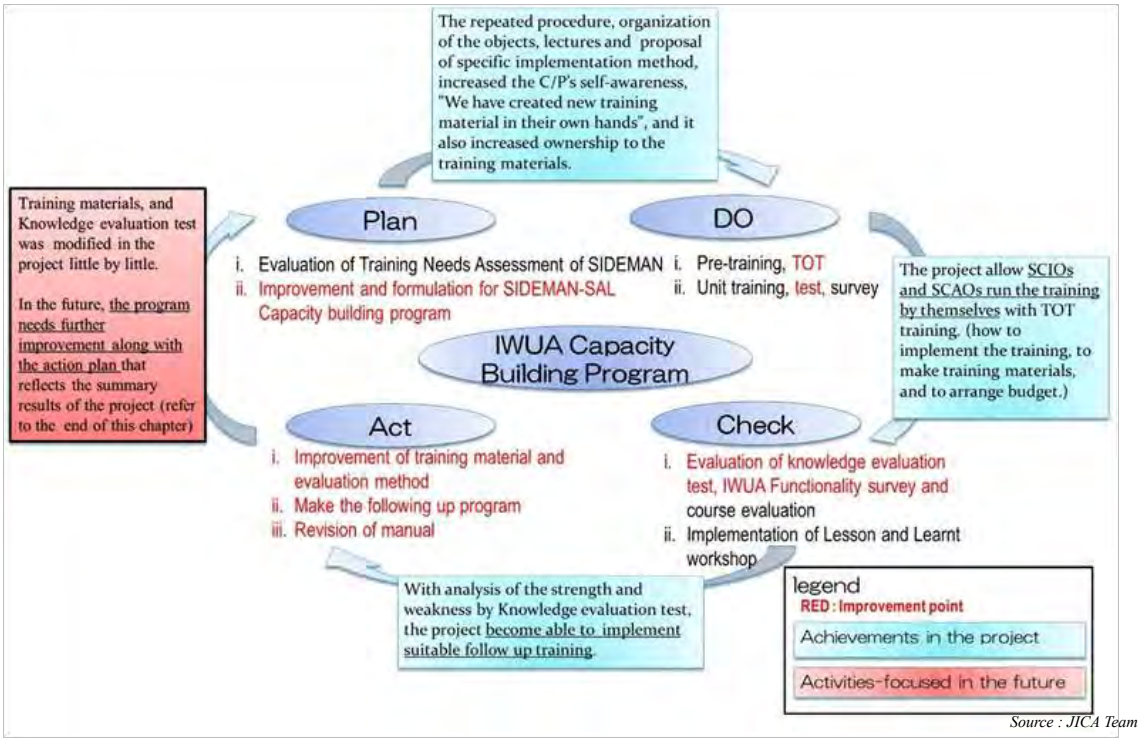


Figure 7.3.1 Improvement and Achievement of IWUA Capacity Building Programme from the View Point of PDCA Cycle

Main points on the above figure are summarised in the following table.

Table 7.3.1 Important Point to Achieve the PDCA Cycle of Training Programme

No	Achievements in the Project	Important Point to the achievement
1	The repeated procedures, organisation of the objects, lectures and proposal of specific implementation method, raised the C/P's awareness for that, "We have created new training material in their own hands", and it also enhanced ownership to the training materials.	1. Note that the process to create training material takes a long time. 2. At first, responsible experts would prepare draft training materials, even while receiving opinion. Then, he/she should take initiative to improve them with tenacious commitment.
2	The Project allows the SCIOs and the SCAOs to run the training programme by themselves with TOT training. The programme showed them to how to implement the training, to make training materials, and to arrange budget.	1. After implement the TOT programme to Sub-County government officials, the PMT members show the role model at Batch 1 at the beginning, then, the SCIOs and the SCAOs carry out by themselves at Batch 2 training. 2. Before the training programme, the PMT should prepare templates including settlement documents, approximate table of the training cost, sheet for evaluation, and basic data of the training materials. Also the SCIOs and the SCAOs should to commit to submit/settle all the data/payment after training within 2 week.
3	The knowledge evaluation test enables to analyse the strength and weakness by each training programme to implement suitable follow up training.	1. Prepare a questionnaire to grasp accurately the matters necessary to achieve the purpose of the training to evaluate if knowledge level of the participants is improved. 2. Development of methods to analyse the questionnaire in a simple way.

Source : JICA Team

7.3.2 Lessons Learnt and Recommendations from Training Results

(1) Course Evaluation Result and Lesson-Learnt Workshop (Embu Dec 2015)

Lessons learnt and recommendations, summarising the views of the participants obtained through the Course Evaluation, and officers' views through the Lesson-Learnt Workshop (Embu Dec 2015) are indicated below.

Table 7.3.2 Summary of Lesson Learnt and Recommendations from Training Reaction

Item	Problems and the fact at the time of Training	Lessons learnt and recommendations
Pre-training, TOT	1. The officers can only develop the training material when PMT deliver the training and session objectives in advance. If the training is so particular, they need more developed guidelines/manual, in addition. i.e. Unit5, O&M manual 2. The content is very effective and relative for training programme.	1. When PMT teach a new content to IWUA, according to the TOT, it is effective to develop a manual. However, when you teach existing content, TOT is not necessary. 2. Pre-training is effective and facilitator should try to harmonise between material and session objectives according to training objective.

Item	Problems and the fact at the time of Training	Lessons learnt and recommendations
	3. It is best for harmonisation for each lecture. 4. Each presenter can work as a team. 5. It enabled us to improve training material and which direction we should go.	
	1. Pre-training notice in 2 weeks' advance make officers develop the material.	1. Pre-training 2 weeks' advance notice is preferable for suitable training quality.
	1. Some officer did not participate in the training even though they attended the pre-training.	1. Restrict the officer who can attend both pre-training and training.
Training Material	1. The quality of material made by the SCIOs and the SCAOs was lower than PMT facilitator	1. Enhance capacities of Sub-County officials during pre training as much as possible
	1. Some farmer couldn't read training material.	1. Materials can be prepared in English but the presentation would be in Swahili and if possible the local language 2. Take account of interpreter as needed 3. Consider selection criteria of farmers
	1. Material is Simplified, Pictorial and localised. 2. If handout is submitted in advance, he farmers understand the content deeply. 3. Technical term prevented farmers' understanding.	1. Facilitators try to make the material that is Simplified, Pictorial and localised. 2. If possible handout is to be submitted in advance. 3. Translate the technical term into easy word.
	1. Some farmer couldn't grasp the outline of the training because of time constraint.	1. Facilitator should focus the most important items and minimise the target to learn effectively. Because participant should receive 6-10 sessions and absorb a lot of new knowledge within 2-3 days 2. Put suitable interval in the lecture for farmer to catch up with the lecture.
	1. Some officers circulated the material within the training team and not developing their own material.	1. Officers should stop circulate the material within the training team and try to develop their own material.
Presentation	Some of the presentation is merely lecture-style sitting very long time, that make farmers less concentrated and some farmer left in the middle.	1. Facilitator should Keep Time schedule 2. 1 session, 2 hour lecture is too long if the facilitators teach only lecture style. However if he/she apply/chose best adult learning Approach such as, roll playing, participatory approach, during training, it may avoid the feeling of bored and the farmers can concentrate on the lecture continuously.
Participant	1. While some scheme almost all leaders were participating in training, the other did not attend the training only a few leaders. 2. The people who attended the training can read and write was participated actively throughout the training period. On the other hand, participants that could not have tendency to avoid test.	1. Try to inform the importance to involve the IWUA leaders to the training in advance. 2. By selecting the participants who can read and write, training can be expected highly effective. However, even taking into account the participants who cannot, translator should explain slowly and repeat especially in the test.
	1. Poor balance of Men, Women of young/ elderly people. That may not be representative of the IWUAs.	1. When the IWUA select of participants (women, young people, etc.), be aware the balance of representative. 2. Before scheme selection, chose the scheme which agree the above-mentioned balance.

Item	Problems and the fact at the time of Training	Lessons learnt and recommendations
Schedule	1. When there is early advance notice, the farmers can participate in three day's training, basically. 2. When farmers are notified immediately before the training, because of communication between the government officials and farmers are not performed smoothly, the participant of the 1st day is smaller than PMT expected.	1. Inform the date to the farmer early enough as possible and PMT also directly notify to the farmer, preventing the contact leakage.
Time schedule	1. Before the training, it was necessary for participants to take care of the livestock. Therefore they couldn't attend the training on time.	1. Consider the style of life work, especially pastoralist.(Start training AM 9 is impossible for them)
	Participants come on time and training time management went very well along with schedule. That could ensure the quality of training On the other hand, as some farmers didn't come on time, it caused delay of training schedule and decrease of training quality.	1. Notify the participants the delay affects the quality of training and they should make efforts to come on time. 2. Spare the appropriate adjustment time. ex registration time of participants etc.
Venue, Location	As the training location is not the centre of the village, some farmers had difficulty to come every day. In addition, sitting on a hard chair for a long time, it was difficult to keep your concentration.	1. Notice the importance of accessibility facilities and chairs which shoud be used at least three days.
Meal subsidy	When the cost allocation was not clear between PMT and farmers, it brought the confusion.	1. Mention the amount of money for lunch and agree the allocation before training.

Source : JICA Team

On the other hand, as the capacity building programme conducted under the Project mainly focused on training programmes for organisational strengthening and system operation and maintenance, there would be need to conduct further programmes, focusing on "demonstration farm", marketing linkages, micro credits support services, together with a follow-up programmes that should be in-built into the whole programme.

(2)Knowledge Evaluation

Relevant questionnaires on the Knowledge Evaluation revealed the positive impact and weakness of the IWUA members. The following lesson and learnt is acquired and recommended to improve quality of the programme.

Table 7.3.3 Summary of Lesson Leant and Recommendations from Knowledge Evaluation

Problems and the fact at the time of Training	Lessons learnt and recommendations
Some question's correct answer rate were more than 80% even before training programme.	Reviewing the training content, if the content itself is too easy, put low emphasis to it and omitted from the questionnaire. Otherwise, if there is a problem with the questionnaire itself, question should be changed to 1) "Open end style answer", 2) Set 5 item to choose instead of 4 or 3) not confused one.
1. Left training in Sub-County officials, questionnaire became simple 2 choices and to change the question. It made difficult to compare the evaluation. (It was modified by the PMT intervention) 2. Some officer lost the evaluation sheet.	The number of answer to the questionnaires should have at least four choices, and the PMT should review the contents. In addition, logistical back support, such as PMT passes a detailed template, is essential.
	Among the Counties, common questionnaires are important to identify weakness of the participants and to compare the results. Therefore, it is desirable to the Sub-County officials not to change the questionnaire by themselves.
The farmers who undergo the Knowledge evaluation test were drastically different from before and after because of some reason.	To prevent this case happen, implement the following methods in advance seems effective. 1) Restrict attendance who can participate the training continuously with by law or managing the group. 2) Convince/indicate the purpose of knowledge evaluation. It is for you and identification of the weakness helps the scheme. 3) At Post training questionnaire, in order to evaluate accurately, provide a column to be checked that is for the farmer was received the lecture or not.
Technical word is difficult; otherwise they can choose correct answer.	Supplement the easy explanation for technical terms in question
In some schemes, test was conducted the field day after lecture training because of rushing the schedule. Then farmers did not care about the test result and result decline sharply. (Unit4, Unit5 part of the scheme)	Farmers learned a lot and became tired after the training time. However, test should be conducted in the classroom instead of the field (the following day).
Participants under low literacy level tend to avoid taking the test even though they participate the training. It seems to different score compared to actual situation	Taking into account of the participants who cannot read and write, especially when the test is conducted, the translator talk slowly and repeat the questionnaire, thinking of the time allocation.
By anonymous method, farmers received a test not to be afraid of comparing others.	Anonymous style goes good considering the specific of group but evaluate individual is important.
An old person is difficult to evaluate this test style. Because they are not familiar with multiple choice styles.	In the case of the elderly, hearing style seems to be effective.
When questions are translated in Swahili, right answer is unconsciously led.	Persons who explain the questionnaire should be aware of avoiding the misleading the participants.

Source : JICA Team

(3) Performance Evaluation

Although scheme performance should be evaluated on a continuous basis, time to conduct the 2nd survey was influenced by the fact that the irrigation infrastructure was not in place. Therefore, the final scheme performance evaluation under the

Functionality Survey should be done when the schemes become operational.

The indicators of the performance evaluation were prepared in due consideration of important issues for smallholders in Kenya. However, there were some indicators, which were overestimated or underestimated to evaluate the IWUA performance. Therefore, it is recommended to review evaluation method, as described below.

[Score allocation in several indicators]

1. Allocation of score in by-law is too underestimated even though improvement of the item is of significance under the IWUA performance evaluation. (Question No. B.6 d：1 point/110points.(Refer to Table 7.3.5)

Table 7.3.4 Improvement of By-Laws after Training

Scheme		Shulakino		Kaben		Olopito	
No.	Contents	Pre	Post	Pre	Post	Pre	Post
1	Name and physical address of the IWUA	－	○	○	○	○	○
2	Mission statement and functions of the IWUA	○	－	○	○	－	○
3	Membership criteria	－	○	○	○	－	○
4	Scheme Leadership, election criteria and length of term in office	－	○	－	○	－	○
5	Rights and roles of members	－	－	○	○	○	○
6	Appropriation and Auditing procedures for IWUA resources	－	－	○	○	－	○
7	Mode of water distribution	－	○	－	○	－	○
8	Election procedures	－	－	－	○	○	○
9	Water fee collection procedures	－	○	○	－	－	○
10	Accounting documents	－	－	－	－	－	○
11	Types and number of meetings	－	－	－	○	○	○
12	Procedure for settling disputes	－	－	－	○	－	○
13	Procedures for liquidation of an IWUA and liquidation of assets Procedures for enforcement of By-laws and types of penalties	－	－	－	－	○	－
14	Procedure for reviewing of By-laws	－	－	○	－	－	－
	Improved item (SUM)	1	5	6	10	5	12

Source: JICA Team

2. The items of "Attendance to the meetings" are overestimated, occupying more than 10 % to the total score. (Question No.B.4,10,11,12: 13 points / 110 points) (Refer to Table 7.3.5).

[Vague indicators to answer]

1. Several questions are difficult to answer with the percentage. Then it is desired to

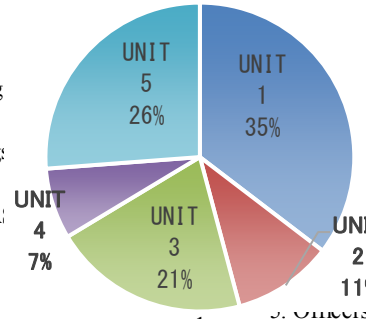
improve the questions. (A 2 a, b, c) .(Refer to Table 7.3.5)

2. Impacts for conducting Unit 2 and Unit 4 training programmes are underestimated compared with the others. There is also a need to review the whole question items.(Refer to Figure 7.3.2)

Table 7.3.5 Score Distribution of IWUA Functionality Survey and Recommended Improved Items (shaded)

1. IRRIGATION&IWUAMANAGEMENTINDICATORS	SCORE		1. IRRIGATION&IWUAMANAGEMENTINDICATORS	SCORE	
A. OPERATION&MAINTENANCEPERFORMANCE (40Points)			B. ORGANIZATIONAL PERFORMANCE (40POINTS)		
1. Planning	**15**		6. Records & files	**5**	
a. Cropping calendar		4	a. Other O&M records, master list of farmers/irrigation fee payment record		1
b. Water delivery and distribution		4	b. Minutes of meetings		1
c. Maintenance & repairs		4	c. Financial records		1
d. Water users fee collection		3	d. By laws and O&M policies		1
2. Implementation	**15**		e. Filing system and quality of files		1
a. Cropping calendar		4	7. Holding of Regular Elections	3	
b. Water delivery and distribution		4	8. Conflict resolution	3	
c. System maintenance		4	9. Attendance in BOD meetings	3	
d. Water users fee collection		3	10. Attendance in General Assembly meetings	3	
3. O&M performance	**10**		11. Attendance in Block/lateral meetings	3	
a. C		3	12. Attendance in community group works	4	
			C. FINANCIAL PERFORMANCE (20POINTS)		
			ncial plan for the year		
3. Block/lateral group meeting			tion for O&M		
4. Board meetings			ontrol	3	
5. General Assembly Meetings			dex (Income divided by Expenses)	3	
II. ADDITIONAL INDICATOR			**. INDICATORS (10POINTS)**	SCORE	
1. Ventures			h Other organized groups	1	
a. Credit assistance			t of women/youth groups	1	
b. Marketing assistance		1	s. Officers/leaders are rendering services for free	1	
c. Agricultural machineries/equipment	1		6. Physical improvement of their system	1	
d. Livelihood programs	1		7. Providing aids to its members	1	
2. IWUA Office	1		**TOAL SCORE (I+II)**	**110**	

Source: JICA Team



Source: JICA Team

Figure 7.3.2 Contribution Percentage of Each Unit in the IWUA Functionality Survey

7.3.3 Dissemination of the Project Achievement and Preparation of Action Plan

(1) Dissemination and Adoption of the Project Achievement

In order to disseminate and adopt the project achievement of the IWUA Capacity Development Programme in the project area, it is necessary for the County officials to implement actual field activities, such as:

1) Operation and maintenance for irrigation system, consisting of operation of headworks, measurement of abstraction water amount and river water level,

operation of the open canal/pipeline, maintenance of the facilities, check of O&M cost and accounting book.

2) On-farm water management with water-saving irrigated farming using completed irrigation facilities in the field (Demonstration farm system).

The SCIOs and the SCAOs have important roles to disseminate the project achievement to the other farmers in the schemes and to farmers in the other irrigation schemes.

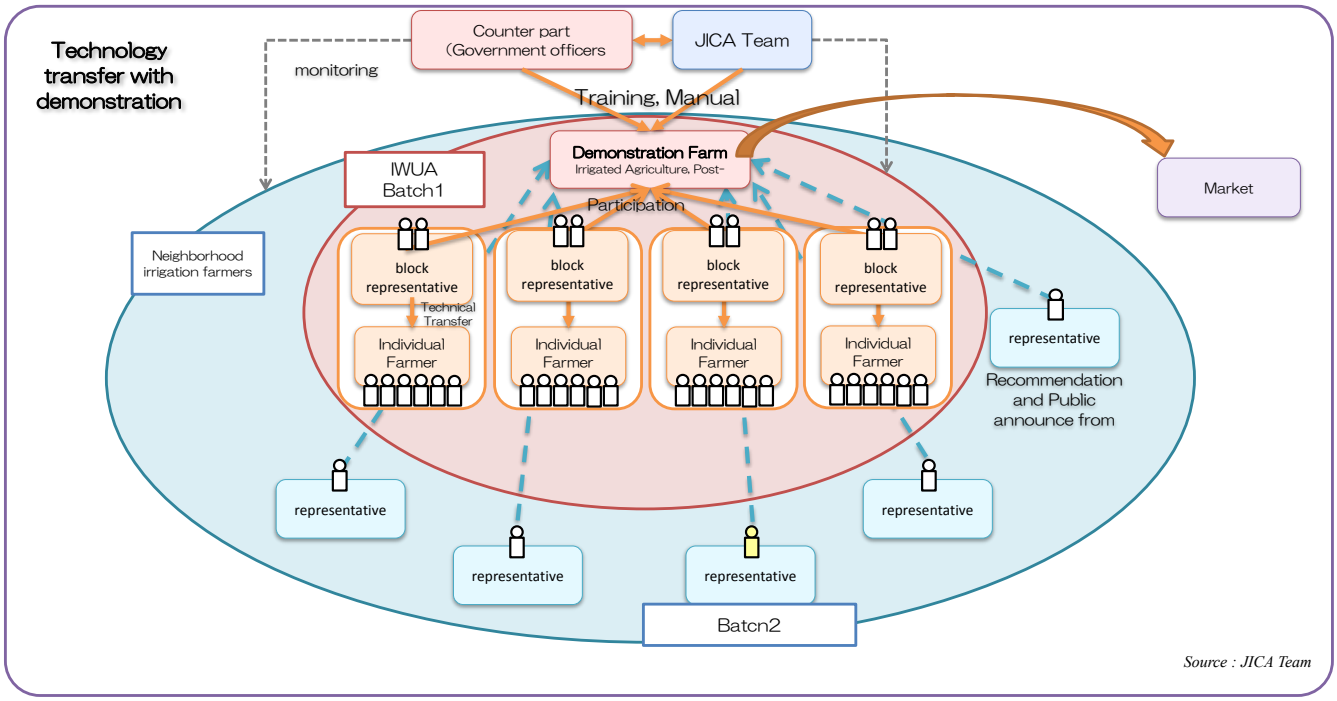


Figure 7.3.3 Technology Transfer with Demonstration Farm

To achieve the above, firstly, the SCIOs and the SCAOs should explain the project activities continuously to Sub-County and make necessary budgetary arrangement. At the same time, based on the manual/booklet developed in the Project, they should take initiative to select candidate areas and farmers, time schedule, and crops for future implementation in other irrigation schemes. It is also important to conduct the follow-up programme based on outstanding issues identified through the Knowledge Evaluation and the Functionality Survey.

(2) Action plan including Following up programme

It was difficult to implement action plan discussed during the training programme due to time constraints and inadequate technical support to the IWUA members. Further, they tended to pay their attention on obtaining irrigation water, and were not so much interested in implementation of the action plan on how to manage the irrigation system.

To implement the action plan effectively, the following methods would be taken into account.

- Ensuring the implementation of action plan in “by-laws”,
- Monitoring of implementation of the action plan by IWUA members,
- Provision of technical guidance by the SCIOs and the SCAOs to the IWUA members to develop the action plan which farmers feel more important and effective

In the future, the National Government as well as the County Government including the SCAOs and the SCIOs are highly recommended to implement the following action plan that was prepared based on the lessons-leant and recommendations obtained from the training results.

Table 7.3.6 Action Plan for IWUA Capacity Building Programme (Draft)

Objective		**Action/activities**	**Inputs/ Resources**	**Responsible person**
1. Dissemination of IWUA Capacity Building Programme	(1)Acknowledgement of the Project Activities for County government and fund-raising	1) Explain the Project activities for County Government and submission of budget proposal (periodical follow up of Hand over report) 2) Report from County to Government 3) Summarise the budget for Capacity building programme	Hand over report(renewed by every 6 month), Travelling expense, Daily allowance	SCIOs, SCAOs, PMT
	(2) Sensitisation to the farmers through actual activities	1) Implement the demonstration farm at site with booklet (On-farm effective water management)	booklets, farm land, Travelling expense, Daily allowance	SCIOs, SCAOs, PMT
	(3) Authorisation and Citification of Manuals and booklets	1)Finalise of Manuals and booklets	Manuals and booklets(Draft)	PMT
	(4) Implementation organisation	1) Study the lack of human resources of the Irrigation Department in collaboration with NIB. 2) Consider how GOK gives logistic support to the County.	-	PMT
2.Improvement for IWUA Capacity Building Programme	(1) Improvement for IWUA Capacity Building Material it self	1) Determine the validity of the training material by the following analysis, if necessary, review the training material, and reflect the training programme. A) Identify challenges by interview from the schemes which operate actual irrigation facilities after training B) Implement IWUA Functionality Survey and analyse the results to verify the enhanced points and weaknesses C) Review the Training Needs Assessment (TNA) under SIDEMAN	Interview Sheet, Travelling expense, Daily allowance	SCIOs, SCAOs, PMT
	(2) Improvement of how to proceed the training programme	1) Verify the training time allocation and the schedule. In particular, Consider how to coincide with time allocation together with construction supervision. In some cases, it is necessary to refine the training content.	-	PMT
	(3) Improvement of evaluation methods	1) Pre & Post Knowledge Evaluation (test) A) Farmers who undergo the Knowledge evaluation test B) Improvement of questionnaire 2) IWUA Functionality survey Allocate new score or change the question.	-	SCIOs, SCAOs, PMT
3.Monitoring	(1) Evaluation after project implementation	1) Implement IWUA Functionality Survey during scheme operation phase.	Travelling expense, Daily allowance	SCIOs, SCAOs
	(2) Confirmation on whether the trained activities is being properly implemented	1) Confirm/monitor the implementation activities, such as 1) Revision of "By law" (Unit1,2), 2) Financial Management(Unit3), and 3) Operation and Maintenance of Irrigation Facilities(Unit 5) 2) Develop/Implement follow-up programme (Unit4,5) based on items having scores with less than 50% at Post Knowledge Evaluation (test), and weakness found by Functionality survey	Following up programme, Travelling expense, Daily allowance	SCIOs, SCAOs

Source : JICA Team

CHAPTER 8 Agricultural Components

8.1 Activities of SHEP Approach and LISA Technology

8.1.1 Background and Outline:

In order to induce farmer awareness of the market-oriented farming management, the SHEP Approach was introduced with the collaboration of SHEP UP project. The SHEP Approach was developed by the Smallholder Horticultural Empowerment Project (SHEP) that was a bilateral technical cooperation project between the GOK and JICA. The SHEP Approach refers to specific methods and techniques for empowering smallholder horticulture farmers, and it includes a series of training session for farmer groups and FEOs/ Group Facilitators. The approach was confirmed as an efficient and effective approach for small-scale farmers by authorities of MOA, then Smallholder Horticultural Empowerment and Promotion Unit was established to extend the SHEP Approach nationwide. The Smallholder Horticulture Empowerment and Promotion project (SHEP-UP) was underway.

In consideration of the fact that the pilot project schemes of the SIDEMAN-SAL are located in the land areas under arid and semi-arid (ASAL) conditions, the activities that are anticipated to contribute augmentation of the resilience of local communities in ASAL area through improvement in their livelihood and nutrition status with alternative selection (diversity) of agricultural enterprises/ produces and with stable productivity of their staple food crops are also required. For this purpose, the Project introduced to farmers the use various technologies known as Low Input Sustainable Agriculture (LISA) technologies. This composed of the Kenyan Traditional Vegetable programme, the Push-pull technology and “Bokashi” fermented organic materials technology. The Kenyan Traditional Vegetable programme (also known as African Leafy Vegetable programme) was introduced with the collaboration of Bioversity International.

Technologies consisting of the technical knowledge and practical skills, which contribute augmentation of the resilience of local communities in ASAL area, would be directly transferred to mainly Sub-County Agricultural Officers (SCAOs), District Agricultural Extension Officers (DAEOs) and Frontline Extension Officers (FEOs) in the pilot project sites through the lectures, workshops, practical trainings, meetings and frequent contacts targeting at the local farmers. A government official appointed by the MoALF worked with project team for smooth implementation of the project activities.

Concept and Strategy:

For the introduction of SHEP Approach, SHEP Experts who are authorised as skilled

facilitators of introducing SHEP Approach conducted the introduction of SHEP Approach to model farmer groups in pilot project sites. Experienced SCAOs also existed in a few Sub-Counties where the SHEP Approach was in practice and their knowledge and experiences in implementation of the training activity were utilised at the pilot project sites in the "SHEP overlapping Sub-Counties." In those pilot project sites above mentioned the general/ original SHEP Approach would be introduced by the experienced SCAO with support from SHEP Unit.

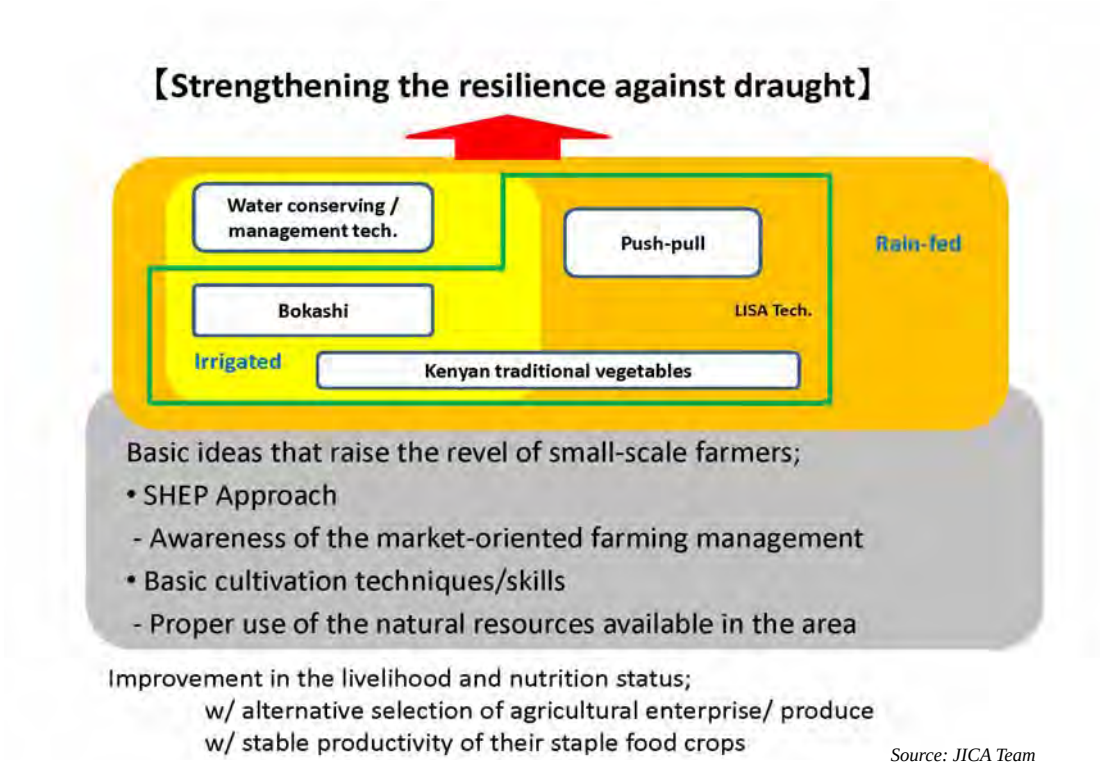


Figure 8.1.1 Basic Concept of Agricultural Support Activities in SIDEMAN-SAL

In other pilot project sites located in the Sub-Counties where the SHEP Approach was NOT in practice, the core components of SHEP Approach would be introduced by the SHEP experts. The series of trainings was mainly focusing on/ aiming to the increment of the farmer's competence/ capacity of the followings;

a) Identifying the present productivity and the cost and benefit in his/her farm production,
b) Understanding the market condition/ demands surrounding farmers,
c) Making strategy for the adaptation to the market demands through crop selection/ranking and crop planting calendar making, and
d) Maintaining awareness of the income-oriented farm production through recording the revenue and expenditure of his/ her farm production activities.

The LISA Technologies were introduced through the adaptation trial/ demonstrations at the selected few pilot farmers fields for the prospective/ candidate technology. Pilot farmers

conducted trial/ demonstration planting at their fields and record the revenue and expenditure for production. After the production period, an evaluation and decision-making meeting was held within the model farmer group. Then accepted candidate technology(s) would be disseminated to the entire model farmer group members for the subsequent production seasons.

