

**Ministry of Agriculture**  
**The Republic of Zambia**

**TECHNICAL COOPERATION  
PROJECT ON COMMUNITY-BASED  
SMALLHOLDER IRRIGATION  
(T-COBSI)  
IN  
THE REPUBLIC OF ZAMBIA**

**FINAL REPORT**

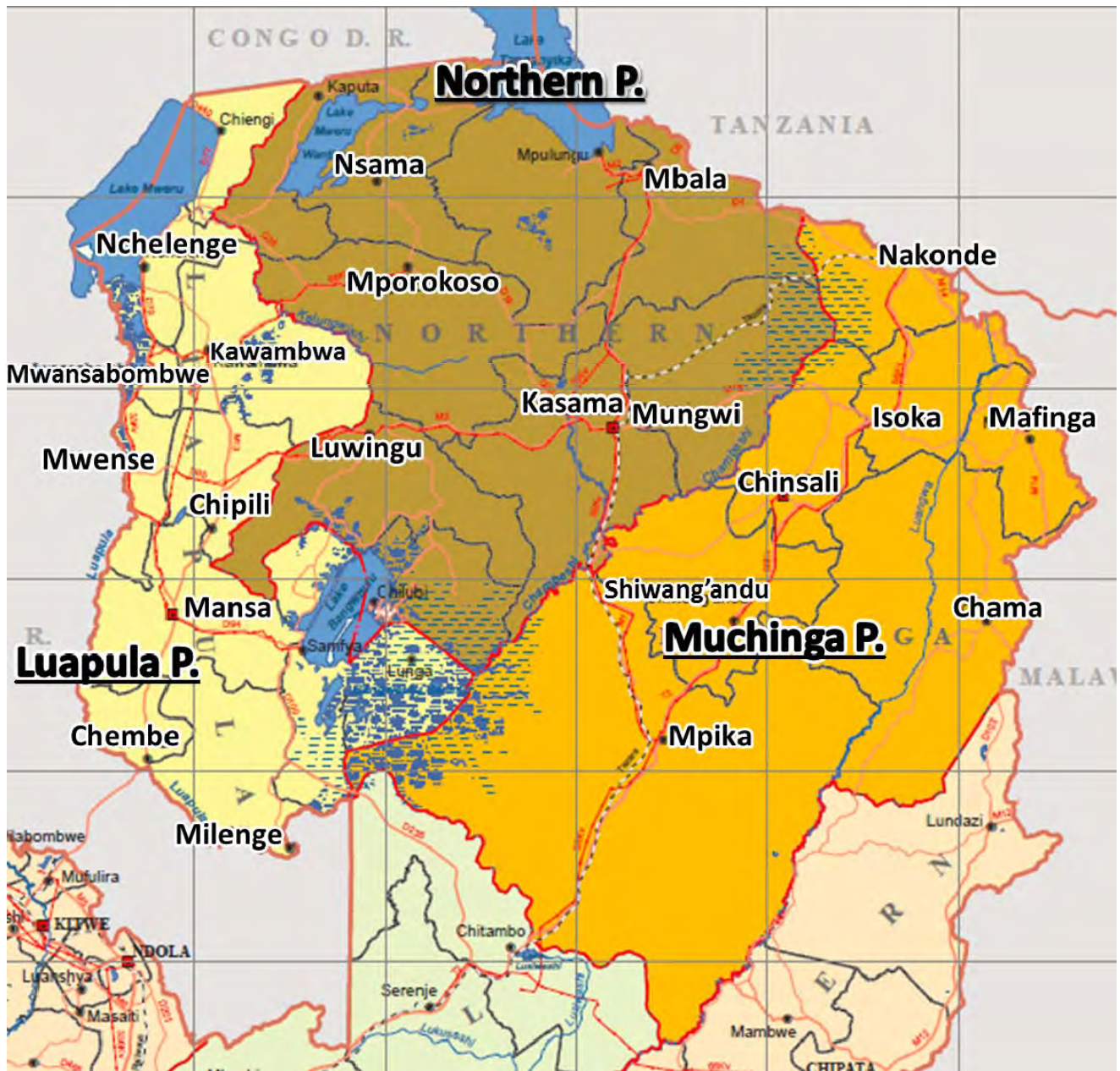
**June 2017**

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**  
**SANYU CONSULTANTS INC.**

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## LOCATION MAP



Province	Capital	Area		Population	No. of Districts	Area per District	
		(km <sup>2</sup> )	(km sq.)	Density (per km <sup>2</sup> )		(km <sup>2</sup> )	(km sq.)
Northern	Kasama	77,900	279	1,105,824 (14.2)	9	8,656	93
Luapula	Mansa	50,567	225	991,927 (19.6)	11	4,597	68
Muchinga	Chinsali	87,410	296	711,657 (8.1)	7	12,487	112
<i>Target Area Total (% to the Nation)</i>		215,877 (29%)	465	2,809,408 (13.0)	26	8,303	91
<b>Zambia Total</b>		<b>752,612</b>	<b>868</b>	<b>13,092,666</b> (17.4)	<b>78</b> (6.5 / prov.)	<b>167,855</b>	<b>410</b>

Reference: <http://www.citypopulation.de/Zambia.html>

Source : (1980) UN Demographic Yearbook 1988. (1990) (2000) (2010) Central Statistical Office Zambia (website).

<http://www.xtremezambia.net/sata-creates-three-more-districts>

Map was provided by MAL HQs.



## PHOTO COLLECTION (Kick-off Training)



**Welcome Remarks:** Welcome remarks are given by the Team Leader of JICA Project Team, addressing the importance of hardworking in irrigation development in the area.



**Presentation:** Introduction to T-COBSI, Provincial Irrigation Engineer of the TSB Northern province gives a presentation on "What's COBSI."



**Field Observation:** In addition to the explanation by the officer in charge, Japanese expert gives tips for better site selection and facility design.



**Lecture on Irrigation Planning:** Japanese expert sometimes cuts in the lecture and shares more precise and/or practical information.



**Practice on canal alignment:** For drawing an effective alignment of the canal, spirit-line level is employed; now, seeing the level of the string.



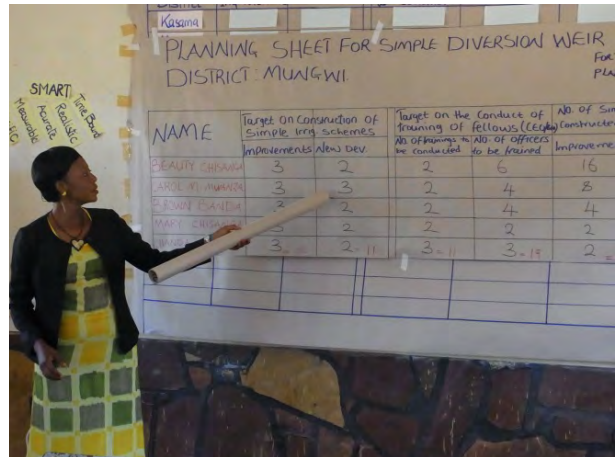
**Field Practice on Simple Weir Construction:** Participants seem to enjoy the cooperative work. For the double-line weir, the required amount of soil is pronouncing.



## PHOTO COLLECTION (Kick-off Training)



**Field Practice on Canal Alignment:** Looking at the spirit-line level, the direction of canal alignment is adjusted. "Pole-holder" needs to move according to the direction of the "level reader".



**Entry Planning (District):** Representative of each district make presentation on their plan and the other participants make comments on it.



**Field Observation:** Interaction with farmers heats up as the participants themselves get excited and curious to know what the secret of this successful farming is.



**Lecture on Irrigation Planning:** Level of participation is enhanced when an interaction between lecturer and participants are well organized.



**Lecture on Irrigation Planning:** The expert gives a quiz, asking which part of the water on the dimension of a canal is running the fastest, and how the average velocity can be estimated.



**Practice on canal alignment:** preparation of a proper instrument is the key for accurate measurement of canal alignment. Setting a string at a correct height from the bottom of the pole.



## PHOTO COLLECTION (Kick-off Training)



**Field Practice on Simple Weir Construction:** horizontal members are placed across the trigonal props so as to connect them and stabilize the structure.



**Take a break:** Co-working cultivates a good relationship among the participants from different districts or countries.



**Field Practice on Simple Weir Construction:** One of the advantages of this kind is not to completely hold water, enabling water continues to flow.



**Practice on Dumpy Level:** As a refreshment of what they might have learned in the college, TSB officers practice how to use dumpy level.



**Lecture on O&M:** Construction of permanent weir and Operation and Maintenance are done in the plenary session where TSB officer and BEO/CEO once again learn together.



**Entry Planning (provincial):** Districts' development plans are summarized as the target of Luapula province (target districts only).



## PHOTO COLLECTION (Mid-term Training)



**Introduction of T-COBSI:** Inviting DACO/SAO and marketing officers who are new to the project, the project concept and its framework are explained.



**Introduction of SHEP approach:** Mr. Banda, PACO of Northern province, who participated in the international training course on SHEP approach make a presentation about SHEP.



**Progress of simple-weir schemes:** Representative of each district, DACO/SAO, make a presentation on the progress of simple weir schemes of their district.



**Confirmation and presentation of the progress:** The progress of simple-weir schemes are presented in plenary session so that it can be seen through the district-wise comparison.



**Lecture on market-oriented farming:** A trainer make a presentation about practical method of making a farm plan based on the market information, which is to be practiced during the workshop.



**Preparation of market survey:** Participants are divided into some groups. Each group make a plan what types of crops they are going to survey at the market.



## PHOTO COLLECTION (Mid-term Training)



**Market survey:** Participants visit the market nearby the venue and practice the market survey, asking the price trend of major crops they selected.



**Market survey:** The participants are concerned of the size and unit of each commodity so that calculation of farm economy can be accountable. They claimed it is difficult to check without scale.



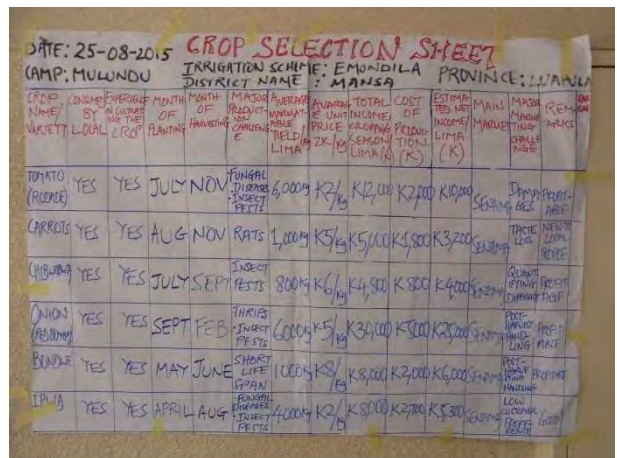
**Market analysis:** Using the price data they just gathered at the market, officers analyze the market trend, which is to be a basis of farm planning.



**Crop selection and farm planning** A farming plan is being made through the discussion in each group based fully on the result of market analysis.



**Presentation of the farm plan:** Each group make a presentation of their farm plan, which was formulated based on the market analysis.



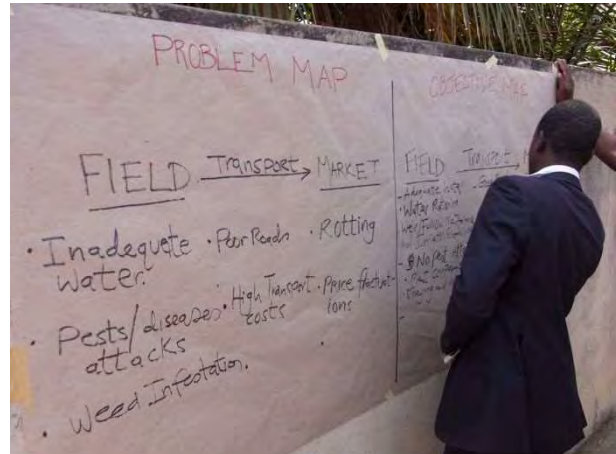
**Crop selection sheet:** An example of the crop selection sheet done by the participants. Types of crop, month of planting and harvest, expected yield, expected price, main market, etc. are summarized.



## PHOTO COLLECTION (Mid-term Training)



**Problem analysis and objective analysis:** Each group conducts a problem analysis and objective analysis in the categories of field, transportation and market.



**Problem analysis and objective analysis:** Some groups prefer to doing this kind of exercise outside of the room.



**Roles of female and male:** A group of female participants, they call themselves "COBSI Women's Club," discusses the typical roles of female and male at village level.



**Presentation about roles of female and male:** Each group makes a presentation of what they have analyzed about the roles of female and male. Q&A session heats up.



**Roles of female and male in agriculture:** Similarly, roles of female and male are also analyzed in relation with agriculture so that rooms for improvement can be found.



**Distribution of materials:** At the end of the training, materials, such as scale, flip-chart, and markers, necessary for the conduct of market-oriented farm planning are distributed.



## PHOTO COLLECTION (TSB Training)



**Preparation Work:** Prior to surveying the sample site for upgrading from the simple weir to permanent one, the TSBs reviewed how to manage the dumpy-level.



**Preparation Work:** Even in the method to stand the staff gauge, the participants of TSB training confirmed to survey the topographic condition correctly.



**Field Practice:** The TSBs actually starts surveying the topographic condition in the sample site to know the site is suitable to construct the permanent weir.



**Field Practice:** The amount of river flow is simultaneously measured to know it the amount of water is enough for irrigated agriculture planned.



**On-farm Irrigation Status:** Physical conditions like topo condition and river flow are not only the element to decide the up-grading site. The TSBs are checking if the on-farm irrigated agriculture is practiced in good condition.



**Social Aspect Survey:** A TSB (left) made an interview to members of simple weir irrigation scheme. Social assessment is also a crucial element to select the suitable site for upgrading.



## PHOTO COLLECTION (TSB Training)



**Lecture:** A JICA Expert lectures “from A to Z” of permanent weir. He emphasized that all design specification have reliable grounds and they exist on the real field, NOT in the office.



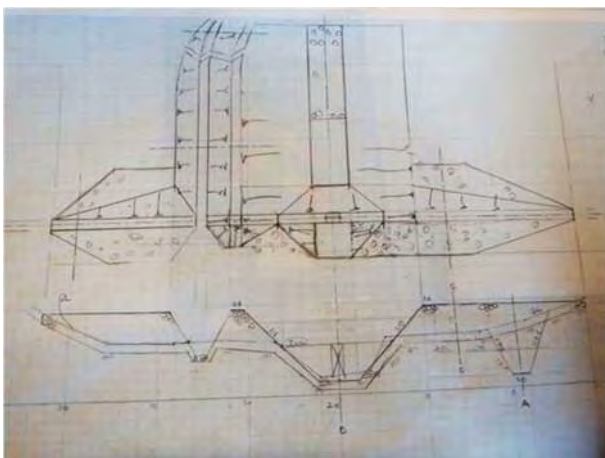
**Discussing the Weir Design:** The participants are carefully checking the design of weir which themselves planned. Through such a group argument, their perception deepens more and more.



**Recapitulation:** The participants review what they learnt previous day together. In order to make the knowledge and experience they got sure, this orientation is good time for them.



**Selection of the Upgrading Site:** The site selection for upgrading was discussed by the TSBs. Taking account of all the things which they learnt through the training, the TSBs finally choose the site suitable.



**A drawing the TSBs designed:** Although this is the first experience for some of the participants to plan the structural figure of this kind, they drew up it finally based on the information collected by the TSBs themselves.



**Congratulations:** The TSBs finally obtained the certification of completion after paying great efforts to learn all the training contents.



## PHOTO COLLECTION (Simple-Weir Irrigation Schemes)

### On-the-Job-Training of Simple Weir Construction (Single Line Type)



**Technical transfer from CEO to Farmers:** CEO participated in the Kickoff Training demonstrates to the farmers how the simple weir is constructed.



**Construction starts:** After getting knowledge, the farmers start constructing the simple weir by using local available material. They are weaving the grass in between the poles drove into the river.



**Full participation:** The community people shows their fully participation to the construction works. Now, they are passing soils which is used for firming the simple weir. In the case of this site, the construction was completed just in 2 hours with 20 farmers.



**Canal alignment using a simple device:** After completion of weir construction, aligning the canal using a simple device is the next step to commence irrigation farming. Provincial TSB is teaching the farmers how to use the tools.



**Farmers align the canal:** Farmers try to make an alignment of the canal. As same as weir construction, this alignment work is not so complicated easy for the farmers if they will get the knowledge and experience once.



**Canal construction:** The farmers start digging the canal according to the alignment which was made by the farmers themselves. Within 1 hour, the irrigation water started running in the canal nicely.



## PHOTO COLLECTION (Simple-Weir Irrigation Schemes)

### On-the-Job-Training of Simple Weir Construction (Double Line Type)



**Driving the poles:** The first step for construction of the double line weir is to drive two lines of wooden poles in parallel at where the farmers want to raise the river water level up.



**Using local material available:** While one group is piling the poles, the other group weaves the grasses.



**Weaving the grass (1):** Weaving the grasses in between the poles of the first line is the second step. In order to make the simple weir firm, the grasses woven are stamped by hoot.



**River water level starts rising:** The grass fence with only one line starts raising the river water level.



**Weaving the grass (2):** The farmers weave the grass along the poles driven downstream side and fill the space in between the grass fences of two lines with soil as to minimize the seepage as much as possible. This is the 3<sup>rd</sup> step of the double line weir construction.



**River water turns into irrigation water:** After completion of the simple weir construction, the water of the starts flowing into the irrigation canal which leads the irrigation water to the farmland.



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)

### PREPARATION WORK



**Orientation:** The project team explained conditions of construction, required manpower, work schedule etc. and confirmed farmers' willingness. Attendance M 15, F 13. LWG 5-2 Mufili Chibwale. August 8, 2014.



**Orientation:** The project team explained conditions of construction, required manpower, work schedule etc. and confirmed farmers' willingness. Attendance M 45, F 34. MPK 1-17 Lubanga. July 24, 2014.



**Delivery of tools:** The project team provided tools for construction such as wheel barrows, shovels, buckets, trowels etc. LWG 5-2 Mufili Chibwale. August 8, 2014



**Site clearing and establishing TBM:** Trees, grass, roots and surface soil were removed and TBM was established. MPK 1-17 Lubanga. August 15, 2014



**Excavation of river diversion:** River diversion is excavated to divert river water to dry up working area. NKD 1-3 Musanza. August 18, 2014



**Completed river diversion:** River diversion is excavated to divert river water to dry up working area. MBL 2-7 Kawama. August 28, 2014



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)



**Construction of coffer dam:** Constructing coffer dam with sand bags. MBL 2-7 Kawama. September 1, 2014



**Construction of coffer dam:** Constructing coffer dam with simple weir technique.. NKD 1-3 Musanza. August 18, 2014



**River diversion:** Cofferdam was completed and the river water was diverted. NKD 1-3 Musanza. August 18, 2014



**Breaking stones:** Stones were gathered near the site breaking rocks. MPR 14-1 Mpela. August 29, 2014



**Ferrying stones :** Stones were ferried from quarry site to the construction site by a truck. MPR 14-1 Mpela. September 11, 2014



**Sand Ferrying:** Sand was ferried from the borrow pit about 5km away from the site. LWG 5-2 Mufili Chibwale. September 5, 2014



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)

### CONSTRUCTION WORK



**Excavation for foundation of apron:** Excavated to solid foundation. Excavation for foundation of apron was done with hoes, shovels, pick axes, and de-watering by buckets. MPK 1-17 Lubanga. August 15, 2014



**Excavation for foundation:** Mud and soft soil on the rock foundation was removed. LWG 5-2 Mufili Chibwale. September 12, 2014.