8.1.2 Selection of Farmer Groups, Pilot Farmers and Group Representatives:

Selection of model farmer groups for the Batch-1 pilot project sites was followed the selection procedure being taken by SHEP Approach. In each pilot project site, an existing formal/ informal farmer group of between fifteen (15) and fifty (50) group membership was selected. Gender was also considered in selection of group representatives. A couple of farmer representatives consisted of a male and a female membership were selected/ invited in each workshop. Also two to three farmers were selected as pilot farmers in a model group for the trial introduction of the Low Input and Sustainable Agriculture (LISA) technologies. The demand-driven approach was also applied in the selection of candidate technologies in the trial introduction of Kenyan traditional vegetables. The selected pilot farmers were expected to disseminate the knowledge learned to neighbouring farmers.

The basis/origin of the selection criteria for the model farmer groups was adopted/ derived by the Project from Smallholder Horticultural Empowerment & Promotion Project (SHEP-UP). There was however minor adjustments which have been made to suit the specific situation/ condition for the Project. One such specific situation includes the area of emphasis whereby for SHEP-UP was horticulture while the emphasis for the Project was crop production inclusive of horticulture.

Table 8.1.1 Selection Criteria for Model Farmer Groups for Batch-1 Pilot Project Sites

No.	Item	Criteria
1	Number of Group	• Each scheme in a Sub-County to choose 1 (one) model farmer group for implementation of the SIDEMAN-SAL Agricultural Activities
2	Group Status	• Select farmers group of the Crop Production and/or Crop Marketing groups from both 'formal' and 'informal' groups • DO NOT form a new group for the Project. Select from the existing groups
3	Membership	• The group membership to be between 15 (fifteen) to 50 (fifty) • Choose a group who has over 60% of its membership drawn from IWUA members for the SIDEMAN-SAL Irrigation Scheme
4	Age	• Members should be over 18 years of age
5	Literacy	• Farmer group officials should be literate in order to read and write during the training session/monitoring/reporting • In addition, s/he will be required to translate the training materials/handouts into their local languages where needed
6	Occupation	• Each group member is practicing crop production or crop produce marketing

No.	Item	Criteria
7	Group Activities	• Choose group whose core business is crop production or crop produce marketing • Choose group whose alternative income generating activities is complementary to crop production • Emphasis on the choice of the farmer group should be those which have NOT started buying inputs and selling their produce together • Avoid choosing group with similar farming /marketing activities which are being supported by other Projects/Programmes • Choose group in which the Project will complement the work done by other service providers
8	Group Attitude	• Choose group with a 'healthy & positive attitude' towards extension service providers to have dialogue • Choose group with 'high motivation' to learn new idea & technologies • Choose group with ability and willingness to mobilise resources
9	Area under Coverage	• Choose group to evenly cover (fairly represent) the production areas in the SIDEMAN-SAL scheme (Avoid choosing only group from the same area) • Avoid choosing group from the area which have security concerns (it might cause some negative effects to the field activities of the Project)
10	Accessibility	• Choose group which is accessible by road (i.e., PSCC/FEO/Group Facilitators need to visit the group for frequent communication and training sessions)
11	Group's Sensibility to Gender Issues	• Chose a group which advocates gender balance and is actively involved in gender promotion • Pro-gender balance. DO NOT choose groups with less than 30% of female/male participation • Provide preference to a group with women official (s) (i.e., women with the leadership roles)
12	Special Groups	• Support should be given to 'Special Groups' of the disadvantaged or discriminated groups in the society

Source: JICA Team

Table 8.1.2 Selected Model Farmer Groups in Batch-1 Pilot Project Sites

Scheme	Sub-County	Name of Farmer Group	No. Membership		
			Total	F	M
Pilot project sites in the Sub-County where SHEP is NOT in practice (SHEP non-overlapped Sub-Counties)					
Olopito	Narok-North	Olopito Irrigation Scheme	50	32	18
Mdachi	Ganze	Mdachi Scheme	55	28	22
G/Muthaiga	Laikipia-West	Gatitu-Muthaiga	53	35	18
Murachaki	Mbeere-North	Ukulima Bora S.H.G	20	6	14
Kaben	Marakwet-East	Kaben Irrigation Scheme	50	33	17
Tumutumu	Igembe-South	Bainthanga Water Project	50	34	16
Pilot project sites in the Sub-County where SHEP is in practice (SHEP overlapped Sub-Counties)					
Kasokoni	Taveta	Ngoyaki Foundation C.B.O	18	6	12
Muungano	Tharaka-South	Turkey Self Help Group	19	10	9

Source: JICA Team

Since the given conditions (such as condition of sites) of model farmer groups in the pilot project sites were different from those in SHEP project areas, we made several modifications for the model farmer group selection and/or formation based on the close dialogue with farmers, government officials such as the SCAO and FEOs, and officers from PMT. The results of the selection and the rationale are summarised in the tables below;

Table 8.1.3 Selected Model Farmer Groups in Batch-2 Pilot Project Sites

Scheme	Sub-County	Name of Farmer Group	No. Membership		
			Total	F	M
Challa/Tuhire	Taveta	Boresha Kilimo	50	16	34
Shulakino	Narok-North	Shulakino Irrigation scheme	50	23	27
Kaumbura	Igembe-South	Kithanga SHG	50	10	40
Mangudho	Ganze	Mangudho Irrigation scheme	46	27	19
Kiamariga/Raya	Laikipia-West	K-Raya Irrigation scheme	49	16	33

Source: JICA Team

Table 8.1.4 Rationale for the Selection of Model Farmer Groups for Batch-2

Sub-County	Scheme Name	Selected Model Farm Group	Rationale/Status
Ganze	Mwagudho	Mwagudho Target Farmers	- Upon; 50 target farmers (who were evenly spread in the scheme) were democratically selected from the two groups to form the Model Farmer Group. - Registration of MFG is ongoing
Taveta	Challa Tuhire	Challa Tuhire Target Farmers	- Upon discussions the farmers agreed that it would be giving undue advantage if any of the above groups where to be chosen as they are not represented in all the irrigation blocks. - It was thus agree to select the 50 target farmers proportionately and in accordance with the number of members in each block. (See in Table 3 below) - Members from each Block elected their representatives separately. - MFG already constituted and registration ongoing
Narok North	Shulakino	Shulakino Target Farmers	- Upon consultations; 50 target farmers were democratically elected to form the Model Farmer Group - Main rationale was that the target farmers were evenly spread in the scheme while all other groups are represented only in certain parts of the scheme. - Model Farmer Group registered under umbrella of main Shulakino group
Laikipia West	Kiamariga Raya	Kiamariga Raya Target Farmers	- Upon consultations; 50 target farmers were democratically elected from the main group to form the Model Farmer Group - The target farmers were evenly spread in the scheme irrigation blocks - Registration of MFG is ongoing
Igembe South	Kaumbura	Kithanga SHG	- Kithanga SHG was ranked number one out the five groups considered as per set selection criteria (see in Table 4 below) - Membership is well spread and literacy higher - MFG has 50 members full paid members

Source: JICA Team

8.1.3 Sensitisation/ Introduction Meetings for SIDEMAN-SAL Agric. Activities:

To promote the relevant officials and beneficiary farmers understanding of the basic concept and purpose of the activities, several opportunities were provided by the Project. The Project held several sensitisation meetings for the County Officials composed of the SCAOs, the SCIOs and other County officials; and another for the members of selected farmer group and local extension officers, such as FEOs and DAEOs.

Table 8.1.5 Sensitisation Activities for Project Pilot Sites

Topic/Activity	Purpose	Content	Facilitator	Participant
Sensitisation Meeting for County Officials	Sensitisation for the County officials, the SCAOs and other relevant staffs (including SCIOs and other County officials)	1) Explanation of the outline of a) SIDEMAN-SAL farming support activity, b) SHEP Approach, c) LISA technologies d) Resilience survey 2) Procedure of reporting/ monitoring of activities	PMT SHEP Experts Bioversity Intl.	SCAOs SCIOs County/ Sub-County officials
Sensitisation Meeting for Local Extension Officials and Farmer Group	Sensitisation for the selected farmer group members and relating local officials, such as DAEOs and FEOs	1) Explanation of the outline of a) SIDEMAN-SAL farming support activity, b) SHEP Approach, c) LISA technologies 2) Procedure of reporting/ monitoring of activities	PMT SHEP Experts Bioversity Intl.	FEOs DAEOs SCAOs Members of the model farmer group

Source: JICA Team

8.1.4 Introduction of the Core Component of SHEP Approach:

The major activities relating to the training in SHEP Approach are outlined below;

Table 8.1.6 Major Activities of SHEP Approach

Topic/Activity	Outline
Sensitisation Workshop	*Facilitation of the understanding of the project activities *Clear definition of the roles and responsibilities of all those concerned with the Project
Baseline Survey	*Participation of farmers' organisations (and individual farmers) in the survey in which various survey tools are used under the guidance of extension workers
FABLIST Forum	*A forum for the meeting between farmers' organisations and members of the horticultural industry for the former to expand their knowledge and network of 'farming as a business.'
JEF2G Training	*Exercises of a series of activities for market research, crop selection, analysis of problems and purposes and preparation of an action plan *Exercise in market research using the format prepared by the project team
Group Activities (Market Research/ Action Plan Making)	*Implementation of market research by farmers assisted by extension workers *Preparation of an action plan on the basis of the results of the market research
FT-FaDDE	*Technical training for extension workers corresponding to the needs of farmers' organisations *Distribution of training material for the extension which can be used at the places of work
In-Field Training	*Dissemination of technologies in accordance with the contents of the action plans in In-field Training *Practical lessons on the knowledge and technologies required for the production of selected crops
Monitoring and Follow Up	*Monitoring of the state of horticultural production and farming technologies of the participating farmers' organisations and changes in the organisations during the implementation and after the completion of the series of activities

Source: JICA Team

In pilot project sites located in the Sub-Counties where the SHEP Approach is NOT in practice, the core components of SHEP Approach would be introduced by the SHEP experts.

Table 8.1.7 Activities for Introduction of the Core Components of SHEP Approach

Topic/Activity	Purpose	Content	Facilitator	Participant
Baseline Survey Workshop	Workshop for baseline survey	1) How to fill the baseline survey tools 2) Baseline survey exercise	PMT SHEP Experts	SCAO, DAEO & FEO Representatives of the model farmer group
Abbreviated Market Condition Survey & Crop Planting Calendar Making Workshop	*Identify the actual market condition in the nearest places in/ from the pilot project site *Crop planting calendar making exercise	1) Exercise in market condition survey 2) Practices in making action plan and crop planting calendar	PMT SHEP Experts	SCAO, DAEO & FEO Representatives of the model farmer group
Record Keeping Management Workshop	Training session of the record keeping management	How to record the revenue and expenditure for farming business	PMT SHEP Experts	SCAO, DAEO & FEO Representatives of the model farmer group

Source: JICA Team

The activities are briefed hereinafter.

(1)Baseline Survey

Submission of the baseline data of farmer group members consisting of 1) Crop Production and Income Analysis Data, 2) General Horticultural Crop Production and Post-Harvest Handling Technique and 3) Group Empowerment Indicator were requested.

1)Crop production and income analysis data

To identify the present condition on the farm household economy, the Crop Production and Income Analysis Data (CP & IAD) sheets were prepared by farmers. Items on the questionnaire are; a) Crop name and variety, b) Area under the crop, c) Total production, d) Total production per acre, e) Net Produce, f) Average price per Kg, g) Total Income, h) Total cost of production, i) Net income.

2)General horticultural crop production and post-harvest handling technique

To assess the level of both individual farmers and Farmers Groups in adopting basic horticultural production techniques, General Horticultural Crop Production and Post Harvest Handling Technique (GHCP&PHHT) survey report was also submitted from each individual farmer.

3)Group empowerment indicator

The Group Empowerment Indicators (GEIs) is a tool to determine the capacity change of the Farmers Groups in terms of Leadership, Cooperation among members & Gender. 5 levels are set from both qualitative aspects (do not require measurement) and quantitative aspects (measurable) which guide the level of farmers group in terms of previous 3 concepts and how they network with other community members.

(2)Market Survey

1)Market survey

Farmer group selected examiners/ representatives including the farmer representatives who participated in the previous Market Survey and Crop Planting Calendar Making Workshop, and formed a survey team. The SCAO and FEOs previously identified appropriate market place and obtained permission from the market authorities for survey. Survey team carried out the survey based on the survey questionnaire forms and recorded information on the forms.

Items on the questionnaire are; a) Name of produce dealer, b) Produce (and variety) handled, c) Quality requirement, d) Peak demand, e) Required quantity and frequency of supply, f) Place of production, g) Purchasing unit price, h) Mode of payment, i) Terms of payment and j) Marketing challenges. At the same time the survey team also collected market information on each target enterprise/crop and recorded.

2)Crop ranking and crop selection

All farmer group members were called together and conducted market survey analysis and crop selection to identify the market opportunities and to choose profitable agro-enterprise. They prepared crop selection information sheet based on the information collected at the market survey. Through the discussion and vote in a democratic manner farmer group selected two (2) prioritised enterprises (crops) for further steps.

3)Problem map and objective map

Then, farmer group practiced to draw the problem map for the purposes of identifying problems/ challenges for selling selected/ prioritised enterprises at competitive price at market. The objective map stating their objectives with regard to the respective problems/ challenges in the problem map was subsequently built.

4)Group action plan and crop planting calendar

Finally the action plan which includes all the activities to enhance the business and the crop planting calendar for those two selected/ prioritised crops were prepared. Group action plan consists of a) Objective b) Activity, c) Resources, d) Implementer, e) Schedule and f) Monitor sections. Based on the consultation with the SCAOs and other field officials, farmer group members built those plans.

(3)Record Keeping Management

The record keeping management workshop was held at each model farmer group site. The knowledge and skills obtained from this training topic would contribute/ produce an effect on the accuracy/ quality of the following (the 2nd year and later) baseline survey reports. The end-products of the activities in this training package included 1) Group Input Purchasing Record, 2) Group Harvesting Record, 3) Group Sales of Produce Record and 4) Planned Group Activities Record. However the training topic and workshop mainly focused on the importance of record-keeping implemented at each farm household. At the time of workshop SIDEMAN-SAL announced that the submission of reporting forms 1) to 4) above mentioned would be collected on voluntary bases. Group purchasing has not been reported from groups. Because of the drought damages, many farmer group members could not adjust the harvest/ shipment timings as group activities.

8.1.5 Trial Introduction of the Low Input Sustainable Agriculture (LISA) Technologies:

The followings were introduced through the farmer's preliminary selections;

(1)Kenyan Traditional Vegetables

Kenyan Traditional Vegetables (KTV), also known as the African Leafy Vegetables (ALV), programme is anticipated to contribute to the improvement in the livelihood and nutrition status of the farming groups in ASAL with alternative selection (diversity) of agricultural enterprise/ produce and with introduction/ revival of the nutritious supplemental food crops. It is expected to create more demand for these nutritious local crops and there by trigger more production of this resource.

(2) The Push-pull technology

The push-pull technology is an effective, low-cost technology for the control of stem borers and suppression of striga weeds in maize cultivation. It is a simple cropping strategy, whereby farmers use Nepier grass and desmodium legume (silverleaf and greenleaf desmodiums) intercrop as repellent "push" plants and trap "pull" plants. In ASAL area the stability in productivity of the dominant crop for staple food through reduction of the pest

damage is essential for augmentation of the resilience of local communities. This technology will also provide fodder for livestock and improve the fertility of the soil.

(3)The "Bokashi" fermented organic materials technology - Composting

This technology will enable farmers to improve yields through low cost use of improved soil fertility and plant nutrition. Basically, it is compositing and consequent reduction on the amounts and cost of commercial fertilisers. Farmers will be introduced to good soil fertility management, soil organic matter management, soil and water conservation, improved pest and disease management, and pest, disease and weed management that complement improved soil fertility and plant nutrition.

The series of activities conducted for the introduction of candidate technologies above mentioned are listed below;

Table 8.1.8 Activities for the Introduction of the Low Input Sustainable Agriculture (LISA) Technologies

Topic/Activity	Purpose	Content	Facilitator	Participant
Technology Introduction Workshop	1) Selection of 2-3 pilot farmers in the model farmer group 2) Technical guidance/ demonstration of Kenyan Traditional Vegetables	Technical training to the selected pilot farmers	PMT Bioversity Intl.	SCAO & FEO Pilot farmers of the model farmer group
Technology Evaluation Meeting	Evaluation of the trial/ demonstration practices, and making decision for further dissemination into the entire model farmer group	1)Report from the pilot farmers 2)Evaluation of the technology 3)Decision making for further dissemination	PMT Bioversity Intl.	SCAO & FEO Pilot farmers and members of the model farmer group
Technology Dissemination Workshop (when the candidate technologies are approved)	Dissemination of the technology into entire model farmer group	Technical workshop for the technology	PMT Bioversity Intl.	SCAO & FEO Members of the model farmer group

Source: JICA Team

8.1.6 Evaluation of the Adoption/ Dissemination of the Introduced Technologies:

Reporting and recording formats used at the Baseline Survey, Market Survey/Crop Planting Calendar Making and Record Keeping Management in the introduction of the core components of SHEP Approach were utilised for this purpose. Baseline survey was conducted periodically as a benchmark survey that identify the degree/ progress of understanding (intelligibility)/utilisation of learned technologies and knowledge obtained from the various training workshops. Various recording formats submitted by farmers would be reviewed for

confirmation of the degree of understanding the concepts of approach. Products/outcome of training sessions, such as crop planting calendar and group action plan, were also used as the indicator of understanding of the introduced technologies/concepts. In addition, the results were verified on what kinds of traditional vegetables were adopted and how many farmers adopted the vegetables could be identified the crop production and income analysis data used at the Baseline Survey. The other points for the verification were how much the Push-pull technology was affected on maize cultivation confirmed by using the crop production and income analysis data.

Not only by the reporting documents but the actual field visits the feedback system on the training programmes could be strengthened. Frequent participations and collaborations to the training sessions of original SHEP Approach at the pilot project site sites would enable the PMT to sent feedback to SHEP Unit on the implementation/ introduction of SHEP Approach in ASAL.

8.1.7 Implementation Schedule:

The programme timetables in the Batch-1 and Batch-2 pilot project sites are attached below;

Table 8.1.9 Implementation Schedule for Batch-1 Pilot Project Sites

Activities		Planned Period
Entire Pilot project sites		
Sensitisation Meeting for the County Officials		Aug. 2013
Pilot project sites in the Sub-County where SHEP is NOT in practice		
Sensitisation Meeting for the Local Extension Officers and Farmer Group		Sep.-Oct. 2013
Introduction of the Core Components of SHEP Approach		
	Baseline survey	Nov. 2013
	Market survey and Crop planting calendar making	Dec. 2013
	Record keeping management	Jan. 2014
Introduction of LISA Technologies		
	Technology introduction workshop	Feb.-Mar. 2014
	Technology evaluation meeting	Aug.-Sep. 2014
	Technology dissemination workshop	Sep. 2014
Trial Implementation of Resilience Survey (only at the selected schemes)		
	Sensitisation and data collection meeting	May-Jun. 2014
	Feedback meeting	May-Jul. 2015
Pilot project sites in the Sub-County where SHEP is in practice		
Implementation of the original SHEP Approach		
	Sensitisation meeting	Dec. 2013
	Baseline survey	Jan. 2014
	FABLIST forum	Feb. 2014
	JEF2G training	Mar.-Apr. 2014
	Group activity	Apr.-May 2014
	FT-FaDDE	Jun. 2014
	In-field training	Jun. 2014 -

Source: JICA Team

Table 8.1.10 Implementation Schedule for Batch-2 Pilot Project Sites

Activity	Content	Implementation Schedule
Sensitisation workshop	Facilitation of the understanding of the project activities. Clear definition of the roles and response- bilities of all those concerned with the Project.	July & August 2014
Baseline Survey workshop and the implementation monitoring	1) How to fill the baseline survey tools 2) Baseline survey exercise 3) Implementation of baseline	October 2014
Abbreviated Market Condition Survey & Crop Planting Calendar Making workshop and the monitoring	1) Exercise in market condition survey 2) Practices in making action plan and crop planting calendar	November 2014
Record Keeping Management workshop and the monitoring	How to record the revenue and expenditure for farming business	December 2014

Source: JICA Team

8.2 Results and Analysis of SHEP Approach and LISA Technology

8.2.1 Introduction of the Core Components of SHEP Approach:

(1) Baseline Survey

To analyse the changes in farm economy, the Annual Baseline Survey of the model farmer groups was implemented. Submission of the survey data of the farmer group members consisting of 1) Crop Production and Income (CPI) Analysis Data, and 2) General Horticultural Crop Production and Post Harvest Handling Technique (GHCP&PHHT) and 3) Group Empowerment Indicator (GEI) were requested to all the SCAOs of the pilot project sites. Since only about a half of the year (6 months) has passed from previous survey that was held at October 2014, the data of the crop production and farm income (the 3rd in Batch-1 and 2nd in Batch-2 pilot project sites) were derived only from the previous short-rain season.

It was not observed drastic changes in the overall trends in the major enterprises produced by the model farmer groups. Maize or green maize was planted at all pilot project sites, and farmers cultivated beans or other leguminous (i.e. peas) crops as intercrop with those maize/ green maize. Major enterprises produced by the model farmer groups in Murachaki, Tumutumu and Kaumbura schemes consist only on grain crops.

In some cases, farmers could not reach to harvest stage and they could not sell at the market. Also they consumed harvests themselves and not sold. In many cases, farmers tend NOT to report the details in Total Income, Average Prices per Kg and Total Cost of Production when they failed to produce the crops and to gain income from the yield, and the tendency of farmers caused the difficulties in confirmation whether farmers have attempted planting the selected crops or not in the observed year. Also in the case of Batch-2 pilot project sites, members of the model farmer groups had just started (even not yet started) their construction works for irrigation system at the time of the 2nd Baseline Surveys implemented in March 2015. It is difficult at this time to say something whether the crop selections through the use of Market Survey activities in SHEP approach contributed to their income growth or not.

Table 8.2.1 Outline of the Crop Production and Income Analysis on the 1st to 3rd Baseline Surveys at Batch-1 Pilot Project Sites

Basic Information		Enterprise	Member Average (1st BLS)					Member Average (2nd BLS)					Member Average (3rd BLS*)				
Scheme	Farmer Group Name	Major enterprises produced in the farmer group	Sample No.	2. Area under the crop (Acre)	8. Total Income (Ksh)	9. Total Cost of Production (ksh)	10. Net Income (Ksh)	Sample No.	2. Area under the crop (Acre)	8. Total Income (Ksh)	9. Total Cost of Production (ksh)	10. Net Income (Ksh)	Sample No.	2. Area under the crop (Acre)	8. Total Income (Ksh)	9. Total Cost of Production (ksh)	10. Net Income (Ksh)
				2b.	(5.x 7.)	9	(8 – 9)		2b.	(5.x 7.)	9	(8 – 9)		2b.	(5.x 7.)	9	(8 – 9)
				Acres	Ksh	Ksh	Ksh		Acres	Ksh	Ksh	Ksh		Acres	Ksh	Ksh	Ksh
Pilot schemes in the sub-county where SHEP is NOT in practice																	
OLOPITO	Olopito Irrigation Scheme	Green Maiz, Beans, Kale, Tomato, Cabbage	48	2.019	91,722	38,531	53,594	40	4.868	52,259	25,787	26,472	30	1.414	12,063	16,069	-3,248
MDACHI	Mdachi Scheme	Green maiz, Cowpie, Kunde, Cassaya, Muchicha	55	3.091	59,257	20,228	39,028	40	2.783	91,632	33,363	58,270	39	1.762	22,272	13,797	8,475
G/MUTHAIGA	Gathitu-Muthaiga	Cabbage, Green Maiz, Tomato, Beans, Onion	47	1.819	284,051	88,505	145,547	35	1.328	187,777	66,360	121,417	25	0.930	216,299	66,117	150,182
MURACHAKE	Uklima Bora S.H.G.	Sorghum, Green Maiz, Cowpie, Maiz, Millet	20	4.755	33,114	20,336	12,778	12	3.492	15,247	18,924	-3,060	14	3.824	43,278	22,010	15,085
KABEN	Kaben Irrigation Scheme	Maize, Mango, Banana, Beans, Green Maiz	46	2.637	212,211	62,940	149,271	19	3.351	236,890	54,719	182,172	34	2.953	145,759	34,719	111,039
TUMUTUMU	Bainthanga Water Project	Maize, Pigeon peas, Cowpie, Beans, Green Maiz	45	3.495	49,080	43,164	5,972	19	6.867	64,087	40,255	23,832	20	2.694	12,828	15,717	-2,890
Pilot schemes in the sub-county where SHEP is in practice (Reported only Hort. Crops)																	
KASOKONI	Ngoyaki Foundation C.B.O.	Banana, Tomato, Kale, Bulb onion, Capsicum	16	0.498	31,218	13,177	18,041	**	**	**	**	**	**	**	**	**	**
MUUNGANO	Turkey Self Help Group	Tomato, Avocado, Mango, Kale, Banana	14	0.025	8,747	633	3,114	**	**	**	**	**	**	**	**	**	**

Source: JICA Team

Table 8.2.2 Outline of the Crop Production and Income Analysis on the 1st and 2nd Baseline Surveys at Batch-2 Pilot Project Sites

Basic Information		Enterprise	Member Average (1st BLS)					Member Average (2nd BLS)				
Scheme	Farmer Group Name	Major enterprises produced in the farmer group	Sample No.	2. Area under the crop (Acre)	8. Total Income (Ksh)	9. Total Cost of Production (ksh)	10. Net Income (Ksh)	Sample No.	2. Area under the crop (Acre)	8. Total Income (Ksh)	9. Total Cost of Production (ksh)	10. Net Income (Ksh)
				2b.	(5 x 7.)	9	(8 – 9)		2b.	(5 x 7.)	9	(8 – 9)
				Acres	Ksh	Ksh	Ksh		Acres	Ksh	Ksh	Ksh
C/TUHIRE	Boresha Kilimo	Banana, Beans, Green Maiz, Onion, Tomato	48	1.444	226,420	61,398	165,022	35	1.760	69,410	37,681	31,929
SHULAKINO	Shulakino Farmers	Beans, Cabbage, Green Maiz, Kale, Tomato	37	2.595	22,061	21,454	-284	33	0.826	40,623	15,562	25,458
KAUMBURA	Kithanga Farmers	Beans, Cowpea, Green Gram, Green Maiz, Maiz	47	1.324	8,709	12,133	-3,425	33	1.483	14,611	7,720	5,838
MANGUDHO	Mangudho Farmers	Cassava, Cowpea, Kunde, Maize, Pojo	35	4.946	31,824	27,503	4,321	29	1.433	7,025	9,709	-2,626
K/RAYA	K/Raya Farmers	Beans, Cabbage, Garlic, Green Maiz, Tomato	40	1.554	252,423	78,206	174,217	29	0.632	91,859	33,322	58,537

Source: JICA Team

To identify the capacity changes of both individual farmers and farmers groups in adopting basic horticultural production techniques, the GHCP&PHHT surveys were conducted annually for model farmer groups.

Table 8.2.3 Outline of the GHCP & PHHT on the 1st to 3rd Baseline Survey at Batch-1 Pilot Project Sites

SCHEME	Sample No.			Q1: Implementation of Market Survey			Q2: Preparation of Crop Planting Calendar			Q20: Record keeping and Cost & Income Analysis		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
OLOPITO	48 (F:17/ M:31)	40 (F:15/ M:25)	30 (F:14/ M16)	10.9	52.5	36.7	30.4	72.5	44.8	20.5	52.5	30.0
MDACHI	55 (F:26/ M:29)	40 (F:16/ M:24)	39 (F:21/ M18)	5.5	87.5	30.6	1.8	87.5	44.4	3.7	87.5	55.6
GATITU-MUTHAIGA	47 (F:14/ M:33)	36 (F:12/ M:24)	25 (F:10/ M15)	14.9	47.2	40.0	14.9	52.8	24.0	26.1	52.8	52.0
MURACHAKE	20 (F:14/ M:6)	12 (F:07/ M:05)	14 (F:09/ M:05)	15.0	91.7	92.9	10.0	91.7	92.9	5.0	91.7	92.9
KABEN	46 (F:12/ M:34)	19 (F:06/ M:13)	34 (F:09/ M25)	17.8	78.9	47.1	13.8	63.2	29.4	19.6	94.7	67.6
TUMUTUMU	45 (F:13/ M:32)	19 (F:04/ M:15)	20 (F:06/ M14)	0.0	5.9	10.0	0.0	23.5	10.0	0.0	0.0	20.0

Source: JICA Team

It is observed that a small proportion of farmers have conducted "Pre-cultivation Preparation" such as undertaking market survey (Q1) and preparing crop planting calendar (Q2) in the 1st survey (before training), however on the 2nd survey, most of the farmers in all schemes except Tumutumu and Kiamariga-Raya schemes had conducted market survey and crop planting calendar making. The percentages of farmer members who implemented the cost income analysis (Q20) were dramatically increased compared to that in previous year(s).

It is observed that a small proportion of farmers have conducted soil testing (Q3) and used recommended compost (Q4) in "Pre-cultivation Preparation." Farmers recognised that they kept using quality planting materials (Q5). For the questions regarding "Land Preparation (Q6,7,8)" and Crop Establishment (Q9,10,11)" the proportion of the adopted farmers in a group members were increased compared to the 1st survey in Batch-1 pilot project sites.

The observation above mentioned proves that the series of training sessions and practices of the core components of SHEP Approach is actually taken hold across the members of farmer groups, and the knowledge obtained at the training contributed the increment of the

farmer's competence/ capacity of the Market-Oriented Agriculture.

Table 8.2.4 Outline of the GHCP & PHHT on the 1st and 2nd Baseline Survey at Batch-2 Pilot Project Sites

SCHEME	Sample No.		Q1: Implementation of Market		Q2: Preparation of Crop Planting		Q20: Record keeping and Cost & Income	
	1st	2nd*	1st	2nd*	1st	2nd*	1st	2nd*
CHARA-TUHIRE	40 (F:14/ M:26)	36 (F:09/ M27)	7.5	83.3	10.0	100.0	45.0	94.4
SHURAKINO	37 (F:14/ M:23)	35 (F:13/ M22)	41.7	48.6	62.9	51.4	22.9	45.7
KAUMBURA	47 (F:08/ M:39)	33 (F:09/ M:24)	0.0	51.5	4.4	33.3	4.3	30.3
MANGUDHO	35 (F:27/ M:08)	28 (F:20/ M:08)	17.1	64.3	14.3	60.7	11.4	37.9
KIAMARIGA	40 (F:13/ M:27)	21 (F:04/ M:17)	20.0	28.6	22.5	23.8	32.5	38.1

Source: JICA Team

(2) Market Survey

On the selection of the 1st and 2nd prioritised crops, farmer group members had taken into account not only the market prices but also the interest, preference, experience, availabilities of planting materials and resources, and technical feasibility of farmer group members.

The selected/ prioritised crops reported by each farmer group are listed below

Table 8.2.5 Selected/ Prioritised Crops (1st & 2nd) of Batch-1 Pilot Project Sites

Scheme	Sub-County	Farmer group	1st crop	2nd crop
Pilot project sites in the Sub-County where SHEP is NOT in practice				
Olopito	Narok-North	Olopito Irrigation Scheme	Green Maize	Dry Beans
Mdachi	Ganze	Mdachi scheme	Okura	Black Nightshade
G/Muthaiga	Laikipia-West	Gatitu-Muthaiga	Cabbage	Bulb Onion
Murachaki	Mbeere-North	Ukulima Bora S.H.G	Green Maize	Tomato
Kaben	Marakwet-East	Kaben Irrigation Scheme	Tomato	Green Gram
Tumutumu	Igembe-South	Bainthanga Water Project	Water Melon	Onion
Pilot project sites in the Sub-County where SHEP is in practice				
Kasokoni	Taveta	Ngoyaki Foundation C.B.O	Tomato	Capsicum
Muungano	Tharaka-South	Turkey Self Help Group	Tomato	Water Melon

Source: JICA Team

Table 8.2.6 Selected/ Prioritised Crops (1st & 2nd) of Batch-2 Pilot Project Sites

Scheme	Sub-County	Farmer group	1st crop	2nd crop
Challa/Tuhire	Taveta	Boresha Kilimo	Tomato	Green Maize
Shulakino	Narok-North	Shulakino Irrigation scheme	Tomato	Kale
Kaumbura	Igembe-South	Kithanga SHG	Green Maize	Tomato
Mangudho	Ganze	Mangudho Irrigation scheme	Tomato	Green Maize
Kiamariga/Raya	Laikipia-West	K-Raya Irrigation scheme	Garlic	Cabbage

Source: JICA Team

For instance the farmer group members in Gatitu-Muthaiga scheme chose Cabbage and Bulb Onion as their selected/ prioritised crops. Although farmers have remarked that the high cost of production on Cabbage and Bulb Onion, it is deduced/ inferred that they expected the reduction of production costs through the group production. At the first crop selection vote the numbers of votes polled were dispersed. However at the vote for the second crop selection many of farmer group members voted for Bulb onion.

Also in case of Olopito and Kaben schemes, farmers also considered the construction periods and water availabilities at the time of selections. Despite the fact that horticultural crops seemed to be better choice as cash crops, they chose the grain crops that were able to grow under rainfed condition and to serve as staple foods. Group members in the several schemes had selected prioritised crops with the expectation of irrigation water after construction periods.

The farmer group members of Mdachi scheme selected Giant African Nightshade as the second prioritised crop for the Introduction of Core Components of SHEP Approach. As the selected varieties for the trial introduction of Kenyan Traditional Vegetables (KTVs) on Introduction of LISA Technology programme, the farmer group members of Mdachi scheme also selected Giant African Nightshade, Amarantus and Spider plant with consideration given to the interest, preference, availabilities of planting materials and technical feasibility of farmer group members. They reported/ mentioned that they found Giant Nightshade in the market when they conducted Market Survey for the Introduction of Core Components of SHEP Approach, and relatives of some group members had experience in planting the Giant Nightshade, so they thought it is feasible for them.

8.2.2 Trial Introduction of the Low Input Sustainable Agriculture (LISA):

LISA technologies were introduced to the pilot project sites located in the four (4) Sub-Counties, which would have the second-batch pilot project sites. After the explanations of 3 candidate technologies in detail, farmer group members prioritised, and then selected two (2) technologies with consideration given to the interest, preference and feasibility of farmer group members. Following the demand-driven-approach, the farmer group members also prioritised/ selected three (3) crops/ varieties in Kenyan Traditional Vegetables (only when

they selected KTVs). Finally each farmer group selected/ appointed two (2) pilot farmers per each selected technology as representatives of the farmer group.

Table 8.2.7 Selection of Candidate LISA Technologies

Scheme	Rank	Crop/ Variety	Note
Mdachi (Kilifi)	1	Kenyan Traditional Vegetables	
	2	Push-pull Technique	
	3	Bokashi Technique	
Olopito (Narok)	1	Kenyan Traditional Vegetables	
	3	Push-pull Technique	
	~~2~~	~~Bokashi Technique~~	Declination/ refusal by model farmer group
Gathitu/ Muthaiga (Laikipia)	1	Kenyan Traditional Vegetables	
	2	Pusj-pull Technique	
	3	Bokashi Technique	
Tumutumu (Meru)	1	Kenyan Traditional Vegetables	
	2	Bokashi Technique	
	3	Push-pull technique	

Source: JICA Team

The activities of KTV, and Push and Pull were largely affected by prolonged drought in 2014, which seemed to be the worst since 2000. All of rainfed pilot farm were failed due to lack of rain. Mdachi scheme was extremely serious because the scheme was suffered from flood after drought. But farmers, who failed in first trial, restarted to grow KTV in different field from the beginning of June 2014. The LISA programme started very well in March/ April 2014, with farmers quite enthusiastic about the programmes. A number of them even bought the seed on their own for planting but majority did not plant due to drought. Those who had irrigation water succeeded in getting good crop for their families and even to sell and generate income (in some incidences with better price than Kales). Those who did not have irrigation water suffered heavily from the effects of drought as were evidenced in Gatitu/Muthaiga and Olopito schemes.

Because of severe and unpredictable drought damage, the most of the pilot farmers failed to continue production for the first planting. Several farmers attempted to re-plant and it caused that some pilot farmers were still under cultivation/ harvesting at the time of evaluation.

Table 8.2.8 Progress of the Introduction of LISA Technologies (as of August 2014)

1) Push-Pull

Scheme		Land Preparation	Seeding	Vegetative growth	Harvest	Comment
Mdachi	1	○	X	-	-	Seeding could not implement due to flooding
	2	X	-	-	-	Land preparation could not implement due to flooding.
Olopito	1	○	○	○	X	Maize grew but did not fruit due to drought and disease.
	2	○	○	X	-	Maize and napier died by drought.
Gatitu/ Muthaiga	1	○	X	-	-	Seeding could not implement due to drought
	2	○	○	○	-	Seeding restarted after drought damage in different field.

2) Kenya Traditional Vegetables

Scheme		Land Preparation	Seeding	Vegetative growth	Harvest	Comment
Mdachi	1	○	○	○	-	Seeding was restarted in garden near by house in May after flood damage.
	2	○	○	○	○	Seeding was implemented in the garden near by his house and the nursery was transplanted in irrigated field after flood. Harvest started in July.
Olopito	1	○	○	○	-	Seeding was restarted in irrigated field in Jun after the first trial damaged by drought.
	2	○	○	○	-	Seeding was restarted in irrigated field in Jun after the first trial damaged by drought.
Gatitu/ Muthaiga	1	○	○	X	-	Seed did not germinate due to drought.
	2	○	○	○	○	Harvest started in Jun and the area is expanding
Tumtum	1	○	○	○	○	Harvest started in Jun
	2	○	○	○	○	Harvesting started in Jun

○ : Started X : Not started or failed 1,2 : Cultivate in irrigated field

Source : JICA Team

At the end of major rainy period (August 2014), with the observation/ participation of local agricultural officers such as the SCAO, DAEO and FEOS, interviews and discussions with pilot and volunteer neighbouring farmers (and other group members) were implemented for the evaluation of candidate technologies and a decision making whether the farmers would like to continue and disseminate the technology to entire group members.

Table 8.2.9 Sample Summary of the Interview/Discussion at the Evaluation of LISA Technologies (at Gatitu- Muthaiga scheme on KTVs)

Gathitu-Muthaiga scheme (KTVs)		
Progress/ Performance	Farmer's Incentive Reported	Challenges Raised on Production
1.Achieved two of pilot demo farmers and a number follower farmers 2.Stanley Murage planted Mnavu (Giant-African Nightshade) and Manugu (Orange-fruited Nightshade) and Saget under irrigation. 3.Mnave performed much better and is most popular in the area 4.Terresia Njiogu planted with no irrigation, and demo failed due to drought 5.The three volunteer farmers who were monitored had poor crop due to drought and others did not follow the technical guidelines. 6.Also number of farmers purchased seeds but could not plant due to drought	1.Production cost was reported to be lower than other horticultural crops 2.Incidence of pests and diseases was reported as less than other horticultural crops, hence limited use of chemicals in production 3.KTVs have a high nutritional value 4.The KTVs are not only food but generate income to the family 5.Most popular KTV was giant managu 6.Farmers requested for more seeds 7.Farmers expressed the need to increase the number of demonstration farmers on KTVs	1.Drought was evident during the implementation of the programe and for those who relied on rains they had very poor germination 2.Did not have ready market for Saget 3.There was also expressed the needs to learn them on how to cook and mix the vegetables 4.This needs to be followed up with the SCAO

Source: JICA Team

During the LISA introduction meeting, farmers were fully informed on the ingredients of the Bokashi compost and the possible cost implications. The technology was nevertheless chosen by one scheme (i.e Tumutumu) but it never took off due to the challenges indicated below;

- Farmers realised that the technology was a bit expensive and could not afford amounts of sugar ingredient as required
- Non-supply by the SCAO and non-collection by farmers of molasses (sugar substitute) hindered take off of the technology

Consequently the farmers requested that they be allowed to choose another technology other than Bokashi Tech.

8.3 Impact of SHEP Approach and LISA Technology

8.3.1 Follow-Up Survey on Introduction of the Core Components of SHEP Approaches

To identify/ confirm the estimated number (or proportion) of membership in the model farmer group 1) who have ever individually (or by inner-group) undertaken Market Surveys after the 1st Market Survey implemented by the representatives of the model farmer groups and 2) who have been keeping crop records individually (or by inner-group), the follow-up interview

survey was held on July 2015. SIDEMAN-SAL sent the SCAOs a questionnaire sheet previously, and the answers were made based on the estimation made by the SCAOs and FEOs

Table 8.3.1 Results of Follow-Up Survey on Introduction of the Core Component of SHEP Approach (Batch-1 Pilot Project Sites)

Scheme	Name of Farmer Group	1) Market survey			2) Record keeping		
		T	F	M	T	F	M
Olopito	Olopito Irrigation Scheme	21	10	11	25	12	13
Mdachi	Mdachi scheme	3	1	2	2	1	1
G/Muthaiga	Gatitu-Muthaiga	6	1	5	10	2	8
Murachaki	Ukulima Bora S.H.G	5	3	2	16	9	7
Kaben	Kaben Irrigation Scheme	**	**	**	21	6	15
Tumutumu	Bainthanga Water Project	1	0	1	**	**	**
Kasokoni	Ngoyaki Found. CBO	---	---	---	---	---	---
Muungano	Turkey Self Help Group	2	0	2	2	0	2

T; Total, F; Female, and M; Male

Source: JICA Team

Table 8.3.2 Results of Follow-Up Survey on Introduction of the Core Component of SHEP Approach (Batch-2 Pilot Project Sites)

Scheme	Name of Farmer Group	1) Market survey			2) Record keeping		
		T	F	M	T	F	M
Challa/Tuhire	Boresha Kilimo	16	6	10	16	6	10
Shulakino	Shulakino Irrigation scheme	14	6	8	21	7	14
Kaumbura	Kithanga SHG	---	---	---	---	---	---
Mangudho	Mangudho Irrigation scheme	2	0	2	**	**	**
Kiamariga/Raya	K-Raya Irrigation scheme	4	1	3	6	2	4

T; Total, F; Female, and M; Male

Source: JICA Team

It is generally reported that the 2nd Market Survey has not conducted by the group representatives again, but it has been done by the voluntary individuals (or "not-so-structured inner-groups") in some pilot project sites. Since farmer groups in the Batch-2 pilot project sites were still using Crop Planting Calendars, which were made on November 2014, it was actually reported that the 2nd Market Survey had not conducted by the group representatives of model farmer groups in Kaumbura, Mangudho and Kiamariga-Raya schemes.

The model farmer group in Mdachi scheme collected contributions from group members for the bus fares for the group representatives. In Tumutumu farmer group members requested and paid money to the SCAO to purchase the paper-filing-folders at nearest town for all membership to keep recording and to file their records. Farmers who are not in the model farmer group have been following the trainings which their colleagues have been undertaking and were keen asking to be taught the same.

Only a small proportion of scheme farmers are keeping records. It is also reported that the records kept by farmers were mainly on input purchase. The almost all group members were

still farming as individuals, however many farmer groups mentioned that they had intensions of implementing activities on the Group Action Plan when irrigation water reaches their schemes.

There were several effects reported t the meeting;

- The trainees went back home and spread news of the training to neighbours who picked it up.
- Darajani FFS are doing it too.
- Some farmers in the neighbouring schemes who produce water melons and green grams in succession have found buyers in Nakuru, Nairobi and Eldored.
- During trainings, farmers outside the irrigation scheme come for the trainings and they were convinced.
- The trained farmers went home and spread the news of the importance of keeping farm records.
- Those producing to sell are keen to keep records to determine the costs incurred and profit margins.

The observation on the results from GHCP&PHHT survey proves that the series of training sessions and practices of the core components of SHEP Approach is actually taken hold across the members of farmer groups, and the knowledge obtained at the training contributed the increment of the farmer's competence/ capacity of the Market-Oriented Agriculture.

8.3.2 Selection of the Prioritised Crops through Market Survey

On the selection of the 1st and 2nd prioritised crops, farmer group members had taken into account not only the market prices but also the interest, preference, experience, availabilities of planting materials and resources, and technical feasibility of farmer group members. The selection/ prioritisation of enterprises/ crops were often made as premises for completion of the rehabilitation of irrigation system at the pilot project sites. In some cases farmer groups reported/ mentioned that they have intensions of planting selected crops after irrigation water reaches their schemes.

Table 8.3.3 Prioritised Crops (1st & 2nd) and Number of Farmers Cultivated/ Harvested those Selected Crops in Each Pilot Project Site (at the 2nd BLS in Batch-1 Pilot Project Sites)

Scheme	Sub-County	1st crop	*No.	2nd crop	*No.
Olopito	Narok-North	Green Maize	24	Dry Beans	20
Mdachi	Ganze	Okura	7	Black Nightshade	7
G/Muthaiga	Laikipia-West	Cabbage	17	Bulb Onion	12
Murachaki	Mbeere-North	Green Maize	nil	Tomato	nil
Kaben	Marakwet-East	Tomato	2	Green Gram	10
Tumutumu	Igembe-South	Water Melon	nil	Onion	nil

Source: JICA Team

Table 8.3.4 Prioritised Crops (1st & 2nd) and Number of Farmers Cultivated/ Harvested those Selected Crops in Each Pilot project site (at the 3rd BLS in Batch-1 Pilot Project Sites)

Scheme	Sub-County	1st crop	*No.	2nd crop	*No.
Olopito	Narok-North	Green Maize	29	Dry Beans	23
Mdachi	Ganze	Okura	3	Black Nightshade	0
G/Muthaiga	Laikipia-West	Cabbage	13	Bulb Onion	12
Murachaki	Mbeere-North	Green Maize	1	Tomato	1
Kaben	Marakwet-East	Tomato	8	Green Gram	21
Tumutumu	Igembe-South	Water Melon	0	Onion	0

Source: JICA Team

Number of farmers above mentioned is the number of farmers who successfully obtained their yields/ harvests and somehow sold them at the market/ to the middlemen. In some cases, farmers could not reach to harvest stage and they could not sell those prioritised enterprises/ crops at the market. Also they consumed harvests themselves and not sold. In many cases, farmers tend NOT to report the details in Total Income, Average Prices per Kg and Total Cost of Production when they failed to produce the crops and to gain income from the yield.

Table 8.3.5 Prioritised Crops (1st & 2nd) and Number of Farmers Cultivated/ Harvested those Selected Crops in Each Pilot Project Site (at the 2nd BLS in Batch-2 Pilot Project Sites)

Scheme	Sub-County	1st crop	*No.	2nd crop	*No.
Challa Tuhire	Taveta	Tomato	28	Green Maize	34
Shulakino	Narok-North	Tomato	4	Kale	0
Kaumbura	Igembe-South	Green Maize	3	Tomato	0
Mangudho	Ganze	Tomato	2	Green Maize	0
Kiamariga Raya	Laikipia-West	Garlic	10	Cabbage	4

Source: JICA Team

Also in the case of Batch-2 pilot project sites, members of the model farmer groups had just started (even not yet started) their construction works for irrigation system at the time of the 2nd Baseline Surveys implemented in March 2015. It is difficult at this time to say something whether the crop selections through the use of Market Survey activities in SHEP approach contributed to their income growth or not.

It is actually observed that the “selected grain crops,” which are mainly grown under rainfed condition, are followed/ planted by lager numbers of farm group members compared to the numbers of farmers cultivating “selected horticultural crops,” which generally require irrigated conditions. In Tumutumu scheme no farmers could start planting their selected crops without completion of the rehabilitation of irrigation system where they selected water melon and onion as prioritised enterprises.

Also many of those SCAOs, FEOs have raised an issue that workload of activities in the Project was heavy and tight. Local staffs should handle not only activities regarding farming

support such as training workshops and field monitoring visits but training session for IWUA members and supervising construction works. The farmers were also regularly mobilised for construction works between an intervals of their daily duties.

8.3.3 Evaluation of the LISA Technologies

Major positive impacts and constraints on Kenyan Traditional Vegetables (KTVs) and Push-pull Technology were reported as follows;

(1)Kenyan Traditional Vegetables (KTVs):

Farmers indicated the following benefits from Kenyan Traditional Vegetables programme;

a) The KTVs are not only food but generate income to the family
b) The vegetables provide nutritional value to the family members
c) KTVs are easy and less costly to grow (There is less incidence of pests and diseases hence limited use of chemicals in production of KTVs than in kales and cabbages and other horticultural crops)
d) There is a ready market for the KTVs at price higher than that of kales
e) KTVs climatically adaptable to the local conditions/ environment and some are already grown in the area
f) Farmers in some of the schemes (notably Mdachi and Olopito schemes) have been producing the local varieties of Mnavu and Mchicha and Saget so have traditional technical knowledge on production and utilisation
g) Can use organic pest control or chemical pesticides
h) KTVs have medicinal value (such as gout quoted in Olopito)
i) KTVs are good rotational crops as they can be rotated with brassicas to break the disease and pest cycle

Farmers also pointed out several constraints;

a) Prolonged drought in all the schemes and flooding in Mdachi caused poor crop production
b) There was poor germination of certain KTV seeds particularly for Spider plant in Olopito and Gatitu Muthaiga

(2)Push-pull Technique:

Farmers indicated the following benefits from the Push-pull technology

a) There is no chemical application to control stem borer hence it reduces the cost of maize production
b) Desmodium crops provides ground cover hence suppresses/ control weeds and increase soil moisture

c) Push-Pull is farmer friendly and is safer to family
d) They indicated that the Napier forms a good guard row around the maize and stray cows graze it first before they reach the maize, by which time the herdsman will have removed the cows
e) There is high demand for fodder crops (Napier and desmodium are very good fodder crop and increase in production of these will enhance availability of fodder in the scheme areas
g) The Push and pull technology helps to control soil erosion
h) The Push–pull technology has reduces production cost (cost of stalk borer control and weeds control are highly reduced
i) The desmodium increases nitrogen in soil hence improves soil fertility

Under the Push-pull technology some of the problems noted were as follows;

a) Prolonged drought
b) Availability of Napier grass
c) Poor germination for desmodium and
d) Maize Lethal Necrosis Disease

In conclusion, farmers have agreed that there was the need to continue with the programme. They also expressed the need to increase the number of demonstration farmers on both technologies. Famers are still enthusiastic to continue with the technology due the associated benefits as indicated above. They want to continue and multiply the Napier in order to obtain the same from close-by.

8.4 Lesson Leant and Recommendations for SHEP Approach and LISA Technology

The lessons learned from the SIDEMAN-SAL agricultural support activities and several recommendations for the future to keep sustainable/ effective project activities are followings;

(1) Selection of the Model Farmer Groups and Members

In most cases the selected farmer groups met the criteria and procedure being taken by SHEP approach. However in several cases the SCAOs encountered difficulties in the selection. For instance there were no existing registered agricultural production/ marketing groups in the Mdachi scheme. The selected model farmer group was comprised of 50 members who were the most active members from the IWUA. Also in the Gatitu-Muthaiga scheme two groups of Gatitu and Muthaiga were already existing and registered as farmer irrigation groups, thus the fifty (50) members of the model farmer group were chosen as representatives of sections/ blocks from those two groups. On the other hand, it was exceptionally happened that a model farmer group of SIDEMAN-SAL

pilot project site containing/ including few member farmers who have their farm field outside the pilot project site area was selected. A SCAO strictly followed the original criteria used for SHEP approach, but the result of selection that few people from outside of the pilot project site received training was complained from other farmer (IWUA members) in the scheme.

Given-condition in the selection of model farmer group in the pilot project sites was slightly restricted because the distribution of group members in the pilot project site should be considered. In many cases almost all existing groups in a scheme are represented only in certain parts of the scheme, and this is not necessary to consider in SHEP project areas/ sites.

Several modifications on the model farmer group selection / formation were made based on the close dialogue with farmers, government officials such as the SCAO, DAEO and FEOs, and the PMT members. For the selection in the Batch-2 pilot project sites, except Kaumbura scheme, group member farmers who were evenly spread in the scheme were democratically elected by the IWUA members in each scheme irrigation block. The 50 farmers were selected proportionately and in accordance with the numbers in each block.

To avoid the confusion the SCAOs should consider/ clearly define whether the all group member should be located/ resident in the pilot project site area or not when select / formulate the model farmer groups at new pilot project sites.

(2)Selection of Prioritised Crops through the Market Survey

For the selection of those 1st and 2nd prioritised crops, farmer group members had taken into account not only the market prices but also the interest, preference, experience, availabilities of planting materials and resources, and technical feasibility of farmer group members.

It is actually observed that the “selected grain crops,” which are mainly grown under rainfed condition, are followed/ planted by lager numbers of farm group members compared to the numbers of farmers cultivating “selected horticultural crops,” which generally require irrigated conditions. Maize or green maize is planted at all pilot project sites, and farmers cultivated beans or other leguminous (i.e. peas) crops as intercrop/ catch crop with those maize/ green maize.

In some pilot project sites including Tumutumu and Olopito schemes, farmers mentioned the importance of planting grain cereals for their staple food crops, despite the fact that the cereal crops were not cash-crop and often caused the negative earnings at the end. Also in case of Olopito and Kaben schemes, farmers also considered the construction periods and water availabilities at the time of selections. Despite the fact that horticultural crops seemed

to be better choice as cash crops, they chose the grain crops that were able to grow under rainfed condition and to serve as staple foods. Group members in the several schemes had selected prioritised crops with the expectation of irrigation water after construction periods. The measure enterprises in Kaumbura consisted only on grain crops, and there are no horticultural crops in the five major enterprises in Mangudho scheme. Maize or green maize is planted at all pilot project sites, and farmers in Tuhire/Challa, Shulakino, Kaumbura and Kiamariga/Raya schemes utilised beans as intercrop/ catch crop with maize/ green maize.

From the observation of crop/ variety selections on Kenyan Traditional Vegetables (KTVs), for instance, the farmer group members of Mdachi scheme selected Giant African Nightshade, Amarantus and Spider plant with consideration given to the interest, preference, availabilities of planting materials and technical feasibility of farmer group members. They had also chosen the Giant African Nightshade as the second prioritised crop for the Introduction of Core Components of SHEP Approach. They reported/ mentioned that they found Giant Nightshade in the market when they conducted Market Survey for the Introduction of Core Components of SHEP Approach, and relatives of some group members had experience in planting the Giant Nightshade, so they thought it is feasible for them.

To identify whether the market survey contribute the dispersion of risk on market prices and the diversification of crop production, need the analysis of selection processes made by the farmers.

(3)Adoption of Crop Selection and Crop Planting Calendar

It is difficult at this time to say something whether the crop selections through the use of Market Survey activities in SHEP approach contributed to their income growth or not. The selection/ prioritisation of enterprises/ crops were made as premises for completion of the rehabilitation of irrigation system at the pilot project sites. In some cases farmer groups reported/ mentioned that they have intensions of planting selected crops after irrigation water reaches their schemes. In Tumutumu scheme no farmers could start planting their selected crops without completion of the rehabilitation of irrigation system where they selected water melon and onion as prioritised enterprises. In many cases, farmers tend to NOT report the details in Total Income, Average Prices per kg and Total Cost of Production when they failed to produce the crops, and the tendency of farmers caused the difficulties in confirmation whether farmers have attempted planting the selected crops or not in the observed year. Also in the case of the Batch-2 pilot project sites, members of the model farmer groups had just started (even not yet started) their construction works for irrigation system, and they hadn't reached harvest stage, thus they had not sold prioritised crops at the

market at the time of the 2nd Baseline Surveys implemented (March 2015).

Also many of those SCAOs, FEOs have raised an issue that workload of activities in the Project was heavy and tight. The County officials should handle not only activities regarding farming support such as training workshops and field monitoring visits but training session for IWUA members and supervising construction works. Farmers are also regularly mobilised for construction works between intervals of their daily duties.

To evaluate the adoption rate/ adaptability of the market survey and crop planting calendar, the major evaluation surveys should be taken after the completion of farmer construction works and irrigation water reaches the farm fields.

(4)Understanding/ Adopting of the Technologies in Agricultural Activities

Technologies consisting of the technical knowledge and practical skills, which contribute augmentation of the resilience of local communities in ASAL area, would be directly transferred to mainly Sub-County Agricultural Officers (SCAOs), District Agricultural Extension Officers (DAEOs) and Frontline Extension Officers (FEOs) in the pilot project sites through the lectures, workshops, practical trainings, meetings and frequent contacts targeting at the local farmers. A government official appointed by the MoALF worked with project team for smooth implementation of the project activities.

In the capacity changes of both individual farmers and the Farmers Groups in adopting basic horticultural production techniques, on the comparison between the 1st BLS in 2013/2014 and the later ones in 2015, it is observed that a small proportion of member farmers have conducted “Pre-cultivation Preparation” such as undertaking market survey (Q1) and preparing crop planting calendar (Q2) in 2013/2014, however in 2015, most of the farmers in all schemes have conducted market survey and crop planting calendar making. Conducting soil testing (Q3) was still low. The percentages of farmer members who implemented the cost income analysis (Q20) were dramatically increased in the most of the pilot project sites compared to that in 2013/2014.

As we can see so far, the observation shown proves that the series of training sessions and practices of the core components of SHEP Approach is actually taken hold across the local agricultural officials, such as the SCAOs, DAEOs, FEOs and the members of farmer groups, and the knowledge obtained at the training contributed the increment of the farmer’s competence/ capacity of the Market-Oriented Agriculture. Not only those extension officials but also farmers have agreed the advantages of the LISA technologies and the need to disseminate them into entire schemes. They also expressed the need to increase the number of demonstration farmers on both Kenyan Traditional Vegetables and Push-pull technologies.

The recommendations are below;

- The County Governments should prepare the opportunities, such as training workshops, to expand the dissemination of technologies to the farmers outside of the scheme.
- Keep taking continuous surveys of the productivities and income analysis, GHCP & PHHT, and the Group Empowerment Indicators to the model farmer groups to analyse their progress.
- Hold periodically the Brash-up workshops with the SHEP experts from SHEP Unit.

8.5 Activities for Demonstration Farm

8.5.1 Farming Instruction at Demonstration Farm

(1) Implementation of the Pre-Demonstration Farm

Establishment of pre-demonstration farm is intended to find if the proposed technique is effective on increasing yield and water saving. The proposed techniques applied to the farm are as follows:

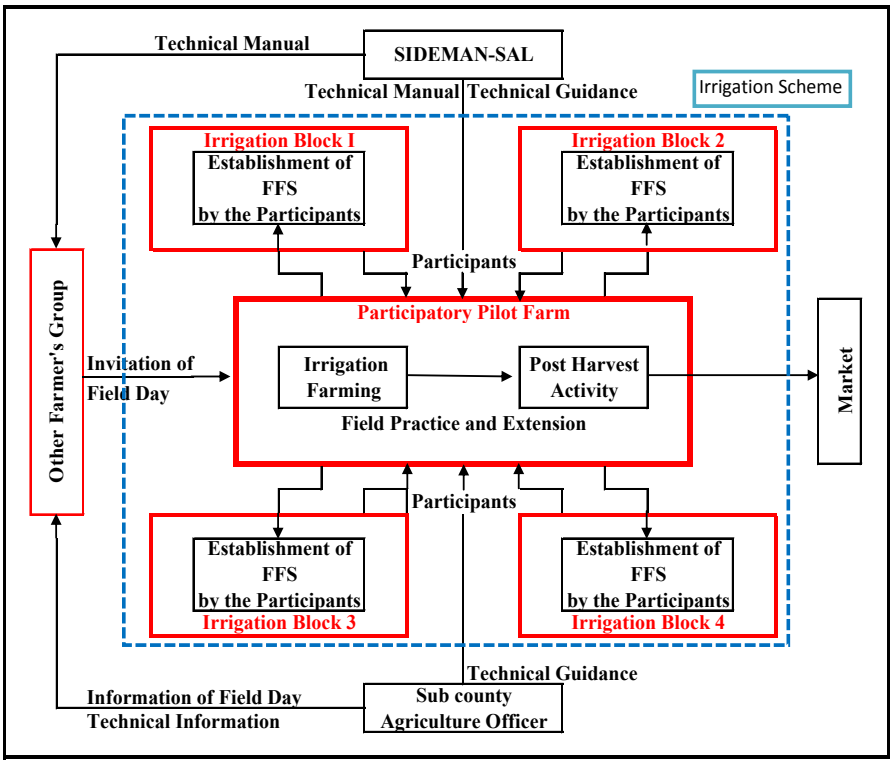
- Shorter irrigation interval (basically twice per week) with small amount of water at the time to avoid water logging.
- Ridging to save water and keep air in the soil for root development.
- Optimal spacing and intensity to obtain high production and increased quality of the vegetables.

Other techniques applying to the farm were as per Kenyan extension material.