**De-watering by buckets:** Buckets are used for de-watering if water leakage from the coffer dam is not so large. MPR 14-1 Mpela. September 10, 2014.



**De-watering by engine pump:** Engine pump was introduced for de-watering due to a lot of water leakage from the coffer dam. MBL 2-7 Kawama. November 26, 2014.



**Mortar mixing:** Mortar is mixed in the prepared mortar mixing place. MPR 14-1 Mpela. September 16 2014.



**Stone masonry work for apron:** Stones are placed and mortar is filled into voids completely. LWG 5-2 Mufili Chibwale. September 12, 2014.



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)



**Installation of spillway stop-log frame and stone masonry work for apron.:** Steel stop-log frame was installed. Ladies also worked for stone masonry work. LWG 5-2 Mufili Chibwale. September 17, 2014.



**Construction of spillway section of stone masonry weir:** Main part of spillway is constructed with stone masonry. MBL 2-7 Kawama. November 27, 2014.



**Completed spillway with stop log :** Spillway with stop log frame was completed. MBL 2-7 Kawama. November 28, 2014.



**Excavation of intake part :** Intake part is excavated to required elevation. MBL 2-7 Kawama. November 28, 2014.



**Completed right side abutment :** Right side abutment was completed up to required elevation. LWG 5-2 Mufili Chibwale. October 27, 2014.



**Installation of intake stop-log frame:** Right side abutment was almost completed and started construction of intake. Intake stop-log was installed. October 17, 2014.



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)



**Construction of left side abutment and intake:** Stone masonry work for left side abutment and intake. During construction, water flow is diverted to main stream. LWG 5-2 Mufili Chibwale. October 30, 2014.



**Upstream view of weir:** Main part of stone masonry weir was completed. LWG 5-2 Mufili Chibwale. November 12, 2014.



**Installation of intake stop-log frame:** Steel intake stop-log frame was installed. MPR 14-1Mpela. November 13, 2014.



**Rammer for compaction of embankment:** Embankment is compacted with rammer. MPK 1-17 Lubanga. November 28, 2014.



**Intake part:** Stone masonry for intake canal wall was completed. Stop log frame of intake. Remaining work is left side slope protection and partial improvement of canal. LWG 5-2 Mufili Chibwale. November 20, 2014



**Stone masonry work for intake canal:** Upstream end of intake canal is built strongly to avoid erosion by river flood water. LWG 5-2 Mufili Chibwale. November 14, 2014.



## PHOTO COLLECTION (Permanent-Weir Irrigation Schemes)



**Upstream view of the weir:** Main part of stone masonry weir was completed. Remaining work is left side embankment and a part of canal lining. MPR 14-1 Mpela December 1, 2014.



**Downstream view of the weir:** Main part of stone masonry weir was completed. MWS 6-1 Buyamntanishi, November 11, 2014.



**Upstream view of the weir:** Main part of stone masonry weir was completed. LWG 5-2 Mufili Chibwale. November 11, 2014.



**Construction of Right side abutment:** Stone masonry works for left side abutment is constructed. Kalila, Mansa. November 19, 2015



**Excavation of foundation:** excavation of foundation was difficult due to ground water. Two engine pumps were mobilized for de-watering. Munyele, Nsama. October 10, 2015.



**Site clearing and putting pegs:** Trees, grass, roots and surface soil were removed and pegs were put. Kalila, Mansa. July 8, 2015



## Photo Collection (Impact Survey)



**Community-Based Survey:** The group survey was conducted to clarify the site characteristics including climate condition and accessibility of socio-economic services.



**Individual Survey:** The farm household survey was conducted to evaluate their agricultural production, household economy, and food consumption etc.



**Anthropometric Measurement (Height):** The measurement was conducted to the kids less than 5 years old to evaluate nutritional condition (to assess short to mid-term malnutrition).



**Anthropometric Measurement (Weight):** Targeting to the same kids as height measurement. Weight measurement was done to assess long-term malnutrition.



**Meal Survey:** The Survey was conducted to understand the villagers' food consumption. Dry season crop such as vegetables and fruits are highly appreciated for their daily meals.



**Ordinal Dishes in the Village:** Nshima/Ubwali is the staple food of Zambia made from maize flour and eaten with side dishes, known as relishes, such as meat, fish, and/or vegetables.



## PHOTO COLLECTION (Annual Evaluation Workshop)



**AEW in Kasama Farmers Institution: 58**  
TSB,CEO/BEO gathered at KFI to share what they achieved in 2015 with other district officers.



**Female CEO officer from Mbala (in KFI):** She bravely advised that snake cannot be the serious problem when other officer presented it serious facing problem.



**Group discussion by each district (in KFI):** They were preparing presentation for their achievement.



**Filling information of format 4 in MFI:** TSB officer was confirming the number of construction of weir from CEO/BEOs.



**Female officer's presentation in Chembe district:**  
Female CEO in Chembe presented most of their achievement as replacement of TSB officers



**Counseling the facing problem:** TSB officer explained the conflict which had happened in the permanent site in Mwense district to Japanese expert.



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**Attachments:**

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## ABBREVIATIONS AND ACRONYM

ADSP	Agriculture Development Support Programme (WB)
AMIC	Agricultural Marketing Information Center
ASP	Agricultural Support Programme (SIDA)
AfDB	African Development Bank
BEO	Block Extension Officer
BOMA	British Overseas Management Administration
CA	Conservation Agriculture
CEO	Camp Extension Officer
COBSI	Community Based Smallholder Irrigation
COBSI Study	Study for the Capacity Building and Development for Community-based Smallholder Irrigation Scheme in Northern and Luapula Provinces (JICA)
C/P or CP	Counterpart
CSO	Central Statistical Organization
DACO	District Agricultural Coordinator
DAM	Department of Agribusiness and Marketing (under MOA)
DC	Department of Cooperatives (formerly under MOA)
DF	Department of Fisheries (under the MOA)
DFID	Department of International Development (UK)
DMDO	District Marketing Development Officer
DOA	Department of Agriculture (under MOA)
DPP	Department of Policy and Planning (under MOA)
DSA	Daily Subsistence Allowance
DVLD	Department of Veterinary and Livestock Department
EU	European Union
FAO	Food and Agriculture Organization
FAWEZA	Forum for African Women Educationalists of Zambia
FoDiS	Food Crop Diversification Support Project for Enhancement of Food Security (JICA)
FoDiS-R	Food Crop Diversification Support Project Focusing on Rice Production (JICA)
FISP	Farmer Input Support Programme (ex FISP)
FNDP	Fifth National Development Plan (of Zambia, 2006 – 2010)
FRA	Food Reserve Agency
FSP	Fertilizer Support Programme (changed to FISP in 2009)
GOJ	Government of Japan
COMACO	Community Market for Conservation
GRZ	Government of Republic of Zambia
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HRA	Human Resources Administration (under MOA)
Ic/R	Inception Report
IDA	International Development Association
IDF	Irrigation Development Fund
IDSP	Irrigation Development Support Project (WB)
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
ISF	Investment Support Fund
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
LISP	Livestock Infrastructure Support Project (AfDB)
LSC	Livestock Service Center
MA	Meal Allowance
MACO	Ministry of Agriculture and Cooperatives (former MAL)
MAL	Ministry of Agriculture and Livestock (former MOA)
MOA	Ministry of Agriculture
MDG	Millennium Development Goal
M/M	Minutes of Meeting
NAP	National Agricultural Policy (2004 – 2015)



NAIS	National Agricultural Information Services (under MOA)
NERICA	New Rice for Africa
NGO	Non-Governmental Organization
NIP	National Irrigation Plan (2006 – 2011)
NPK	Nitrogen, Phosphate, Potassium
NUSFAZ	National Union for Small-scale Farmers of Zambia
OJT	On-the-Job Training
O&M	Operation and Maintenance
PACO	Provincial Agricultural Coordinator
PAO	Provincial Agricultural Officer
PaViDIA	Participatory Village Development in Isolated Areas (JICA)
PCM	Project Cycle Management
PDM	Project Design Matrix
PELUM	Participatory Ecological Land-Use Management (NGO)
PIE	Provincial Irrigation Engineer
PIU	Project Implementation Unit (for T-COBSI project)
PLARD	Program for Luapula Agricultural and Rural Development (Gov. of Finland)
PR1	Progress Report No.1 (this report)
PRA	Participatory Rural Appraisal
PRBS	Poverty Reduction Budget Support
PRP	Poverty Reduction Programme
R/D	Record of Discussion
RESCAP	Rural Extension Services Advancement Project
RIF	Rural Investment Fund, the World Bank
SAPMSP	Smallholder Agricultural Production and Marketing Support Project
SMS	Short Message Service
SAO	Senior Agricultural Officer
SCCI	Seed Control and Certification Institute
SHA	Self Help Africa (NGO)
SHEP	Smallholder Horticulture Empowerment Project
SIDA	Swedish International Development Cooperation Agency
SIP	Small Scale Irrigation Project (AfDB)
SIWUP	Smallholder Irrigation and Water Use Programme (FAO)
SNDP	Sixth National Development Plan (of Zambia, 2011-2015)
SNV	Netherlands Development Organization
S3P	Smallholder Productivity Promotion Programme (IFAD)
SWOT	Strengths, Weaknesses, Opportunities, and Threats
T-COBSI	Technical Cooperation Project on Community-based Smallholder Irrigation (JICA)
TOT	Training of Trainers
TSB	Technical Services Branch (the principal counterpart organization at the DOA)
VCDC	Village Community Development Committee
WB	World Bank
WFP	World Food Programme
ZESCO	Zambia Electricity Supply Company
ZMW	Zambian Kwacha
ZARI	Zambia Agricultural Research Institute (under MOA)
ZISSP	Zambia Integrated Systems Strengthening Program
ZNFU	Zambia National Farmers Union
ZPCT	Zambia Prevention Care Treatment Partnership

**UNIT CONVERSION**

1 lima = Quarter hectare (50m ×50m)

**ZAMBIA FISCAL YEAR**

January 1 to December 31

**CURRENCY EQUIVALENTS** [Designated by JICA as of June, 2017]

US\$ 1.00 = 9.2062 ZMW

US\$ 1.00 = 111.326 Japanese Yen (JPY)

ZMK 1.00 = 12.0921 JPY





## **CHAPTER 1 INTRODUCTION**

Submitted herewith is the Draft Final Report of the “Technical Cooperation Project on Community-based Smallholder Irrigation (T-COBSI) in the Republic of Zambia” (referred to as “the Project”). The project has been implemented in Zambia from May 2013 to April 2017 in collaboration between the Ministry of Agriculture (MoA, former Ministry of Agriculture and Livestock (MAL)) and Japan International Cooperation Agency (JICA). This report presents outline, implementation process, achievement, impact, lessons learned of the project for the whole project period, as well as the way forward for future.

### **1.1 BACKGROUND OF THE PROJECT**

In the Republic of Zambia (Zambia), approximately 70% of the total population is living in rural area and about 90% of those living in rural areas are engaged in agriculture. In some areas particularly in Agricultural and Ecological Zone III, annual rainfall reaches 1,000 to 1,200mm; in which 90% of this rainfall occurs during the rainy season from November to April. Unstable rainfall pattern causes fluctuation in agricultural productivity, resulting in serious food shortages from time to time.

Prior to the Project, the “Study for the Capacity Building and Development for Community-based Smallholder Irrigation Scheme in Northern and Luapula Provinces in the Republic of Zambia” (referred to as “COBSI Study”) had been implemented from 2009 to 2011 under a cooperation between MAL and JICA. Based on the outcomes of COBSI Study, then, this Project was implemented with the aim at developing the capacity of relevant officers, promotion of smallholder irrigation, and enhancement of agricultural productivity of smallholder farmers in the target areas.

In COBSI Study, pilot project on smallholder irrigation schemes had been implemented for two dry seasons. As a result, a total of 568 sites had been developed using simple weirs, which had irrigated a total of 544ha, with a total of 6,874 beneficiary households. Although the average area irrigated was only 0.96 ha per site and an average area per household was 28 m squire, additional income generated by the smallholder irrigation schemes was considered significant.

For example, an estimated amount of ZMW 1,510 was required for the typical farmer household who are living below the poverty line. As the income generated by COBSI schemes was, on an average, ZMW 1,550, it was suggested that additional income had an impact as much as lifting average poor farmer households beyond the poverty line. Moreover, additional income, ZMW 1,550 million, was as big as 33% of the original income, ZMW 4,670 (based on the commodity price during 2009-2011). Based on these positive impacts proven by COBSI Study, then, this project had been commenced.

### **1.2 OUTLINE OF THE PROJECT**

#### **1.2.1 RATIONALE AND OBJECTIVE**

##### **1) Rationale**

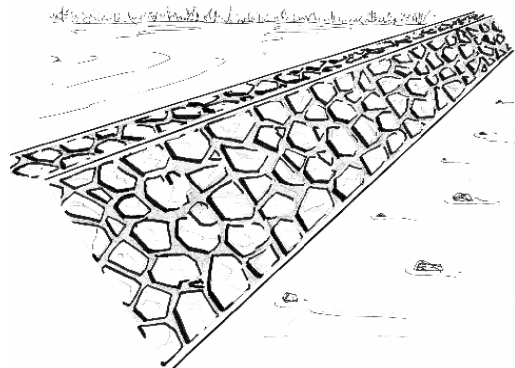
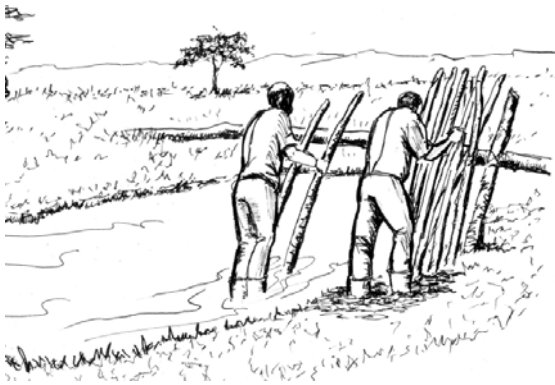
In many countries, irrigation development has been implemented predominantly by the government in terms of planning, design and implementation as well as operation and maintenance (O&M). In medium to large scale irrigation schemes, however, operation and maintenance of irrigation facilities which are transferred to the responsibility of farmer households after the completion of the construction often becomes challenge technically and financially.

On the other hand, small-scale irrigation schemes can be implemented in quite a primitive manner by famers themselves. In developing smallholder irrigation, agriculture extension officers play a pivotal



role. Instead of waiting for a medium-to-large scale irrigation development to be funded by donors, technologies associated with smallholder irrigation schemes can be disseminated to extension officers and then implemented by farmers, leading to an increased numbers of irrigated areas. In comparison with traditional “project” approach where planning, designing and implementation are done independently by consultants, “extension” approach in small-scale irrigation development can be widely implemented in a shorter period of time, and with less transaction cost.

In addition, in the “simple weir” schemes that are the key scheme for COBSI approach, necessary materials, such as wooden poles, grasses, and stones, can be obtained in the locality and thus, construction of diversion weirs can be easily managed by farmers themselves. On the other hand, diversion weir may need to be reconstructed at the beginning of every dry season as it may not completely endure against strong river flow during rainy season. Thus, relatively large-sized schemes shall be upgraded to permanent structures, or “permanent weir.”



A picture and an illustration on the left side show a typical simple weir, while one on the right shows a typical permanent weir, which is usually constructed by rubble masonry works. By upgrading from simple weir to permanent weir, sustainability can become more promising.

For the construction of permanent weirs, on the other hand, major materials such as rubbles, gravels, and cements are brought from outside the community but the construction itself can be done mainly by farmers under a proper supervision by technical officers. In the standard design proposed in COBSI Study, no reinforced concrete and metal gates are employed because contractors are usually required for the construction. Instead, permanent weir is constructed by masonry works with cement mortar.

In this project, both simple-weir irrigation and permanent-weir irrigation were addressed. A lot numbers of simple schemes can be developed through an “extension approach,” wherein irrigation development can be implemented in a wider range of areas. And then, some of the simple schemes were upgraded to permanent schemes—this upgrading itself is an essence of COBSI approach. After a certain period of practice in irrigated agriculture under such systems, farmers can get used to doing the O&M of irrigation facilities. So, this upgrading approach also ensures better operation and maintenance in permanent schemes in the long run.

## 2) Objectives

Overall goal, project purpose, project outputs and activities are as follows, which were agreed upon between MOA and JICA as stipulated in the R/D document. In the process of pursuing the project purpose, capacity development of various stakeholders had been carried out. The latest PDM is shown in Attachment A.

### Overall Goal

Irrigated agriculture production in the target areas is increased.

### Project Purpose

To promote and increase irrigated land through the provision of irrigation infrastructure for smallholder farmers in the target area

### Project Outputs and Activities

1. Through hands-on experience, practical skills in design, construction, operation, and maintenance of simple and permanent irrigation facilities for smallholder irrigation schemes are transferred to Technical Staff from TSB (Technical Service Branch).
  - 1.1 Conduct group training for Technical Staff from TSB on design, construction, operation and maintenance (O&M) of smallholder irrigation schemes.
  - 1.2 Train farmers on basic O&M of smallholder irrigation schemes through the on the job training (OJT) for Technical Staff from TSB.
2. Through hands-on experience, practical skills in construction, operation, and maintenance of simple and permanent irrigation weirs for smallholder irrigation are transferred to MAL extension officers.
  - 2.1 Conduct group training for extension officers on construction, O&M of smallholder irrigation schemes.
3. Knowledge and skills of farmers in irrigated farming and operation and maintenance of simple and upgraded permanent irrigation schemes are improved.
  - 3.1 Conduct group training for extension officers on the on-farm water management.
  - 3.2 Disseminate knowledge and techniques of on-farm water management to the farmers in the target areas.
  - 3.3 Conduct group training for extension officers on techniques of irrigated crop production
  - 3.4 Disseminate knowledge and techniques of irrigated crop production to the farmers in the target areas.

### 1.2.2 TARGET AREA

Target area is shown in the location map attached at the beginning of this report. The target area is composed of three provinces, Northern, Luapula and Muchinga provinces where COBSI Study was implemented. Muchinga province was newly created consolidating some districts formerly located in Northern Province and also a part of former Eastern province. The number of target districts is 6 in Northern, 5 in Muchinga and 8

**Table 1.2.1 List of Target Districts**

Province	District			
	No	Fomer	No	Current
Northern	1	Kasama	1	Kasama
	2	Luwingu	2	Luwingu
	3	Mbala	3	Mbala
	4	Mporokoso	4	Mporokoso
	5	Mungwi	5	Nsama
Muchinga			6	Mungwi
			1	Isoka
	1	Isoka	2	Mafinga
			3	Shiwanga'ndu
	2	Mpika	4	Mpika
Luapula	3	Nakonde	5	Nakonde
			1	Kawambwa
			2	Mwansabombwe
	2	Mansa	3	Mansa
			4	Chembe
	3	Milenge	5	Chipili
	4	Mwense	6	Milenge
	5	Nchelenge	7	Mwense
		8	Nchelenge	

Source: JICA T-COBSI Project Team (2017)

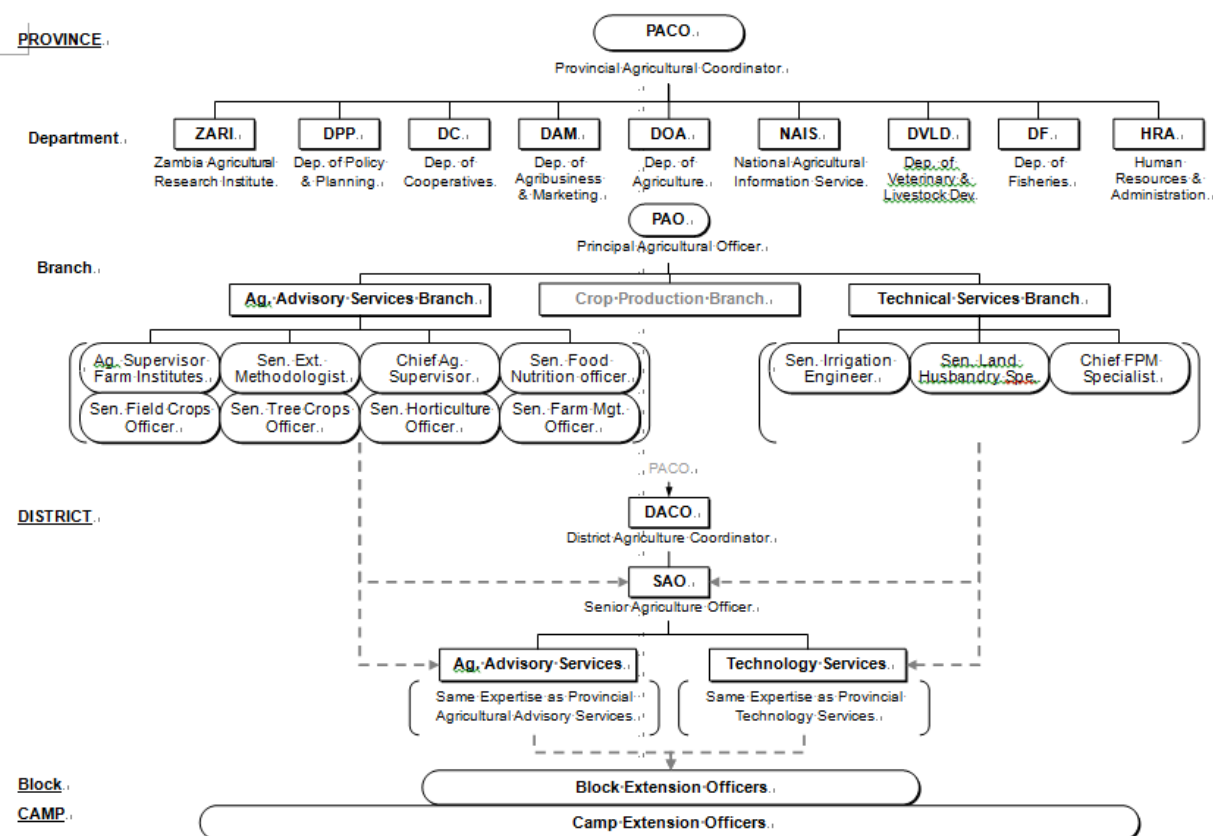


in Luapula, totaling 19 districts. These districts had been identified as potential districts during COBSI Study. The list of the target districts are shown as Table 1.2.1.

### 1.2.3 IMPLEMENTATION STRUCTURE

#### 1) Organizational Structure of the Counterpart Agency

The organizational structure of the Ministry of Agriculture, the counterpart agency, at a provincial level is shown below. Same as the structure at the headquarters, there are a total of nine departments under the authority of Provincial Agricultural Coordinator (PACO). Under the Department of Agriculture (DOA), there are usually three branches: Agricultural Advisory Service Branch, Crop Production Branch, and Technical Services Branch (TSB). T-COBSI’s main counterparts were officers at TSB of each province. Then, similar structure is constituted at district level where there is also TSB. Finally, under the supervision of district office, particularly District Agricultural Coordinator (DACO), and Senior Agricultural Officer (SAO), extension officers are deployed at block (Block Extension Officer: BEO) and camp (Camp Extension Officer: CEO).

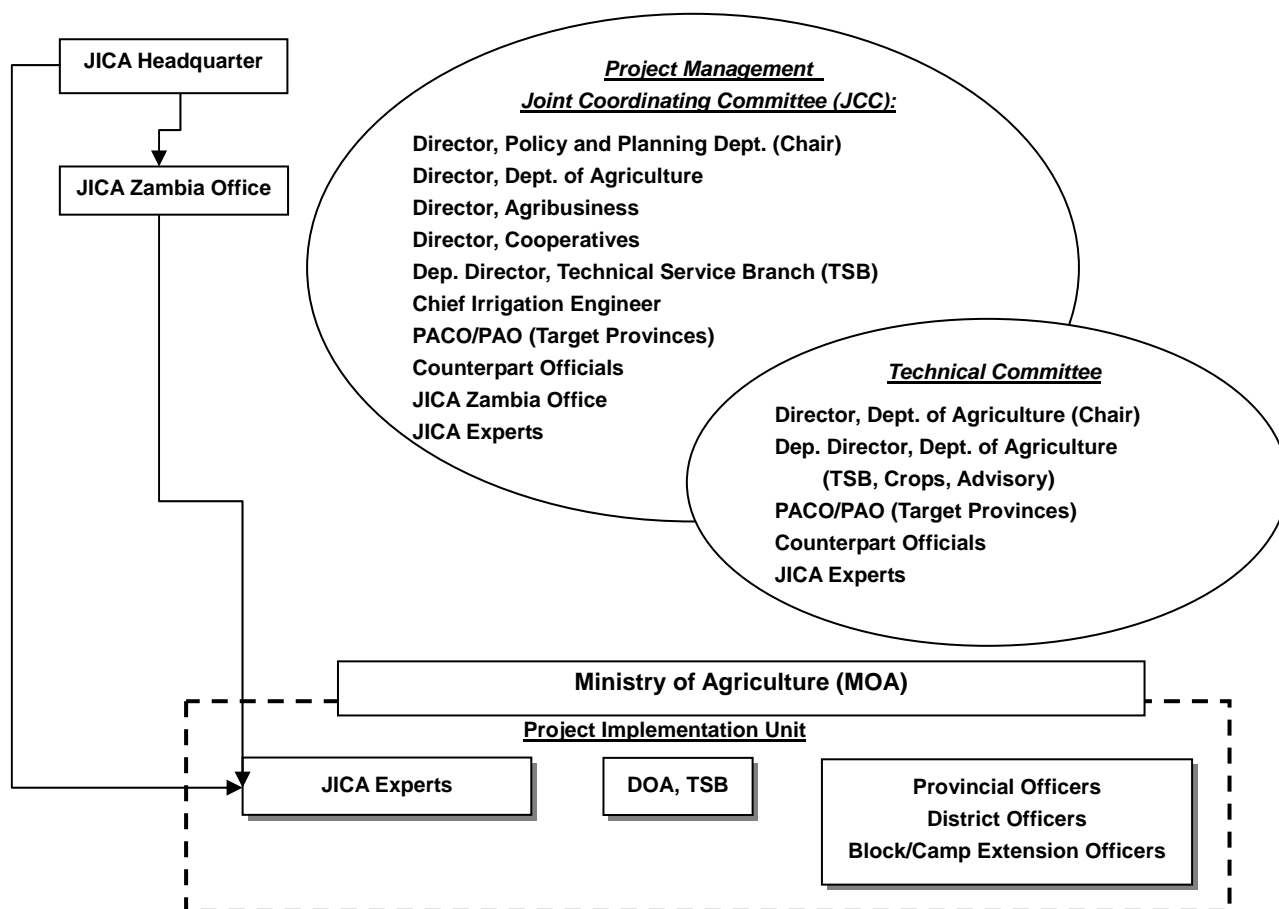


**Figure 1.2.1 Organizational Structure of MOA**

Source: JICA T-COBSI Project Team (2017)

#### 2) Implementation Structure of the Project

For the implementation of the Project, JICA organized an expert team, composed of seven experts of Sanyu Consultants Inc. The counterpart organization of the Project (MOA) arranged counterpart personnel and implemented the Project with a technical assistance from the Project Implementation Unit. The figure below shows the implementation arrangement of the Project.



**Figure 1.2.2 Project Implementation Structure**

Source: JICA T-COBSI Project Team (2017)

Note: This structure is based on the information at the time of commencement of the project. In 2016, Department of Agribusiness and Cooperatives were transferred to the other ministry due to the restructuring.



## CHAPTER 2 ACHIEVEMENT OF THE PROJECT

### 2.1 INPUT

#### 2.1.1 JAPANESE EXPERT

Dispatch of Japanese Expert is summarized in the table below. Detailed assignment schedule is also shown in Attachment B.

**Table 2.1.1 Assignment of Japanese Expert**

Name	Field	Total Assignment Period	Days assigned	Affiliation
Tatsuya Ieizumi (Mr.)	Team Leader/ Irrigation Planning and Management	- May 7 – June 2, 2013 - Apr 26 – Sep 14, 2014 - Oct 15, 2014 – Jan 4, 2015 - Apr 13 – May 21, 2015 - Jun 8 – Dec 4, 2015 - Mar 28, 2016 – 30 Apr, 2017	27 142 82 incl. 26 of OH 31 118 217	SCI
Hideaki Hiruta (Mr.)	Co-Team Leader/ Farming System/ Training Design	- May 7 – June 12, 2013 - Aug 26 – Oct 22, 2013 - Jan 21 – Mar 5, 2014 - Apr 26 – Jun 19, 2014 - Jul 18 – Sep 12, 2014 - Oct 13 – Dec 21, 2014 - Apr 13 – Jun 21, 2015 - Aug 1 – Sep 4, 2015 - Nov 3 – Dec 4, 2015 - May 4 – Jun 2, 2016 - Oct 1 – Nov 3, 2016 - Feb 17 – Apr 7, 2017	37 58 44 55 57 44 incl. 26 of OH 70 35 32 53 45 50	SCI
Nobuaki Chiba (Mr.)	Irrigation Facility Design/ Construction Control	- May 7 – June 12, 2013 - Aug 26 – Nov 16, 2013 - Apr 26 – Sep 20, 2014 - Nov 5 – Dec 21, 2014 - Apr 13 – Aug 28, 2015 - Sep 21 – Dec 16, 2015 - Apr 4 – Aug 2, 2016 - Sep 1 – Dec 30, 2016 - Jan 13 – Apr 7, 2017	37 83 148 47 138 87 141 104 84 incl. 1 of OH	SCI
Yoshihiro Sagawa (Mr.)	Water Management/ Irrigation Facility Design/ Construction Control (2)	- Aug 7 – Oct 22, 2014 - Apr 20 – Jul 13, 2015 - Sep 2 – Oct 3, 2015 - Nov 9 – Dec 9, 2015 - Mar 28 – Jun 2, 2016 - Jul 28 – Dec 23, 2016 - Jan 17 – Mar 7, 2017 - Apr 1 – Apr 28, 2017	75 incl. 2 of OH 85 32 31 90 149 50 incl. 18 of OH 28 incl. 4 of OH	SCI
Masaya Fukumoto (Mr.)	Agricultural Marketing	- Nov 1 – Dec 15, 2013 - May 29 – Jul 27, 2014 - May 24 – Jul 7, 2015 - Jun 9 – Jul 23, 2016	45 60 45 45	SCI
Makiko Yamamoto (Ms.)	Rural Society/ Farmers Organization/ Gender	- May 7 – Jun 12, 2013 - Oct 1 – Dec 14, 2013 - Jan 21 – Mar 5, 2014 - Apr 26 – Jun 29, 2014 - Sep 23 – Dec 15, 2014 - Apr 20 – Jul 18, 2015 - Oct 9, 2015 – Jan 9, 2015 - Apr 4 – May 27, 2016 - Nov 1 – Dec 29, 2016	37 75 44 65 81 90 incl. 60 of OH 92 incl. 62 of OH 54 incl. 24 of OH 59 incl. 29 of OH	SCI
Shokohifard Gholamhossein (Dr.)	Environmental and Social Considerations	- Apr 26 – May 25, 2014	30	SCI
Tougo Shinohara (Mr.)	Project Evaluation/ Livelihood Analysis	- Oct 12 – Dec 10, 2016	60	SCI
Yuri Saito (Ms.)	Project Evaluation/ Nutrition Improvement	- Oct 12 – Nov 5, 2016 - Nov 13 – Dec 23, 2016	25 41 incl. 6 of OH	SCI
Ritsuko Hara (Ms.)	Farming System (2)/ Rural Society (2)	- Aug 13 – Sep 12, 2014 - Oct 26 – Dec 9, 2014	31 of OH 45 of OH	SCI
Kazuya Yoshizawa (Mr.)	Farming System (2)/ Agricultural Marketing (2)	- Jun 13 – Jul 13, 2015 - Aug 4 – Oct 3, 2015 - Jul 1 – Jul 31, 2016	31 of OH 61 of OH 31 of OH	SCI

<b>Total</b>		3,764 incl. 464 of OH	
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Note: Assignment Schedule includes the ones dispatched by the consultants' own expenses (Overhead)  
SCI: Sanyu Consultants Inc. OH: Overhead

## 2.1.2 COUNTERPARTS

### 1) Assignments of Counterparts

Project Implementation Unit (PIU) was established in each of three provinces: Northern, Muchinga and Luapula. As the expert team is stationed in Kasama, Northern province, the PIU members of Northern province were the main counterparts working closely with the Japanese experts. Detailed profiles of the counterpart personnel are shown in the Attachment C.

### 2) Counterparts' Participation in Training Overseas

Counterparts' participation in training overseas funded by JICA is summarized as Table 2.1.2. Relating to this project, there are a total of eight officers who have attended overseas trainings supported by JICA.

**Table 2.1.2 Counterparts' Participation in Overseas Training**

Name	Position	Theme of Training	Implementing Institution	Training Period
Mr. Andrew Banda	PACO, Northern Province	Market Oriented Agriculture Promotion for Executive Officer in Africa	JICA Kansai and JICA Kenya	- November 16 to 29, 2014 in Japan - November 30 to December 6, 2014 in Kenya
Mr. Peter K. Lungu	Director, Department of Agriculture	Market Oriented Agriculture Promotion for Africa (Planning and Management)	JICA Kansai and JICA Kenya	- May 17 to 30, 2015 in Japan - May 31 to June 6, 2015 in Kenya
Mr. Kellies Sakajila	TBS Officer, Nakonde District, Muchinga Province	Capacity Development for Water Management for Africans- On Farm Water Management	JICA Egypt	- October 4 to November 12, 2015
Ms. Karen Chenda Mukuka	Chief Food and Nutrition Officer	Market Oriented Agriculture Promotion for Executive Officer in Africa	JICA Kansai and JICA Kenya	- May 8 to 21, 2016 in Japan - May 22 to May 28, 2016 in Kenya
Mr. Chibeyeye Remmy	TSB officer, Luapula province	Participatory Irrigation Management Systems for Paddies	JICA Hokkaido	- Aug 11 to Sep 22, 2016 in Japan
Mr. Chanda Obed	TSB officer, Luapula province	Rural Development Course (Young Leaders)	JICA Hokuriku	- Sep 5 to Sep 22, 2016
Ms. Mary Chininga	TSB officer, Mungwi district, Northern province	Agribusiness Promotion and Rural Development in African Countries	JICA Tsukuba	- Oct 10 to Nov 26, 2016
Mr. Chitongwa Phillip	TSB officer, Kasama, Northern province	Maintenance, Operation and Management of Irrigation Facilities	JICA Tsukuba	- Feb 26 to Apr 22, 2017

Source: JICA T-COBSI Project Team (2017)

## 2.1.3 EQUIPMENT

Office equipment, such as copy machine, printers, and laptop computers, were procured by JICA's budget. In addition, two of four wheel drive vehicles were procured and used by the expert team together with the counterpart personnel. Three sets of auto level were procured and provided to each provincial TSB offices one by one; and one set of auto level was provided to each of 19 district offices. One digital camera was provided to each of 19 district offices for monitoring activity.

Furthermore, some additional equipment were procured and handed over to the ministry, they are: motorbikes, GPS, personal computers, and printers. These new equipment are to be used for monitoring and database management. All the equipment listed had been handed over to the ministry by the termination of the project. Provision of equipment is summarized in Attachment D.



## 2.1.4 LOCAL OPERATIONAL EXPENSES

### 1) Local Operational Expenses Covered by Japan

Local operational expenses covered by Japanese government are summarized in the table below:

**Table 2.1.3 Local Operation Expenses Covered by Japan**

Item	Contracted Amount in JPY and ZMW	
	Japanese Yen	Equivalent to Zambian Kwacha
General	117,154,000	(6,327,000)
Equipment	2,498,000	(140,000)
Construction of irrigation facilities	26,010,000	(1,417,000)
Total	145,662,000	(7,884,000)

Note: Figure shows the budgeted amount under the contract between JICA and the consultant, which does not include the international travel cost and remuneration of the experts/ Japanese Yen is converted by JICA's designated rate @17.564.(2013) and @19.101 (2015).

### 2) Local Operational Expenses Covered by Partner Country

The Ministry of Agriculture has been facing a big financial challenge in the past few years; the budget disbursement remains allegedly only 15%-20% of the activity budget of each year. As the result, disbursement for the mobilization of government officers had remained low. In addition, the government's own initiative in construction of permanent weir had also been discouraged.

In Northern province, for example, 215,000ZMK was budgeted for the year 2014, which was to serve for the construction of two permanent weir schemes but the construction was not been availed. Same was true for Luapula province. The situation did not improve in 2015 and thereafter. GRZ planned to construct 36 permanent weirs in two years of 2015 and 2016; however, none of them has been constructed due mainly to the lack of financial allocation to the irrigation development.

On the other hand, the counterpart agency had provided some physical properties for the project such as: 1) government-owned vehicles, 2) dumpy level, 3) office space, and 4) office expenses such as water and electricity, all of which had contributed to daily work of the project implementation unit and mobilization of provincial TSB officers for the supervision of the construction at remote areas.

## 2.2 MAIN ACTIVITIES OF THE PROJECT

### 1) Overall Schedule

To attain the objectives, the project was carried out in four-year period from May 2013 to June 2017. The first year was the preparation stage of the project wherein the survey on current situation of the irrigation schemes constructed through the pilot project of COBSI Study was conducted to draw lessons from the past activities in smallholder irrigation development. From the second year, on-the-job trainings had been conducted in each of three dry seasons from April to December. Following shows the overall schedule and the scopes of the project, which is also described as a flow chart as

#### Year 1: Preparation Stage

- Planning of project approaches and scopes
- Exchange of opinions with other donors and projects concerned
- Preparation of the Inception Report (Ic/R)
- Establishment of Project Implementation Unit (PIU) in each province
- Survey on current situation of the irrigation schemes developed through the pilot project of the COBSI Study (follow-up survey) (questionnaire survey and in-depth survey)

- Conduct of agricultural marketing survey
- Preparation of the training schedule for the implementation stage

#### Year 2-4: Implementation Stage (Trainings and OJTs)

- Conduct of the Training of Trainers (TOTs) for TSB officers
- Conduct of the Kick-off Training for TSB officers and extension officers
- Supporting the farmers' on-farm activities related to COBSI (incl. demo-farm)
- Conduct of the Follow-up Workshop for monitoring  
<Continuation of the above activities for three years>
- Final evaluation of the project (final year)

## **2) Major Activities Carried Out in Each Year**

In 2013, preparatory activities including the amendment of the scope of the project, preparation of the inception report, establishment of Project Implementation Unit were conducted. Also, survey on current situation of the irrigation schemes developed through the pilot project of the COBSI Study was carried out and the preliminary screening of the potential sites for upgrading to the permanent structure was implemented. Then, agricultural marketing survey was conducted, by which a gap in the understanding of market trend between producers and marketers was found.