(2)Implementation of Demonstration farm (1)

(Using water pump prior to completion of irrigation facilities)

Implementation of demonstration farm was to extend the techniques to the farmer after they are confirmed to be effective for yield improvement and water saving. There are many farmers who don't have experience of irrigated agriculture. Therefore, the activity focuses on extension of the technologies with participatory method. To extend the technologies, field day was held to show farmers the field during the demonstration farm. The farm were carried out as many schemes as possible. The Sub-County agricultural officers in charge of each demonstration farm were expected to implement it together with JICA experts to transfer the technique. And they carried out the technical extension after the demonstration farm. The extension method is summarised in following figure.



- Each irrigation plot select 2-3 participants for the pilot farm
- Each participant manages about 10 ridge
- Irrigation farming includes ridging, irrigation method, technologies to grow priority crops of the scheme
- Post harvest activity includes cooperative shipping, quality selection of product and preservation method of sub-standard products if possible
- Participants shoud establish Farmers Field School (FFS) in your field to transfer the technology after the pilot project

Source: JICA Team

Figure 8.5.1 Technical Extension Flow of Demonstration Farm

(3)Implementation of Demonstration Farm (2)

(Using irrigation facilities after the completion of the irrigation facilities)

In the third stage, the object of the pilot farm was to implement demonstration using irrigation water through the completed irrigation facilities to fill the gap between the demonstration farm and actual irrigation farm. Therefore, it can be said more practical.

8.5.2 Proposed Irrigation Method

As mentioned in the previous chapters, main problems of irrigated crop cultivation in the project area were identified as follows:

- Low yield caused by water logging.
- Wasting too much irrigation water.

To improve irrigated crop yield is urgent issue to solve before completion of the irrigation facility. To achieve it, the Project proposed the method which maintains adequate moisture

and air in soils as follows.

Proper irrigation interval

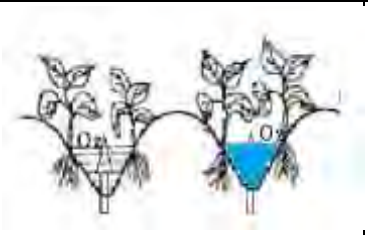
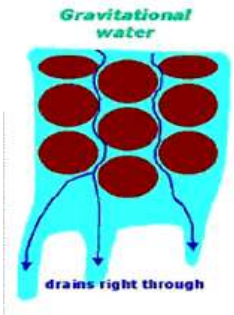
It is said that proper irrigation interval can play a major role in increasing the water use efficiency and the crop productivity. In the schemes, crops are fed by excessive irrigation water at the time because irrigation is applied with long interval. Therefore, it is recommended that the shorter irrigation interval be applied.

Raised beds

Planting on raised beds allows excess moisture to drain out of the root zone and also permits air to move around the plant roots, which reduce the potential for root rot.

Comparison between the local and the proposed methods by the Project is summarised in the following table.

Table 8.5.1 Summery of the Local and the Proposed Irrigation Methods

Plot	Farmer's	SIDEMAN-SAL
Name	Local Furrow Irrigation	Furrow Irrigation on Wide Raised Bed
Irrigation and cultivation method		
Irrigation interval	About 10 days with a lot of water at a time	Twice per week with a small quantity of water
Characteristic of the method	- It is easy to generate root rotting caused by water logging. - The irrigated water can not be absorbed by crop because the most is gravitational water.	- Root is grown healthy because drainage of soil is improved by making ridge and proper irrigation method. - It is easy to save water because irrigation is just around the roots and much of water is capillary water that plant can absorb.
Schematic diagram of soil water		

Source: JICA Team

8.6 Result and Analysis for Demonstration Farm

8.6.1 Pre-Demonstration Farm

(1) Objective

The pre-demonstration farm was established in Mdachi scheme because there were many types of soils. And the results can be applicable to the other schemes because the information in different soil conditions, such as well drain and poor drain soils, can be obtained. The main objectives to operate the pre-demonstration farms were to confirm:

- Whether the proposed method is effective to improve yield under clayey and sandy soils,
- Whether farmer can adopt the proposed method, and
- Comparison of yield and irrigation water consumption between the local and proposed methods.

To measure the irrigation water amount, water was stored into 1000 litre tank at once and it uses for irrigation.

Irrigation water in Mdachi scheme contains much salt. It is well known that the higher salt concentration of the irrigation water, the greater risk of salt accumulation in soil. In this context, changes in the salt concentration in soil should be monitored during operation of the pre-demonstration farm.

(2)Contents of Implementation of Pre-Demonstration Farm

Main contents and conditions of the implementation are summarised in Table 8.6.1.

Table 8.6.1 Contents of the Pre-demonstration Farm

Scheme	Crop	Period	Measurement of water amount		Block	Soil	Area	
			Proposed	Local			Proposed	Local
Mdachi	Okra, Maize	Oct. - Dec.	No distinction		A	LC	10mX5m	10mX5m
					B	Sandy	10mX5m	10mX5m

Source: JICA Team

Land preparation, irrigation and seeding of the proposed method are shown in Figure 8.6.1.

Ridging	Irrigation	Seeding

Source: JICA Team

Figure 8.6.1 Proposed Method of Ridging and Irrigation

Initially, the objectives were to compare crop yield, irrigation water consumption and salt accumulation in soil between the two methods. However, the farmers, who were asked to apply the local irrigation method for the comparison, have applied the proposed method in their field shortly after starting the farm because growth of the proposed method was much better than that of the local method. Therefore, the comparing of the two methods was impossible.

The results and monitoring record are summarised in Table 8.6.2. Unfortunately, maize yield was impossible to calculate due to damage by monkey.

According to the FAO Irrigation Agronomy, expected yield of okra is 2 tons per ha. Yields of the each Block are much higher than the expected (see Table 8.6.2). The difference of yield between the proposed and the local methods is small. This fact indicates that this technology can be adapted by farmer. In this context, it is clear that the method can be adaptable to the farmers in the area and effective to enhance productivity.

The yields are much deference between sandy soil and loamy clay soil. Low yield in the sandy soil is probably attributed to low water and nutrient retention in the soil. Irrigation interval is relatively long as instructed because there was a large amount of rainfall.

Table 8.6.2 Results of the Pre-demonstration Farm

Block	Crop	Irrigation Method	Yield T/Ha	Irrigation water ammount(mm)	Production* T/100mm	Income /ha Ksh
Block A	Okra	Proose	12.8	192	6.7	738,560
Block B	Okra	Proose	5.0	248	2.0	279,048

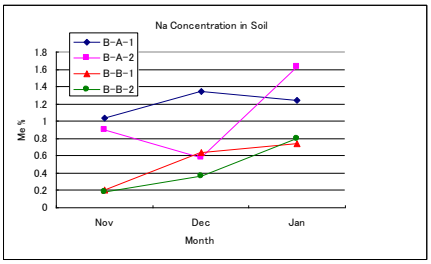
*: Production/100mm Irrigation Water

Source: JICA Team

From result of the soil analysis, change in the salt concentration in the soil was not clear (see Figure 8.6.2). Salt concentration of all samples shows within adequate range according to evaluation of the National Agriculture Research Laboratories.

Land preparation under FEO guidance

Comparison of Crop growth by irrigation method



(B-A-1: Block A-Proposed, B-A-2: Block A-Local, B-B-1:Block B-Proposed, B-B-2: Block B Local)

Comparison of root growth	Change of salt concentration in Soil

Source: JICA Team

Figure 8.6.2 Photos on the Pre-demonstration Farm

8.6.2 Implementation of Demonstration Farm

(1) Objective

From the results of the Pre-demonstration farm, the proposed irrigation method was proven effective to improve crop productivity. Based on this achievement, demonstration farms were carried out in four schemes, namely, Mdachi, Kasokoni, Gatitu/Muthaiga, and Tumutumu schemes. The main objectives of the demonstration farm were:

- To confirm the effects in other scheme and other crops,
- To expand the technology to farmers, and
- To measure the water saving effect through their activities if possible.

Main contents applied to each scheme are summarised as follow.

Table 8.6.3 Main Contents of the Demonstration Farms

Demo Farm Type	Scheme	Crop	Growing Period	Companion Plant
Test farm	Mdachi	Okra	2015 Jan - 2015 Apr	-
	Kasokoni	Okra, Tomato	2015 Feb - 2015 Jul	Onion
	Tumutumu	Kale, Tomato, Watermelon	2015 May - 2015 Sep	Onion
	Gatitu/Muthaiga	Cabbage	2015 May - 2015 Sep	-
Actual irrigation farm	Kasokoni	Tomato	2015 Oct - 2016 Feb	Onion

Source: JICA Team

(2) Result of Demonstration Farm

Results of the demonstration farm are shown in Table 8.6.4. Main result by each scheme is explained hereinafter.

Table 8.6.4 Results of the Demonstration Farm

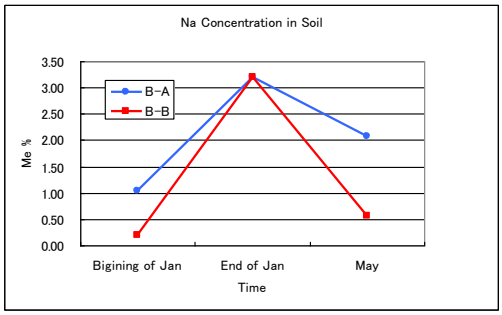
Demo Farm Type	Scheme	Block	Crop	Irrigation Method	Yield (t/ha)	Irrigation water amount (mm)
Test farm	Mdachi	A	Okra	Proposed	3.8	202
				Local	0.8	202
		B	Okra	Proposed	1.4	296
				Local	0.2	296
	Kasokoni	A	Okra	Proposed	7.0	76
				Local	17.9	243
			Tomato	Proposed	5.4	76
				Local	15.0	217
		B	Okra	Proposed	3.7	244
				Local	2.8	878
			Tomato	Proposed	24.3	314
				Local	11.3	1,085
	Tumutumu	A	Kale	Proposed	14.1	252
			Watermelon	Proposed	-	250
		B	Tomato	Proposed	38.0	200
			Watermelon	Proposed	19.3	125
	Gatitu/Muthaiga	A	Cabbage	Proposed	182.0	111
				Local	56.0	429
		B	Cabbage	Proposed	126.0	283
				Local	49.0	450
Actual Irrigation Farm	Kasokoni	A	Tomato	Proposed	60.8	124
				Local	31.2	353
		B	Tomato	Proposed	59.1	94
				Local	46.2	412

Source: JICA Team

(3)Mdachi

The demonstration farms in Mdachi scheme have been implemented from 8th of January 2015 when it was hot and during dry season. Main findings and results are as follows.

1) Yield of Block A and B was much lower than that of the Pre-demo Farm. However, yield of Block A with proposed method exceeded the expected yield (2 tons per ha).
2) Yield of Block B was extremely lower than that of the Pre-demo farm because it seemed to be water shortage due to low water retentions of soils and long irrigation interval under high temperature.
3) Both yields with the proposed method were much higher than that of the local method.



Okra is wilting due to water shortage and heat.	Change of salt contents in soil (B-A: Block A, B-B: Block B)
	
Salt accumulation on soil surface	Field day

Source: JICA Team

Figure 8.6.3 Photos on the Demonstration Farm in Mdachi

(4)Kasokoni

The demonstration farm in Kasokoni Scheme has started in early February 2015, when it was just before the rainy season. Main results and findings by each block are described below.

1)Demonstration farm implemented under test farm condition (1st Demo farm)

Block A

The yield in both crops cultivated with the local irrigation method was higher than that of the proposed irrigation method. Main reasons are as follows:

- Tomatoes cultivated with the proposed irrigation method were severely affected by the disease.
- Irrigation interval of the both fields was longer than that of the instructed despite dry season. It was severely affected the crop growth in the field of proposed method because the irrigation water amount at the time was much smaller than that of the local.
- The planting density of the local was much higher. However, the field was too small to occur mutual shading.

Block B

- Yields of okra and tomato cultivated with the proposed method were higher than that of

the local method.

- Low yield of okra may be caused by severe climate such as dry and high temperature during early stage.
- Irrigation water amount of the proposed method was much lower than that of the local method; tomato and okra were about a quarter and one third, respectively. .
- Irrigation interval was kept properly, with 3 to 5 days.

	
Field day (Description of irrigation method by FEO) (Block B)	Tomato infected with disease (Block A)
	
Local irrigation method (Basin irrigation)(Block B)	Growth comparison of tomato between the proposed and basin irrigation (23rd April) (Block B)

Source: JICA Team

Figure 8.6.4 Photos on the Demonstration Farm in Kasokoni

2)Demonstration farm implemented with actual irrigation facilities (2nd Demo farm)

The 2nd demonstration farm has started in the beginning of October 2015 when it was starting rainy season to February 2016, dry season. Main results and findings are explained as follows.

- The proposed method produced 3 times (59.1 - 60.8 tons per ha) as Kenya standards yield, 21.0 ton per ha (FAO).
- Irrigation water amount in the proposed method was from one third to one-quarter compared with the local method.
- Demonstration farm implemented with the completed irrigation facilities (2nd Demo farm) showed 2 – 12 times yields compared with that in test farm (1st Demo farm) because of the following reasons.

1. Tomato was suffered high temperature damage in the 1st Demo farm,
2. Tomato was attacked by mites and it caused severe reduction of produce in the 1st

Demo farm, and

3. The farmers could manage the agricultural activities well in 2nd Demo Farm.

Table 8.6.5 Comparison between 1st and 2nd Demo farm

Field Type	Block A Yield (t/ha)		Block B Yield (t/ha)	
	Proposed	Local	Proposed	Local
1st Test Demo-Farm	5.4	15.0	24.3	11.3
2nd Actual irrigation Demo-Farm	60.8	31.2	59.1	46.2

Source: JICA Team

Date :25/1/2016

Pruning and re-staking of tomatoes in plot B-2; to get rid of old and rusty leaves for easy spraying.

Date : 26/1/2016

Sorting out of tomatoes from plots B-2 and B-3 before being packed for transportation.

Date :27/1/2016

Spraying of tomatoes to prevent attack from mites

Date : 27/1/2016

Irrigation of tomatoes in plot B-2 with water from main canal.

Source: JICA Team

Figure 8.6.5 Photos on the Demonstration Farm in Kasokoni (2nd Demo farm)

(5)Tumutumu

The demonstration farm in Tumutumu scheme has commenced in end of May 2015 when it was cooler season and during dry season. Main results and findings are explained as follows.

1)Block A

- All crops grew well by the middle of August 2015. However, the participants were disappointed and stopped taking care of the farm because kale was eaten by cattle, and onion and watermelon were stolen in September 2015. In such a situation, harvest amount could not be recorded.
- Yield of kale up to mid-August 2015 was 14.1 tons per ha, which was equivalent to the national average. The yield might have been much more than the national average, unless there was the crop damage.

2)Block B

- About half of tomato seedlings has died just after transplanting because the participants did not irrigate for a week. But the participants could not re-transplant because they had not spare seedlings.
- Although many of the seedlings had died during the early stage, yield of tomato was recorded at 38 tons per ha, which equivalent to about 2 times of that in the national average.
- Watermelon was harvested earlier to avoid animal damage. Therefore, the irrigated water amount was less than that of tomato.

	
Field day on Kale field (Block A)	Kale eaten by cattle (Block A)
	
Many tomato seedlings died (Block B)	Then the growth is recovered (Block B)

Source: JICA Team

Figure 8.6.6 Photos on the Demonstration Farm in Tumutumu

(6)Gatitu/Muthaiga

The demonstration farm in Gatitu/Muthaiga scheme has started in the end of May 2015, when it was cooler season. Main results and findings are indicated as follows.

1) Block A

- The yield of the proposed method was much higher than that of the local, 182 tons per ha and 56 tons per ha, respectively. The yield of the local method was about two times of average in Laikipia County.
- Although yield of cabbage was higher, the revenue was unsatisfactory because the selling price fell down sharply during the harvesting period, from Ksh 20 to Ksh 5 per head (Usually the price is 40 Ksh per head).
- Irrigation water amount was 111mm, which was far below irrigation requirement, because watering was not necessary in June due to heavy rain, and consequent high water retention of soil and cooler climate.
- Irrigation water amount of the proposed method was about one fourth of the local method.

2)Block B

- Irrigation water amount under the proposed method was almost half of that in the local method.
- Yield of the proposed was about 2.5 times of the local.
- Water productivity is about 4 times of the local.

	
Vegetative stage	Time of harvesting
	
Harvesting	Well developed root in the field of the proposed irrigation method

Source: JICA Team

Figure 8.6.7 Photos on the Demonstration Farm in Gatitu/Muthaiga

8.6.3 Summary of the Results

Important issues of the demonstration farm such as salt accumulation and comparison of irrigated water amount and yield are summarised as follows.

(1)Comparison of Irrigation Water Amount and Yield

Comparison of the yield and irrigation water amount between the proposed and the local methods is shown in Table 8.6.6. Main results are;

1) Proposed method under Demonstration farm implemented with actual irrigation facilities (2nd Demo farm) produced 3 times (59.1-60.8 t/ha) as Kenya standards yield, 21.0 t/ha, FAO.
2) Irrigation water amount of the proposed method was from 1/3 to 1/4 lower than that in the local method.
3) The yields of all crop under the proposed method shows from 1.5 to 2.0 times higher than local one except the crops attacked by mites. Furthermore, some remarkable results show much higher yield than FAO standard.

Table 8.6.6 Comparison of Yield and Irrigation Water between the Proposed and the Local Method.

Scheme	Demo Farm Type	Crop	Block	Irrigation Method	Yield (t/ha)		Water Amount (mm / total growing period)		Growing period
					Demo Farm	FAO	Irrigated Water	Crop water need*1 *2	
Kasokoni	Test farm	Okra	A	Proposed	7.0*3	2.0	76	502	Dry to Rainy season 2015 Feb- Jul
				Local basin	17.9		243		
			B	Proposed	3.7		244		
				Local basin	2.8		878		
		Tomato	A	Proposed	5.4*3	21.0	76	400-800	
				Local basin	15.0		217		
			B	Proposed	24.3		314		
				Local basin	11.3		1,085		
	Actual irrigation farm	Tomato	A	Proposed	60.8	21.0	124	400-800	Rainy to Dry Season 2015 Oct to 2016 Feb
				Local basin	31.2		353		
			B	Proposed	59.1		94		
				Local basin	46.2		412		
Gatitu/Muthaiga	Test farm	Cabbage	A	Proposed	182.0	25 - 35	111	350-500	Dry Season 2015 May to Sep
				Local Furrow	56.0		429		
			B	Proposed	126.0		283		
				Local Furrow	49.0		450		

*1 Journal of Basic and Applied Sciences, 6(9): 196-206, 2012 V.C. Patil, 196

*2 FAO CHAPTER 3: CROP WATER NEEDS http://www.fao.org/docrep/s2022e/s2022e07.htm

*3 Crops was damaged by insect and disease.

Source: JICA Team

(2)Salt Accumulation in Soil

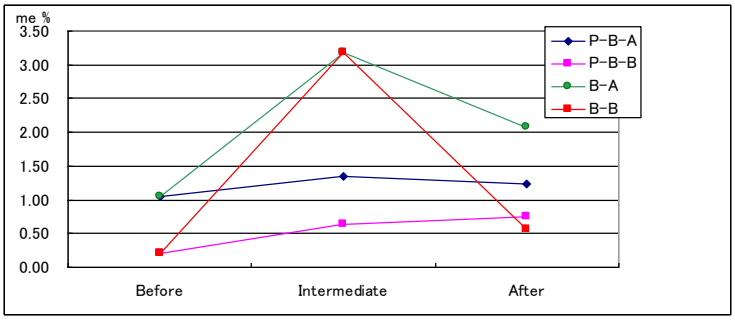
In Mdachi irrigation scheme, the level of EC (Electric Conductivity = Salinity level) in irrigation water is from 2 to 4 dS/m. That value is much higher than that in the other irrigation scheme. Therefore, the scheme may have a risk of incurring salinity accumulation problem in soil.

The Project implemented soil salinity test in the Mdachi demonstration farm both in rainy

and dry seasons. The timing of the tests was at the beginning, middle, and end of the crop season. For the activities implemented in 2 blocks, Block A is under clay soil and Block B is under sandy soil.

As a result, while salinity accumulation in soil was not observed in the rainy season, in the dry season, the problem occurred in the middle of the cultivation period due to high evapo-transpiration without rain. Although it induced salt accumulation in the top soil, it was recovered by the end of the dry season.

The salinity level of Block B (Sandy soil) was recovered to the same level as that in the beginning of cultivation, 0.5dS/m. However, in Block A (Clay soil), the level has dropped to 2.0dS/m. That was due to the difference of salinity (Cation) holding capacity between sandy soil and clay soil. Sandy soil has less capacity compared with clay.



P-B-A (Rainy season): Pre-Demo-Farm-Block A (Clay)
P-B-B (Rainy season): Pre-Demo-Farm-Block B (sand)
B-A (Dry season): Demo-Farm-Block A (Clay)
B-B (Dry season): Demo-Farm-Block B (Sand)

Source: JICA Team

Figure 8.6.8 Change of Salt Concentration in Soil

The Soil salinity in Mdachi scheme is categorised into "Slightly saline" or "Moderately saline", and it is classified as “Soil affects the reduction of the yield for sensitive or many normal crop”

Table 8.6.7 Soil Salinity and Crop Yield

Soil Salinity Class	$EC_{1:2}$ (dS/m)*	Effect on Crop Plants
Non saline	0 – 0.5	Salinity effects negligible
Slightly saline	0.5 – 1.0	Yields of sensitive crops may be restricted
Moderately saline	1.0 – 2.0	Yields of many crops are restricted
Strongly saline	2.0 – 4.0	Only tolerant crops yield satisfactorily
Very strongly saline	> 4.0	Only a few very tolerant crops yield satisfactorily

＊USDA (United States Department of Agriculture)

Source: JICA Team

It is concluded that farmers should monitor irrigation water, checking the salinity of irrigation water before irrigating. In the case that the Salinity level is high, it is

recommended to stop irrigation. In the field, it is proposed for farmers to implement irrigation farming, keeping the following three points in mind.

1. Avoid over-irrigation and monitor both salinity level of irrigation water and soil, and observe any symptom of salt damage to the crop.
2. Suspend cropping when the salinity problem occurs. After rainfall, monitor the declining level of soil salinity. Restart the cultivation after the salinity level becomes normal.
3. For clay soil field, deep plough and apply manure/compost in farm yard to ensure soil permeability and plant a salt tolerant crop.

8.7 Lesson Leant for the Demonstration Farm

(1) Necessity of Further Technical Extension

According to the results of the demonstration farms, it is clear that the proposed method is viable to enhance crop yield and water saving. Expanding the positive effects would significantly contribute to sustainability of the Project because water resources in arid and semi-arid areas are fluctuating due to climate change.

The participants in the demonstration farms wished to continue the demonstration farm. The implementation was only once at four schemes. Almost all of the participants awarded the effects of the proposed technology. Although some farmers were tried to apply the technology to their farm, they could not practice in the same way as the demonstration farm such as ridging and planting density etc.

The FEO and WAO of each Sub-County, who participated in the demonstration farm and implemented the technical guidance with the Project, have the capacity to teach the technology to farmers.

On the other hand, the farmers need to practice repeatedly to learn the techniques. In this context it is essential that Sub-County agriculture officers, including FEO and WAO, be effectively used to extend the technology.

(2)Compensation of Market Risk

The demonstration farms were implemented in Mdachi, Kasokoni, Tumutumu and Gatitu/Muthaiga schemes. Crops being selected by farmers based on the results of market survey were cultivated in the demonstration farms. The crops were expected to obtain much profit because of selecting the marketable crops. However, their profits of the demonstration farm were not as high as expected without tomato despite the higher yield, quoting an example in cabbage of Gatitu/Muthaiga scheme.

In the scheme, the selling price of cabbage was Ksh 40 per head in average year. However, the price in the year fluctuated from Ksh 20 to Ksh 5 per head during the harvest season, from August to October 2015. Many farmers also cultivated cabbage in the scheme during the same period of the year. The farmers who cultivated cabbage during the period were largely affected by the low price.

Usually, the vegetable prices are highly volatile, which severely affect the profitability in the event of imbalance of supply and demand. As price fluctuations for agricultural products are difficult to predict, this may put farmers in a difficult situation if commodity prices decrease drastically during the production. In order to mitigate such effects, crop diversification is a logical response to help small land holders, stabilising the farmer's income because other crops can compensate for the loss if market prices drop.

The crop diversification might be an effective tool to help farmers deal with several types of risk including price risk.

In this context, it is recommend that crop diversification in individual farms field be accelerated to mitigate the risks for horticulture cultivation.

CHAPTER 9 Staff Capacity Development Component

9.1 General

During a whole Project implementation period, namely, planning and implementation of construction of irrigation facilities, operation and maintenance, and agricultural farming, the Project carried out a capacity building programme for Sub-County officials, making the maximum efforts to improve capacity and skills of the Sub-County level officers in order to efficiently play their respective roles during and after project implementation.

9.2 Planning of Staff Training Programme

9.2.1 Training Programme for SCIO

The SCIO, who is responsible for implementation of smallholder irrigation schemes in terms of project formulation, planning, design, procurement, construction supervision and operation and maintenance of smallholder irrigation scheme, is expected to act a role to evaluate requested irrigation scheme by farmers from the viewpoints of technical and social aspects.

In addition the SCIO expected to act as a facilitator, who is in charge of communication with farmers to obtain consensus for development plan.

The Project planned to assist the SCIO so that the officers would enhance their capabilities and experience for the both aspects.

The training programme for the SCIOs would also be conducted based on the SCIOs demand assessment. The topics and detailed contents are under planning/ contemplation.

The five major prospective/ requested topics/ area for the training programme were listed below;

- Auto CAD civil 3D
- Total Station/data analysis
- Irrigation scheme design
- Green house/ Drip system designs
- Contract management

9.2.2 Training Programme for SCAO

During the project implementation period, much attempt should be made to enhance the capacity for the SCAO, drawing attention to the realisation of a market-oriented agriculture with demand-oriented approach so that the farmers would be encouraged by the project activities supported by the SCAOs.

The training programme for the SCAOs would also be conducted based on the SCAOs demand assessment. The topics and detailed contents are under planning/ contemplation.

The five major prospective/ requested topics/ area for TOT are listed below;

a) Integrated Pest Management (IPM)
b) Value chain development
c) Agro-processing in horticulture
d) Green house management
e) Global gaps and certification

9.3 Achievement and Impacts

9.3.1 Summary of Achievement

The training programmes conducted during the project implementation period is summarised below.

Table 9.3.1 Summary of Achievement for Training Programme

As of December 31, 2015

Description of Activities	Dates for the Training	Unit	Target	Achievement	Nos. of Participants	Remarks
Sensitization workshop for implementation method of the Project	18th - 19th April 2013	Nos. of Workshop	1	1	32	Participants: SCIOs/SCAO and Directors in 8 counties
Sensitization workshop for agricultural activities	22nd August 2013	Nos. of Workshop	1	1	32	
TOT Program for IWUA Capacity Development Training	17th - 21st February 2014 18th - 19th August 2015	Nos. of Workshop	2	2	16	Participants: SCIOs/SCAO in 8 counties
Feasibility Study, Detailed Design, Construction Supervision and Construction Guidance for IWUA	3rd - 7th March 2014	Nos. of Workshop	1	1	16	
Contract Management	16th - 20th June 2015	Nos. of Workshop	1	1	16	
Lesson Learnt Workshop	14th - 17th december 2015	Nos. of Workshop	1	1	16	
Agricultural development	11th - 14th January 2016	Nos. of Workshop	1	1	16	Participants: SCAO and SCCO in 8 Counties

Source: JICA Team

9.3.2 Staff Sensitisation Workshop

This workshop was held in Naivasha in April 2013. It was organised by the PMT for the government officials drawn from the 8 Sub-Counties where the project was being implemented comprising of CDWs, DIOs, CDAs and DAOs. The objectives for the workshop were to explain the roles of the various stakeholders including MWI, MOA, JICA and IWUAs the approach to project implementation, review and adoption of the IWUA

capacity building programme, review and adoption of the agriculture capacity building programme, agreement on the cost sharing agreement between the project and the IWUAs, agreement on the reporting formats for various activities, budget preparation by Sub-County officials for the 2014/2015 fiscal year and how monitoring and evaluation would be carried out during project implementation. Althugh the objectives were met, finalisation of the budgets was to be undertaken by the various SCIOs in their respective schemes and submit them to the PMT. Training programmes are itemised below (Refer Section 8.1.3).

Table 9.3.2 Staff Sensitisation Workshop

No.	Description of Training
1.	Roles of Stakeholders, IWUAs & Ministry Staff (MWI & MOA) in project implementation
2.	Project management including : field supervision, work plan and operationalisation of PSCC
3.	Capacity building programme (IWUA water management) : review, adoption & logistics
4.	Capacity building programme (Agronomy) : review, adoption & logistics
5.	Cost sharing agreement with the farmers per scheme during construction and capacity building and draft MOU
6.	Monitoring & Evaluation (project progress reporting template)
7.	Financial Budget preparation and finalisation per scheme for the coming fiscal year
8.	Way forward

Source: JICA Team

9.3.3 Agricultural Sensitisation Programme

Sensitisation meeting for the County officials including the County Directors of both Agriculture and Irrigation and the Sub-County Agricultural and also Irrigation Officers was held in Nairobi on August 22nd, 2013. At the meeting a workshop in the selection criteria of model farmer group in the pilot project sites was held, and the SCAOs were requested to select a farmer group and to submit the membership list and the group profile sheet by the time when the sensitisation meeting for local agricultural officers and farmers of selected farmer groups would be held at each pilot project site.

Table 9.3.3 Agricultural Sensitisation Workshop

No.	Description
1	Brief introduction of the Agricultural Development / Farmer Support Activities at the SIDEMAN-SAL Project
2	Brief Explanation of the Introduction of SHEP Approach
3	Brief Explanation of the Trial Introductions of Agricultural Technologies for Low Input Sustainable Agriculture (LISA) such as Kenyan Traditional vegetables, Push-pull Technique, and “Bokashi” fermented organic material technology
4	Brief Explanation of the Resilience Surveys at selected SIDEMAN-SAL Project
5	Reporting and Monitoring Procedures for the Agricultural Development Activities
6	Selection Criteria of Model Farmer Group in SIDEMAN-SAL

Source: JICA Team

9.3.4 Briefing Programme for SCIO and SCAO for Batch 1 & 2 Pilot Projects

A briefing programme for Batch 1 & 2 pilot projects was carried out for the relevant SCIO

and the SCAO from 03rd to 07th March 2014 in order for them to share performance and experience obtained from the feasibility study and the detailed design during the Batch 1 and to enable them to commence the works for the Batch 2 pilot project sites. Further, for smooth implementation of the construction works in Batch 1 pilot project sites, methodology of construction management for the contractors' works and the IWUA's works was also be presented.