In 2014, a series of training had been carried out: TOT, Kick-off Training, and Mid-term training, through which TSB officers and agricultural extension officers have learned necessary knowledge and skills on irrigation development, market-oriented farming and gender consideration in addition to environmental consideration. Throughout the dry season of 2014, these officers have implemented construction of irrigation schemes based on the full participation of the beneficiary farmers. As far as permanent irrigation schemes are concerned, a total of seven schemes were constructed: three sites in Northern province (Luwing, Mbala and Mporokoso districts), two in Muchinga (Mpika and Nakonde) and another two in Luapula (Mwense and Nchelenge).

In 2015, same series of trainings as 2014 were carried out. Additionally, TSB training on actual plan and design of permanent weir was conducted for TSB officers. These officers implemented construction of irrigation schemes based on the full participation of the beneficiary farmers. As far as permanent irrigation schemes are concerned, weirs were constructed at a total of four sites: Nsama district in Northern province, Isoka district in Muchinga province, Mansa and Kawambwa district in Luapula province.

In 2016, the same series of trainings on simple weir irrigation schemes and irrigated farming continued. Additionally, TSB training on actual plan and design of permanent weir was conducted for TSB officers as a continuation from 2015. These officers implemented construction of irrigation schemes at three sites: Mungwi and Kasama districts, Northern province, and Chipili district in Luapula province.

Toward the end of the project period, additional training and seminars had been organized, which include a series of on-the-job training for TSB officers in planning, designing and estimation of cost for applying to any donor-funded project especially S3P. Also, the wrap-up TSB training was organized for information sharing among TSB officers. Lastly, for the continuation of the project approach, dissemination seminar inviting as many as 130 people from other provinces, donors, and NGOs were organized in Lusaka.



## 2.3 ACHIEVEMENTS OF THE OUTPUTS AND PROJECT PURPOSES

### 1) Status of Achievement of Objectives Outlined in the PDM

Table below summarized the status of the achievement associated with the objectively verifiable indicators. As shown in the table, all of major indicators stipulated in the PDM had been achieved by the end of the project period.

**Table 2.3.1 Status of Achievement of Objectives Outline in PDM**

Objectively Verifiable Indicators	Status
1.1 Preparatory activities are conducted for at least 400 existing simple irrigation schemes which were developed in the previous study in 2009 to 2011 for upgrading to permanent schemes.	Questionnaire survey was conducted and the data was compiled for a total of 413 simple irrigation schemes developed in the COBSI Study, which was summarized in the Progress Report 1. It was then found that approximately 25% of the existing simple schemes maintain some potential for the upgrading to permanent schemes.
1.2 At least 20 technical staff from TSB acquire training experience and skills through design and construction of 14 permanent irrigation weirs and 486 simple irrigation weirs	A total of 37 TSB officers acquired training experience through Kick-off Training; 37 TSB officers through Mid-term training; and at least 10 TSB officers had experienced the planning, and construction of a total of 7 permanent weirs in 2014. In 2015, 41 TSB officers acquired training experience through Kick-off Training, and 42 officers through TSB Training, and also at least 15 TSB officers had experience in the construction of permanent weir construction in 4 sites. In 2016, a total of 47 TSB officers acquired training experience through Kick-off Training, and 46 officers (net) through TSB Training, and also at least 10 TSB officers gained experience in the construction of permanent weir construction at 3 sites.
1.3 At least 15 Technical Staff from TSB acquire training experience and skills on permanent weir construction for 36 permanent weirs (Note 4) to be constructed by GRZ	No permanent weir has been constructed yet by the GRZ budget. Thus, no practical training was provided through the construction of permanent weirs by the GRZ budget.
2.1 More than 150 extension officers acquire training experience and skills in smallholder irrigation farming and on operation and maintenance of smallholder irrigation schemes.	A total of 185 extension officers (55 in 2014, 70 in 2015, and 60 in 2016) have acquired training experiences in smallholder irrigation farming and operation and maintenance of smallholder irrigation schemes through the Kick-off Training and also a total of 158 extension officers (52 in 2014, and 57 in 2015, and 49 in 2016) on market-oriented agriculture and gender mainstreaming through Mid-term training. As the number of extension officers who have been trained reached 123% for Kick-off training and 105% for Mid-term training of the target in three years.
2.2 More than 90% of trained extension officers disseminate techniques in smallholder irrigation farming and operation and maintenance of smallholder irrigation schemes to farmer groups in their respective areas.	According to the site inventory survey conducted at the time of evaluation workshop in 2016, 91% of the main officers who participated in the Kick-off Training and 92% of the fellow officers trained by the main officers had disseminated any type of smallholder irrigation farming and operation and maintenance to farmer groups where simple weir was constructed during the project period from 2014 to 2016.
3.1 More than 50% of farmer groups in the developed schemes apply at least one of the irrigated farming technologies disseminated by the trained officers.	According to the site inventory survey conducted in 2016 as a summarization, 88% of the farmer groups that are engaged in smallholder irrigation under T-COBSI have applied at least one of the irrigated farming technologies disseminated by the trained officers, of which O&M (operation and maintenance of irrigation facilities) and on-farm irrigation demonstrated the highest application rate with 69%, followed by market-oriented farming (62%) and soil improvement (61%).

Source: JICA T-COBSI Project Team (2017)

## 2) Status of Achievement of the Project Purposes

Project Purpose: “To promote and increase irrigated land through the provision of irrigation infrastructure for smallholder farmers in the target areas” has been achieved by the time of project completion.

**Table 2.3.2 Status of Achievement of Objectives Outline in PDM**

Indicator	Achievements																				
Indicator 1. More than 500 farmers groups in the target areas are engaged in improved irrigation farming with community-based irrigation schemes.	<ul style="list-style-type: none"> <li>A total of 774 farmer groups (250 in 2014, 248 in 2015, and 276 in 2016) has been confirmed engaged in improved irrigation farming with community-based irrigation schemes.</li> </ul>																				
Indicator 2. The community-based smallholder irrigation schemes cover 700 ha (70ha by permanent weir and 630 ha by simple weir) or more in target areas.	<ul style="list-style-type: none"> <li>By the completion of the project, a total of 948.2 ha has been developed under irrigation, which comprised of 876.0 ha with simple weir scheme and 72.2 ha with permanent weir scheme.</li> </ul> <table border="1" data-bbox="580 658 1391 799"> <thead> <tr> <th>Year</th> <th>Simple Weir</th> <th>Permanent Weir&lt;*</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>2014</td> <td>292.0 ha</td> <td>50.8 ha</td> <td>342.8 ha</td> </tr> <tr> <td>2015</td> <td>214.6 ha</td> <td>9.4 ha</td> <td>224.0 ha</td> </tr> <tr> <td>2016</td> <td>369.4 ha.</td> <td>12.0 ha</td> <td>381.4 ha</td> </tr> <tr> <td>Total</td> <td>876.0 ha</td> <td>72.2 ha</td> <td>948.2 ha</td> </tr> </tbody> </table>	Year	Simple Weir	Permanent Weir<*	Total	2014	292.0 ha	50.8 ha	342.8 ha	2015	214.6 ha	9.4 ha	224.0 ha	2016	369.4 ha.	12.0 ha	381.4 ha	Total	876.0 ha	72.2 ha	948.2 ha
Year	Simple Weir	Permanent Weir<*	Total																		
2014	292.0 ha	50.8 ha	342.8 ha																		
2015	214.6 ha	9.4 ha	224.0 ha																		
2016	369.4 ha.	12.0 ha	381.4 ha																		
Total	876.0 ha	72.2 ha	948.2 ha																		



## CHAPTER 3 IMPLEMENTATION PROCESS

### 3.1 MODIFICATION OF THE PDM

The PDM was modified on July 30, 2013 for the first time and February 24, 2015 for the second time. In the first modification, in essence, construction of simple diversion weirs was removed from the project approach and accordingly project period and target areas were also modified as to maximize the number of permanent sites to be constructed. Then, in the second modification, construction of simple diversion weir was re-incorporated as the benefit of these technologies was re-confirmed by the mid-term review team. The transition of the change of component stipulated in the PDM is summarized in the table below and the latest PDM and PO is attached in Attachment A.

**Table 3.1.1 Transition of the Change of the PDM**

PDM Version	Remarks
Original (Version 0)	<ul style="list-style-type: none"> <li>As per attached to R/D (2012.11.21)</li> </ul>
Version 0	<ul style="list-style-type: none"> <li>Amended on July 30, 2013.</li> <li>Description associated with the sub target area was removed.</li> <li>Description associated with simple irrigation schemes was removed.</li> <li>Target number of beneficiary farmer groups was turned to pending.</li> <li>Target number in area under irrigation was turned to pending.</li> <li>Target number of extension officers to be trained was removed as they were to be engaged in simple schemes.</li> <li>The Project period was shortened from 2013.5-2018.5 to 2013.5-2016.12</li> </ul>
Version1.0	<ul style="list-style-type: none"> <li>Amended on December 10, 2014.</li> <li>(M/M was signed between MAL and JICA on February 24, 2015)</li> <li>Benefit of simple weir irrigation was reconfirmed by Mid-term Review and training of MAL officers on simple weir irrigation development was incorporated into the Project frame.</li> <li>The number of simple weirs was decided as 486.</li> <li>The number of permanent weirs was decided as 14 by JICA budget and 36 by GRZ budget.</li> <li>The Project period was extended from 2013.5-2016.12 to 2013.5-2017.6</li> </ul>

Source: JICA T-COBSI Project Team (2017) with reference to the terminal evaluation report.

### 3.2 PLAN OF APPROACH

The plan of approach formulated at the commencement of the project is summarized as follows:

#### 3.2.1 BASIC STRATEGIES

Expected outcome of the project was to enhance the capacity of targeted officers and farmers in development of smallholder irrigation. They are categorized into three major groups: 1) TSB officers at Provincial and District levels who promote the smallholder irrigation development, 2) agricultural extension officers (BEO: Block Extension Officer, and CEO: Camp Extension Officer) on the frontline for wider extension of the techniques, and 3) farmers who actually construct the irrigation systems and practice irrigated agriculture. In addition to knowledge and skills of irrigation development, practical know-how on irrigated agriculture and marketing were addressed. In this chapter, three major development approaches are introduced:

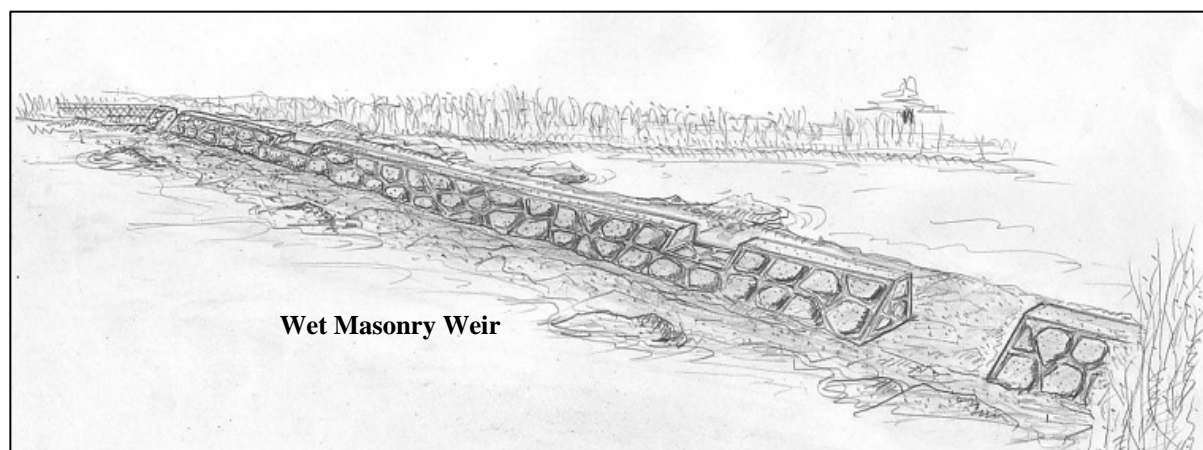
#### Basic Strategy to Permanent Irrigation Schemes

##### *Upgrading from the existing simple irrigation schemes*

In this project, diversion weirs with permanent structure, made of concrete, stones, and mortar, were constructed. As it was a smallholder irrigation development, the type of weirs should have been something that can be constructed with farmers' participation, not by the contractor, and then manageable by the farmers for operation and maintenance.

In this project, river diversion weir was given the highest priority as it enables gravity irrigation with

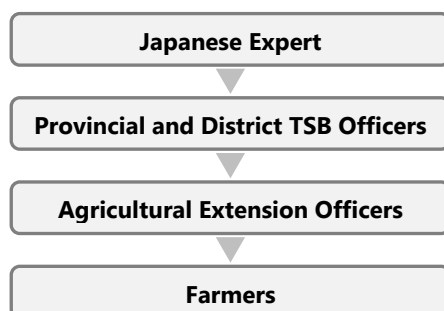
easier operation and maintenance among others such as pump irrigation and farm pond. In the project area, there were already a number of simple irrigation schemes developed through COBSI Study. These schemes have been developed entirely by the farmers' participation and therefore beneficiaries were already used to practicing irrigated agriculture and also operation and maintenance. Thus, the main focus was put on the shifting from existing simple weir to permanent weir. The illustration below shows an example of permanent weir constructed with stones, sand, and mortar.



### **Basic Strategy for Capacity Development**

*Training opportunities tailored to each target group, technical transfer through a cascade mechanism from TSB officers through agricultural extension officers to farmers, and also peer to peer extension*

In the four-year period of the project, the project aimed to help develop knowledge and skills of irrigation engineers and agricultural extension officers. In this regard, technologies were to be disseminated through a cascade mechanism from officers at province and district levels, through agricultural extension officers at block and camp levels, to farmers at field level (see figure below). Horizontal technical dissemination from ones to the other agricultural extension officers was also an important function of the capacity development. Thus, the combination of vertical and horizontal information dissemination was the key approach.



**Figure 3.2.1 Cascade-like Extension System**

Source: JICA T-COBSI Project Team (2017)

### **Basic Strategy to the Promotion of Irrigated Agriculture**

*Extension in selection of suitable crops, application of appropriate techniques, and improvement of soil conditions*

Irrigation development is not the end; it is a means to irrigated agriculture. To convert the “potential” of water resource into tangible benefit in a sustainable manner, the strategy in irrigated agriculture was focused on 1) selection of suitable crops, 2) application of appropriate techniques, and 3) improvement of soil conditions.



As for the selection of suitable crops, agricultural extension officers assist farmers to choose the appropriate crops, considering the aspects of: 1) nutrition status of household members, 2) level of farming technologies, 3) marketability, and 4) cost required. In such areas where marketability is high, crops need to be selected in light of 1) farmers' past experience in cultivation, 2) growing period, 3) main market targeted, 4) expected income, and 5) required condition when selling.

As for the appropriate technologies, rather than putting focus on developing a new technology, it was emphasized to utilize technologies already in existence. To this end, useful technologies identified by other project were utilized or representatives from other projects were invited to introduce their promoting technologies suitable to irrigated agriculture.

### 3.2.2 PROJECT ACTIVITIES

In order to extend small-scale irrigation schemes in wider area and to develop the capacity of the government officers, it was necessary that province and district TSB officers and extension officers were actively involved in the project activities. Every dry season, from April to December, a series of trainings for these government officers were carried out. The government officers were expected to formulate their own action plan using knowledge and skills learned in the training. This process had been continued as a routine during the project implementation period so that transferred technology should surely be rooted in this country.

Taking account the concept mentioned above, the Project conducted a series of activities which included Training of Trainers (TOT), Kick-off Training (KOT) for TSB officers and extension officers, and Mid-Term Training (MTT) for the training of marketing aspect as well as for mid-term monitoring of the officers' performance. In addition, TSB training specifically spared for TSB officers had started from 2015 as to train more technical issues required for the planning and construction of permanent weirs. Lastly, achievement of the officers' work was reported and the lessons were shared during the Annual Evaluation Workshop (AEW). The list of training and workshop is shown in the tables below.

**Table 3.2.1 Trainings in Each Year**

Irrigation Season												
Month	1	2	3	4	5	6	7	8	9	10	11	12
Main Target Area /				TOT	KOT	TSB		MT				AEW
TOT: Training of Trainers, KOT: Kick-off Training, TSB: TSB Training MT: Mid-term Training, AEW: Annual Evaluation Workshop												

Source: JICA T-COBSI Project Team (2017)

**Table 3.2.2 Main Contents of the Trainings and Workshop**

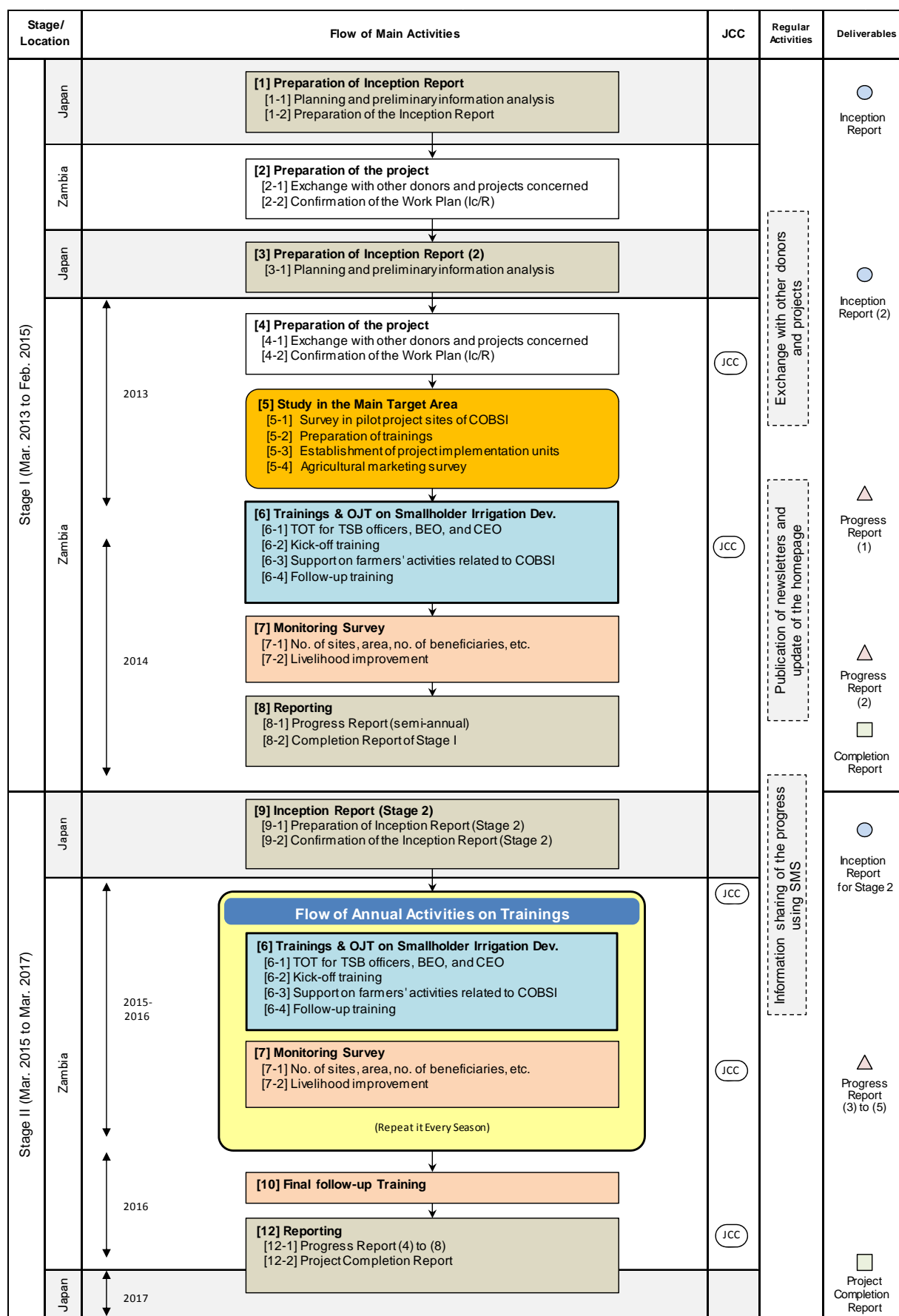
No.	Time	Title of workshop / training	Contents	Days/time	Participants and Venue
1	Apr	Training of Trainer (TOT)	It is training for the provincial and district TSB officers who are expected to be the trainer in the following trainings.	4 days (3 times in 3 years)	Provincial office 20 Trainer candidates <sup>1</sup> Venue: Kasama
2	May	Kick-off Training	This is the core training in the view of the expansion of smallholder irrigation schemes, including basic concepts for the project, basic policy for its implementation, sharing output and issues from COBSI project, methods for constructing simple weir and permanent weir, and irrigated agriculture.	5 days (3 times in 3 years)	Provincial & district level TSB officers, and Extension officers (CEO, BEOs) 92 officers in 2014 114 officers in 2015 107 officers in 2016 Venue: Kasama, Mansa

<sup>1</sup> Expected trainees are TSB staff and extension officers who participated in COBSI pilot project to construct weir.