At the end of the training programme, the participants were expected to be inducted with the necessary knowledge, skill and attitudes in conducting feasibility study and detailed design under the Batch 2 pilot project sites as well as construction supervision for both contractors' works and IWUA's works under the Batch 1 pilot project sites. The detail of the programme is shown below.

Table 9.3.4 Briefing Programme for SCIO and SCAO for Batch 1 & 2 Pilot Projects

No.	Description
1	Introduction to FS, Project identification and selection
2	FS – Data collection
3	FS – Cropping calendar and gross margins
4	FS – Assessment of water resources/hydrological report
5	FS – Estimation of irrigation water requirements
6	FS – Preparation of Feasibility study report
7	Introduction to IWUAs' construction works
8	Management of IWUAs' construction works
9	Environmental, Health & Safety management in Irrigation Development
10	Survey Work for effective instruction to IWUA
11	Site supervision/ Quality control of IWUA works
12	Experience sharing (Interim)
13	D/D - Design of weir/intake/ Irrigation scheme layout
14	D/D Hydraulic calculation of open channels
15	D/D – Hydraulic calculation of pipelines and preparation of Design Report
16	Tendering and tender documents
17	Construction management (Contractors works)
18	Site supervision/Quality control (intake weir and other contracted works)
19	Site reports and progress monitoring
20	Experience sharing/ Way forward

Source: JICA Team

9.3.5 Training of Trainers for IWUA Trainings Unit 2 & 3

Training of trainers for IWUA Trainings for Units 2 & 3 was held in Embu for the SCIOs and the SCAOs drawn from the 8 Sub-Counties where the project was being implemented. The objective of the training was to equip the staff with necessary skills necessary for implementation of the training programme. The farmers were introduced to the IWUA capacity building programme and the various trainings that would be held per scheme. They were trained on the training cycle, training needs assessment, adult learning theories and principles, training design and programme development, training delivery, training

evaluation, training reporting and follow-up. The staff had the opportunity to develop the training objectives and budget for Units 2 and 3. Training logistics were also discussed.

Following this TOT, the PMT was expected to allow the SCIOs and the SCAOs to take up the coordination role for the trainings while PMT would play a backstopping role.

Table 9.3.5 Training of Trainers for IWUA Trainings Unit 2 & 3

No.	Description
1	Introduction to Training & Training Cycle
2	Training Needs Assessment (TNA), Design & Development
3	Adult Learning Theories & Principles
4	Training Design & Programme Development
5	Training Delivery
6	Experience Sharing Workshop
7	Training Evaluation
8	Training Reporting & Follow-up-
9	Feedback on Unit 1 training-
10	Sideman-Sal IWUA capacity building programme
11	Review of Unit 2& 3
12	Training Budgeting & Logistics

Source: JICA Team

9.3.6 Contract Management

The Training in Contract Management was organised by the Project and conducted for sixteen (16) participants drawn from 8 project schemes for 5 days from 16 – 20 June 2014. The purpose of the training was to ensure that the above staff currently involved in the implementation of construction works under the Project and the training programmes were sufficiently equipped with the necessary knowledge, skills and attitude to ensure successful management of construction contracts. The training as designed focussed on the following key areas:

- Public procurement processes,
- Tendering for construction works,
- Preparations for tendering, including preparation of tender documents,
- Contract documents, and
- Contract administration.

Table 9.3.6 Contract Management

No.	Description
1	Introduction to Construction Contracts
2	Principles of Tenders
3	Bid Documents
4	Opening of Bids and Evaluation
5	Contract Documents
6	Bill of Quantities
7	Condition of Contract
8	Award & Mobilisation of Contractor

9	Standard Specification
10	Contract Administration & Site Records
11	Payment Certificates and Certificate of Completion

Source: JICA Team

9.3.7 Training of Trainers for IWUA Training Unit 5

The objective of training of trainers for IWUA Training Unit 5 was to review the generic O&M manual drafted by the PMT, review of Unit 5 session objectives and planning for Unit 5 training implementation. Finally discussion on how the individual scheme O&M manuals were to be finalised was to be done. The staff reviewed the manual and made recommendations for its revision and finalisation. The session objectives for Unit 5 were also revised and the SCIOs and the SCAOs made commitments on how they would finalise the individual schemes O&M manuals. Finally, the approach to Unit 5 training was decided upon – to hold 3 days plenary trainings and one day field tour to an operating scheme. The PMT would be also involved in the trainings.

Table 9.3.7 Training of Trainers For IWUA Training UNIT 5

No.	Description
1	Introduction to O&M manual (Ch. 1)
2	Irrigation System Components & Summary Design (Ch. 2)
3	Institutional Arrangements for irrigation system management (Ch. 3)
4	Agriculture planning (Ch.4)
5	System Operation (Ch. 5)
6	System Maintenance (Ch. 6)
7	Environment Management (Ch. 7)
8	Water Service Fee Management (Ch. 8)
9	Action Planning for Irrigation System Management (Ch. 9)
10	System monitoring and evaluation (Ch. 10)
11	Introduction to Unit 5 Training
12	Discussions on Unit 5 general and session objectives
13	Discussions on O&M manual finalisation
14	Discussions on Unit 5 implementation

Source: JICA Team

9.3.8 Lessons Learnt Workshop

The objectives of Lessons Learnt Workshop were; (1) to review project activities, approaches and achievements in line with the purpose and goal of the project, (2) to identify challenges, constraints and mitigation measures adopted to address these during the project implementation and (3) identification of best practices and to chart the way forward for the ongoing and future projects as lessons learnt. The SCIOs and the SCAOs provided feedback on all activities undertaken by the Project including IWUA capacity building, agriculture training, environment related activities, engineering activities and staff capacity building.

The IWUA framework and the SHIDD guideline were also to be reviewed. The workshop drew lessons learnt that would be used in planning for the exit strategy for the Project as

well as charting a way forward for future projects. The officers also reviewed the IWUA framework and SHIDD guidelines and made recommendations for areas that need revision.

Table 9.3.8 Lessons Learnt Workshop

No.	Description
1	Overview of IWUA capacity building programme
2	Introduction to IWUA performance evaluation and its relationship to capacity building.
3	Presentation of results of performance evaluation and impacts of the capacity building programme
4	Overview of Staff Capacity Building programme
5	Overview of Agricultural programme
6	Overview of Environment programme
7	Challenges/lessons learnt
8	Overview of Infrastructure development programme
9	Review of Participatory approaches to infrastructure construction
10	Successes ,Challenges and lessons learnt
11	Introduction to IWUA framework
12	Identification of key concepts in the IWUA framework.
13	Review of implementation of key concepts in the overall programme
14	Challenges experienced
15	Introduction to Irrigation guidelines
16	Challenges/experiences
17	Presentation of Summary of lessons learnt
18	Discussion of exit strategy/Sustainability measures

Source: JICA Team

9.3.9 Training Programme for Agricultural Officers

Training programme for agricultural officers was designed to address some of the current challenges affecting horticultural producers. It also equipped the participants with knowledge and skills on some of the technologies being adopted by farmers such as greenhouse horticultural production. The training involved the SCAOs, SCCDOs and the extension officers in the schemes. In addition, the course also covered some of the topics delivered in unit 4 training programme that the Project noted some of the staff had deficiencies while trying to deliver to the farmers.

Table 9.3.9 Training Programme for Agricultural Officers

No.	Description of Training
1	Climate setting & levelling of expectations
2	Introduction to market led irrigated agricultural production
3	Introduction to Greenhouse farming technology
4	Market information services and Contract farming
5	Principles of horticultural production in Good Agricultural Practices
6	Soil treatment, water application and crop husbandry in greenhouse technology
7	Value chain analysis and preparation of business plans
8	Plant, soil water relationships.
9	Development of farm business plans
10	Irrigation crop water requirements
11	Greenhouse technology – pest and disease management
12	Pre-harvesting and Harvesting of horticultural produce
13	Irrigation scheduling and water application.

14	Integrated pest management (IPM)
15	Agro-processing and value addition
16	Course evaluation

Source: JICA Team

9.4 Impacts of the Training Programmes

(1) Sensitisation workshops

The officers attendimg the sensitization workshop reported that these were very important, effective and relevant. It was because the various stakeholders roles were explained clearly and they allowed the staff to participate in the selection and prioritisation of project activities. The staff understood their level of involvement during project implementation.

(2)FS & DD Training

The officers who were implementing the Batch 2 pilot project sites were able to utilise some of the knowledge learnt especially in estimating the crop water requirements As a result of the training, the officers were able to collect enough and relevant data for Feasibility Study in the Batch 2 pilot project Sites.

(3)TOT Programme for IWUA Trainings

The series of TOT programme were effective and very relevant. The officers participating in the programme gained skills especially on adult learning techniques.

(4)Contract Management Training

The officers attending the contract management training programme remarked that the training was effective and the knowledge gained was very beneficial during construction supervision.

(5)Training Programme for Agricultural Officer

As for the training programme for the agricultural officer, knowledge and skills gained as remarked by the Officers were:

1. Green house technology and management
2. Preparing a farm business plan
3. Estimating crop water requirements
4. Irrigation water scheduling
5. Pest and disease management in irrigation agronomy
6. Value addition and agro processing
7. Plant, soil and water relationship

The officers remarked that they would use the knowledge and skills gained in (1) improving extension delivery services, (2) disseminating learned information to farmers and farmers groups and (3) training other agriculture extension officers within the Sub-County.

9.5 Challenges and Lesson Learnt

(1) Sensitisation workshops

Some of the challenges experienced, however, were that some of the activities had not been undertaken including AUTOCAD training and agriculture trainings. Some activities drawn up for the agriculture component were not undertaken including soil sampling in farms within the schemes. The officers recommended that future programmes should hold these meetings.

(2)FS & DD Training

The challenges experienced included the fact that the officers were not well equipped to be able to analyse the data collected for FS and DD and this was undertaken by the PMT. The officers also cited lack of training on AUTOCAD software, though it was provided for the officers who were implementing the Batch 2 pilot projects. The officers recommended that the training for AUTOCAD was necessary, during preparation of TORs the relevant authorities would be consulted and that in future projects.

(3) Contract Management Training

The challenges experienced included communication between the PMT, the SCIO and contractors, lack of synchronisation in various activities e.g. procurement of materials, farmer work and contractor works. There were also some delays in approving construction variations. The recommendation was that in future, communication should be as per the agreement during engagement, proper management of construction activities and approvals for variation would be fast-tracked.

(4)Summary

Table 9.5.1 Summary of Lessons Leant

Items	Major Lessons Leant
Sensitisation workshop	Sensitisation workshops are important for they provide a frame-work for the Project and also prioritise certain issues, however not all identified activities were implemented and this affects the implementing officers morale.
FS & DD by staff	A follow-up training on AUTOCAD for SCIOs is necessary. They also need to be trained on how to analyse data collected during FS
Participatory approach in dealing with extension staff	Capacity building of staff in participatory approaches has been significant, this knowledge should be extended further to other officers who did not participate (benefit directly).

Source: JICA Team

CHAPTER 10 Environment Component

10.1 EIA Process

10.1.1 EIA System in the Republic of Kenya

The statutory Environmental Impact Assessment (EIA) system in Kenya was established by the Environmental Management Coordination Act (EMCA) of 1999 and the Environmental (Impact Assessment and Audit) Regulations of 2003. The EMCA specifies the projects which are subject to the EIA in the Second Schedule and also requires the Environmental Audit (EA) under Sections 68 and 69 and the Strategic Environmental Assessment (SEA) for specific fields under Part IV Section 37 – 41 of the Act.

There are 7 objectives of the EIA described in "Draft Environment Impact Assessment Guidelines and Administrative Procedures[1]" prepared by NEMA in November 2002.

To identify potential environmental impacts of proposed project, policies, plans and programmes;

- To assess the significance of these impacts;
- To assess the relative importance of the impacts of alternative plans, designs and sites;
- To propose mitigation measures for the significant negative impacts of the project on the environment;
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the project cycle;
- To present information on the impact of alternatives; and
- To present results of the EIA in such a way that they can guide informed decision-making.

10.1.2 EIA Procedure and Required Documents

(1)Project Report (PR)

All the project proponents of the project under the Second Schedule of EMCA are initially required to submit a PR consisting of the contents. NEMA shall send the PR to lead and relevant agencies and request them for their comments within 21 days after the lead and relevant agencies' receipt. If there is no comment received from the concerned agencies by the end of the period of 30 days from the PR's receipt date, NEMA shall proceed to determine the project report. As a total, 45 days after the submission of the PR, NEMA

[1] "Draft Environment Impact Assessment Guidelines and Administrative Procedure" is an effective document since introduced as a guidelines at NEMA's website at
http://www.nema.go.ke/images/stories/pdf/EIAGUIDELINES202002_latest.pdf

will issue a decision letter to the concerned agencies and the project proponent. If the project is considered to have no significant environmental and social impacts or have sufficient mitigation measures by NEMA based on the contents of the PR, the project is approved without conducting the EIA. On the other hand, if any adverse impacts or inappropriate mitigation measures are identified by NEMA, it requires the project proponent to conduct a full EIA study or submit additional information.

(2)Requirements of the EIA Study (EIAS)

1) Projects which require the EIAS

Although the Second Schedule is the list of the project types which are subject to EIA, whether the project needs EIA shall be decided by NEMA.

As described in the previous section, once NEMA requires the project proponent to conduct the EIA, the project proponent needs to 1) submit the EIA's TOR as a part of the scoping report, 2) obtain NEMA's approval of the TOR, 3) submit the names and qualification of the EIA experts including a Lead EIA Expert registered by NEMA, and 4) conduct the EIA in accordance with the TOR as described in Part III of the Environmental (Impact Assessment and Audit) Regulation 2003.

2)Contents of the Scoping Report

According to "Draft Environment Impact Assessment Guidelines and Administrative Procedure of 2002," there are 12 items to be covered by the Scoping Report.

3) Contents of the EIAS

According to "the Environmental (Impact Assessment and Audit) Regulation 2003" and "Draft Environment Impact Assessment Guidelines and Administrative Procedure" of 2002, there are 18 items to be covered by the EIA Study Report.

(3) EIA Preparation & Review Procedure

The project proponent shall conduct an EIA and prepare an EIA report in accordance with the approved TOR. The stages of the procedure of the EIA preparation and review are summarised below and in the following figure.

Step 1: Assemble the team of experts

Step 2: Examine the TORs for each expert and:

1. Assign responsibilities of each member of the team;
2. Specify that the lead expert shall be responsible for the study; and
3. Agree on time schedule.

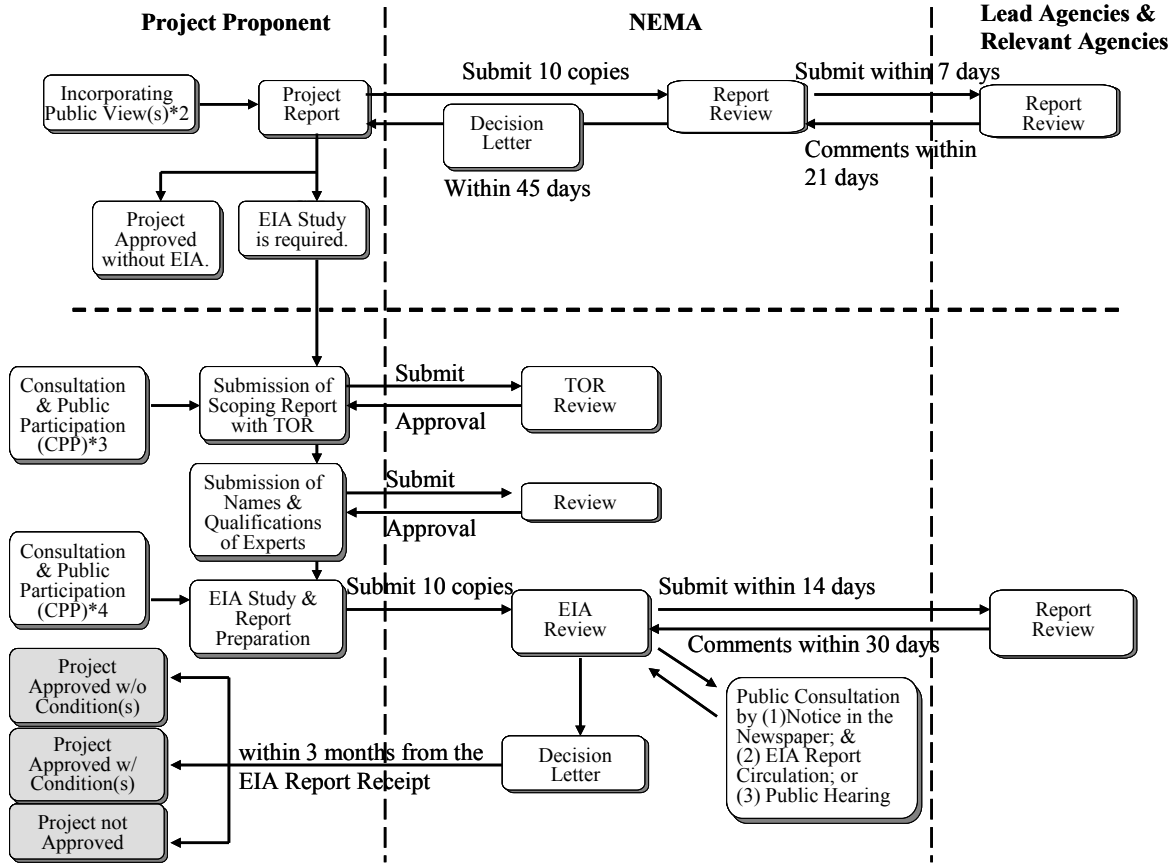
Step 3: Plan field work including consultations and public participation and provision for:

1. Collection of baseline data and information;
2. Awareness creation;
3. Generation of primary data;

4. Ecological, socio-cultural and economic surveys;
5. Designing of EMP to implement the mitigation measures and involving all the affected persons

Step 4: Report writing

Source: Section 2.6 of Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002



Source: Prepared by JICA Team based on the Environmental (Impact Assessment and Audit) Regulations 2003; and the Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002

Source: JICA Team

Figure 10.1.1 EIAS Report Preparation & Review Procedure

As for the EIA license fee, the payment of 0.1% of the total cost of the project was required

[2] Section 2.4 of the Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002 states that "[t]he views of the public on all these activities [within the project cycle] should be incorporated in the project report" by "indicating representativeness of the potentially affected people."

[3] Section 2.5.6 of the Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002 specifies that CPP for the scoping report should be target the affected persons, the methods of CPP include a) securing written submission from Lead Agencies and the public; (b) public opinion; (c) holding community meetings and public hearings; (d) conducting preliminary fields study/site visits; (e) conducting workshops/seminars; and (f) establishing inter-sector task forces.

[4] Section 2.9 of the Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002 requires that the CPP for EIAS should "involve the affected person, lead agencies, private sector, among others" and "[its] methodology may include (a) meetings and technical workshops with affected communities; (b) interpersonal contacts; (c) dialogue with user groups and local leaders; (d) questionnaire/survey/interview; and (e) participatory rural appraisal or rapid rural appraisal (PRA/RRA) techniques.

for the project proponent in the both the private and public sectors by the Environmental (Impact Assessment and Audit) Regulation 2003. However, it was amended as described in the following table by the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2009 dated 11th February 2009. Additionally, 50% of the license fee shall be paid upon submission of the project report, and the rest shall be paid when collecting the EIA License.

Table 10.1.1 EIA Report Reviewing Fee

Range of Project Cost	Amount of the License Fee
Less than Ksh 200,000	Minimum Payment of Ksh 10,000
Ksh 200,000 – 20,000,000Ksh	0.05% of the total cost of the project
More than Ksh 20,000,000	Maximum Payment of Ksh 1,000,000

Source: Prepared by JICA Team based on the Environmental (Impact Assessment and Audit) (Amendment) Regulations 2009 *Source: JICA Team*

(4) Public Meetings and Information Disclosure

As a public meeting at each stage, namely preparing the PR, the Scoping Report and EIAS report, the Environmental (Impact Assessment and Audit) Regulations specifies only a public meeting for EIAS report in Section 17 of the Regulations. The public meeting for the PR and scoping report is described only in the Draft Environment Impact Assessment Guidelines and Administrative Procedure, Nov. 2002.

1) Public Meetings for the Project Report by the Project Proponent

Although the public consultation for the project report is not specifically required by the Environmental (Impact Assessment and Audit) Regulations, it is described in Section 2.2.4 of the Environmental Impact Assessment Guideline and Administrative Procedure of Nov. 2002 that the public view on the project activities shall be incorporated in the project report by indicating representativeness of the potential PAPs.

2) Public Meetings for the Scoping Report by the Project Proponent

Section 2.5.6 of the Environmental Impact Assessment Guideline and Administrative Procedure of Nov. 2002 state that "scoping must ensure continuous consultation between the proponent, the experts, the public (especially potentially affected persons) and the Authority." There are 6 methods for public involvement and information collection which are identified by NEMA:

- Securing written submissions form Lead Agencies and the public;
- Public opinion;
- Holding community meetings and public hearings;
- Conducting preliminary field study/site visits;
- Conducting workshops/seminars; or
- Establishing inter-sector forces.

3) Public Meetings for the EIAS Report by the Project Proponent

The Environmental (Impact Assessment and Audit) Regulations of 2003 specified 4 steps of the public consultation during the EIAS in Section 17 of Part III:

(a) Publicise the project and its anticipated effects and benefits by-

- Posting posters in strategic public areas in the vicinity of the site of the proposed project informing the affected parties and communities of the proposed project;
- Publishing a notice on the proposed project for 2 successive weeks in a newspaper that has a nationwide circulation; and/or
- Making an announcement of the notice in both official and local languages in a radio with a nationwide coverage for at least once a week for 2 consecutive weeks.

(b) Hold at least 3 public meetings (per project site) with the affected parties and communities to explain the project and its effects, and to receive their oral or written comments;

(c) Ensure the appropriate notices are sent out at least 1 week prior to the meetings and that the venue and times of the meeting are convenient for the affected communities and the other concerned parties; and/or

(d) Ensure, in consultation with the Authority that a suitably qualified coordinator is appointed to receive and record both oral and written comments and any translations thereof received during all public meetings for onward transmission to the Authority.

4) Information Disclosure and Public Hearing for the EIAS Report by NEMA

After the submission of the EIAS report, NEMA shall publicise the EIAS report by the newspaper and radio for comments and may organise a public hearing if it is considered necessary by NEMA. Details are described below as specified in Section 21-22, Part IV of the Environmental (Impact Assessment and Audit) Regulations of 2003.

(a)Publish 2 successive weeks to gazette and in a newspaper with a nationwide circulation and in particular with a wide in the area of the proposed project, a public notice once a week inviting the public to submit oral or written comments on the environmental impact assessment study report;

(b)Make an announcement of the notice in both officer and local languages at l east once a week for 2 consecutive weeks in a radio with a national wide coverage; and/or

(c)Upon receipt of both oral and written comments, the Authority may hold a public hearing if it is considered necessary by NEMA.

(5) EIA Approving Agency

NEMA is the EIA approving agency in Kenya as prescribed in the EMCA. However, since December 2008, the review system of the EIA reports was decentralised, and in principal, the project report and/or EIA report shall be reviewed and approved by the provincial office of NEMA where the project is going to be implemented.

10.2 Implementation of EIA Study

10.2.1 Overview of EIA Study

The terms of reference (TOR) for the environmental consultants were prepared and sent to consultancy firms of experts registered by National Environment Management Authority (NEMA). The scope of work for local consultants was to prepare the Project Report (PR) and not including preparation of the EIA Study Report since the EIA Study Report may not be required by NEMA for the magnitude of the project was minimal.

The environmental consultants collected data and held public meetings (Baraza) with the farmers and all relevant stakeholders in and outside the irrigation schemes. The below is a summary of the impacts and mitigation measures that were across all irrigation schemes.

Table 10.2.1 Major Negative Impacts and Mitigation Measures

Environmental Impacts Construction and operational Phases		
Item	**Impacts**	**Mitigation Measures**
Soil erosion	➢ May arise from water flowing from very steep slopes. ➢ Arise from clearing of vegetation during construction works to pave way for the pipeline and intake works. ➢ Excess water from un-manned sprinklers	➢ Stabilise high slopes with terraces, grass and gabions ➢ Clear only affected (construction) area. ➢ Reinstate sites immediately after construction by planting grass ➢ Plant trees to stabilise river banks and protect the intake works. ➢ Train farmers on appropriate soil conservation techniques.
Fauna, Flora and Ecosystem	➢ Vegetation may be cleared to pave way for the pipeline and canal route destroying the fauna habitats.	➢ Vegetate the area but it is expected that most of the vegetation will grow by the time the Project is complete. ➢ The contractor should concentrate only on the area they are laying pipes the rest of vegetation should not be cleared. ➢ Vegetation can be trimmed instead of removing them completely. ➢ Plant grass and trees after construction works.
Occupational health and safety, accidents and incidents	➢ During construction period, accidents and incidents may occur	➢ Contractor should train workers on occupational health and safety including first aid ➢ The contractor should provide first aid kits on site. ➢ Appropriate use of personal protective equipment (PPEs) ➢ Contractor should have emergency evacuation plan in place in case of accidents.

Environmental Impacts Construction and operational Phases		
Item	**Impacts**	**Mitigation Measures**
Groundwater contamination/ salinity (**only in Mdachi Irrigation Scheme**)	➢ Tendency of over irrigation and under irrigation would bring toxic salts to the surface. ➢ The water and soils in the scheme are saline	➢ Periodic leaching of salts from the root zone with rain fall water. ➢ Plant salt tolerant crops e.g. Okra, green maize, onions, Amaranthus ➢ Ensure adequate drainage within the scheme. ➢ Apply well decomposed manure/compost to regularly to improve soil structure thus enhance leaching ➢ Quarterly monitoring of soils and water.
Soil contamination	➢ Oil leakages from the machinery used on site i.e. concrete mixer, vehicles ➢ Waste water from construction activities ➢ Fuel from servicing and maintenance of construction equipment. .	➢ Ensure machinery and vehicles are well serviced to prevent oil and fuel leakages. ➢ Ensure vehicle and machines are fuelled at specific places that spillages can be controlled. ➢ Dispose of waste water safety
Water pollution/water resource degradation	➢ From construction sites- from concrete mixing ➢ Agrochemical used in the farms washed to the river	➢ Ensure waste water is disposed off from the river. ➢ Train farmers on proper agrochemical use, handling and disposal. ➢ Encourage farmers to use manure instead of fertiliser. ➢ Each farmer should leave 50m buffer to the river as required by NEMA, WRMA and they should plant trees not crops for daily consumption. ➢ Water quality monitoring should be carried out on quarterly basis.
Resource conflicts such as water resources, conflict of interest	➢ Conflict for water between farmers in the scheme. ➢ Conflict for water between upstream and downstream users.	➢ IWUA to prepare and adhere to water schedules in the scheme. ➢ Adhere to WRMA abstraction permit ➢ Establish WRUA to ensure equity in water use of the water resource and put in place catchment rehabilitation programme.
Diseases such as HIV/AIDS, Malaria, Bilharzias	➢ Stagnant water is breeding ground for mosquitoes and snails thus cause malaria and bilharzias. ➢ Due to interaction of the locals with new people brought by the contractor this may lead to social degradation and hence HIV/AIDs ➢ Lack of sanitary facilities at the construction site may lead to people using the bushes for the calls which can be washed into the river causing waterborne diseases.	➢ The contractor shall provide adequate sanitation facilities to the workers. ➢ Construction site should be in clean and safe condition and provide and maintain appropriate facilities for temporary storage of all wastes before transportation and disposal. ➢ Manage irrigation efficiency to prevent water ponding. ➢ Training to farmer on disease prevention and control ➢ Train and provide information on HIV/AIDs

Source: JICA Team

10.2.2 Submission and Approval of Environmental Impact Assessment Project Report

The EIA PR reports for seven (7) schemes out of eight (8) in the Batch-1 pilot project sites were submitted to NEMA in May 1013, reviewed by the authority and issued with approval letter and subsequently issued with licenses in July 2013. The EIA PR report for Mdachi irrigation was submitted in November, 2013 and EIA PR licence issued in March 2014.

Table 10.2.2 EIA Licenses of Batch 1 Pilot Project Sites

Scheme	License date
Olopito	Approved on 24/07/2013
Gatitu/Muthaiga	Approved on 25/07/2013
Tumutumu	Approved on 25/07/2013
Muungano	Approved on 24/07/2013
Murachaki	Approved on 24/07/2013
Kasokoni	Approved on 25/07/2013
Mdachi	Approved on 03/03/2014
Kaben	Approved on 25/07/2013

Source: JICA Team

The EIA PR reports for five (5) in the Batch-2 pilot project sites were submitted to NEMA in February 2015, reviewed by the authority and issued with licenses in April and June 2015.

Table 10.2.3 EIA Licenses of Batch 2 Pilot Project Sites

Scheme	License date
Kaumbura	Approved on 10/04/2015
Kiamariga-Raya	Approved on 11/06/2015
Tuhire-Challa	Approved on 21/04/2015
Shulakino	Approved on 10/04/2015
Mangudho	Approved on 10/04/2015

Source: JICA Team

The licenses were issued with conditions which should be incorporated in the Environmental Management and Monitoring Plan (EMMP).

10.3 Environmental Management and Monitoring Plan (EMMP)

10.3.1 Outline of EMMP

After issuance of the EIA license, EMMP consisting of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) has to be developed based on the results of EIA study, in short in consideration of anticipated environmental impacts and proposed mitigations and NEMA's recommendations. The EMMP would be conveyed to the farmers.

(1)Environmental Management Plan

The EMP gives a breakdown of all the negative impacts and mitigation measures for the scheme development. The EMP is divided into construction phase and operational phase where each stakeholder/player's responsibility is outlined in the matrix i.e. Contractor, farmer/IWUA, SCIO, SCAO, PMT.

The main role of the SCIOs and the SCAOs was to ensure compliance with the law and in most cases backstopping. The farmers' role was mainly implementation, monitoring and reporting on the various activities in the EMP. PMT is responsible for general monitoring

and evaluation, report writing and reporting to NEMA. PMT had the overall supervision and backstopping responsibility.

The results of the discussions on the EMP with the SCIOs and the SCAOs were explained to the farmers as per the conditions on the EIA license issued by NEMA through the public baraza held in each scheme. The Officers also explained the roles of the farmers during implementation of the Project.

(2)Environmental Monitoring Plan

The EMoP consists of construction and operational phase. All the negative impacts with their mitigation measures identified in the EMP matrix were specifically identified in the following: the respective activity, time i.e. an impact (noise and vibration) would occur during the construction works for intake works/ canal works, point of monitoring i.e. project site, frequency of monitoring i.e. monthly, quarterly, reason for monitoring for compliance with EIA licence condition 2.1,how to monitor which could be through observation and monitored by the SCIOs and the SCAOs and Environment team.

The actual monitoring and reporting during construction phase should be conducted on monthly basis.

(3)Environmental Monitoring and Action plan

Once discussions on the EMMP are finalised, the SCIOs and the SCAOs were supposed to prepare Environmental Monitoring and Action Plans (EMAP) for the schemes and outlined details in the construction phase and operational phase of the schemes development which included the following:

10.3.2 Summary of EMMP

EMMP for each scheme is commonly summarised below.

Table 10.3.1 Summary of EMMP (during Construction Phase)

ITEM	MITIGATION MEASURES	ACTION/RESPONSIBILITY
WRMA construction permit	Authorisation permit to be obtained	IWUA- Obtain authorisation SCIO-Facilitate acquiring of authorisation. PMT-Overall supervision and backstopping
Project Sign board	Project sign board to be erected among other details display EIA licence number	Contractor- Erect and maintain a sign board IWUA-Provide site for erection of a sign board
Sanitary facilities	Provision of sanitary facilities to construction workers	Contractor-Construct sanitary facilities IWUA-Provide site for construction of sanitary facility, monitoring and reporting

ITEM	MITIGATION MEASURES	ACTION/RESPONSIBILITY
		PMT-Overall supervision and backstopping
Ecological degradation of the river and river bank	-Provide slope protection by vegetative stabilisation. -Designate storage for excavated materials, provisions for re-use of excavated material	Contractor- Excavate evacuation channels and stabilise slopes SCIO- Ensure compliance PMT-Monitoring and Evaluation and overall supervision.
Soil Erosion	-Backfill excavated areas -Revegetate backfilled area	Contractor-Backfill excavated area, plant grass IWUA- Backfill excavated pipeline route and plant grass SCIO- Ensure compliance PMT- Monitoring and Evaluation and overall supervision.
Health, safety and accidents	-Appropriate use of personal protective equipment -Provide first aid kit -General register to record all incidence and accidents -Provide warning signage's	Contractor- Provide PPEs, first aid kit, warning signage's, fencing. IWUA-Provide PPEs, first aid kit SCIO- Ensure compliance, monitoring and reporting. PMT- Overall supervision.

Source: JICA Team

Table 10.3.2 Summary of EMMP (during Operation Period)

ITEM	MITIGATION MEASURES	ACTION/RESPONSIBILITY
Water abstraction permit from WRMA	Obtain water abstraction permit.	IWUA- obtain abstraction permit SCIO-Facilitate the process PMT-Monitoring, evaluation and overall supervision
Soil Erosion	-Train farmers on appropriate soil conservation techniques. -Stabilise high slopes with terraces, grass -Plant trees to stabilise river banks and protect the intake works.	IWUA-Implement soil conservation measures SCAO/SCIO- Train farmers on soil and water conservation, Supervise and backstopping PMT- Monitoring, evaluation and overall supervision
Water logging and Stalinisation	-Provide adequate drainage to ensure disposal of excess water -Train farmers on correct water application rates. -Soil analysis and monitoring should be carried out frequently so as to monitor changes thus potential problems can be managed.	IWUA- Ensure drainages for water are clear, repair damaged pipes, conduct soil analysis once in 2-3 years subject to review, Adopt appropriate irrigation water schedules SCAO/SCIO- facilitate soil analysis process, monitoring and reporting, Sensitise farmers on correct water application PMT- Monitoring, evaluation and overall supervision
Agrochemicals pollution	-Train farmers on proper agrochemical use, handling and disposal -Agrochemicals used should be approved by PCPB -Use of Personal protective	IWUA- Attend training and adopt proper/safe use and disposal of agrochemicals, use of PPEs when handling agrochemicals SCAO/SCIO-Train farmers, monitoring and reporting

ITEM	MITIGATION MEASURES	ACTION/RESPONSIBILITY
	equipment	PMT- Monitoring, evaluation and overall supervision
Sanitary facilities	-Availability of sanitary facilities to avoid water borne diseases at farm level	IWUA- Construct sanitary facilities to avoid contaminating the river SCAO/SCIO- Monitor, guide and sensitise farmers in collaboration with public health PMT- Monitoring, evaluation and overall supervision
Human –wildlife conflicts	-Fencing the cultivated farms to keep off wild animals. -Report stray animals to KWS for restraining	IWUA- Fencing respective land, Reporting SCAO/SCIO- Monitor and guide farmers in collaboration with KWS PMT- Monitoring, evaluation and overall supervision
Water use conflicts	-Farmers should join relevant WRUA -WRMA should give water abstraction permit specifying how much water should be drawn from the river to cushion downstream users.	IWUA- prepare and use water distribution schedule, SCAO/SCIO-Supervise, sensitisation and backstopping PMT- Monitoring, evaluation and overall supervision

Source: JICA Team

10.3.3 Environmental Monitoring

Monitoring tools for implementation of the EMMP for contractor and farmers works were prepared and presented to the SCIOs, the SCAOs and the clerks of works to monitor contractor works and presented to the farmer's representatives for the monitoring of farmers works. They are 1) Monitoring Questionnaire, 2) Personal Protective Equipment Checklist, 3) Water Quality Parameter Checklist, and 4) Accident and Incident Monitoring.

During field visit for monitoring for the construction works, the following issues were observed.

Table 10.3.3 Observation during Field Monitoring

Scheme	Compliance with EMMP
Kasokoni	-Contractor provided workers with PPEs -5 accidents occurred during the construction -Contractor provided first aid kit at the construction phase -Adequate diversion of the river was done during intake construction
Mdachi	-Contractor provided workers with PPEs - 5 cases of accidents -Contractor provided well equipped first aid kit -Vegetation was cleared during construction and the area revegetated -Borrow pit was levelled to prevent water ponding -water and soil analysis was conducted to check on salinity levels. -Adequate diversion of the river was done during intake construction
Olopito	-Contractor provided workers with PPEs -No cases of accidents and incidences

Scheme	Compliance with EMMP
	-Contractor provided well equipped first aid kit -Adequate diversion of the river was done during intake construction
Gatitu Muthaiga	-IWUA provided first aid kit -IWUA worked without PPE -There were no cases of accidents and incidences
Kaben	-Contractor provided workers with PPEs -No cases of accidents and incidences -Contractor provided well equipped first aid kit -Vegetation was cleared during construction and the area revegetated
Tumutumu	-Contractor provided workers with PPEs -10 accidents occurred during construction period -Contractor provide a sanitary facility -Vegetation was cleared during construction and the area revegetated. -Adequate diversion of the river was done during intake construction

Source: JICA Team

Decommissioning of sanitary facilities, contractor site office, clearing of all wastes, water pit was checked at the site.

- In Muungano scheme, the contractor cleared the site by backfilling the latrine, removal of site office, clearing all solid waste in the site.
- Kasokoni contractor removed the site office, removed all solid waste, but the latrine was not backfilled (dangerous pit).

10.4 Training Programme

10.4.1 Induction Training

Induction training was conducted for farmers in the Batch 1 and 2 pilot project sites were inducted on environmental issues, conservation and on occupational health and safety in the irrigation schemes.

10.4.2 Environment, Health and Safety Training

EHS (Environment, Health and Safety) trainings for IWUA members in the Batch 1 & 2 pilot project sites were conducted in MIAD. Batch 1 EHS training was conducted from 26th to 28th March 2014. In the Batch 1, 31 farmers were trained 4 participants from each scheme. In the Batch 2, the EHS training was conducted between 13th and 16th July 2015. 29 farmers were trained, 6 participants from each scheme. Topics for the training were

- Soil and water conservation
- Introduction to environment and Environmental Law in Kenya
- Environmental Impacts and Mitigation Measures in irrigation development
- Introduction to health and safety and Occupational Accidents in irrigation development
- Pre construction guidance (Batch 2 only)
- First aid at work place (2 days for the Batch 2 only)

- Public health disease, HIV and AIDs

10.5 Management of the Saline Irrigation Water in Kilifi County

As a result of the EIA studies, Mdachi and Mangudho schemes located in Kilifi County are to be operated under strict and sensitive conditions so as to avoid damage to the soils. The result indicated that the salinity levels of water in the both schemes might affect seriously in irrigated farming in the schemes. This is a major problems experienced in irrigation development and adequate measures need to be addressed to those in Kenya. In this respect, various measures were proposed to manage salinity problem to achieve long-term sustainable irrigated agriculture. The current situation in the two schemes and proposed mitigation measures for salinity management is shown below.

Table 10.5.1 Current Situation and Salinity Mitigate Measures of Mdachi and Mangudho Irrigation Scheme

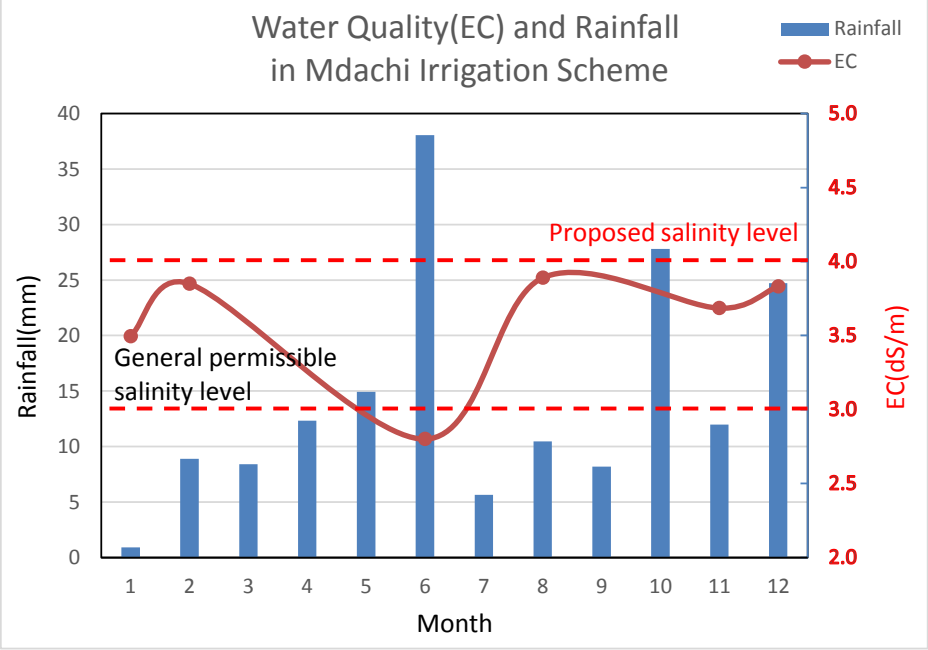
Scheme	Current situation	Proposed mitigate measure for salinity management
Mdachi	1. Irrigation water source Springs, 2km upstream from the intake 2. Irrigation water quality EC*: 1.8-4.8 dS/m * Electrical Conductivity : A measure of salinity in irrigation water、unit : dS/m（Way of reading: desi Siemens） 3. Agriculture information (1) Irrigation method Rain fed（pump irrigation partially） (2) Main crop Green Mai e , Sugar Cane, Cassava, e ans, okra, a le, a nana, Capsicum, Eggplant, Watermelon, Spinach (3) Challenge - Watering during daytime - mixed cropping which irrigation water amount is significantly different	1. Outside of the farm (1) Stop irrigation at intake If the salinity level of the irrigation water exceeds the permissible level. 2. Inside of the farm (1) Plant salt tolerant crop *1 Cereal and Beans : barley, wheat, sorghum, rice, sugar beet, soybean, cowpea Vegetables: Tolerant: asparagus, zucchini, broccoli, tomatoes, spinach, celery, squash, cucumber Medium Tolerant : Green Maize, Sugar Cane Fruit : Dates, figs, olives, pomegranate, papaya, pineapple, cantaloupe Others: cotton, safflower oil (2) Protection from Salt accumulation in soil 1) Ensure reliable drainage a. Provide good drainage b. Deep plough and Application of manure/compost in farm yard ensuring soil permeability c. Field levelling 2) Appropriate management of irrigation water a. Water-saving irrigation b. Cultivation of the same crop in each field c. Appropriate irrigation timing and amount - Adjust Irrigation amount in accordance with the Crop-Growth-Stage - Apply water in the morning/evening to prevent high evaporation. 3) Periodic leaching of soil salinity Leaching with rainfall
Mangudho	1. Irrigation water source A Spring (water is high in salinity), 1km upstream from the intake and Subsoil water upstream of the catchment 2. Irrigation water quality EC : 0.55dS/m ～ 10.0dS/m A large seasonal variation 3. Agriculture information (1) Irrigation method Rain fed（pump was broken） (2) Main crop Green Maize, Cassava, Beans, Kale, Watermelon, Spinach (3) Challenge - Drip irrigation equipment is left - Salinity damage occurred in some field when pump irrigation was operating	

Source: JICA Team

Although there are a variety of mitigation measures, as described above, for salinity, the most effective way to avoid long-term damage caused by salinity on the soil is through controlling irrigation water at intake site. When the water is saline, it leads to accumulation of salts in the soil and cause long-term reduction of crop production.

Therefore, during Unit 4 training" On Farm Water Management and Practical Irrigated Agriculture" and Unit 5 training "Irrigation System Management", the capacity building team discussed salinity hazard with the farmers. Then if salinity reached hazardous levels, the team recommended that the farmers should stop irrigation as a control measure. Moreover the farmers were trained how to measure salinity by use of the EC meter, and how to report on the salinity levels to the committee members and agree on when to stop irrigation.

The permissible salinity level is 3.0dS/m [T.A. Bauder] for the irrigation level but the current level for the two irrigation schemes was more than 3.0 dS/m. Moreover, once if the permissive salinity level is set to 4.0dS / m from the aspect of only convenience of irrigation, there is a possibility that sustainable agriculture become impossible. Therefore the Project proposes the optimum salinity level to be set in the irrigation scheme management.



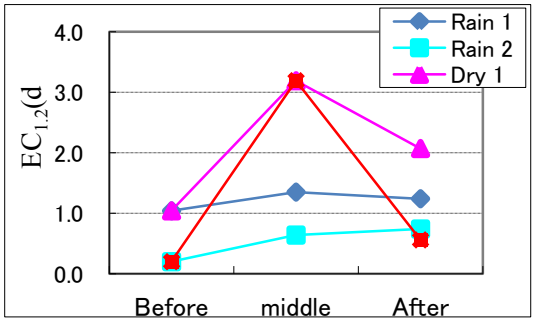
***Rainfall : Mean monthly rainfall (mm) at Galole Weather Station (2009-2013), EC : Average EC data at Mdachi intake（2013-2015）**

Source: JICA Team

Figure 10.5.1 Water Quality and Rainfall at Mdachi Scheme

To set up the optimum use of the irrigation water in the schemes, series of field tests have been conducted in Mdachi scheme during the rainy season, from 2014 October to December 2014, and the dry season, from January to Mar 2015 to monitor salinity level of the irrigation water and soils, and the crop yields.

As a result of the field measurement, even though EC of irrigation water remained at 3.0 ~ 4 8dS / m in this period, the yield of the crop is normal or more by irrigation methods. Moreover, as shown in the following figures, although the salinity of the soil rose in the dry season, it was restored to almost original condition after the rainfall of midterm in most of the field.



Source: JICA Team

Figure 10.5.2 Salinity of the Soil at Rainy and Dry Season

The Soil salinity in this case corresponds to "Slightly saline" or "Moderately saline", it is classified “Soil affects the reduction of the yield for sensitive or many normal crop”

Table 10.5.2 Soil Salinity and Crop Yield

Soil Salinity Class	$EC_{1:2}$* (dS/m)	Effect on Crop Plants
Non saline	0 – 0.5	Salinity effects negligible
Slightly saline	0.5 – 1.0	Yields of sensitive crops may be restricted
Moderately saline	1.0 – 2.0	Yields of many crops are restricted
Strongly saline	2.0 – 4.0	Only tolerant crops yield satisfactorily
Very strongly saline	> 4.0	Only a few very tolerant crops yield satisfactorily

Quote: USDA (United States Department of Agriculture), Soil salinity and crop yield
＊In order to match an index of the research institutes of Kenya in the table, following formula is adopted :
ECe = 4 EC1: 2 (ILRI, 2003)
ECe : EC measured by extracted water from saturated soil water
EC1: 2 : EC measured by Soil “1” and Water “2” mixed

Source: JICA Team

In addition, SAR (Sodium Absorption Ratio) which is useful indicator of soil salinity is less than 6.0. It means less possibility to cause severe drainage problem by the sodium affected soil.

From the above results, the “Proposed salinity level” for this operation is set to be 4.0dS / m. Under this condition, there is possibility to use irrigation system continuously and the farmers may not suffer extreme operation constraints, even though the level of upstream spring water salinity is high.

However, during the operation with this condition, the farmers should avoid over irrigation, monitoring both salinity level of irrigation water and soil, and observe the symptom of salt damage of the crop. Then if they find abnormal issue, irrigation should be stopped immediately. In addition, the farmers and Government officers would cooperate to study the possibility

whether the standard can be change or not together with continuous monitoring data (For details, refer to the monitoring plan).

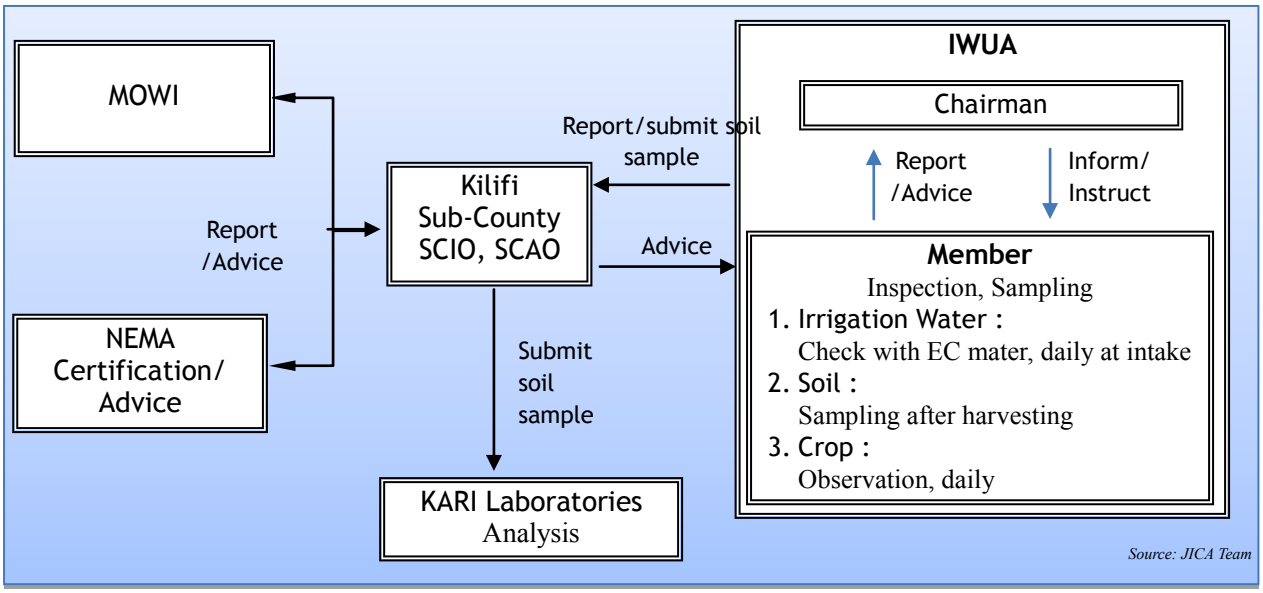


Figure 10.5.3 Monitoring Structure of Salinity Survey

10.6 Achievement, Challenges and Lessons Leant

10.6.1 Achievements

Achievements for Activities for environment during the project implementation are itemised below.

- Obtaining EIA licenses for 13 schemes
- Obtaining WRMA authorisations for 7 schemes
- EHS trainings for Batch 1 and 2 pilot project sites
- Monitoring during construction works for 8 Batch 1 schemes
- Initial Environment Auditing for Mdachi, Gatitu Muthaiga, Tumutumu, Kasokoni, Kaben schemes

10.6.2 Challenges and Lesson Learnt

Table 10.6.1 Challenges and Lesson Leant

Description	Challenges	Lesson learnt
Preparation of EMMP	SCIOs were occupied with a lot of work thus EMMP monitoring was not conducted as planned by the SCIO	Initially, project implementation programme should be prepared, considering time for the EIA and EMMP.
Implementation of EMMP	The officers have not been trained on EMMP and therefore they are unable to undertake it on their own	Officers need training more on Environment issues during the project implementation
Monitoring	Most of the contractors adhered to the rules e.g. PPEs, decommissioning sites except a few (Murachaki)	Continuous monitoring should be done
	Farmers are still not sensitised enough on use of PPEs. One of reasons was they could not manage to purchase PPE.	Continuous sensitisation on safety to the farmers focusing on the safety construction period.
Environmental Audits	Officers feel they are not empowered enough to undertake EA on their own	There is need for officers training on environment
WRMA authorisation	Some schemes have had their licenses being cancelled and have to be reapplied (Gatitu/Muthaiga) Other schemes have not yet obtained this authorisation	There is need to follow up on the rest of the schemes
WRMA abstraction permits	Farmers have not managed to contribute towards application for the permits	Farmers should be informed they must contribute and pay for this before project ends*
	Farmers have been complaining on WRMA charges being too high	The Water Act to be passed is expected to address these issues WRMA as a stakeholder should be involved more during project implementation

Source: JICA Team

CHAPTER 11 Revision of Guidelines

11.1 Guidelines Developed under the SIDEMAN Project

11.1.1 General

The following guidelines were developed during the Period of the Mini-Project

- SHIDD Guideline
- IWUA Framework, and
- Training Master plan

Out of the three guidelines, the SHIDD Guideline and the IWUA Framework were reviewed and revised under the SIDEMAN Project

11.1.2 SHIDD Guidelines

The Smallholder Irrigation and Drainage Development (hereinafter referred to as "SHIDD") schemes were undertaken as part of the rural development process. To development process of SHIDD schemes, Irrigation and Drainage Branch developed the guidelines (1986, 1993) for the agency staff. However these guidelines did not contribute much to increase the irrigation Area. Because of many stakeholders was involved in that scheme, Resources of water, land, and financial budget was often used improperly.

GOK-JICA modified "SHIDD guideline" and set the general direction on planning, development and management of SHIDD. The new guideline "2003 SHIDD guideline" was improved to define the stakeholder roles, approach to the employee and given a comprehensive guide to a SHIDD project cycle. After modification, GOK-JICA project for 'sustainable smallholder irrigation development and management' (hereinafter referred to as SIDEMAN) was implemented with the guidelines, since 2005 to 2010.

The revision work was conducted in accordance with experience obtained through implementation of SIDEMAN project.

Under the concepts as below (same between Guidelines 2003 and 2010), SHIDD Guideline give the directions.

[Concept of Guideline]

1. Participatory Development Approach including IWUA ensures the sustainability
2. Coordination between Stakeholders
3. Capacity Building for both IDD and Farmers

The Guideline gives the direction to

1. Financial arrangement for SHIDD including farmer's contribution
2. Stakeholders roles & coordination
3. Capacity Building in environmental, gender, soil, topography, land tenure, marketing, rural infrastructure and availability of funds;

SHIDD based on new guideline entailed the development of irrigation and drainage schemes with farmer's ownership and management. This is opposed to the centrally managed, state owned, large scale, schemes such as those managed by the National Irrigation Board (NIB).

The Contents of SHIDD guideline are:

1. INTRODUCTION
2. SHIDD STAKEHOLDERS
3. Water Users Association (WUA)
4. FINANCIAL ARRAGEMENT FOR SHIDD
5. SHIDD PROJECT FORMULATION
6. SHIDD DEVELOPMENT PROCESS
7. SUPPORT SERVICES TO SHIDD
8. ANNEX 1- CONTENTS OF AN IMPLEMENTATION AGREEMENT

11.1.3 IWUA Framework

This is the first Framework developed by the Ministry of Water Resources Management and Development on the Formation, Development and Management of Irrigation Water Users" Associations (hereinafter referred to as "IWUA") as an input towards sustainable community-based irrigation and drainage development.

Due to the complex functions expected to IWUAs, the framework draws attention to the broad concept and scope of capacity building as opposed to just training. Poor performance and eventual collapse of many government/donor-initiated community irrigation projects is attributable to weak farmers' organizations and inadequate participation of the beneficiaries.

The factors contributing to weak farmers organizations are:

- Weak financial base of IWUAs
- Inadequate management skills
- Inadequate technical skills in crop production and water management

The above challenges and opportunities motivated the formulation of this framework. The objective of this IWUA Framework is to guide the policy makers, planners and irrigation farmers in the organisation, development and management of IWUAs towards sustainable SHIDDM.

Towards the direction of sustainable SHIDD, this framework covers:

1. The IWUA in terms of: its Vision, Mission, Objectives, roles/functions in all phases of SHIDD development; composition and structure; its by-laws; and brief enumeration of qualities.
2. Community Mobilisation and IWUA formation process in terms of: Participatory community mobilisation and roles of a community mobilise
3. Farmers participation for sustainability: institutionalisation of Participatory Approach (PA) in SHIDD and environmental issues
4. Capacity Building in IWUAs including: Purpose and Areas of capacity building, capacity building process and basic training programmes for IWUAs
5. The process of organisation, development, and scheme participation as guided by basic principles and approaches in participatory development.
6. Scheme operation and maintenance
7. Other supporting aspects such as gender participation, mobilisation of stakeholders, environment and monitoring and evaluation.
8. Participatory monitoring & Evaluation including the steps in PM&E and stakeholders roles in PM&E

It also demonstrates the major shift from centralised management of irrigation schemes to farmer-owned and managed schemes (called 'shop- floor' approach).

11.1.4 Training Master Plan

The Training Master Plan presents a comprehensive guide for capacity building of irrigation and drainage Sub-Department manpower in the smallholder sub-sector.

The Training Master Plan has identified critical areas in which capacity building for both farmers and the government officials should be trained. For the officials the priority areas include: on-farm water management, irrigation and drainage systems operation and maintenance, formation, capacity building and effective backstopping of the IWUA, Irrigation agronomy, Harvest and Post Harvest management of irrigated produce, and marketing skills relative to irrigated produce. On the side of the farmers, the critical areas include on-farm water management, systems operation and maintenance, formation, development and sustainable management of IWUA, selection and effective management of irrigation enterprises, irrigation agronomy, harvest and post-harvest management of irrigated produce, marketing channels and techniques, including export marketing, and participatory development techniques.

11.2 Issues to be Addressed for the Revision of the Guidelines

At the Lesson Leant Workshop in December 2015, the IWUA Framework and the SHIDD guideline were reviewed in the following aspects.

11.2.1 Review of SHIDD Guideline

The officers had noted that most of the concepts in the guideline had been implemented including cost sharing, environmental issues, designing a construction works, stakeholder involvement, IWUA capacity building, gender issues, conflict management in the IWUA, IWUA organisation, the SHIDD process among others.

Some of the concepts noted to have not been implemented included insufficient gender mainstreaming, resource mobilisation for farmers, partial involvement of stakeholders, insufficient support services, food for work, testing of the system, land tenure issues, SHIDD development model among others.

The recommendation is that the document is that there is need for enhanced participatory approach in irrigation development. The SHIDD guideline needs to be reviewed to address the areas of concern in the document.

Table 11.2.1 Review of SHIDD Guidelines

Areas of Revision	**Proposed changes**
Cost sharing	Guidelines need to quantify farmer work (contributions), Need to look at other strategies to raise funds from farmers and the MOU should be checked to address any ambiguity especially in locally available materials
Land tenure	Issues of land ownership must be addressed before scheme development The guidelines need to include rights of use of land, rights of access and control. Riparian land need to be specified and laws governing it should be included
Farmers participation	The critical area of the guidelines is the issue of participation where it should be spelt out clearly and also quantified either in materials and un-skilled labour.
Model of implementation	There is need to specify the model that irrigation development should take in the guidelines and in irrigation policy. There is also need to articulate the preferred mode of engagement with the donors in the guidelines
Stakeholder participation	There is need to involve the stakeholders that are beyond development. Those that will work with farmers during operations and maintenance
Overall review	The guidelines needs to be reviewed to capture the current status and articulate the issues of irrigation developed noting devolution requirement. There is need to involve all the counties and all other stakeholders in policy formulation and project implementation

Source: JICA Team

11.2.2 Review of IWUA Framework

The officers attending the workshop outlined the various concepts from the framework that had been implemented during the capacity building programme among them formulation of

by-laws, trainings, IWUA organisation, participatory approaches, community mobilisation and gender considerations.

The concepts that had not been implemented included TNA, farmers' participation in tendering, resource mobilisation strategies, full stakeholder involvement, scheme O&M, use of a community mobiliser and water undertaker among others.

The recommendations included institutionalisation of all participatory approaches and removal of the community mobiliser and water undertake concept among others.

Overall, the officers recommended a detailed review of the document.

Table 11.2.2 Review of IWUA Framework

Areas of Revision	**Proposed changes**
Training needs assessment	This should be carried out in any new capacity building programme to be undertaken in future
Resource mobilisation	The framework needs to be clear on the scope of farmers work and resources contribution There is need to develop and include strategies and guidelines on resource mobilisation
Participatory approaches to irrigation development	There is need to institutionalise participatory approaches in the framework including IWUA networking
Gender mainstreaming	This should be institutionalised in the framework
IWUA empowerment beyond training	There is need to develop guidelines and strategies of 'beyond training' for the IWUAs
Community mobiliser and water undertaker concept	These 2 are not viable in the smallholder schemes and therefore they should be reviewed in the framework Guidelines on alternative community mobilisation to be developed
Overall framework	The framework has GAPs that need to be filled from the lessons learnt in the Project

Source: JICA Team

11.3 Revision of Guideline

Based on the review and discussion at the workshop, the guidelines, such as SHIDD Guideline, IWUA Framework, and the Training Manual for IWUA were decided to be revised to capture the current status and articulate the issues of irrigation developed noting devolution requirement and Irrigation Policy and Acts. Following the decision, another workshop was held in May 2016 to finalise the guidelines and the frameworks, which should be published by GOK, taking necessary procedure for public comments.

CHAPTER 12 Recommendations

12.1 Implementation of Activities According to the Exit Strategy

In February 2016, a workshop was held to discuss an exit strategy for implementation of activities after the completion of the Project. Major items for the implementation are indicated below.