N o.	Time	Title of workshop / training	Contents	Days/time	Participants and Venue
3	Jun	TSB Training	Special training on irrigation development associated with permanent weir construction exclusively for provincial and district TSB officers. On-site training and 4 day workshop.	4-day workshop with on-site training (2015 and 2016)	Provincial & district TSB officers 42 (Net) officers in 2015 46 (Net) in 2016 (4 times of TSB training were conducted in May, July, September in 2016, and March in 2017 as the Wrap-up) Venue: Kasama
4	Aug	Mid-term Training	Mid-term report of outputs and lessons from the activities by each participant in smallholder irrigation development after Kick-off training. Agricultural marketing methods will also be included as a part of training topics.	4 days (3 times in 3 years)	Trainees in Kick-off training and additional participants 92 officials in 2014 113 officers in 2015 98 officers in 2016 Venue : Kasama, Mansa
5	Nov	Annual Evaluation Workshop / Final Evaluation Workshop	Annual report of activities, sharing outputs and lessons learned from all the activities. One in the 2016 was the final evaluation of activities of entire period.	3 days (3 times in 3 years)	Trainees and participants in mid-term training and additional participants Evaluation Workshop 97 officers in 2014 123 officers in 2015 114 officers in 2016 Venue: Kasama, Mansa

Source: JICA T-COBSI Project Team (2017)





**Figure 3.2.2 Workflow of the Project**

Source: JICA T-COBSI Project Team (2017)

### 3.3 TRAINING AND WORKSHOPS

As described in the previous section, there were four major training events conducted every year that are: Kick-off Training, Midterm Training, TSB Training, and Annual Evaluation Workshop. The following briefly explains the outline of each training/workshop.

#### 3.3.1 KICK-OFF TRAINING (KOT)

As to spearhead the smallholder irrigation development in the target area, this project employed a cascade-like mechanism of technology dissemination, by which informative technologies goes along the government's agricultural extension system, coupled with an engagement of technical officers at Technical Service Branch (TSB) of the Ministry. In essence, a set of technologies or theories associated with irrigation, irrigated farming and marketing, were transferred from a smaller numbers of experts to a larger number of officers through stand-alone trainings and On-the-Job Trainings (OJT), as simplified as Figure 3.3.1.



**Figure 3.3.1 Cascade-like Technology Dissemination System**

Source: JICA T-COBSI Project Team (2017)

As a first step of this process, Training of Trainers (TOT) and the Kick-off Training have been conducted during April to May 2014 which is the first implementation year of the project. TOT was a training wherein integrated technologies and theories were transferred from Japanese experts to the counterpart personnel at provincial level. As the main contents of the training were associated with irrigation development, most of officers in the TOT were engineers of provincial TSB offices. On the other hand, the Kick-off Training was a training wherein the trained officers played a main role of trainers and taught technologies and theories to the district TSB officers and agricultural extension officers.

The objective of the Kick-off training was to disseminate technological information to agricultural extension officers particularly for simple weir irrigation schemes and to district TSB officers for permanent weir irrigation schemes. The following summarizes the participants and outline of both trainings.

#### 1) Training of Trainers (TOT)

In very beginning of dray season of each three year, TOT had been carried out in Kasama in April inviting several officers from each provincial office. Then, Kick-off Training was conducted in two places: one for the officers of Northern and Muchinga provinces at Kasama Farm Institute (KFI) located in Kasama and another for the officers of Luapula province at Mansa Farm Institute (MFI) in Mansa, Luapula province.

#### Participants of TOT

A total of 20 officers received the TOT for three years from 2014 to 2016 as Table 3.3.1 shows. The trainees of the TOT were expected to act as the trainers in the forth-coming Kick-off Training. Thus, these officers were required to have prior experience in general irrigation development or the pilot

project of the COBSI Study that was conducted in 2009-2011. Taking this into consideration in the first TOT of 2014, a total of 11 officers were invited to the TOT. Since, the number of trainees increased year by year with the aim of securing human resources capable of taking charge of lecturers for Kick-off training, and eventually reached 20 officers.

**Table 3.3.1 List of Participants in the TOT for KOT**

Province	Name	Position
Northern	Kenneth ZULU	Senior Irrigation Engineer (SIE)
	Mufalali SIFAYA	P-TSB, Senior Farm Power Mechanization Officer (SFPMO)
	Innocent B. MULAUI	Senior Land Husbandry Officer (SLHO)
	Bwembya Lawrence	P-TSB, Senior Land Husbandry Officer (SLHO)
	Elizabeth Nakamanga	P-TSB, Assistant Technical Officer (ATO)
	Kelvin SIMUKOKO	P-TSB, Senior Technical Officer (STO)
	Ackson MBEWE	P-TSB, Assistant Technical Officer (ATO)
	Annie BULAYA	P-TSB, Assistant Technical Officer (ATO)
Muchinga	David Tembo	P-TSB, Assistant Technical Officer (ATO)
	Frank Mporokoso	D-TSB, Assistant Technical Officer (ATO)
	Stephen Syansingu	P-TSB, Senior Technical Officer (STO)
	Kalolo Simbeya	D-TSB (Mpika), Assistant Technical Officer (ATO)
Luapula	Kellies Sakajila	D-TSB (Nakonde), Assistant Technical Officer (ATO)
	Mwamba Martin	D-TSB (Nakonde), Assistant Technical Officer (ATO)
	Sayila Mayson	P-TSB: Provincial Irrigation Officer (PIO)
	Chanda Obed	P-TSB: Senior Land Husbandry Officer (SLHO)
	Sinkolongo Jonathan	P-TSB: Provincial Technical Officer (PTO)
	Nicholas Chanda	P-TSB: Senior Land Husbandry Officer (SLHO)
Remmy Chibeyeye	P-TSB: Agricultural Specialist-Engineer (AS-Eng)	
Andrew Mwape	D-TSB (Mansa), Assistant Technical Officer (ATO)	

Source: JICA T-COBSI Project Team (2017)

### Training Program of TOT

A two-day training program was prepared as presented in Table 3.3.2. Most of the training modules were associated with general irrigation engineering for TSB officers to be able to plan, design, construct, supervise, operate and manage irrigation schemes. In particular, there were a total of seven modules: 1) program orientation, 2) overview of COBSI, 3) type of COBSI Schemes, 4) theory and preparation of field observation, 5) implementation of smallholder irrigation development, 6) appropriate farming technologies, and 7) entry planning and preparation, which is also followed by the preparation of the Kick-off Training. The training was conducted by presentation of power point materials and lecture.

**Table 3.3.2 Training Program of the Training of Trainers (TOT) for KOT**

<b>DAY 1 : Orientation and Introduction</b>
Module 1 - Program Orientation
Module 2 - Overview of COBSI
Module 3 - Type of COBSI Schemes (weir type, canal, ancillaries, etc.)
Module 4 - Theory and Preparation of Field Observation
Module 5 - Implementation of Smallholder Irrigation Dev. (permanent-weir)
<b>DAY 2 : Irrigation Planning and On-Farm Technologies</b>
Module 6 - Appropriate Farming Technologies
Module 7 - Entry Planning and Preparation

Source: JICA T-COBSI Project Team (2017)

## 2) Kick-off Training (KOT)

A series of Kick-off Training were conducted in Kasama Farm Institute (KFI) located in Kasama district, Northern province for those who are from the target districts of Northern and Muchinga provinces, and in Mansa Farm Institute (MFI) located in Mansa district, Luapula province for those who are from the target districts of Luapula province. The objective of the Kick-off training was to disseminate technological information to agricultural extension officers particularly for simple weir irrigation schemes and to district TSB officers for permanent weir irrigation schemes.



### Participants of KOT

Table 3.3.3 summarizes the number of participants in the Kick-off Training for three years from 2014 to 2016. As shown in the table, a total of 313 peoples participated in the KOT. 310 officers from the targeted districts participated including the trainers; 35 provincial TSB officers, 90 district TSB officers, and 185 extension officers as BEO and CEO. Three members were invited from National Union for Small-scale Farmers of Zambia (NUSFAZ) in 2014.

**Table 3.3.3 Number of Participants in KOT**

Category	2014	2015	2016	Total
Provincial TSB officer	11	13	11	35
District TSB officer	26	28	36	90
Extension Officer (BEO, CEO)	55	70	60	185
<b>Sub Total</b>	<b>92</b>	<b>114</b>	<b>107</b>	<b>310</b>
Others	-	3		3
<b>Total</b>	<b>92</b>	<b>114</b>	<b>107</b>	<b>313</b>

Source: JICA T-COBSI Project Team (2017)

Every time, profile of the participants was surveyed using the “pre-training knowledge inventory survey sheet,” which was distributed at the beginning of the training. Issues surveyed includes 1) Age, 2) year of experience in MOA, 3) problems they faced as government officers, 4) effort taken to solve the problems, 5) best experiences as government officers.

### Training Program of KOT

The training program of the Kick-off Training is shown as Table 3.3.4 as an actual program done in 2015's. On the first day, training was opened with program orientation including pre-training knowledge inventory survey. Then, in the module 2, outline of the T-COBSI project as well as its impact were explained so that participants was able to have a general idea what COBSI was all about. Also, the video presentation based on the experience in the previous year was presented (except for 2014), which covered the whole process of T-COBSI activities during a year. In the afternoon, weir types, canal, and ancillaries employed in the T-COBSI were presented as a theory and some technologies were practiced at the venue like construction of trigonal prop weir and drawing proper alignment of furrow using sprit line level.

On the second day, participants went on a field visit to see what simple irrigation scheme was and what permanent irrigation scheme was. In addition, on-farm irrigation methods was explained and practiced in the field, which was followed by the explanation of the Operation and Maintenance (O&M) of the irrigation schemes. Observation of the actual scheme helped participants understand the essence of the T-COBSI approach. It was especially important to understand the design concept of the permanent weir introduced by the T-COBSI project, which was a bit different from ordinal design in Zambia in terms of the safety level.

**Table 3.3.4 Training Program of the Kick-off Training**

#### **DAY 1: Orientation and Introduction**

##### *Module 1 - Program Orientation*

##### *Module 2 – Overview of T-COBSI*

10:00-10:45 Introduction to the T-COBSI Project

10:45-11:15 COBSI approach at glance (video)

##### *Module 3 –Type of COBSI Schemes (weir type, canal, ancillaries, etc.)*

12:30-12:45 Weir type and construction method (theory)

12:45-13:00 Canal alignment, ancillaries and potential diversion site (theory)

13:00-15:00 Weir construction and canal alignment (practice at the venue)

15:15-16:00 Environment and social consideration

16:00-16:30 Institution and gender mainstreaming

16:30-17:00 Preparation of the field observation (distribution of gumboots)

**DAY 2: Field Observation**

*Module 4 – Field Observation*

10:30-12:00	Field observation at a simple irrigation scheme
	- Contour ridge
	- On-farm irrigation
13:30-15:00	Field observation at a permanent irrigation scheme
	- Construction of permanent weir (theory)
	- Operation and maintenance (O&M)

**DAY 3: Irrigation Planning and On-Farm Technologies**

*Module 5 – Implementation of Smallholder Irrigation Dev. (permanent-weir)*

08:30-08:45	Implementation procedure
08:45-09:15	Selection of candidate sites
09:15-09:30	Items to be clarified by the investigation
09:45-10:00	Basic of irrigation planning
10:00-10:30	Preparation of basic plan
10:30-11:30	Irrigation plan: (1) water requirement
11:30-12:30	Irrigation plan: (2) On-farm irrigation plan
13:30-14:00	Practice of irrigation
14:00-14:30	Design of irrigation facilities

*Module 6 – Appropriate Farming Technologies*

14:30-15:00	Food and nutrition improvement through irrigated farming
15:15-15:30	Integrated soil fertility management (Biochar)
15:30-15:45	Contour ridge for soil conservation
15:45-16:00	Companion cropping
16:00-16:15	Appropriate technologies (RESCAP)
16:15-17:00	Planning demonstration sites

**DAY 4: Field Practice**

*Module 7 – Field Practice*

09:00-13:00	Construction practice of a simple diversion weir
14:00-15:00	Practice of canal alignment using spirit line level

**DAY 5: Entry Planning**

*Module 8 – Entry Planning*

08:30-12:00	Presentation and adjustment of the entry plans by district
12:00-12:30	Reporting mechanics
13:30-15:00	Selection of the districts for permanent-weir scheme development
15:00-15:15	Introduction of S3P project of IFAD
15:30-16:00	Distribution of dissemination materials

*Module 9 – Program Evaluation and Closing*

Source: JICA T-COBSI Project Team (2017)

On the third day, participants learned irrigation planning, which includes investigation procedure, environmental and social consideration, and detailed method of irrigation planning. As the module 6, appropriate farming technologies were addressed, which includes food and nutrition improvement, integrated soil fertility management using carbonized rice husks, contour ridge, and companion cropping. In 2014, this module was actually done at the Mid-term Training (MTT), then is shifted to the Kick-off Training in 2015 and 2016 as extension officers can start preparing the demonstration site as soon as the irrigation scheme is developed in their own place. To this end, planning demonstration sites was also organized in this module.

On the day four, a field practice was carried out, in which participants constructed a simple diversion weir and aligned a canal line using spirit line level. This became a basis of their extension activities in irrigation development, on which extension officers can sensitize farmers on the benefit of simple technologies and teach them how to construct it.

Fifth day was the final day of the Kick-off Training. Training itself was not meaningful unless officers apply it on the ground. In this concern, the Kick-off Training always ended with the planning of each

officer, called “entry planning.” Basically, it was to make their own plan in terms of number of site they develop and number of fellow officers they train. After confirming the monitoring systems, necessary materials, such as posters, leaflet, and manuals, were distributed and the training was closed upon the completion of the evaluation of the Kick-off Training. The training was led by the officers in charge of each day and each module, which was assigned during the TOT.

### 3.3.2 MID-TERM TRAINING (MTT)

#### *Participants of MTT*

The number of the Mid-term Training for the project implementation period of three years is summarized in Table 3.3.5. A total of 303 officers had participated in the training, composing of 6 PACO/PAO, 37 DACO/SAO, 36 district market development officers (DMDO), 34 provincial TSB officers, 32 district TSB officers, and 158 agricultural extension officers (BEO/CEO). In principle, agricultural extension officers were those who attended the Kick-off Training in the same year so that what they learn during the Mid-term Training can be applied in the sites they managed constructing smallholder irrigation schemes.

In the year of 2016, types of invitees were modified as same as that of year of 2015. In 2014, basically the same officers with those attended to the Kick-off Training were invited to the Mid-term Training: namely, provincial TSB officers as trainers, district TSB officers, and agricultural extension officers. However, district TSB officers were not invited in these two years of 2015 and 2016 because they are not in charge of marketing that was the core subject of the training. On the other hand, marketing officers were invited; they are expected to play a pivotal role in guiding the extension officers in the district especially for those who will be in charge of demo site where a series of market trainings are to be conducted.

In addition, SAO were invited. SAO are supervisors at district level and thus their contribution is essential for a better mobilization of agricultural extension officers. Therefore, they were invited for the first day of the Mid-term Training wherein the outline of T-COBSI was explained and the progress in simple-weir construction scheme in each district was reported. By welcoming these supervisors on board, improved arrangement of fuel distribution and actual conduct of weir construction can be expectedly improved.

**Table 3.3.5 Number of Participants in MTT**

Category	2014	2015	2016	Total
PACO, PAO	-	2	1	3
DACO, SAO	-	20	17	37
DMDO	-	18	18	36
Provincial TSB officer	13	10	11	34
District TSB officer	24	6	2	32
Extension Officer (BEO, CEO)	52	57	49	158
Others	3	-	-	3
Total	92	113	98	303

Source: JICA T-COBSI Project Team (2017)

#### *Training Program of MTT*

As shown in Table 3.3.6, Mid-term Training was conducted in a four-day period. On the first day, the training was opened by the program orientation, which includes the pre-training knowledge inventory survey, welcome remarks, self-introduction and overview of the training.

Then, as an introduction of the T-COBSI project itself particularly for the participants who came for the first time, i.e. Senior Agricultural Officer (SAO) and Market Development Officer (MDO) of the target districts, outline of the project was explained as “What’s T-COBSI.” Then, the introduction of SHEP approach was made by Mr. Banda, the Provincial Agriculture Coordinator (PACO) of Northern



province, in both trainings in Kasama and Mansa. In fact, Mr. Banda had participated in the JICA's SHEP training conducted in Japan and Kenya in 2014. Based on his own experience during that training, he made a thorough presentation about SHEP as well as his action plan on SHEP activity.

In the afternoon of the first day, presentation on the progress of simple-weir construction, permanent-weir construction, and demonstration plot in each district was made by the representative of each district, in principle by SAO. Some districts prepared PPT presentation employing some photos and others used a manual presentation material written on the flipchart. The progress of the simple-weir construction is summarized in Chapter 2). The first day was ended with the introduction of market-oriented farm activity, the introduction part of the SHEP practice. In this session, general idea of market-oriented farming activity and practical method of participatory market survey were explained.