Table 12.1.1 Major Activities in the Exit Strategy

Category	Activities
Construction of Irrigation Facilities	Implementation of the remaining works under the Batch 1 & 2 pilot sites
Capacity Development for IWUA	Continuation of the Trainings for other IWUA members
	Monitoring of IWUA activities, such as amendment of by-law, financial management
	Facilitation to IWUA to prepare O&M Plan
	Provision of field Guidance to System O&M and collection of O&M Fee
	Preparation of Specific O&M Manuals
Agricultural Development	Continuation of the Trainings for other IWUA members, such as SHEP approach and LISA Technology
	Management of Demonstration Farm for extension of irrigated agricultures with water saving technologies
Environment	Facilitation to IWUA to obtain WRMA water abstraction permits
	Conduct of Environmental Audit for the Batch 2 pilot project sites
	Assistance to IWUA to implement EMMP during operation stage
Revision of Guidelines	Conduct of Public comments and workshops
	Finalisation and publication of the Guidelines

Source: JICA Team

As per the exit strategy, it is recommended that MWI and MOA would make necessary budgetary arrangement to implement the above activities towards sustainable management of the irrigation system and to disseminate the project outputs to other areas.

12.2 Construction of Irrigation Facilities

Under 5 schemes of the Batch 1 pilot project sites, namely, Kasokoni, Mdachi, Olopito, Gatitu/Muthaiga, and Tumutumu schemes, and the Batch 2 pilot project sites, the scope of works agreed at the 1st PSC Meeting were not fully completed due to time and budgetary constraints. It is, therefore, recommended to complete the whole scope of the construction works using the resources of the National Government and the County Government.

As for schemes partially constructed in the Batch 1 pilot project sites, namely, Kaben, Murachaki and Muungano schemes, it is appreciated that budgetary arrangements followed by procurements of construction materials have been carried out by the County Governments. It is recommended that the remaining works, such as pipeline system and canals are to be implemented continuously under resources of the Counties with farmers' participation.

Major recommendations for the engineering aspects are indicated below.

Table 12.2.1 Recommendation for Construction of Irrigation Facilities

Subject	Lessons Learnts	Recommendations	Actions
Construction Supervision			
Legal Requirements to obtain authorisation for NEMA and WRMA	➢ To prepare the realistic implementation schedule taking into consideration time frame needed for the authorisation. ➢ To avoid set back for the approval process of the authorisation through close communication with staff concerned.	➢ To implement a following up training to obtain the apropriate knowledge for the application process.	<MWI/County> To carry out the follow-up training programme <SCIO> To attend the training programme to obtain the basic knowledge.
Consensus building and the sharing of roles and responsibilities for farmers work	➢ To communicate closely between SCIO and IWUA to make appropriate action against challenges during the construction period.	➢ To prepare an action plan by IWUA so as to explain to IWUA members their responsibilities during the construction period. ➢ To monitor progress of IWUA participatory construction works by IWUA committee members and SCIO.	<IWUA> To share the action plan among the IWUA members <SCIO> To support the activity of the IWUA <IWUA/SCIO> To carry out the monitoring of the IWUA's Works
Promotion of IWUA members' participation in the construction works	➢ To consider poverty level as well as farmers' experiences for irrigated agriculture for determination of the IWUA's contribution to the works	➢ To analise the IWUA's contribution rate for the construction works according to their capability, and consequently to corporate the result of analysis into the Guideline.	<MWI> To analise the project contribution ratio and to incorporate the result into the Guideline.
Wayleave issues	➢ To solve wayleave issue before commencement of the construction works as much as possible. ➢ To sort out internal wayleave issues initiated by the IWUA members. ➢ To involve SCIO in terms of solution between IWUA members and persons out of the members.	➢ To involve SCIO for prior explanation of stakeholders in order to solve the wayleave issues. ➢ To obtain consent by IWUA non-members, having their lands along proposed irrigation canals/pipelines, through prior explanation by SCIO to the land owners. ➢ To conduct walk-through by IWUA members and the land owner to identify the route and to make consensus for the wayleave issue.	<SCIO/IWUA> To intervene thoroughly before commencement of construction works. <SCIO> To intervene before commencement of construction work for way leave issue with non IWUA members. <SCIO and IWUA> To build consensus on wayleave, conducting walk-through with relevant land owners at project planning stage.
Expedition of decision making on design variation	➢ To share understanding among SCIO and the PMT members on necessary procedures for design variation so as to expedite the design variation process..	➢ To carry out a follow-up training programme in order to enhance SCIOs' capacities for the required survey, design, and cost estimation for the design variation procedure.	<MWI> To carry out the follow-up training program. <SCIO> To attend the training programme to enhance their knowledge. <MWI/County> To clarify the authority of the field representative of works of SCIO in the construction site. <SCIO> To raise awareness on SCIO's responsibility, as a field representative, for works in the construction site.

Source: JICA Team

Subject	Lessons Learnts	Recommendations	Actions
Coordination among of the related construction works (IWUAs' works and Contractors' works)	➢ To coordinate appropriately by SCIO, as a field representative of works, among contract packages as well as IWUA's works. ➢ To monitor progress of the construction works by SCIO so that the procurement of construction materials and skilled labours can be made appropriately to expedite the works.	➢ To optimise construction method and schedule, holding a site meeting with contractors and IWUA members.. ➢ To conduct a follow-up training programme so that SCIO can provide proper technical guidance for smooth implementation of the construction works.	<SCIO/IWUA> To carry out s site progress meeting to optimize construction method and schedule. <MWI/County> To hold a follow-up guidance to SCIO. <SCIO> To attend the guidance to enhance knowledge of construction management.
Estimation of Construction Cost			
The accuracy of project cost at the time of project formation	➢ To conduct site investigation, interviews to farmers during project formation period so that design and cost estimation can be made accurately.	➢ To review unit price for cost estimation during project formation period for estimating accurate construction cost.	<SCIO> To review the unit price of the cost estimation during project formation period.
Conduct of detailed survey during design period	➢ To conduct field survey including geological investigation before the detail design so as to conduct detail design in due consideration of the field condition. ➢ To consider physical and price contingencies to cope with unforeseeable situation revealed during construction period. ➢ To determine scope of IWUA works taking into consideration ability and previous experience for the construction works.	➢ To enhance capacities of SCIO in terms of field investigation required for detailed design works. ➢ To improve capacities of SCIO for cost estimation. ➢ To strengthen a design review system.	<SCIO> To enhance the knowledge for required field survey needed for detailed design works. <SCIO> To improve capacities for detailed design works. <MWI/County> To implement the design review activities.

Source: JICA Team

12.3 IWUA Capacity Development

Major recommendations for the IWUA capacity development are described below.

Table 12.3.1 Recommendation for IWUA Capacity Development

Subject	Lessons Learnts	Recommendations	Actions
Dissemination activity of capacity building program for IWUA			
Awareness raising for activities and financing to the County	➢ To raise awareness to County officers for IWUA capacity building programme as the future programme would be led by them.	➢ To facilitate County officers to prepare and submit work plan and budget so that they can continue the activities for farmers. ➢ To collect the necessary information to training budget.	<SCIO、SCAO> To prepare work plan and budget to implement the training programme. <County> To report the results of the activities to MWI. <MWI> To advise the Counties for implementation of the programme.
Enhancement of capacity building of practical field activities for farmers	➢ To carry out practical field training and guidance for on-farm water management to farmers in order to enhance effect of the in-house training conducted during the project period.	➢ To continue to manage a demonstration farm, utilising a training manual, after completion of irrigation infrastructures.	<SCIO、SCAO> To manage the field demonstration farm for on-farm irrigation management.

Subject	Lessons Learnts	Recommendations	Actions
Upgrading of the training programme			
Upgrading of the training material	➢ To improve of the contents on manuals based on the level of understanding and the reaction of the participants.	➢ To finalise the various manuals are carried out.	<Irrigation board> To hold the workshop for manual finalization. <SCIO,SCAO> To participate in the workshop.
Improvement of training methodology	➢ To review and improve methodology of the trainings so as to enhance effectiveness of the programme	➢ To review and revise the training programme taking into consideration time allocation as well as role and responsibilities of the trainers and participants.	<SCIO、SCAO> To revise the training program as per particular condition of the schemes..
Improvement of evaluation method for the trainings	➢ To review and revise the method of training evaluation so that effect of the training programmes is appropriately incorporated into the evaluation.	➢ To evaluate method for the knowledge evaluation and functional survey for IWUA.	<MWI> To review and revise the evaluation method.
Follow-up and Monitoring			
Progress monitoring of the Follow-up programme	➢ To conduct practical field technical guidance to the IWUA members in terms of the system operation and maintenance so as to ensure sustainability of the irrigation system.	➢ To conduct field guidance to the farmers in system operation and maintenance, monitoring the field activities by the IWUA members.	<SCIO、SCAO> To carry out the follow-up training to IWUA.
	➢ To hold a follow-up training programme so as to raise participants' understanding on subjects with low scores in the knowledge evaluation as well as the functionality survey..	➢ To conduct the follow-up training programme for enhancing capacity of the IWUA members, which was indentified through the knowledge evaluation as well as the functionality survey.	<SCIO、SCAO> To guide the water management and operation and maintenance to IWUA.
Monitoring of training achievements	➢ To monitor effect of the training programme on water management and system O&M as actual system operation is awaited for the completion of works for irrigation facilities.	➢ To carry out the functional survey after commencement of the system operation so that the effect of the training programme can be evaluated appropriately.	<SCIO、SCAO> To conduct the functionality survey during the scheme operation period ＜MWI＞ To collect the result of the functionality survey and to advice SCIO/SCAO further technical guidance to the IWUA members.

Source: JICA Team

12.4 Agricultural Development

Major recommendations for the agricultural development are indicated below.

Table 12.4.1 Recommendation for Agricultural Development

Subject	Lessons Learnts	Recommendations	Actions
SHEP approach and LISA			
Selection of the model famers group and members	➢ To adopt the selection criteria in each scheme for the model farmers' group and members taking into consideration local condition of the scheme so that the achievement of the training can be disseminated effectively.	➢ To select the model group as per opinion and intension of the IWUA members, aiming at the maximum effect for the dessimination of the activities results.	<SCAO> To conduct optimum selection of the model farmers' group in consultation with the IWUA members.
Absorption / effect of selection of crops and cropping calendar	➢ To carry out the market survey and crop selection after irrigated farming is realised in each scheme so as to enhance farmers' undersnandings on the market-oriented agricultre.	➢ To conduct the baseline survey to evaluate if the farmers culvitate crop selected during the market survey.	<FEO> To carry out the baseline survey <SCAO> The collect and analise results of the baseline survey
The understanding and the absorption of the transfer technology in farming support activities	➢ To agree by the officers concened that introduced technology in agricultural support programme, such as SHEP approach, Kenyan Traditional Vegetable and Push-pull, are viable and applicable to semi-arid area.	➢ To continue the activities in the selected model farmers' group. ➢ To expand participants for the trainings to dessiminate the output to the others. ➢ To conduct a follow-up training programme for SHEP approach.	<County> To set up additional pilot demonstration farms. To hold the follow-up training programme for SHEP approach to the SCAO.
Pilot Demonstration for Irrigated Agricuture			
Dessemination of Water-saving Agricultural Technology	➢ To conclude that the irrigation method applied to the pilot demonstration farm was viable in the simi arid lands in terms of improvement of productivity and water-saving irrigation.	➢ To provide technical guidance by the FEOs to farmers to dessiminate the introduced technology.	<SCAO> To activate FEOs to desseimnate the technology.
Crop Diversification against Risks	➢ To observe that if the price of agricultural products do down farmers can not obtain the expected incomes.	➢ To raise awareness for promotion of crop diversification on individual farmer level to eliminate risks encountered.	<Fermers> To promote the crop diversification.

Source: JICA Team

12.5 Staff Capacity Building

- Utilisation of training outputs for future project implementation

  As the SCIOs and the SCAOs obtained knowledge and experience though series of the training programmes conducted by the Project, it is recommended for them to apply the training outputs to future project implementation.
- Participatory approach in dealing with extension staff

  Since the capacity building programmes in participatory approaches have been significant,

this knowledge should be extended further to other officers who did not participate in the programme.

12.6 Environment

Major recommendations for the environmental aspects are indicated below.

Table 12.6.1 Recommendations for Environmental Aspects

Subject	Lessons Learnts	Recommendations	Actions
Implementation of Environmental Management and Monitoring Plan (EMMP)			
Technical guidance to the County staff	➢ To deepen knowledge and understanding of the County Officers in the Environmental Management and Monitoring Plan so as to provide technical guidance to the IWUA for implementation of the Plan.	➢ To carry out the training program to the County officers for appropriate technical guidance to the IWUA.	<MWI> To plan and implement the training programme for EMMP <SCAO> To attend the training to guide the planning and implementation to IWUA.
Mitigation Measure against saline irrigation water			
Strengthening of water quality monitoring of irrigation water	➢ To consider agricultural farming under saline irrigation water to avoid adverse effects to lands and cultivated crops.	➢ To conduct technical guidance to IWUA on appropriate farming practice and monitoring of water quality.	<SCAO/SCIO> To supervise monitoring activities by IWUA as per EMMP. <IWUA> Implement relevant activities as per the EMMP.
WRMA permission for water abstraction			
Promote awareness for the water abstraction permission to WRMA	➢ To facilitate IWUA to obtain water abstraction permission, promoting awareness for importance of the permission to commence irrigation practice.	➢ To raise awareness to the IWUA for obtaining water abstraction permission, providing technical guidance to construct water storage facilities, which are essential for obtaining the permission.	<SCIO/SCAO> To held a baraza for explaining WRMA permission to expedite its process with fund raising for the application.

Source: JICA Team

Source: JICA Team

12.7 Preparation/Revision of Guidelines and Manuals

- Revision of Guidelines

  As the revision of the guidelines, namely the SHIDD Guideline and the IWUA Frameworks, has been completed, it is recommended to finalise the documents to capture the current status and articulate the issues of irrigation developed as per devolution requirement, involving all the Counties and all other stakeholders in policy formulation and project implementation.

- Preparation of Manuals

  Knowledge gained from the project activities should be institutionalised through documentation in the form of manuals. There is need to complete the IWUA capacity building manuals. It is important to develop materials for farmers in simplified format and languages (develop relevant leaflets written in local languages or Kiswahili).

Attachment 1

Record of Discussion (R/D)

RECORD OF DISCUSSIONS

ON

SUSTAINABLE SMALLHOLDER IRRIGATION DEVELOPMENT AND MANAGEMENT IN SEMI-ARID LANDS PROJECT

IN

THE REPUBLIC of KENYA

AGREED UPON BETWEEN

THE AUTHORITIES CONCERNED
OF
THE GOVERNMENT OF THE REPUBLIC OF KENYA

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Nairobi, 30 March, 2012

Hideo Eguchi
Chief Representative
JICA Kenya Office
Japan

Eng. David Stower, OGW, CBS
Permanent Secretary
Ministry of Water and Irrigation
The Republic of Kenya

Romano M. Kiome, PHD, CBS
Ministry of Agriculture
Permanent Secretary
The Republic of Kenya

Joseph K. Kinyua, CBS
Ministry of Finance
Permanent Secretary
The Republic of Kenya

THE PERMANENT SECRETARY
MINISTRY OF WATER
P. O. Box 3000
NAIROBI

PREAMBLE

Based on the minutes of meetings concerning the survey on the "Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project" (hereinafter referred to as "the Project") signed on 2nd February 2012 between Ministry of Water and Irrigation (hereinafter referred to as "MWI") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and on the subsequent series of discussions with JICA, MWI, and other relevant organizations, a detailed plan of the Project was developed.

Both parties agreed to the details of the Project and main points discussed as described in the Appendix 1 and the Appendix 2, respectively, and to request their respective governments to proceed with the necessary procedures for implementation of the Project.

Both parties also agreed that MWI, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Republic of Kenya (hereinafter referred to as "Kenya.")

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on 24th April 2004 (hereinafter referred to as "the Agreement") and the Note Verbales exchanged on 28th March 2012 between the Government of Japan (hereinafter referred to as "GOJ") and Government of Kenya (hereinafter referred to as "GOK").

The effective date of the record of discussions is subject to the approval of JICA .

Appendix 1: Project Description
Appendix 2: Main Points Discussed
Appendix 3: Minutes of Meetings Concerning the Survey

Appendix 1

PROJECT DESCRIPTION

Both parties confirmed that there is no change in the Project Description agreed on in the minutes of meetings signed on 2nd February 2012 concerning the survey on the Project (Appendix 3).

I. BACKGROUND

The area called "the Horn of Africa" which includes the Northern part of Kenya is one of the most vulnerable areas in the region often affected by severe droughts. Due to the shortage of rain in the recent past, some part of this area has been facing the worst and the severest drought of the past 60 years. In order to strengthen the resilience against these droughts which occur frequently, an urgent mitigation measure needs to be undertaken.

Approximately, 84% of Kenya land area is arid and semi-arid lands (ASAL). The ASAL are increasingly prone to severe droughts. These areas experience low, unpredictable and unreliable rainfall which constraints crop and livestock production resulting in recurrent droughts, food insecurity and famine. Irrigation can reduce the vagaries of weather and significantly boost agricultural production and thereby enhance food security, increase farmers' incomes and increase on-farm and off-farm employment opportunities.

Therefore, JICA and GOK conducted a survey, and agreed that the objective of this Project is to strengthen the resilience against drought which occurs frequently through provision of irrigation water by development of smallholder community irrigation projects to enable farmers to grow crops and minimize losses that would otherwise be experienced during the drought. As a result of the series of discussions, the request for the Project was submitted to GOJ.

II. OUTLINE OF THE PROJECT

1. Title of the Project

"Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project" (SIDEMAN –SAL)

2. Overall Goal

Food security condition during drought is improved.

3. Project Purpose

Resilience against drought and food insecurity is improved through participatory smallholder community irrigation development, management and appropriate farming system.

4. Outputs

1) Smallholder Community Irrigation facilities are constructed through participation of IWUA.
2) IWUA capacity is improved for effective Sustainable O&M and appropriate farming systems.
3) Capacity of technical staff is enhanced for participatory irrigation development.
4) SHIDD guideline is improved.

5. Activities

1-1 Finalize selection of batch 1 project sites (8 No.)
1.2 Selection of batch 2 sites (8 No.).
1.3 Start-off meeting with farmers to elaborate participatory irrigation development based on the SHIDD guideline.
1.4 Conduct feasibility study (F/S) at each site.
1.5 Conduct irrigation facility design at each site.
1.6 Agree on responsibilities of construction activities with IWUA.
1.7 Procure required materials for construction based on the agreement with IWUA.
1.8 IWUA to undertake part of the construction as agreed
1.9 Outsource part of construction activities based on the agreement with IWUA.
1.10 Testing the system after construction and initiate O&M with IWUAs.

2.1 Train farmers through participatory construction activities.
2.2 Conduct O&M trainings including proper water management, water fees collection, etc.
2.3 Prepare cropping calendar at each pilot site.
2.4 Implement cropping calendar
2.5 Conduct marketing research with farmers.
2.6 Conduct training needs assessment.
2.7 Implement required trainings to farmers*.
(*At the trainings for the farmers, it is useful to use the SHEP-UP method.)

3.1 Conduct orientation meeting with MWI staffs on IWUA participatory irrigation development based on the SHIDD guideline.
3.2 Train MWI staffs on irrigation development activities.
3.3 Develop manuals for O&M and farmer's participatory construction.

4.1 Study and revise SHIDD guideline.
4.2 Study and revise IWUA framework.
4.3 Study and revise the training manual for IWUA.

6. Input

1) Input by JICA
(a) Dispatch of Mission
Irrigation facility design & construction 1
Irrigation facility design & construction 2
Systematic farming 1

Systematic farming 2
Training planning
Material development
Irrigation & water management
* There is a possibility of change of the mission member under the implementation process.

(b) Pilot Project
16 Pilot projects will be implemented in arid and/or semi-arid lands. These pilot projects include the development of smallholder community irrigation schemes with farmers' participation.

(c) Training

(d) Machinery and equipment necessary for project implementation and operation.

Input other than indicated above will be determined through mutual consultations between JICA and MWI during the implementation of the Project, as necessary.

2) Input by MWI

MWI will take necessary measures to provide at its own expense:

(a) Services of MWI's counterpart personnel as referred to in II-7;
(b) Suitable office space with necessary furniture;
(c) Replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project provided by JICA;
(d) Suitable furnished accommodation information for members of the JICA missions and their families;
(e) Information as well as support in obtaining medical service;
(f) Credentials or identification cards;
(g) Available data (including maps and photographs) and information related to the Project;
(h) Share running expenses necessary for the implementation of the Project;
(i) Expenses necessary for transportation within Kenya of the equipment referred to in II-6 (1) as well as for the installation, operation and maintenance thereof; and
(j) Necessary facilities to members of the JICA missions for the remittance as well as utilization of the funds introduced into Kenya from Japan in connection with the implementation of the Project

7. Implementation Structure

The Project organization chart and the assignments in each level are given in the Annex 1. The roles and responsibilities at each level are as follows:

1) Implementing Agency

The collaborating institutions will be MWI and JICA. The Irrigation and Water Storage Department (IWS) will be the implementing agency on behalf of MWI.

2) Project Steering Committee (PSC)

PSC will be the highest decision-making organ of the project. The PSC will be responsible for policy direction, approving of project work plans and budgets.

3) Project Coordinating Committee (PCC)

The PCC will be responsible for the technical matters of the project and will be responsible for reviewing work plans, budgets and necessary reports by the PMT.

4) Project Management Team (PMT)

The PMT will be responsible for executing all project activities including:

- Participant recruitment for scheme level and in-country training
- Coordination scheme-level baseline surveys and field follow-up activities
- Coordination of scheme implementation activities
- Harmonize and compile annual project work plans and budgets
- Coordinate revision of SHIDD guideline
- Carry out trainings for farmers and staffs
- Preparation of necessary reports.

5) Pilot Scheme Coordinating Committee (PSCC)

The PSCC will be responsible for implementation of the project activities at scheme level and will be responsible for the whole support to IWUAs.

- Identify project activities
- Prepare work plans and budgets

8. Project Site(s) and Beneficiaries

16 Pilot sites selected in Semi-Arid Land of the country. Beneficiaries will be identified farmers living in those areas.

9. Duration

Three (3) years from May 2012 to May 2015.

10. Reports

JICA will prepare and submit the following reports to the MWI and the MOA in English.

(1) 9 copies (6 for MWI, 3 for MOA) of Inception Report at the commencement of the first work period in Kenya
(2) 9 copies (6 for MWI, 3 for MOA) of Interim Report at the time about 13 months after the commencement of the first work period in Kenya
(3) 13 copies (10 for MWI, 3 for MOA) of Progress Report (1) at the time of 10 months after the commencement of the first work period in Kenya
(4) 13 (10 for MWI, 3 for MOA) copies of Progress Report (2) at the time of 16 months after the commencement of the first work period in Kenya
(5) 13 (10 for MWI, 3 for MOA) copies of Progress Report (3) at the time of 22 months after the commencement of the first work period in Kenya
(6) 13 (10 for MWI, 3 for MOA) copies of Progress Report (4) at the time of 28 months after the commencement of the first work period in Kenya
(7) 13 (10 for MWI, 3 for MOA) copies of Draft Final Report at the end of the last work period in Kenya

JKK

(8) 23 (20 for MWI, 3 for MOA) copies of Final Report within one (1) month after the receipt of the comments on the Draft Final Report

* There is a possibility of change of the schedule under the implementation process.

11. Environmental and Social Considerations

MWI agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF MWI

1.MWI will take necessary measures to:

(1) ensure that the technologies and knowledge acquired by the Kenya nationals as a result of Japanese technical cooperation contributes to the economic and social development of Kenya, and that the knowledge and experience acquired by the personnel of Kenya from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project;

(2) grant privileges, exemptions and benefits to members of the JICA missions referred to in II-6 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Kenya;

(3) provide security-related information as well as measures to ensure the safety of members of the JICA missions;

2.MWI will bear claims, if any arises, against members of the JICA missions resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Project, except when such claims arise from gross negligence or willful misconduct on the part of members of the JICA missions.

IV. EVALUATION

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. The MWI is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, MWI will take appropriate

measures to make the Project widely known to the people of Kenya.

VI. MUTUAL CONSULTATION

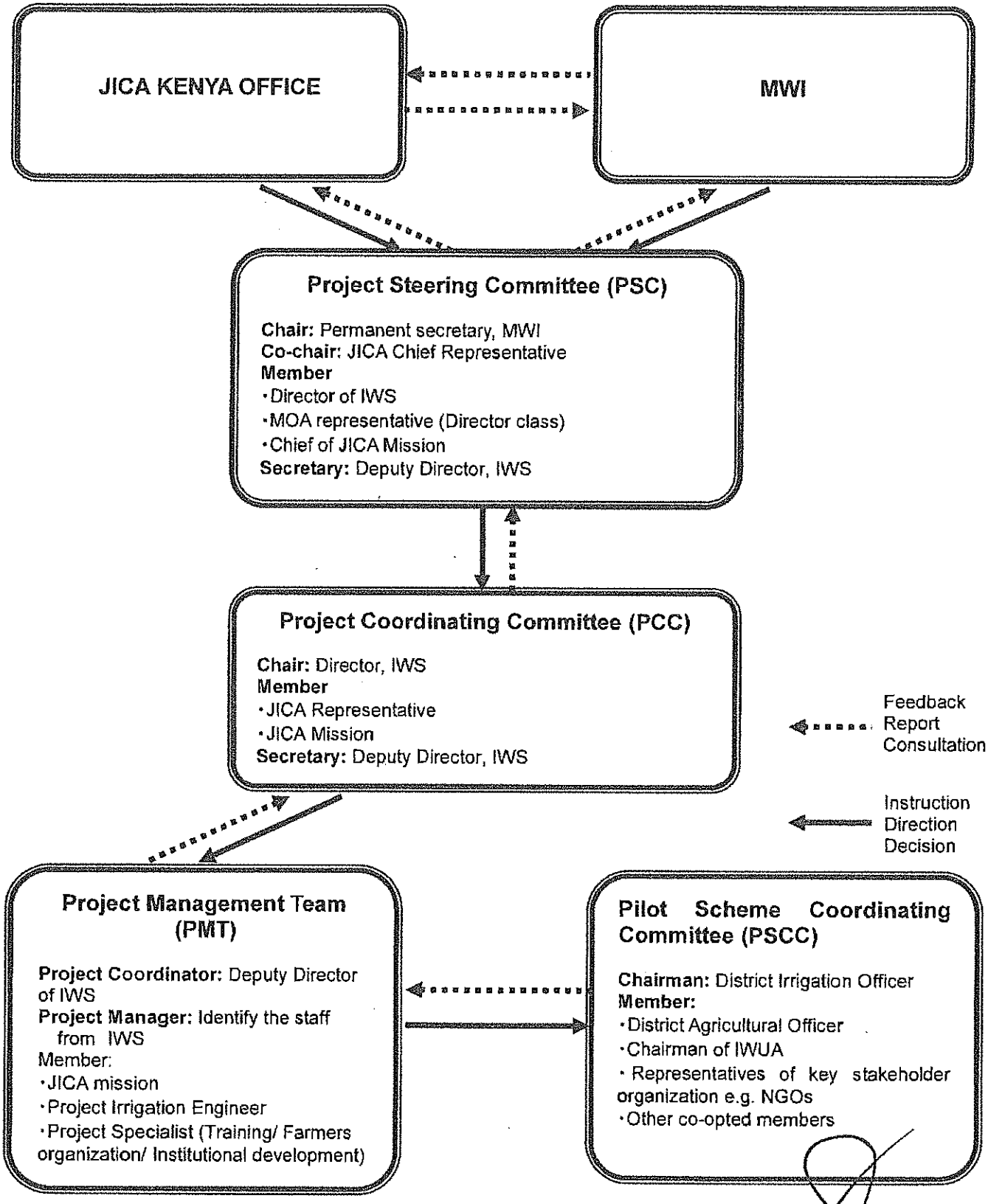
JICA, MWI and MOA will consult each other whenever any major issues arise in the course of Project implementation.

VII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA, MWI and MOA.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex 1 The Project organization chart



Appendix 2

SUMMARY OF MAIN POINTS DISCUSSED

MWI will make the following undertakings,

- MWI shall act as a counterpart agency to the Project team and also as a coordination body in relation with other governmental and non-governmental organizations and/or development partners concerned for the smooth implementation of the Project.
- MWI shall provide the Project team, in cooperation with other organizations concerned, all available data and information related to the Project.
- MWI shall assign appropriate personnel for the daily project activities.
- MWI shall allocate the necessary budget of counterpart fund for the Project activity.
- After the successful implementation of this SIDEMAN SAL project, MWI will continue implementation of other new community based irrigation schemes using the methodology established.
- It is envisaged that , the outcome of the project, including the guidelines to be developed, shall be disclosed to the public or made available for public viewing in line with JICA's public accountability requirement.

MOA will make the following undertaking,

- MOA shall implement extension services and training on market survey.
- MOA will collaborate fully especially on issues concerning farming and marketing
- MOA will be members of the PSC and PSCC.

JICA will make the following undertakings,

- JICA shall dispatch mission for project implementation and operation.
- JICA shall provide necessary machinery and equipment for the project.

JICA, MWI and MOA shall maintain constant communication and consult each other in respect of any matter that may arise from or in connection with the Project.

MINUTES OF MEETINGS BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY AND
THE AUTHORITIES CONCERNED OF
THE GOVERNMENT OF THE REPUBLIC OF KENYA
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS ON
SUSTAINABLE SMALLHOLDER IRRIGATION DEVELOPMENT AND
MANAGEMENT IN SEMI-ARID LANDS PROJECT

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the authorities concerned of the Government of the Republic of Kenya (hereinafter referred to as "GOK") hereby agree that the Record of Discussions on Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project (hereinafter referred to as "the Project") signed on 30th March, 2012 will be amended as follows;

1. Duration

Before	Amended Version
Three (3) years from May 2012 to May 2015	Forty-six (46) months from August 2012 to June 2016
Reason: Since the dispatch of mission started from August 2012, both parties recognized that the duration of the Project was three (3) years from August 2012 to August 2015. Based on the request from GOK on the extension of the Project dated 30th April, 2015, both parties agreed to extend the duration of the Project for ten (10) months from September 2015 to June 2016 in order to achieve the Project Purpose successfully.	

This amendment will become effective once after both parties sign this Minutes of Meeting.