On the second day, participatory market survey was actually practiced at the markets near the venue by the groups of officers. Participants visited the markets and interacted with the marketers to see what kinds of vegetables are being sold with which ranges of prices throughout the year. After the market survey, each group documented the market survey results, based on which crop ranking was done. Then, for the crops chosen, cropping calendars were prepared and the farm plan was verified.

On the third day, the action plan was formulated which is to carry out the farm plan they planned. In particular, problem analysis and objective analysis were carried out to finalize the plan. After, the participants are shared time for the introduction of the practical methods of gender mainstreaming, which continued until the fourth day of the training workshop. Gender mainstreaming is to find out any rooms for improvement associated with the roles of male and female through the comparison of current roles of each gender so that agricultural production and/or the income can be increased in the future. The Mid-term Training was completed upon the evaluation of the training and closing by PACO.

**Table 3.3.6 Typical Training Program of MTT**

<b>DAY 1: Introduction to the Project/ Project Progress/ Market Survey</b>	
<i>Module 1 - Program Orientation</i>	
<i>Module 2 –Introducing SHEP Approach and Action Plan of Northern Province</i>	
<i>Module 3 – Presentation of the Project Progress</i>	
13:00-15:00	Presentation by district
15:00-15:45	Lessons learned and challenges
<i>Module 4 – Participatory Market Survey</i>	
15:45-17:00	Introduction of market-oriented farm activity
<b>DAY 2: Market Survey/ Formulating a Farm Plan</b>	
07:30-08:30	Registration and recapitulation
<i>Module 4 – (Continued) Participatory Market Survey</i>	
08:30-09:00	Preparation of the participatory market survey
09:00-11:00	Conduct of participatory market survey
<i>Module 5 – Formulating a Farm Plan based on Market Information</i>	
11:00-12:00	Documentation of the market survey result
12:00-13:00	Lunch
13:00-15:00	Crop ranking and its selection
15:00-15:15	Health break
15:15-16:30	Preparation of cropping calendar
16:30-17:00	Verification of the farm plan
<b>DAY 3: Action Plan/ Gender Mainstreaming</b>	
07:30-08:30	Registration and recapitulation
<i>Module 6 – Formulating an Action Plan to Carry out the Farm Plan</i>	
08:30-09:00	Problem analysis
09:00-09:30	Objective analysis

09:30-10:30	Formulating action plan
10:30-10:45	Health break

*Module 7 – Organization / Gender Issues to be Considered for Agr. Development*

10:45-11:00	Training contents and section-1 ~Brain storming~
11:00-11:45	Exercise-1 of section-2 ~Who's role in daily life~
11:45-12:15	Presentation and discussion of exercise-1
12:15-12:30	Exercise-2 of section-2 ~Daily activity calendar~
12:30-13:30	Lunch
13:30-15:00	(Continued) Exercise-2 of section-2 ~Daily activity calendar~
15:00-15:30	Presentation and discussion of exercise-2
15:30-15:45	Health break
15:45-16:30	Exercise-3 of section-2 ~Who's role in irrigated farming~
16:30-17:00	Presentation and discussion of exercise-3

**DAY 4: Gender Mainstreaming/ Program Evaluation**

07:30-08:30 Registration and recapitulation

*Module 7 – (Continued) Organization/ Gender Issues to be Considered for Agr. Development*

08:30-09:45 Exercise-4 of section-3 ~Action plan making~  
09:45-10:15 Presentation and discussion of exercise-4

*Module 8 – Program Evaluation and Closing*

10:15-10:30 Evaluation of the training program  
10:30-11:15 Closing

Source: JICA Project Team, 2017

### 3.3.3 TSB TRAINING (TSB)

#### 1) Introduction

During the Kick off Training conducted in 2014, technical training was conducted only for TSB officers for two days separately from CEOs. However, the Project Team considered that practice for construction of simple weir is also useful for TSB officers and more practical training for design and construction of permanent weir is effective. Therefore, the Project Team decided to conduct an additional technical training for TSB officers.

**Table 3.3.7 Schedule of TSB Taining**

Date	Training item
May 27 and 28, 2015	Training on site survey (Northern Province)
June 1, 2015	Training on site survey (Muchinga Province)
June 1 and 2, 2015	Training on site survey (Luapula (1))
June 4 and 5, 2015	Training on site survey (Luapula (2))
June 8-11, 2015	Implementation of permanent weir project
May 27, 2016	Temporary work and layout of the weir
July 15, 2016	Design report, construction of weir
September 29 and 30, 2016	Preparation of S3P project, GPS, construction of intake

Source: JICA T-COBSI Project Team (2017)

#### 2) Training on Site Survey in 2015

##### Participants

Training on site survey was conducted from May 27 to 28 in Nsama district, June 1 in Shiwang'andu district, June 1 and 2 in Mansa district, June 4 and 5 in Mwansabombwe and Kawambwa districts.

**Table 3.3.8 Number of Participants in the Training on Site Survey**

Province	TSB Officers (District)	Date	Location	Number of participants
Northern	All of Northern	May 27, 28	Nsama district	13
Muchinga	All of Muchinga	June 1	Shiwang'andu district	13
Luapula (1)	Mansa, Chembe, Mwense, Chipili, and Milenge	June 1, 2	Mansa district	9

Province	TSB Officers (District)	Date	Location	Number of participants
Luapula (2)	Mwansabombwe, Kawambwa, and Nchelenge	June 4, 5	Mwansabombwe district, Kawambwa district	6

### Training Program

Training items were: surveying natural conditions, environmental conditions and socio-economic conditions. Surveying natural conditions including river cross-section survey was done at the proposed weir site. Socio-economic condition survey was done through the interview to farmers.



*Practice on surveying with auto-level*



*Interviewing farmers on socio-economic view point*

### 3) TSB Training 2015

TSB Training 2015 was conducted in Kasama Farm Institute (KFI) in Kasama district, Northern province for those who are from the target districts of Northern, Muchinga and Luapula provinces. The objective of the TSB training was to learn procedure of actual design of permanent weirs for candidate sites. The following summarizes the participants and outline of the training.

#### Participants

Number of participants is summarized in Table 3.3.9 by category. The total number of participants reached 42 officers, which is composed of 5 females (12%) and 37 male (88%). By province, total numbers of participants are: 14, 10, and 18 in Northern, Muchinga and Luapula provinces respectively. Average ages of the participants are nearly the same among the provinces: 39.6, 37.4 and 40.8 respectively, which result in 39.7 years old as an overall average of the three provinces.

**Table 3.3.9 Profile of Participants by Sex, Age and Experience in MAL**

Item	Sex			Age	Experience in MAL		
	Female	Male	Total	Average	Ave.	Max	Min
<b>Northern</b>							
Provincial TSB	0	4	4	42.3	15.5	27.0	2.0
District TSB	3	7	10	38.6	10.7	23.0	2.0
Sub Total/Ave.	3	11	14	39.6	12.1	27.0	2.0
<b>Muchinga</b>							
Provincial TSB	0	1	1	38.0	1.0	1.0	1.0
District TSB	0	9	9	37.4	11.4	30.0	2.0
Sub Total/Ave.	0	10	10	37.4	10.1	30.0	1.0
<b>Luapula</b>							
Provincial TSB	0	3	3	45.7	20.0	28.0	9.0
District TSB	2	13	15	39.8	13.5	32.0	1.0
Sub Total/Ave.	2	16	18	40.8	14.6	32.0	1.0
<b>Provincial TSB</b>	0	8	8	43.0	15.4	28.0	1.0
<b>District TSB</b>	5	29	34	38.8	12.2	32.0	1.0
Grand Total/Ave.	5	37	42	39.7	12.8	32.0	1.0
	12%	88%	100%				

Source: JICA T-COBSI Project Team (2017)



### Training Program

On the first day, training was opened with program orientation including pre-training knowledge inventory survey. Then, in the module 1, 2 and 3, implementation procedure, selection of candidate site and site investigation presented in KOT was reviewed according to the actual activities so far done by the time of TSB training. In the module 4, participants learned basic concept of design. They learned how to decide elevations and dimensions of permanent weir. In the afternoon, utilization of GPS and Google earth was introduced and calculation of irrigation water requirement with CROPWAT was practiced.



*JICA expert instructs how to make drawings.*

On the second day, participants learned how to make drawings for permanent weir. The participants tried to draw cross section of river, longitudinal section and plan of permanent weir based on the actual survey result of candidate sites for up-grading during the OJT on site investigation. They also learned how to decide the elevations of permanent weir.

On the third day, participants continued making drawings. After completion of drawings, they calculated quantity of stone masonry, sand, rubble stones and cement. According to the calculated quantity, they estimated the cost for permanent weir. On the fourth day, TSB officers continued finalizing quantity and cost for permanent weir. After finalizing the cost estimation, they made a comparison table including technical view, farming and O&M, social and environmental view, socio-economic view and overall evaluation based on the information and data obtained in the OJT on site investigation. Finally, according to the comparison table, they prioritized the candidate schemes.

#### **4) TSB Training 2016**

In 2016, TSB training focused construction and construction control of permanent weir and it was three staged as initial stage, middle stage and final stage. TSB Training was conducted in Kasama Farm Institute (KFI) and Musanda scheme in Kapanda camp in Kasama district, Northern Province for those who are from the target districts of Northern, Muchinga and Luapula provinces. Second and third training were funded by 2KR counterpart fund.

### Participants

The first training was conducted on May 27, the second one on July 15, and the third one on September 29 and 30, 2016, gathering a total of 131 participants.

**Table 3.3.10 Number of Participants of TSB Training 2016**

Training	Date	Number of participants			
		Northern	Muchinga	Luapula	Total
The first	May 27, 2016	16	12	17	45
The second	July 15, 2016	16	10	16	42
The third	September 29 and 30, 2016	14	12	18	44
<b>Total</b>		<b>46</b>	<b>34</b>	<b>51</b>	<b>131</b>

Source: JICA T-COBSI Project Team (2016)

### Training Program

In the first training, participants reviewed which they had learnt in training conducted in 2015 and visited Musanda site in Kasama district where permanent weir construction started in May 2016 and they confirmed the layout of temporary facilities and how to construct cofferdam and river diversion, how to carry out excavation of foundation and de-watering.

In the second training, participants learned how to prepare design report for permanent weir and how to do surveying the elevation of important positions on the site and weir itself, mortar work including measurement of volume of sand, mortar mixing, ferrying mortar and mortar placing work including ferrying stones at site.

The third training was conducted in two days. On the first day, the participants learned the procedure to apply S3P project and prepared implementation schedule for making documents which will be submitted to S3P. Districts which are not covered



*TSB participants practically learned how to construct weir body at actual construction site in Kasama*

S3P project also prepared implementation schedule of such documents to find the support from other donors. In the module 3, they learnt how to use GPS for measurement of irrigated area, length of furrow and alignment of furrow. On the second day, they visited Musanda site and then confirmed if construction is being progressed as the drawing shows. Further, participants practiced to construct intake, intake furrow, and installation of stop-log and demobilized temporary facilities. Surveying with GPS was practiced too.

### 3.3.4 ANNUAL EVALUATION WORKSHOP (AEW)

A series of the workshop were conducted to confirm and share the achievement and the experience of the officers in community-based smallholder irrigation development at the end time of dry season in each year from 2014 of 2016, which were normally implemented in November or December. The workshops were held at Kasama Farm Institute (KFI) invited the officers of Northern and Muchinga Provinces and at Mansa Farm Institute (MFI) invited the officers of Liapula Province. This chapter shares about participants and workshop program to grasp overview of the workshop at first, and then reports outputs from several aspects raised by participants of the final evaluation workshop held in November 2016.

#### 1) Participants and Workshop Program

##### Participants

During the project implementation period for three years from 2014 to 2016, a total of 334 officers have participated in the workshop. The total number is composed of 97 in 2014, 123 in 2015, and 114 in 2016. Among them, 50 DACO/SAO, 33 are provincial TSB officers, 87 are district TSB officers, and 163 are extension officers either BEO or CEO. So, about 49% of the participants were extension officers who had been engaged in smallholder irrigation development through the three years. Number of participants is shown in Table 3.3.11 below

**Table 3.3.11 Number of Participants in AEW**

Category	2014	2015	2016	Total
PAO	1	0	0	0
DACO, SAO	12	20	18	50
Provincial TSB officer	11	11	11	33
District TSB officer	25	29	33	87
Extension Officer (BEO, CEO)	48	63	52	163
Total	97	123	114	334

Source: JICA T-COBSI Project Team (2017)

The AEW in 2016 was held as the final evaluation workshop to discuss the T-COBSI comprehensively.

##### Workshop Program

This section introduces workshop program of the final evaluation workshop held in 2016. The objectives and arrangement of participants are summarized in Table 3.3.15 and the workshop program at that time is shown as Table 3.3.16. It is composed of four main topics: simple scheme, permanent schemes, demo, and overall evaluation of the project. In order for making the workshop fruitful, participants were divided into two groups: TSBs and BEOs/CEOs as the first group attended to discuss achievements and lessons in terms of simple scheme, permanent scheme and demo-site developed in 2016 dry season, which were on the first and second day. Then, on the third day, SAO and TSBs as the second group evaluated what T-COBSI has done since 2013.

On the first day, the workshop started with recollection of the T-COBSI activities carried out in dry season of 2016 by slides and videos. Then, participants presented their achievements in simple scheme development by using power-point material which was prepared by participant in advance. The presentations made by district were followed by the crossover comparison of the achievement among the districts so that participants can have objective point of view for each district.

On the second day, the participants focused the topic of permanent scheme construction. The presenters represented each permanent site reported the construction process, lessons, finding and recommendation so that even the participants who didn't take part in the permanent weir construction can get a whole picture of how the permanent weirs were constructed. The other main topic on the second day was the presentation of demo-site activities, which include the progress in baseline survey, establishment of demo-plot, introduction of market oriented irrigation farming, and gender analysis.

As the last session on the second day, T-COBSI activities during 2016 dry season were reviewed from several aspects. Participants were required to discuss proud achievement and events as well as challenges and actions take on the field, which were presented by representative of district to share the lessons and experiences among all.

On the last day, SAOs and TSBs evaluated T-COBSI. Presentations on smallholder irrigation development during the project whole period from 2013 to 2016 were made by district. Then, the participants discussed T-COBSI project from advantage, disadvantage, lessons learned, challenges, and way forward the irrigation development in Zambia points of view. Lastly, the officers confirmed what T-COBSI has done and concluded what T-COBSI is.

The objectives and the program of final evaluation workshop are below.

**Table 3.3.12 Objectives and Participants of the Final Evaluation Workshop**

Schedule	Participants Requested to Attend	Activities and Objectives
Day 1 to Day 2	TSB officers, and BEOs/CEOs participated in 2016	<ol style="list-style-type: none"> <li>1) Report the simple weir scheme development in each district in 2016</li> <li>2) Report the permanent weir scheme development in each district in 2016</li> <li>3) Report the demo activities in each district in 2016</li> <li>4) Share lessons learned from the smallholder irrigation development in 2016</li> </ol>
Day 3	SAOs and TSB officers participated since 2013	<ol style="list-style-type: none"> <li>1) Report the simple weir scheme development in each district from 2014 to 2016</li> </ol>

Source: JICA T-COBSI Project Team (2017)

The AEW in 2016 was held as the final evaluation workshop to discuss the T-COBSI comprehensively.

**Table 3.3.13 Program the Final Evaluation Workshop in 2016**

**DAY 1: Review of Simple Scheme Dev. in 2016 | TSB and BEOs/CEOs**

**Module 1: Program Orientation**

07:30-08:00	Registration and filling up of the questionnaire
08:00-09:00	Opening remarks, self-introduction, overview of the workshop, in-house issue Explanation of the preparation of presentation material for each module



Collection of fuel receipts, and fuel distribution records (monthly record)  
 Collection of the monitoring format (one set for BEO/CEO, other one for TSB, and one for SAO/TSB)

**Module 2: Recollection of the T-COBSI Activities in 2016 Dry Season**

09:00-09:30 Presentation on the T-COBSI activities in 2016 dry season (slides & video)  
 09:30-09:45 Explanation of terminologies related to T-COBSI

**Module 3: Output Presentation of Simple Scheme Development**

09:45-10:30 Finalization of the monitoring Form (TSBs, total as district ) and Form (CEOs/ BEOs as individual) and preparation of presentation material (PPT) by district

Note: Finalize the monitoring Formats based on the monitoring sheets distributed during Kick-off training in May (one for BEO/CEO, and another for TSB).

10:30-10:45 Health Break

10:45-12:30 Presentation on simple weir development in each district including the champion sites in the district (15 min/district by 11 districts) | Indicators are shown

Note: Presentation material is prepared by the District TSB officer in advance  
 Major indicators of the achievements, i.e., number of sites developed, number of household, length of canal dug, area irrigated, etc. are presented according to the Formats prepared on the projector

12:30-13:30 Lunch

13:30-15:00 Presentation continues

15:15-16:00 Crossover comparison of the districts

16:00-17:00 Discussion on the lessons, findings and recommendation on simple weir schemes  
 Selection of the king of the champion sites

Note: Indicators suggested are: area irrigated, on-farm irrigation, O&M, area improved, length of furrow, gender consideration, enthusiasm of farmers group, adaptation of technologies, etc.

17:00-17:15 Submission of Forms by district (for those who did not submit in the morning)

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**DAY 2: Permanent Scheme and Demo in 2016**

07:30-08:00 Registration

08:00-08:30 Recapitulation (2 from the participants)

**Module 4 – Lesson Sharing on Permanent Weir Schemes**

08:30-09:30 Presentation of the general information, the construction process, issues raised etc. by site (20 min/site by 3 sites in Mungwi, Kasama, Isoka)

Note: Presentation material (PPT) is prepared by the District TSB officer concerned in advance  
 PPT includes the dimensions of the weir, findings, lessons, challenges, technical aspect they have learned, and recommendations, etc.

09:30-10:30 Discussion on the lessons, findings and recommendation on permanent weir schemes

Note: Reporting and discussion of what TSB learned through TSB trainings

As plenary session, discuss over the all issues in implementing the construction of permanent schemes, which should be extended to the area of administrative issues and the technical issues.

Discussion will be facilitated by using flip chart.

10:30-10:45 Health break

**Module 5 – Output Presentation of Demo-Site Activities**

10:45-12:30 Presentation of demo-site activities by district (10 min /district)

Note: Presentation material is prepared by the participants in advance.

Representative of the district makes a presentation on demo site activities, which have been conducted in each district.

Activities conducted are confirmed along with the planning format of the demo site, such as 1) selection of 10 farmers, 2) baseline questionnaire survey to the 10 farmers, 3) preparation of demo plot, 4) market survey training, 5) gender training.

Particularly for the demo-plot, size of the plot, type of the technology applied, the types of crops planted, and amount of inputs need to be clarified.

12:30-13:30 Lunch

13:30-14:00 Discussion on the lessons, findings and recommendation (for the future)

**Module 6 – Sharing Lessons on T-COBSI Activities during 2016 Dry Season (General)**

14:00-16:00 Preparation and speech of proud achievements / challenges (10 min/district)

Note: Format is distributed to the participants

Each district makes a speech on the proud achievement and challenges

16:00-16:15 Health break

**Module 7 – Training Evaluation**

16:15-16:50 Submission of the monitoring formats (final)

Note: All kinds of formats, which have been finalized by the participants, are collected. Payment for the allowance is made upon the submission of all these formats.

16:50-17:00 Closing of the first session for 2016 activities with BEO/CEOs

17:00- Provision of DSA (if time does not allow, provision of DSA will be done on the following day)  
 Gathering to Venue (SAO)

Preparation of the presentations and location map of the simple-weir sites by district

### DAY 3: Evaluation of T-COBSI Project (2013-2016) SAO/TSB

Home Sweet Home (BEO/CEO) after the payment of DSA07:30-08:30 Registration and recapitulation

07:30-8:00 Registration (SAO/TSB)

8:00-8:15 Opening remarks, self-introduction, overview of the workshop, in-house issue, submission of the list of potential camps, and officers yet trained, submission of the form in simple-weir irrigation development up to 2016 (2014-2015 sites).

8:15-10:15 Presentation on smallholder irrigation development during the T-COBSI whole period by district (15 min /district by a total of 11 districts: Northern Province: 6district, Muchinga Province: 5 districts = a total of 2:45 net hrs)

10:15-10:30 Health break

10:30-12:00 Presentation continues

12:00-13:00 Lunch

13:00-15:00 Discussion and conclusion of smallholder irrigation development in the project area (advantage, disadvantage, lessons learned, challenges, way forward toward the irrigation development in Zambia).

15:00-16:00 Finalization of the location map of the simple weir sites in each district

16:00-16:30 Confirmation of the further schedule

Closing

Provision of DSA

Source: JICA T-COBSI Project Team (2017)

## 2) Findings from the Workshop

During the 3-days workshop, the officers shared extensive outputs from experience they had. In the session of Day-1 and Day-2, TSBs and BEOs/CEOs presented best experience, challenges, efforts taken, etc. which they acquired by participating T-COBSI activity in 2016 dry season. And then, on Day-3, SAOs and TSBs comprehensively evaluated T-COBSI project itself from several aspects. The discussions the officers did are summarized as follows.

### Outputs from TSBs and BEOs/CEOs

#### a) Best Experience

TSBs and BEOs/CEOs have had prior experiences that they are proud of. Among them, the most popular one is “construction of simple weirs” followed by “construction of permanent weir”. Although these top two shares 50% of all answer, some specified such as “knowledge transfer”, “increase the area under irrigation” and “capacity development”. It implies that government offices are delighted when they are of assistance of farmers. The table below summarizes officer’s responses.

**Table 3.3.14 Officer’s Best Experiences in T-COBSI Project**

Description	KFI	MFI	TOTAL	%
Construction of simple weirs	23	16	39	30%
Construction of permanent weirs	17	9	26	20%
Interacting with farmers	7	4	11	9%
Diversion of water	5	3	8	6%
Canal alignment	5	3	8	6%
Knowledge transfer	4	3	7	5%
Market oriented farming	4	1	5	4%
TSB trainings	3	1	4	3%
Increase the area under irrigation	3	1	4	3%
Surveys	3	1	4	3%
Capacity building	2	1	3	2%
Improvement of farmers livelihood	3	0	3	2%
Nothing	2	1	3	2%
Host horticultural field day	2	0	2	2%
Site investigation	1	1	2	2%
<b>TOTAL</b>	<b>84</b>	<b>45</b>	<b>129</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### b) Challenges Faced in T-COBSI Program

The table below shows that “lack of transportation” is the top challenge for the officers, which is also

negatively supported by “low GRZ funding” claimed among the officers. These issues were repeatedly taken up in the discussion, together with another challenge of “no field allowance”. Some listed climatic condition like “drying up of streams”. The other challenges for officers are related to mobilization of farmers such as “lack of participation and cooperation”, “low adoption rate by farmers”, and “difficult to mobilize farmers because of elections in 2016”. These answers show that officers are facing challenges in working with farmers.

**Table 3.3.15 Officer’s Challenges in T-COBSI Project**

Description	KFI	MFI	TOTAL	%
Lack of transportation	33	12	45	46%
Drying up of streams	9	6	15	15%
Lack of participation and cooperation	8	6	14	14%
Low adoption rate by farmers	4	5	9	9%
No field allowances	2	4	6	6%
Difficult to mobilize farmers because of elections	1	2	3	3%
Low GRZ funding	0	3	3	3%
Delay in distribution of fuel	1	1	2	2%
Others	1	0	1	1%
<b>TOTAL</b>	<b>59</b>	<b>39</b>	<b>98</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### c) Efforts Made to Overcome the Challenges

Some efforts were taken to overcome the challenges mentioned above. “Holding sensitization meeting” was the most frequent followed by “asked from the farmers” and “formation of simple weir committees”. In order to cope with lack of transportation, some officers “worked in collaboration with other stakeholders” and also some pointed “hiring for transport and booking”. They tackled on the matter of transportation by borrowing other officers’ motorbike means of transportation and fuel.

**Table 3.3.16 Efforts Made by Officers to Overcome the Challenges**

Description	KFI	MFI	TOTAL	%
Holding sensitization meetings	9	12	21	24%
Worked in collaboration with other stakeholders	16	3	19	22%
Hiring for transport and booking	15	3	18	21%
Use of personal transport	9	6	15	17%
Asked from the farmers	4	2	6	7%
Formation of simple weir committees	2	3	5	6%
Others	3	0	3	3%
<b>TOTAL</b>	<b>58</b>	<b>29</b>	<b>87</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### d) Advantage of Simple Weir

It was asked what advantages of promoting simple weir scheme are in this part of Zambia area. The most popular reason was “easy and cheap to construct” supported by the answer of “promote the use of locally available materials”. Other officers see the advantage from farmers’ life aspect such as “improved farmers’ livelihood” and “increase food production all year round” because the irrigated agriculture makes it possible for farmers to produce crops/ vegetables during dry season.

**Table 3.3.17 Advantages of Simple Weir**

Description	KFI	MFI	TOTAL	%
Easy and cheap to construct	22	6	28	26%
Promote the use of locally available materials	18	2	20	19%
Improved farmers livelihood	10	6	16	15%
Increase food production all year round	6	9	15	14%
There is abundance of water	6	8	14	13%
Increase the area under irrigation	4	2	6	6%
Easy to carry out operation and Maintenance	4	1	5	5%
Labor is reduced on irrigation	1	2	3	3%
Nothing	1	0	1	1%
<b>TOTAL</b>	<b>72</b>	<b>36</b>	<b>108</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)



### e) Disadvantage of Simple Weir

The most dominant answer in terms of disadvantage of simple weir was related to hard work: “labor intensive because maintenance is done every year”. The low durability was also addressed such as “washed away during the rainy season”. These two points were considered as two sides of the same coin. Some listed a structural feature of simple weir as “low water levels”. Although the response of “deforestation” was not so frequent, this shows a point to be aware of when simple weir is constructed.

**Table 3.3.18 Disadvantages of Simple Weir**

Description	KFI	MFI	TOTAL	%
Labor intensive because maintenance is done every year	16	7	23	27%
Low water levels	5	9	14	16%
Washed away during the rainy season	9	5	14	16%
Need to construct permanent weirs	4	2	6	7%
Lack of participation by farmers	1	5	6	7%
Inadequate inputs	3	1	4	5%
Deforestation	2	2	4	5%
Lack of transportation	3	0	3	3%
Others	9	3	12	14%
<b>Total</b>	<b>52</b>	<b>34</b>	<b>86</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### f) Reason for Promoting Simple Irrigation Schemes

It was asked if the promotion of the simple irrigation is important in agricultural extension work or not. 99% (87 out of 88) of participants responded it is necessary to promote simple weir. Among them, the most frequent answer was that “farmers have an opportunity of farming all year round” and then the second rank was “promotes income generation”, which share more than 50% of all answers. The other officers refereed existence of natural resources in the project area and effective usage of them, such as “because there is abundant water” and “use of locally available materials”.

At the same time, easy construction without much money (“they are cheap and easy to construct”) can be seen as following responses to support the simple weir construction despite the fact that hard work and low durability were also pointed out hereinbefore as disadvantages. As sum up, officers believe that promoting simple weir is a key to improve farmer’s livelihood through the step of increasing productivity and generating income.

**Table 3.3.19 Reasons for Promoting Simple Irrigation Scheme**

Description	KFI	MFI	TOTAL	%
Farmers have an opportunity of farming all year round	13	12	25	28%
Promotes income generation	9	12	21	24%
They are cheap and easy to construct	11	2	13	15%
Promotion of Irrigated Agriculture	9	4	13	15%
Because there is abundant water	6	0	6	7%
Use of locally available materials	2	3	5	6%
There is interaction between officers and farmers	2	2	4	5%
Others	1	0	1	1%
<b>Total</b>	<b>53</b>	<b>35</b>	<b>88</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### g) Action to Improve Farmers’ Livelihood

The table below summarized the participants’ perception on the action to be taken by officers themselves for further improvement of farmers’ livelihood. The most frequent response was “facilitate, promote and monitor irrigated agriculture and livelihood programs” followed by “conduct sensitization meetings and trainings on market survey” and “encourage farmers on community based smallholder irrigation”. There top three answers shares nearly 80% of all responses. It seems that officers wish to improve farmer’s livelihood through continuously promoting irrigated agriculture by conducting training for farmers. “Promote the construction of weir” and “continue disseminating

T-COBSI technology information” come as the next frequent answers, which also seem to be officer’s willingness for improvement of farmers’ livelihood.

**Table 3.3.20 Officer’s Next Action to Forward Development**

Description	KFI	MFI	TOTAL	%
Facilitate, promote and monitor irrigated agriculture and livelihood programs	13	12	25	30%
Conduct sensitization meetings and trainings on market survey	18	6	24	29%
Encourage farmers on community based smallholder irrigation	8	6	14	17%
Promote the construction of weirs	7	3	10	12%
Continue disseminating T-COBSI technology information	5	4	9	11%
Others	2	0	2	2%
<b>TOTAL</b>	<b>53</b>	<b>31</b>	<b>84</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### **h) Action Farmers have to Take for Further Improvement**

It was asked what is necessary for farmers to improve their own livelihood. Nearly 80% of valid responses were related to T-COBSI technology and irrigation farming such as “adopt and implement the T-COBSI technologies”, “farmers should have interest in irrigation farming” and “construct weirs”. “Get involved in irrigated market oriented agriculture” and “grow crops that are marketable” of the answer came to the next. It seems that the officers got a perception of advantage of market oriented irrigation farming by participating in MTT.

**Table 3.3.21 Farmer’s Next Action to be Expected for Further Development**

Description	KFI	MFI	TOTAL	%
Adopt and implement the T-COBSI technologies	18	12	30	42%
Farmers should have interest in Irrigation farming	12	2	14	19%
Construct weirs	4	8	12	17%
Get involved in irrigated market oriented agriculture	5	4	9	13%
Grow crops that are marketable	3	2	5	7%
Others	1	1	2	3%
<b>TOTAL</b>	<b>43</b>	<b>29</b>	<b>72</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### **i) What Government Have to Take for Further Improvement of Smallholder Farmers**

The table below shows the officers expectation and/ or perception of what kinds of action government have to be taken for further improvement of small scale farmer’s livelihood. The majorities were “increase funding allocation to promote irrigated agriculture” and “provide adequate resources such as transport and logistics”, which are talking about budget allocation. There responses related to funding shares more than 80% of all the answers indeed. Scarce of funding to the project by government is crucial issue.

**Table 3.3.22 Officer’s Expectation to the Government**

Description	KFI	MFI	TOTAL	%
funding allocation to promote irrigated agriculture	21	13	34	45%
Provide adequate resources such as transport and logistics	18	11	29	39%
Government should empower farmers by funding them	3	3	6	8%
Engage other donors	1	3	4	5%
Others	0	2	2	3%
<b>TOTAL</b>	<b>43</b>	<b>32</b>	<b>75</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### **j) Action Donors have to Take for Further Improvement of Smallholder Farmers**

Lastly, officers’ expectation to donors was asked. The officers have high expectation for what donors bring to them and how donors should support them. Most frequent response out of 75 valid responses was to “continue funding the irrigation project fully” followed by “partner with the government in

providing adequate resources”. And “mobilize resources and conduct trainings” came to the top three. It is important for officers to participate the workshop/training to career up. Officers also want to train farmers to extend their skill of agriculture. Request for the allowance is always taken up as the main issue as same as the request for transportation with fuel: “provide adequate transport and allowances”.

**Table 3.3.23 Officer’s Expectation to Donors**

Description	KFI	MFI	TOTAL	%
Continue funding the irrigation project fully	16	17	33	44%
Partner with the government in providing adequate resources	11	6	17	23%
Mobilize resources and conduct trainings	7	4	11	15%
Provide adequate transport and allowances	6	3	9	12%
Others	2	3	5	7%
<b>TOTAL</b>	<b>42</b>	<b>33</b>	<b>75</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### **Outputs from SAOs and TSBs**

This session reports the outputs from SAOs and TSBs, which was discussed on the last day of workshop. The officers reviewed 3 years activities of T-COBSI and assessed the project from several aspects such as T-COBSI project itself, methodology of T-COBSI approach and room for improvement, promotion of smallholder irrigation and possibility of it in other area, permanent weir scheme, simple weir scheme, farming technology, and institutional development and gender mainstreaming.

#### **a) T-COBSI Project | Positive and Negative Point**

SAOs and TSBs discussed positive and negative points of T-COBSI. As per positive point, “promotion of smallholder irrigation” as not only conceptually but also practically was the most popular answer followed by “knowledge and skills”, and “technical transfer”. It seems that there three indicates officers’ interesting in technical and movement of smallholder irrigation brought by T-COBSI. The others also support the top three response such as “provides support and capacity building”, “providing resources, materials and equipment”, “conduct trainings”, and “knowledge on weir construction”. Some pointed out one of impacts of the project as “realization of income generation”.

**Table 3.3.24 Positive Point of T-COBSI**

Description	KFI	MFI	TOTAL	%
Promotion of stallholder irrigation	12	4	16	24%
Knowledge and skills	8	2	10	15%
Technology transfer	6	3	9	13%
Income generation	4	4	8	12%
Provides support and capacity building	4	4	8	12%
Providing resources, materials and equipment	2	3	5	7%
Conduct trainings	2	3	5	7%
Knowledge on weir construction	2	2	4	6%
Others	2	1	3	4%
<b>Total</b>	<b>42</b>	<b>26</b>	<b>68</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

Although 29% of participants gave “no negative impact”, “poor funding (DSA)” and “lack of transportation” were listed with almost same frequency to the top. As it was discussed in previous part, budgetary issue is often raised whenever this kind of workshop is held as a crucial matter for officers to implement the project properly. “Others” was accounted for 19%, which implied “too much concentration on simple weir scheme, impact could be more if permanent weirs where developed”, “limited number of camps targeted to disseminate T-COBSI idea”, and so on.

**Table 3.3.25 Negative Point of T-COBSI**

Description	KFI	MFI	TOTAL	%
No negative impact	8	9	17	29%
Poor funding (DSA)	3	7	10	17%
Lack of transportation	4	2	6	10%



Description	KFI	MFI	TOTAL	%
Inadequate time for trainings	2	2	4	7%
Minimal involvement of the government personnel	2	2	4	7%
Limited resources	2	1	3	5%
Temporal sites not sustained	2	0	2	3%
Too much paper work	0	2	2	3%
Others	8	3	11	19%
<b>Total</b>	<b>31</b>	<b>28</b>	<b>59</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

## b) T-COBSI Project | Lessons Learnt

The officers have learnt a lot as seen in the table, in fact. “Construction of simple weir” and “construction and design of permanent weirs” were the top two responses which accounted for a half of all answers. Others also suggested that there were several kinds of technical lessons as “irrigation technology”, “market oriented agriculture”, “use of GPS and dumpy level”, and so on.

**Table 3.3.26 Lessons Learnt from T-COBSI**

Description	KFI	MFI	TOTAL	%
Construction of simple weir	21	12	33	28%
Construction and design of permanent weirs	15	10	25	21%
Irrigation technology	7	3	10	9%
Use of GPS and dumpy level	3	6	9	8%
Market Oriented Agriculture	5	3	8	7%
Use of locally available materials	4	2	6	5%
Water utilization and management	2	2	4	3%
Promotion and implementation of irrigated agriculture	1	3	4	3%
Contour ridge	2	1	3	3%
Inter-cropping and companion cropping	1	1	2	2%
On-farm irrigation	1	1	2	2%
Canal alignment	0	2	2	2%
Others	6	3	9	8%
<b>Total</b>	<b>68</b>	<b>49</b>	<b>117</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

## c) T-COBSI Project | Cooperating Approach by JICA Project in Agriculture Sector

Although several responses were appeared, it seems that officers positively consider the cooperating approach taken by JICA project in agriculture sector in general, such as “should continue supporting irrigated agriculture”, “expansion of T-COBSI to other areas”, “the approach should be adopted by the ministry for continuity even in other provinces”, and “continue conducting trainings through workshops”. Apart from the opinion of this kind, some emphasized importance to know new technology and to monitor the results of project; “to introduce more other new technologies” and “To monitor and ensure that targets are achieved”. As it is discussed repeatedly, funding issues was raised here saying “provide enough resources and allowances to officers” and “Should include the aspect of providing transportation means such as motor bikes, vehicles etc.”.

**Table 3.3.27 JICA Project' Approach in Agriculture Sector**

Description	KFI	MFI	TOTAL	%
Should continue supporting irrigated agriculture	6	5	11	22%
Expansion of T-COBSI to other areas	1	5	6	12%
To introduce more other new technologies	2	2	4	8%
The approach should be adopted by the ministry for continuity even in other provinces	2	2	4	8%
To monitor and ensure that targets are achieved	1	2	3	6%
Provide enough resources and allowances to officers	2	1	3	6%
Should include the aspect of providing transportation means such as motor bikes, vehicles etc.	3	0	3	6%
Continue conducting trainings through workshops	1	1	2	4%
Develop more permanent weir schemes	1	1	2	4%
When JICA phases out it should link farmers to incoming projects for continuity	1	1	2	4%
Others	7	2	9	18%
<b>Total</b>	<b>27</b>	<b>22</b>	<b>49</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### d) Methodology of T-COBSI Approach | Training Structure

It was asked if the training structure of T-COBSI in a year, which starts with TOT in April followed by a series of training: kickoff training (KOT) in May, midterm training (MTT) in July, annual evaluation workshop (AEW) in November, and TSB training took place in a timely manner, was effective enough or not. “Yes” was accounted for 94% with comments further improvement of T-COBSI training, e.g., “time allocated to module in each training was not enough”, “market oriented farming training should be in KOT”, “more time to be given to TSB training”, and so on.

**Table 3.3.28 Training Structure of T-COBSI**

Answer	KFI	MFI	TOTAL	%
Yes, training structure of T-COBSI effective enough	26	21	47	94%
No, it is not effective	3	1	4	6%
<b>Total</b>	<b>29</b>	<b>22</b>	<b>51</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### e) Methodology of T-COBSI Approach | Any Other Trainings to Promote Smallholder Irrigation in the Future

Question to the officers was if any other training is needed for further promotion of smallholder irrigation in the future or not. Although SAOs and TSBs satisfied with the training structure as answered above, 77% of the officers considered that there needs to conduct trainings which can further promote smallholder irrigation. Responses emphasizes impact of irrigation farming to marketing and also nutrition, such as “linkage between crop production and irrigation system”, “consideration towards promotion of more commercial crops”, “more training on market oriented irrigation”, “nutrition improvement through irrigation”.