Annex : Record of Discussions (signed on 30th March, 2012)

Nairobi, 16th July, 2015

Hideo Eguchi
Chief Representative
JICA Kenya Office

Sicily K. Kariuki, ~~MBS~~
Principal Secretary
Ministry of Agriculture, Livestock and Fisheries
The Republic of Kenya

Kamau Thugge, ~~EBS~~
Principal Secretary
National Treasury
The Republic of Kenya

Attachment 2

Minutes of Meeting (M/M) on the Inception Report

MINUTES OF MEETING

ON

INCEPTION REPORT

FOR

SUSTAINABLE SMALLHOLDER IRRIGATION DEVELOPMENT AND MANAGEMENT IN SEMI-ARID LANDS PROJECT

(SIDEMAN-SAL)

Nairobi, September 13, 2012

Eng. Robinson K. Gaita
Director of Irrigation, Drainage and Water Storage
Ministry of Water and Irrigation

Dr. Johnson Irungu Waithaka
Director of Agriculture Crop Management
Ministry of Agriculture

Mr. Shinichi Hamada
Deputy Team Leader of JICA Team
Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project
(SIDEMAN-SAL)

MINUTES OF MEETING

Date	:	September 13, 2012
Time	:	12:30-13:30
Venue	:	Meeting room, 4th floor, Maji House, Nairobi
Attendance	:	See attachment
Subject	:	Inception Report

1. The Meeting was opened and presided by Eng. Robinson K. Gaita, Director of Irrigation, Drainage and Water Storage, Ministry of Water and Irrigation.
2. Mr. Kazumasa Sanui, Senior Representative of JICA Kenya Office, gave a brief to express sentiments on the occasion of launching the Project as well as JICA's intentions/considerations during the formulation of the Project.
3. Mr. Shinichi Hamada, Deputy Team Leader of the JICA Team, made a presentation on the Inception Report.
4. The following were discussed:
   (1) The Implementing Agencies are Ministry of Water and Irrigation (MWI), and JICA. MOA is the collaborating agency.
   (2) Various project organizational committees, namely, Project Steering Committee (PSC), Project Coordinating Committee (PCC), Project Management Team (PMT) and Pilot Scheme Coordinating Committee (PSCC) will be established among MWI, MOA and JICA Team in accordance with the R/D. In addition to these committees, Pilot Project Site Selection Committee (PPSSC) would be also established for the purpose of maintaining transparency on selection process for the Pilot Project Sites in Batch-1. Role and responsibility of each committee would be clarified in detail in the Report on Plan of Operation to be prepared in the beginning of October 2012.
   (3) Provincial Irrigation Officers (PIOs) and Provincial Directors of Agriculture (PDAs) in Eastern, Rift Valley and Coast Provinces would participate in the Workshop to select the Pilot Project Sites and be also involved in the project monitoring.
   (4) Coordination/collaboration between SIDEMAN-SAL Project and SHEP-UP Programme for the implementation of the Project was confirmed by the both parties.
   (5) Cooperation of the MWI and MOA personnel involving the Project was assured.
   (6) The Kenyan side basically accepted the contents of the Inception Report, however, the following comments and suggestions were made during the meeting:
      (a) On the organization for the construction works by the Contractors, the Engineer should be Director of Irrigation, Drainage and Water Storage, and DIOs should be Resident Engineers. The JICA Team agreed to it.
      (b) Observation visits to other agricultural development projects, such as "Small Scale Horticulture Development Project (funded by AfDB)" was suggested for the JICA Team. The JICA Team agreed to it.

(c) Tentative training programmes mentioned in the Inception Report should be reviewed according to the actual conditions and situations. The JICA Team agreed to it.

(7) The JICA Team requested to the Kenyan side and the Kenyan side replied as follows:

(a) The following counterpart personnel will be appointed by the Kenyan side for the Project. The Kenyan side replied that all these counterpart personnel would be appointed as soon as possible.

(i) Project Coordinator: 1 person

(ii) Project Manager: 1 person

(iii) Project Engineer/Irrigation Engineer: 1 person

(iv) Institutional Development/Farmers' Organization/Environmental Expert: 1 person

(v) Agricultural Expert: 1 person

(b) Office space equipped with furniture would be prepared for the activities of the JICA Team. The Kenyan side replied that the office space equipped with furniture would be prepared as much as possible taking account of the actual activities of the JICA Team.

(c) SIDEMAN and other relevant data/information under MWI should be provided to the JICA Team. The Kenyan side agreed to it.

(d) SHEP and other relevant data/information under MOA should be provided to the JICA Team. The Kenyan side agreed to it.

(8) The Kenyan side requested to JICA and JICA replied as follows:

(a) Because of inadequate and untimely release of counterpart funds in some cases, JICA agreed to support for the activities of counterparts for the time being, however, the process for the counterpart funds should be continued so as to assure the funds for the Project.

(b) Transportation for the activities of DIOs are not sufficient at present, therefore vehicles (4WD) would be provided to DIOs within the selected Project Sites. JICA replied that this matter would be revisited according to the actual field conditions and situations.

END

<LIST OF ATTENDANTS>

Sustainable Smallholder Irrigation Development and Management in Semi-Arid Lands Project (SIDEMAN-SAL)

Title Inception Report Meeting
Date September 13, 2012
Venue Meeting room, 4th floor, Maji House

No.	Name	Affiliation	Position	Telephone No.	Signature
1	Eng R.K. Gaita	MoWI	Director		
2	Dr Johnson Irungu	MoA	DA- Crops		
3	Eng W. Onchoke	MWI	DD/ID		
4	Kazuhisa Kobayashi	JICA Kenya	Representative		
5	Kazumasa Sanui	JICA Kenya	Senior Rep		
6	Sebastian Odanga	JICA Kenya	Consultant		
7	Tetsutaka NIIDE Ph.D	SIDEMAN-SAL	Expert		
8	Allan Abwoga	MWI	WMO		
9	Nobuhiro Moriyama	JICA / MWI	Jica advisor		
10	S. HAMADA	SIDEMAN-SAL	Deputy Team Leader		
11	Keita SAITO	SIDEMAN-SAL	Environmental Eng.		
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Attachment 3

Minutes of Meeting (M/M) on the 1st Project Steering Committee (PSC) Meeting

MINUTES OF 1ST SIDEMAN-SAL PROJECT STEERING COMMITTEE MEETING HELD ON 27TH NOVEMBER 2013 AT KILIMO HOUSE NAIROBI

PRESENT

1.	Ann Onyango	-	Ag. Agriculture Secretary- Chairing
2.	Mr. Junichi Hanai	-	Senior Representative, JICA Kenya office- Co- Chair
3.	Mr. Kazuhisa Katayama	-	Representative, JICA Kenya Office
4.	Mr. H. Ito	-	Design and construction Engineer, JICA team
5.	Dr. T. Niide	-	Agronomist, JICA team
6.	Mr. H. Aoyama	-	Capacity development expert, JICA team
7.	Eng. W.O Onchoke	-	Ag. Director, IDD/ Project Coordinator
8.	Eng. Richard Mbogo	-	Project Manager
9.	Mr. Bernard Maina	-	Agriculture Representative- SHEP-UP approach
10.	Eng. George W. Kahuro	-	Counterpart Project Engineer

AGENDA

The agenda of the day was proposed and adopted as follows:

1. Introduction
2. Presentation of project overview
3. Presentation of progress of project activities
4. Discussion issues
5. Way forward for the project

AGENDA 1/11/2013- INTRODUCTION/OPENING REMARKS

The meeting started at 10.15am with the Chairlady welcoming members to the meeting. She thanked the JICA team for the continued corporation and noted that the meeting was important as irrigation development is highly prioritized by the Government especially for the next 5 years and that this project is contributing to the set target area to be brought under irrigation. She also noted that despite the delay in holding the 1st PSC meeting, it was a good beginning to start addressing the challenges that may be affecting the implementation of the project.

The acting Director, IDD/ Project Coordinator called upon the members to be focussed in their discussion during the meeting. He then invited the members to do self-introduction.

AGENDA 2/11/2013 – PRESENTATION OF PROJECT OVERVIEW

The Project manager presented a detailed overview of the project. The following were the key highlights of the presentation:

- **Sustainable Smallholder Irrigation Development And Management in Semi-Arid Lands Project** (SIDEMAN-SAL) project is a follow up of an earlier JICA

interventions in the irrigation and drainage sub-sector and was particularly formulated to upscale the gains of SIDEMAN project (2005-2010) to semi-arid lands.

- The project period is three years running from August 2012 to July 2015
- The project purpose is to improve resilience against drought and food security through participatory smallholder community irrigation development, management and appropriate farming systems.
- The project outputs include construction of irrigation facilities, capacity building of IWUAs & technical staff, improved farming systems and improvement of Smallholder Irrigation & Drainage development (SHIDD) guidelines
- The project set out to implement 16 projects, 8 under batch 1 and 8 under batch 2 in 8 Counties
- The project is being implemented by GOK Counterpart staff and experts from Nippon Koei Co. Ltd which was appointed by JICA as Project Implementation Mission on their behalf.

AGENDA 3/11/2013 – PRESENTATION OF PROGRESS OF PROJECT ACTIVITIES

The project Manager presented the report on achievements of the project activities in the 1st year (2012/13) and 2nd year (2013/14). He also presented the work plans for the 2nd and 3rd year (2013/2014 & 2014/15). Project budgets for year 1 to 3 were also presented and discussed. The key highlights of the presentation were as follows:

- 8 pilot sites on batch one have been selected and feasibility studies and designs done
- Start off meetings and induction workshops with farmers and staff have been held
- EIAs done for the 8 sites
- Preparation of tender documents in progress
- Training of IWUA members in progress
- NEMA and WRMA authorizations being concluded
- Sensitization program for agricultural activities carried out
- Planned activities include implementation/construction of batch 1 schemes, selection of batch 2 schemes and training of SCIOs & SCAOs and IWUA's (farmers)
- Planned scheme construction activities have exceeded the estimated cost given during the preliminary study by the appraisal mission

AGENDA 4/11/2013 – DISCUSSION ISSUES

The report on the main challenges and issues affecting the project implementation was presented and these came out as follows:

- The estimated construction cost had been exceeded as indicated by the preliminary survey cost of Kshs 265.8 million against actual detailed design cost of Kshs 432 million
- Due to the devolved system of Government, working modalities had changed contrary to what was envisaged in the project organizational structure
- The Pilot Scheme Coordinating Committee(PSCC) is still not operational due to lack of facilitation.

- There is inadequate working facilities especially for the county implementing units i.e. transport, office facilities and survey equipments
- Almost all the selected schemes in Batch 1 fall under class D category under WRMA Classification and this requires a scheme to have in its design an adequate flood storage facility before Authorization for construction of the intake works for irrigation purposes

The chairlady commended the project team for the good progress made even as without the guidance of the PSC and suggested that the challenges presented be discussed one by one so that a way forward could be found. The discussions and decisions made on the five issues are as outlined below:

1. Batch 1 Construction Costs Exceeding the estimated cost

- The original plan was to construct fully all the 8 projects under batch 1 schemes but due to JICA Budget constraint, the new proposal presented is to construct 5 projects fully i.e. Kasokoni, Mdachi, Olopito, Gatitu/Muthaiga and Tumutumu and do partial construction especially head works for the remaining 3 projects i.e. Kaben, Murachake and Muungano during batch 2 period.
- Further 5 more schemes will be selected and constructed under batch 2 giving a total of 13 irrigation schemes where 10 will be implemented fully and three partially (Headworks (Intake weir and intake structure) only).
- The batch 2 projects will be selected from the same Sub-counties so that the implementing teams could use the experience gained during the implementation of batch 1 in line with the project implementation approach. Furthermore this being a technical corporation project, the SCIOs needed to take the lead role in batch 2 based on batch 1 experience
- Regarding whether the issue of additional funds had been discussed with the treasury, it was explained that the matter was first being handled with JICA since June 2013.
- It was also noted that negotiating for additional funds with Treasury needed proper justification as Ministries are expected to meet all their budgetary requirements within their tight annual budgetary ceilings given by treasury which already have been finalized.
- In normal circumstances Treasury allows a counterpart budgetary provision of about 10% for projects supported from development partners.
- The meeting adopted the revised proposal as in bullet 1 above. It however recommended that the County Governments and scheme members be properly sensitized on the adjusted plan. The implementation team was also requested to be careful in the selection of batch 2 projects in view of the resource constraints.

(Action: PMT)

2. Change of implementation organizations due to devolution

It was noted that the PMT may not have direct contact with the Sub-County implementation technical staff of the project unless through established County structures.

It revealed that a correspondence is being prepared to be signed by PS for all the on-going National programs/projects to the relevant Counties explaining the need for collaboration to

ensure proper implementations of the programs/projects. The correspondence will go through the laid down channel of communication i.e. through Ministry of Devolution and copied to the Transition Authority.

(Action: Project Manager to follow up)

3. Provision of working facilities

It was noted that JICA had committed itself to making necessary arrangements to provide site specific facilities on need basis.

It was recommended that the project engages other projects and programmes implemented in same counties e.g. ASDP, SHEP-UP etc., in order to build synergy including supporting project engineers.

(Action: PMT)

4. Operation of PSCC

It was reported that counterpart funds were available for this purpose but the challenge was how to send the same to the field offices

It was recommended that the project liaises with the Ministry's accountant on modalities of opening project accounts as projects have been allowed to do that.

(Action: Project Manager)

5. Water storage for WRMA authorization

- It was explained that SIDEMAN-SAL projects scheme design flows were at class D category and according to WRMA regulations the schemes must have an adequate water storages. However there are no sites at the schemes for that capacity of storage
- JICA team reported that a meeting has been arranged with WRMA to iron out the issue
- The project team presented a compromise proposal for water storage at block level to be discussed with WRMA

It was recommended that a round table discussion with WRMA be called to discuss the proposal and the outcome be reported to the Project Coordinator. It was also agreed that WRMA can be invited to the PSC on ad-hoc basis when need arises.

(Action: JICA team)

After the discussions on the issues and passing the necessary resolutions, the meeting approved the project Work plan and budget, agreed on the working modalities, PSC operationalization and the project's proposed approach to WRMA water storage challenge.

5. AGENDA 5/11/2013 – WAY FORWARD FOR THE PROJECT

The following was agreed as the way forward for the project:

- The PSC meetings should be held biannually with provision for special meetings on need basis
- The progress reports should continue being prepared quarterly. The treasury needs to be regularly briefed on the absorption of JICA funds. This should be captured in the quarterly report and should include all funds utilized including JICA technical costs.
- Printed estimates for the 2013/14 financial year reflect a figure of Kshs 680 million as AIA. Utilization of this should be reported to the Ministry for reporting to the Treasury who monitor the financial absorption rates of various projects/programs. It is therefore necessary to give returns on absorption rate to the Ministry to be reflected in IFMIS system.
- It was recommended that PSC members should visit the project sites before future meetings so as to appreciate challenges and suggest solutions. The meeting also proposed adoption of SHEP-UP approach of holding PSC meetings at site where relevant county Ministers are invited
- It was recommended that WRMA should be invited in future PSC to share the experiences found in the field as it relates to the adequate storage requirement for irrigation schemes
- It was recommended that the PMT should link with ASDSP unit at the county level and identify areas of collaboration
- It was recommended that, during the courtesy call to the County Governors where the projects are being implemented, the PMT would request the Governor to consider assisting the IWUA's to complete the partially implemented projects

CLOSING REMARKS

The chairlady thanked all for availing themselves for the meeting at short notice and noted that this was the beginning of the success of the project as the Government endeavours to meet the goals of development and vision 2030 on irrigation development and management. The success of the project will therefore add to the achievement of the 1 million acres target in 5 years. She assured the Project team of support of the PS's office and invited the team to consult the office whenever need arose.

There being no other business, the meeting ended at 4.00pm.

Confirmed:

Chair's Signature..... Date.....

Secretary Signature..... Date .....

Attachment 4

Minutes of Meeting (M/M) on the 2nd Project Steering Committee (PSC) Meeting

MINUTES OF THE 2ND PROJECT STEERING COMMITTEE (PSC) MEETING OF THE SIDEMAN –SAL PROJECT HELD AT KILIMO HOUSE ON THE 16TH OF APRIL 2015

In Attendance

1. Eng. W. Onchoke - Director ITM(Chairman)
2. Mr. Hideo Eguchi - JICA Chief Representative
3. Mr. Hiroshi Itoyama - JICA Kenya
4. Mr. Sebastian Odanga - JICA Kenya
5. Dr. Masahiko Murakami - JICA advisor
6. Mr. joseph Ngetich - DDA crop resources
7. Mr. Joshua Ngoko - Senior Finance officer
8. Mr. Hajime Ito - JICA mission
9. Mr. Takuya Igawa - JICA mission team leader
10. Eng. Richard Mbogo - Project manager
11. Eng. George Kahuro - Counterpart officer
12. Mr. Benson Mureithi - Counterpart officer
13. Mr. Allan Abwoga - Counterpart officer(Minuting)
14. Mr. Haruhiko Aoyama - JICA mission
15. Mr. Ryosuke Makino - JICA mission

AGENDA

1. REVIEW OF PREVIOUS MINUTES
2. MATTERS ARISING
3. PROJECT OVERVIEW
4. PROJECT PROGRESS & INTERNAL MONITORING AND EVALUATION
5. ANNUAL WORKPLAN AND BUDGET
6. PROJECT CHALLENGES
7. THE WAY FORWARD

The meeting started at 10.10 am with the chairman welcoming members to the 2nd PSC meeting.

MIN1/2015 – REVIEW OF THE PREVIOUS MINUTES

The previous minutes were read by the project manager and subsequently confirmed as a true record of the deliberations at the previous PSC meeting.

MIN 2/2015 – MATTERS ARISING

The following were the matters arising from the previous PSC meeting

1. The county governments have been brought on board since devolution took place. This was done through courtesy calls to all the county governors. The governors agreed to support the implementation of the project. Their commitment is demonstrated by their agreement

to co-sign an implementation memorandum of understanding (MOU) with the farmers. Concern was raised whether the roles of each party to the agreement were clearly spelt out, especially the expectation that county governments will fund implementation activities that the project will be unable to fund at the end of the project. The project management should ensure that this is done especially for the MOUs for the second batch of projects (**ACTION: PROJECT MANAGER**).

2. Water Resources Management Authority requires every irrigation development to have water storage of at least 90 days of the daily requirement. This has been a challenge for the project. The project has therefore negotiated with WRMA who have allowed storage of 10% of daily requirement at block level. This is a gentleman's agreement. The implementation team was advised to get this agreement in writing as verbal agreements may not be binding in the future. The implementation team was also advised to make immediate efforts to comply by assisting in the identification of sites for water storage and ensuring designs for the storage structures are done.(**ACTION: Project manager/ JICA team leader**).

3. On the issue of GOK funding. Counterpart funding from the government of Kenya has not been forthcoming. The meeting was advised that there was no provision for counterpart funds in the current budget. The deputy CFO advised that counterpart funds are capped at 10% of the donor funding and restricted to funding local running expenses of the project. For the next financial year (2015/2015) the project has been allocated Kshs 3.3million. This is based on a donor commitment of Kshs 33 million for the period July-August 2015. The project manager was directed to establish how these funds could be disbursed to the county level, especially the possibility of opening project accounts at the county level.(**ACTION:PROJECT MANAGER**)

4. The project is yet to comply with the requirement of making monthly expenditure returns to the ministry. The project management was directed to comply with this requirement and to liaise with the external resources section and the Project coordination Unit at the ministry to discuss the modalities of complying. The returns should be submitted by the second week of every month. (**ACTION: JICA MISSIION team leader/project manager**).

Min 3/2015 PROJECT OVERVIEW

The project overview was presented by the project manager, highlighting the project purpose, objectives, project sites, implementation structure and project activities.

MIN 4/2015 PROGRESS OF THE PROJECT

The progress report was presented by the project manager, the following were highlights

1. Many project activities are currently ongoing ranging from construction of batch 1 schemes and preparation of batch two schemes for construction and capacity building activities. Preparation works for batch two schemes involve feasibility studies, hydrological studies and environmental impact assessments.

2. A total of 8 schemes in batch one are being constructed to completion and a further three are being constructed partially. In batch two schemes it is expected 5 schemes will be constructed.
3. Capacity building the IWUAs is ongoing and schemes of batch 1 and batch 2 are at the same level currently.
4. The report of the internal monitoring and evaluation was presented alongside with the progress report. Key recommendations of the internal M&E were:
    a. Any works not completed by the SIDEMAN-SAL project should be proposed for inclusion in the National expanded irrigation project.
    b. Capacity building activities for the IWUA members should continue so as to ensure cohesiveness of the groups for future sustainability
    c. Since the overall objective of the project was strengthen the capacity of local irrigation officers there is need for delegation of decision making to the grass root levels.
5. It was reported that the ongoing activities will not be completed by the time the project is expected to end in July 2015. This has been occasioned by delays due to unforeseen circumstances such as long procurement processes and challenges presented by the new devolved system of government.
6. After long deliberations the meeting agreed that there was need for extension of the project to ensure that the project objectives are met. However details of the extension are yet to be worked out, such as analysis of how much work is outstanding, the time required to complete the work that will be outstanding at the end of the project duration (August 2015) and the amount of additional resources required.

MIN 5 /2015 PROJECT WORKPLAN AND BUDGET

1. The project has planned to complete the construction of the batch 1 schemes and embark on the construction of batch 2 schemes and completion of the capacity building activities. Specifically the planning is summarised as follows:

    1. Undertake construction of batch 1 schemes, 5 complete and 3 partially.
    2. Undertake construction of 5 batch 2 schemes
    3. Complete IWUA capacity building in both batch 1 and batch 2 schemes
    4. Complete agricultural capacity building in both batch 1 and 2 schemes
    5. Review of the IWUA frameworks and irrigation guidelines.
    6. Undertake capacity building of staff and development of training materials.

2. The planned budget for these activities is Kshs 332 million of which Kshs 175 million has been spent. These figures are exclusive of the Japanese technical costs. This budget is for the 2014/2015 financial year. An additional amount of Kshs 33 million has been committed by JICA for the period July to August 2015. This has resulted in GOK making a provision for the counterpart funds of Kshs 3.3 million in the 2015/2016 financial year budget estimates.

MIN 6/2015 PROJECT CHALLENGES

It was reported in the meeting that the project has been facing a number of challenges that have contributed to delays making it difficult to complete the planned works by the end of July 2015. These challenges are listed below:

1. Change of implementing organisational structure due to new constitution and devolution requirements.
2. The re-organisation of the agricultural component to focus on the needs of the farmers.
3. Operationalisation of the grass root implementation structure of PSCC(Project Scheme Coordinating Committee)
4. Inadequate equipment for field operations such as transportation and survey equipment.
5. Financial challenges. This includes inadequate funds to undertake full construction for the schemes and lack of counterpart funds.

Most of the above challenges have been addressed except for the financial challenge.

MIN 7/2015 THE WAY FORWARD

1. The project management team was directed to urgently prepare a proposal for extension of the project duration within two (2) weeks. This proposal will be submitted to JICA with a request for additional funding. The proposal should clearly outline the planned targets, achievements, outstanding works (by the end of July 2015), and the required resources to complete the works. In addition the analysis of the remaining works should also take into account the water storage requirements to meet the WRMA regulations**.(ACTION : Project Manager and JICA team leader)**

2. The project extension proposal should consider the three (3) schemes (Batch 1) that were to be partially implemented with a view to completing them.

3. Another PSC meeting may be called to deliberate on the extension proposal if deemed necessary.

The chairman thanked the members for attending the meeting and specifically thanked JICA for the continued support of Irrigation development in Kenya.

There being no other business the meeting ended at 12.20 pm

Confirmed

Chairman…….. Date……

Attachment 5

Minutes of Meeting (M/M) on the 3rd Project Steering Committee (PSC) Meeting

MINUTES OF THE 3RD PROJECT STEERING COMMITTEE (PSC) MEETING OF THE SUSTAINABLE SMALL HOLDER IRRIGATION DEVELOPMENT AND MANAGEMENT IN SEMI-ARID LANDS (SIDEMAN –SAL) PROJECT HELD AT MAJI HOUSE ON THE 19TH OF MAY 2016

In Attendance

1.	Mr. Nduati Mwangi	-	PS- Irrigation(Chairman)
2.	Mr. Kazuhiro Tambara	-	JICA Senior Representative
3.	Mr. Hiroshi Itoyama	-	JICA Representative
4.	Mr. Sebastian Odanga	-	JICA Kenya
5.	Dr. Masahiko Murakami	-	JICA advisor- Agriculture
6.	Mr. Takuya Igawa	-	JICA mission team leader
7.	Mr. Leonard maina	-	Ministry of Agriculture
8.	Eng. Richard Mbogo	-	Project manager
9.	Eng. George Kahuro	-	Counterpart officer
10.	Mr. Benson Mureithi	-	Counterpart officer
11.	Mr. Allan Abwoga	-	Counterpart officer(Taking Minutes)
12.	Mr. Takashi Hotta	-	JICA mission

AGENDA

1. Opening Remarks
2. Review And Confirmation Of Previous Minutes
3. Matters Arising
4. Project Progress
5. Project Remaining Works
6. Project Financial Status
7. Project Exit Strategy
8. Handing Over Of Vehicles And Equipment
9. The Way Forward

1. MIN1/2016 – OPENING REMARKS

The meeting started at 2.10 pm with the chairman welcoming members to the meeting. He noted that he would kick off the meeting and leave to attend to other urgent matter in Parliament. He welcomed the Project Manager to give a short brief of the project.

The project Manager highlights

The project Management structure

The project manger highlighted the **a**chievements of the project under the four components namely Engineering, agriculture, Capacity building and Review of guidelines;

- He noted that only Engineering had not completed all its works. However the Ministry has written to JICA requesting for kshs 75 million to complete the works under the project scope
- Another request has been sent to JICA for handover of project equipment and vehicles to the Ministry when the JICA mission leaves the project.

The PS thanked JICA for the support and noted that it was a valued partner. He hoped that the support would lead to sustainable agriculture. He noted that the Ministry will take the lead to ensure the SIDEMAN-SAL model is expanded in the Counties. This would call for further collaboration to continue the good work.

The JICA representative reacted to the remarks and noted the following:

- The Ministry should take the lead in finalizing the Irrigation guidelines and champion their use in collaboration with the Counties.
- The kshs 75million requested for completion of remaining engineering works was being considered in JICA headquarters, Tokyo. The approval and release of funds is expected in July.
- Request for handing over of equipment and vehicles will be considered favourably. When handed over they should be utilized and maintained well.
- It was noted that the soft component support (agriculture training and Capacity building should continue in the counties with the Ministries support to ensure sustainability if the project interventions
- The JICA senior representative requested the PS to find time to see what was implemented in close corporation with the Counties. The Ministry should continue guiding the counties and other stakeholders based on the JICA approach and experience
- Proper support for the remaining construction works will be necessary using the expected kshs 75million. The PMT personnel can be used for this purpose
- On further collaboration, JICA is ready and appreciates the need for further collaboration. However there should be a clear road map for further irrigation expansion especially in arid areas. To this end the government should have a clear master plan for the irrigation sector
- The government should initiate the Master-plan while JICA will consider giving experts and advisors subject to further discussion

In conclusion the PS noted that this was a good idea of a road map and master-plan as there is need to map the whole country in terms of available resources. Meanwhile JICA can structure other financial support geared towards food security. The PS proposed a meeting with JICA early next week to explore possibility of further financial and technical support **(Action: JICA, PM)**

At this juncture the PS excused himself to attend to parliament and handed over the chairing to the PM.

MIN2/2016 – REVIEW AND CONFIRMATION OF PREVIOUS MINUTES

The minutes of the 2nd PSC meeting were read confirmed as a true record of the deliberations at the previous PSC meeting. They were proposed by Mr. Mureithi and seconded by Mr. Odanga

MIN 3/2016 – MATTERS ARISING

The following were the matters arising from the previous PSC meeting

1. There is need for follow up on the 90 day storage for the projects as agreed with WRMA (**ACTION: PMT**)

2. The funds for completion of remaining works (kshs 75 million) should be followed up (**ACTION: Project manager**)

Min 4/2016 PROJECT PROGRESS

The project overview was presented by the JICA Team leader, highlighting the progress per component. The following issues were raised from the presentation:

- The projects were not completed even after 11 months extension. This was explained that number of challenges led to the delay and the gap will hopefully be closed with the expected funds
- Practical capacity building should be done after the completion of the projects for sustainability
- Up-scaling of the project activities should be the responsibility of stakeholders- MWI, Counties etc

MIN 5/2016 PROJECT REMAINING WORKS

The team leader presented the report on the remaining works for both Batch 1 and batch 2 sites. He noted that the remaining works to cover the SIDEMAN-SAL project scope required kshs 75 million. This was direct cost to finish the remaining infrastructure e.g. canal, pipes, rock excavation and infield system

MIN 6 /2016 PROJECT FINANCIAL STATUS

The financial status of the project for four financial years was presented by the team leader. A total of kshs 853 million had been spent as follows:

- 2012/13 FY- Kshs 177 million
- 2013/14 FY- Kshs 179 million
- 2014/15 FY- kshs 351 million
- 2015/16 FY- Kshs 146 million

MIN 7/2016 PROJECT EXIT STRATEGY

The project exit strategy was presented per project component. The following were the highlights:

- Engineering- Implementation of remaining works
- Capacity building- continuation of IWUA training, M&E, guidance on O&M
- Agriculture development- continuation of training, SHEP approach and LISA technology
- Environment- IWUA to obtain abstraction permits, conduct environmental audit of B2 sites
- Revision of guidelines- engage stakeholders, finalize and publicize

It was noted that good will for collaboration and taking over remaining activities has been observed in most of the Counties.

MIN 7/2016 HANDING OVER OF VEHICLES AND EQUIPMENT

The JICA Senior representative informed the meeting that the request for handing over the vehicles and equipment had been accepted. Three vehicles and assorted office equipment would be handed over. Handing over modalities were being considered and communication to that effect will be made to the PS.

The Kshs 75 million was forwarded to JICA. The funds are expected to be released in July. There is need to confirm how the funds will be released and

utilized for efficient and effective implementation of the intended works. JICA proposed a detailed discussion with the Ministry prior to funds release.

MIN 8/2016 THE WAY FORWARD

1. The guidelines are still in draft form. They require;
   - Polishing by Headquarter team (irrigation staff) and aligning to the Irrigation policy and Bill
   - Stakeholder consultation
   - Finalize, publish and distribute to stakeholders
2. Counties should be encouraged to allocate budget for continuous training of IWUAs, O&M and on-farm water management
3. Counterpart funds for supervision of infrastructure development using the expected kshs 75 million should be discussed with JICA and PS
4. There is need for a meeting between JICA and the PS to consider further collaboration. JICA noted that the future collaboration will depend on governance issues related to sustainability and commitment from the Kenya Government. The Date of the meeting will be communicated by JICA representative (Itoyama) and communicated to the PM for PS briefing
5. JICA volunteers will be disbursed to SIDEMAN-SAL projects possibly Meru sites

The chairman appreciated the PS's participation in the meeting. He reminded the meeting of the PS's sentiments for interventions to ensure food security even as plans are made to do master plan for irrigation. He thanked all for the corporation during the implementation of the project and noted that the interventions were being felt at County and farmer level. He hoped that the project would not be the end but the start of major corporation.

There being no other business the meeting ended at 16.34 pm

Confirmed

Chairman……

Date……