**Table 3.3.29 Trainings to Promote Smallholder Irrigation**

Answer	KFI	MFI	TOTAL	%
Yes, there are trainings which can promote stallholder irrigation in the future	21	12	33	77%
No, trainings T-COBSI has provided are enough	3	7	10	23%
<b>Total</b>	<b>24</b>	<b>19</b>	<b>43</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### f) Methodology of T-COBSI Approach | Farmers' Evaluation to Simple Weir Scheme

As a perspective on smallholder irrigation development, it was asked farmers evaluation to simple weir irrigation development via officers. The most frequent one was related to minimal inputs to start irrigation farming, namely, “because of the technology, farmers are able to construct weirs with minimal supervision” having 29% of all response, which is supported by the reason of “by use of locally available materials”. The principle of irrigation is also addressed: “it is effective because water reaches their farm lands and makes it easy to irrigate their fields”, “increased the area under irrigation”, and “there is an increase in the production of irrigated crops”. As a result, the response pointed that “it has improved farmers livelihood, because crops can grow all year round” came to the second top. Interestingly, the answers from the officers are logically interconnected along with the activities of the simple weir irrigation scheme development.

**Table 3.3.30 Farmers' Evaluation to Simple Weir Scheme**

Description	KFI	MFI	TOTAL	%
Because of the technology, farmers are able to construct weirs with minimal supervision	6	10	16	29%
It has improved farmers livelihood, because the can grow crops all year round	10	3	13	24%
It is effective because water reaches their farm lands and makes it easy to irrigate their fields	5	1	6	11%
Increased the area under irrigation	2	4	6	11%
By use of locally available materials	4	1	5	9%
There is an increase in the production of irrigated crops	2	1	3	5%

Description	KFI	MFI	TOTAL	%
Others	3	3	6	11%
<b>Total</b>	<b>32</b>	<b>23</b>	<b>55</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### g) Methodology of T-COBSI Approach | BEOs/CEOs' Evaluation to Simple Weir Irrigation Scheme

SAOs and TSBs answered about how BEOs/CEOs evaluate simple weir irrigation scheme. There was same frequency of response such as “increased production and improved livelihood”, “have enough skills on the construction of weirs”, “farmers are technically involved on their own in the construction and usage of weirs”, and “BEOs/CEOs have imparted knowledge to the farmers”. These top four related to income increment to farmers and technical transfer for both officers and farmers shares more than 50% of all responses. Other answers also supported indirectly the top four, e.g. “BEO/CEO carry out operation and maintenance of weirs”, “utilization of water”, and “increase area under irrigation”

**Table 3.3.31 BEOs/CEOs' Evaluation to Simple Weir Scheme**

Description	KFI	MFI	TOTAL	%
Increased production and improved livelihood	3	4	7	14%
Have enough skills on the construction of weirs	5	2	7	14%
Farmers are technically involved on their own in the construction and usage of weirs	3	4	7	14%
BEOs/CEOs have imparted knowledge to the farmers	4	3	7	14%
They implement using the locally available materials	4	2	6	12%
They are promoting T-COBSI technologies to farmers	4	1	5	10%
BEO/CEO carry out operation and maintenance of weirs	2	2	4	8%
Utilization of water	2	2	4	8%
Increase area under irrigation	2	2	4	8%
<b>Total</b>	<b>29</b>	<b>22</b>	<b>51</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### h) Promotion of Smallholder Irrigation | Approach Taken by T-COBSI for the Irrigation Development in Zambia

It was asked if approach taken by T-COBSI was effective for the irrigation development in Zambia or not, and it was quite obvious as shown in the table below. The responses pointed the reason of “Yes” from several aspects: “because there has been an improvement in the irrigation system and the land under irrigation has expanded”, “Because the community can have food security at household level”, “the farmers should not only be depending of Government support because they can immediately start irrigation without much capital by using local material”, “it is farmer centered using participatory approach which involves the community in its implementation bringing sustainable irrigation activity”, “because is discloses the untapped resources and creates an enabling environment for local recourses utilization”, etc.

**Table 3.3.32 Approach Taken by T-COBSI for the Irrigation Development in Zambia**

Answer	KFI	MFI	TOTAL	%
Yes, it was effective	28	18	46	96%
No	0	2	2	4%
<b>Total</b>	<b>28</b>	<b>20</b>	<b>48</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### i) Promotion of Smallholder Irrigation | Action to be Taken after completion of T-COBSI For Simple Weir Scheme

The most frequent answer was “continue facilitating and promoting the construction of simple weirs” followed by “incorporated by GRZ existing action plan”, “by use and implementation of learnt technologies”, and “trainings will continue to be conducted to farmers and new staffs”. These responses showed that officers have willingness to further disseminate simple weir scheme, which



shares 54% of all responses. Although the frequency of answers is not so high, some suggested practical ways for further promotion of simple weir irrigation “by monitoring all districts where T-COBSI approach takes place” and “through the dissemination of materials such as pamphlets, pictures etc. provided by T-COBSI to farmers”, which district offices could do in their reality.

**Table 3.3.33 Action to be Taken for Simple Weir Scheme after Completion of T-COBSI**

Description	KFI	MFI	TOTAL	%
Continue facilitating and promoting the construction of simple weirs	8	4	12	16%
Incorporated by GRZ existing action plan	6	4	10	14%
By use and implementation of learnt technologies	4	5	9	12%
Trainings will continue to be conducted to farmers and new staffs	6	3	9	12%
Government should provide enough resources to have the activities to continue	5	1	6	8%
By use of locally available materials	4	1	5	7%
Government to fully fund the project	3	2	5	7%
Engage other stakeholders for support	2	3	5	7%
By monitoring all districts where T-COBSI approach takes place	3	1	4	5%
Increase Government staff involvement and farmers commitment	2	2	4	5%
Increase budgeting allocation	1	2	3	4%
Through the dissemination of materials such as pamphlets, pictures etc. provided by T-COBSI to farmers	1	1	2	3%
<b>Total</b>	<b>45</b>	<b>29</b>	<b>74</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### For Permanent Weir Scheme

On contrary to the above question, further promotion of permanent weir scheme was confirmed with funding issue. The major responses related to the issue were “lobby from other stakeholders for funding support”, “government should fund the project and include in the budget”, and “increase budgeting allocation”. These answers account for 43% of all responses. On the other hand, there were more realistic answers to promote permanent weir scheme from technical point of view such as “by use of learnt technologies” and “carry out operations and maintenance”, the frequency was only 24% though.

**Table 3.3.34 Action to be Taken for Permanent Weir Scheme after Completion of T-COBSI**

Description	KFI	MFI	TOTAL	%
Lobby from other stakeholders for funding support	9	9	18	23%
By use of learnt technologies	7	7	14	18%
Government should fund the project and include in the budget	8	3	11	14%
Continue facilitating, promoting, and monitoring the construction of permanent weirs	6	3	9	12%
Carry out operations and maintenance	2	3	5	6%
Increase budgeting allocation	1	4	5	6%
Conduct surveys and designs on project development	2	2	4	5%
Continue conduct trainings	2	2	4	5%
Use of locally available materials	2	1	3	4%
Others	3	1	4	5%
<b>Total</b>	<b>42</b>	<b>35</b>	<b>77</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### **j) Promotion of Smallholder Irrigation | Bottlenecks to Promote Smallholder Irrigation**

SAOs and TSBs were asked what are constraints and challenges for promotion on smallholder irrigation in Zambia. The top one was “inadequate funding and resources from the government” followed by “lack of transportation”. It may include “the cost of permanent weir construction is very expensive” too as same category of response. These three answers related to funding shares more than 50% of all responses. Scarce of funding by government is pointed as quite crucial issue here again. The other offices raised an issue from technical point of view as “few number of skilled officers”. This

cannot be overlooked as a point emphasized by SAOs and TSBs themselves. It seems that the officers recognize to increase the number of skilled engineer (TSBs) for further promotion of smallholder irrigation as their own important role.

**Table 3.3.35 Bottlenecks for Promotion of Smallholder Irrigation**

Description	KFI	MFI	TOTAL	%
Inadequate funding and resources from the government	19	9	28	41%
Lack of transportation	3	6	9	13%
Climate change (drying up of streams)	4	3	7	10%
Lack of sensitization meetings and demonstrations	3	3	6	9%
The cost of permanent weir construction is very expensive	2	3	5	7%
Few number of skilled officers	2	2	4	6%
Others	7	2	9	13%
<b>Total</b>	<b>40</b>	<b>28</b>	<b>68</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### k) Promotion of Smallholder Irrigation | Solution to Bottlenecks for Promotion Smallholder Irrigation

It was surveyed officers' perspective in terms of solution to cope with the bottlenecks raised above. In response to officers' answer, the most and foremost frequent answer was associated with funding issue such as "adequate funding towards irrigation agriculture from the government" and "lobby funds from other cooperating partners". As more specific idea of solution, officers listed the action which they could work on by using knowledge and experience acquired through T-COBSI, such as "conduct trainings and sensitizations", "engage/employ more trained offices", "emphasize on market oriented crops", and "promote the use of locally available materials".

**Table 3.3.36 Solution to Bottlenecks**

Description	KFI	MFI	TOTAL	%
Adequate funding towards irrigation agriculture from the government	14	6	20	32%
Conduct trainings and sensitizations	5	5	10	16%
Lobby funds from other cooperating partners	5	5	10	16%
Engage/employ more trained offices	5	2	7	11%
Emphasize on market oriented crops	4	1	5	8%
Promote the use of locally available materials	2	1	3	5%
Others	5	3	8	13%
<b>Total</b>	<b>40</b>	<b>23</b>	<b>63</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### l) Simple Weir Scheme | Challenges to Promote Smallholder Irrigation Using Simple Weir Scheme

Of a total of 50 valid responses, the most major challenge was "lack of consistency, participation and no team work (31%)" among the farmers thorough construction of simple weir, which affected officers to supervise the community work for promoting smallholder irrigation. "Lack of transportation (29%)" came to the next frequent answer. This issue was repeatedly taken up in the discussion, together with another challenge of "no funding from GRZ". These answers show that officers are facing challenge in terms of construction of simple weir and mobilization of farmers even it doesn't take long time to supervise them.

20% of answer pointed out "climate change (drying up of stream)". There were areas where precipitation was little during rainy season of 2014/2015, it was reported in the workshop. The low durability of the simple weir was addressed from responses such as "no continuous maintenance" and "they are temporal". Although technology for construction of simple weir is not so difficult for farmers but it is imagined that when farmers maintain weir/furrow, they might show reluctant to consume their own labor work.

**Table 3.3.37 Challenges to Promote Smallholder Irrigation Using Simple Weir Scheme**

Description	KFI	MFI	TOTAL	%
Lack of inconsistency, participation and no teamwork	4	12	16	31%
Lack of transportation	11	4	15	29%
Climate change(drying up of streams)	6	4	10	20%
No continuous maintenance	4	0	4	8%
They are temporal	2	1	3	6%
No funding from GRZ	3	0	3	6%
<b>Total</b>	<b>30</b>	<b>20</b>	<b>50</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

**m) Simple Weir Scheme | Efforts to be taken to Resolve the Challenges**

In order to cope with the challenges answered above, the offices considered “facilitate and supervise farmers on the importance” as the top priority” and “working hand in hand with farmers and address issues” ranked as the forth one, which shares nearly 50% of all responses. Although some points challenges to work with farmers, the officers show their willingness to contribute to improvement of farmers’ livelihood through what they can do on the field level. Financing issues are also listed; “lobby funds from stakeholders to construct permanent weirs” and “transportation should be available” are given 30% responses.

**Table 3.3.38 Efforts to be taken to Resolve the Challenges**

Description	KFI	MFI	TOTAL	%
Facilitate and supervise farmers on the importance	11	6	17	33%
Lobby funds from stakeholders to construct permanent weirs	6	2	8	16%
Transportation should be available	5	2	7	14%
Working hand in hand with farmers and address issues	2	5	7	14%
Sensitize farmers on climate change	4	2	6	12%
To institute the construction of permanent weirs	2	1	3	6%
Conduct training	0	3	3	6%
<b>Total</b>	<b>30</b>	<b>21</b>	<b>51</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

**n) Permanent Weir Scheme | Difficulties and Facilities of Permanent Weir Irrigation Scheme Development**

It was asked what the most difficulties and the easiest part and/or step of the permanent weir scheme development. Actually, TSBs are the ones who have participated in a series of TSB training. More than sixty percent of valid responses were related to “design” followed by “cost estimation” indeed. On contrary to this, the most frequent answer was “supervision” followed by “survey” as facilities. Theses top two related to field works shares more than 60% of all responses.

**Table 3.3.39 Difficulties and Facilities of Permanent Weir Irrigation Scheme Development**

Difficulties					Facilities				
Description	KFI	MFI	TOTAL	%	Description	KFI	MFI	TOTAL	%
Design	15	14	29	48	Supervision	12	10	22	34
Cost estimation	7	3	10	16	Survey	12	6	18	28
Supervision	6	3	9	15	Design	4	3	7	11
Survey	3	2	5	8	Nothing	7	0	7	11
Nothing	4	1	5	8	Cost estimation	3	3	6	9
Others	0	3	3	5	Others	1	3	4	6
<b>Total</b>	<b>35</b>	<b>26</b>	<b>61</b>	<b>100</b>	<b>Total</b>	<b>39</b>	<b>25</b>	<b>64</b>	<b>100</b>

Source: JICA T-COBSI Project Team (2017)

**o) Permanent Weir Scheme | Needs to Lean More or to be Improved in TSB Training**

Reflecting the response to the above question, the most frequent answer was “more trainings on design and cost estimation”, which shared almost a half of all responses, followed by “training period should be extended” and “needs to know more on the construction of permanent weirs”. Although each and every TSB has different educational back ground and job carrier, and this should be considered as a matter of course, TSB training is still required to boost up TSBs’ capacity in terms of permanent weir



construction.

**Table 3.3.40 Needs to TSB Training**

Description	KFI	MFI	TOTAL	%
More trainings on design and cost estimation	18	10	28	47%
Training period should be extended	7	3	10	17%
Learn more on how to use GPS and dumpy level	0	5	5	8%
Needs to know more on the construction of permanent weirs	2	3	5	8%
Improve on the logistics and venue	2	3	5	8%
Others	6	1	7	12%
<b>Total</b>	<b>35</b>	<b>25</b>	<b>60</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### p) Farming Technology | Recommended Farming Technology under Smallholder Irrigation

It was asked what kind of farming technology farmers should know and practice under smallholder irrigated agriculture. The most popular one was “furrow and gravity irrigation”; upon some experience in irrigation development, officers may have found that gravity irrigation is not understood well by farmers and then the bucket irrigation is still practiced at the level of on-farm, as the result. “Conservation agriculture” came to the next frequent response, which has been promoted as a government program since the late 2000s and officers are familiar with the approach. They were interested in market oriented farming too, such as “post-harvest technology” and “emphasize on high value crop production” as recommended farming technology under smallholder irrigation.

**Table 3.3.41 Farming Technology Recommended under Smallholder Irrigation**

Description	KFI	MFI	TOTAL	%
Furrow and gravity irrigation	10	6	16	31%
Conservation Agriculture	4	10	14	27%
Post-harvest technology	3	2	5	10%
Emphasize on high value crop production	4	0	4	8%
Contour ridging and canal alignment	2	2	4	8%
Construction of more permanent weirs	1	2	3	6%
Others	6	0	6	12%
<b>Total</b>	<b>30</b>	<b>22</b>	<b>52</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

#### q) Institutional Aspect | Consideration for Gender Equity in Smallholder Irrigation Development

Table below shows the things considered for gender equity in smallholder irrigation development. As T-COBSI is the irrigation project, the most frequent answer was “engaging female farmers in irrigated agriculture”. This is supported by the behavior of “equal allocation of irrigated land”, which is a movement in irrigation development emphasized by government itself, and “utilization of (irrigation) water”. The second one was “conduct trainings on gender equality”. During the discussion in the workshop, the officers pointed some difficulties in promotion of gender mainstreaming, such as “women are afraid of leadership positions”, “less women participation”, “cultural barriers”, and so on. So, the response shows necessity of further opportunity of gender equity training for farmers.

**Table 3.3.42 Consideration for Gender Equity in Smallholder Irrigation Development**

Description	KFI	MFI	TOTAL	%
Engaging female farmers in irrigated agriculture	17	13	30	48%
Conduct trainings on gender equality	5	3	8	13%
Equal allocation of irrigated land	4	3	7	11%
Engage traditional leaders	2	2	4	6%
Utilization of water	1	2	3	5%
Others	7	4	11	17%
<b>Total</b>	<b>36</b>	<b>27</b>	<b>63</b>	<b>100%</b>

Source: JICA T-COBSI Project Team (2017)

### 3.4 ON-THE-JOB TRAINING (OJT)

Trainings and workshops were not the only opportunities for the officers to gain their knowledge and skills in irrigation development and irrigated farming. In T-COBSI, on-the-job trainings were the core of the technology development or capacity development of the officers. Here, two major categories of OJT activities are discussed: simple weir scheme development and permanent weir scheme development.

#### 3.4.1 SIMPLE-WEIR SCHEME DEVELOPMENT

##### 1) Target of the Simple Irrigation Schemes Development

On the last day of the Kick-off Training, target for the simple weir irrigation scheme development during the dry season was set by each agricultural extension officer. First, participants individually proposed the plan using a planning format. In this form, officer fills out the number of site to develop both for new development and for improvement of existing irrigation schemes.

Here, “improvement” is defined as the improvement of existing irrigation scheme which is still primitive in shape and function. Note that improvement does not include the ones which were constructed by the former COBSI Pilot Project or previous year under T-COBSI. On the other hand, “new development” is the ones which are newly developed where there is no existing irrigation scheme at all.

In addition, participating officers are expected to train other extension officers who have never participated in the Kick-off Training so far. Accordingly, officers were asked to set a target of the number of fellow officers to be trained.

Individual plans were then aggregated by district to be the target of the district for the dry season of each year. The district plans were then presented in front of other participants to discuss whether it is reasonable and feasible based on SMART concept, which stands for “Simple,” “Manageable,” “Achievable,” “Realistic,” and “Time-bound.” Officers in the venue challenged the plan of each district by saying “this is too modest,” for example. Based on such suggestions and comparative review among the districts, plans were modified, if necessary, and finalized.

Tables below summarize the target of simple weir irrigation scheme development of each district for three years of implementation period. As shown in the table, a total of 513 new development sites and 466 improvement sites were targeted for a total of 19 districts of the three provinces, resulting in a total of 979 sites. On average, 27 sites of new development and another 25 sites of improvement were planned in each district. (The targeted number of Chama district, Muchinga province, which participated in the project in 2015 only as observer, is not included.) In addition, a total of 355 fellow officers were to be trained on COBSI technologies through a lecture or on the job training at the construction site.

**Table 3.4.1 Number of Sites targeted for Simple Weir Irrigation Scheme Development**

District/Province	2014			2015			2016			Total for 3 Years		
	New	Imp	Total	New	Imp	Total	New	Imp	Total	New	Imp	Total
Kasama	20	11	31	10	10	20	13	12	25	43	33	76
Luwingu	5	13	18	14	10	24	8	8	16	27	31	58
Mbala	14	17	31	13	17	30	12	13	25	39	47	86
Mporokoso	9	13	22	6	14	20	5	15	20	20	42	62
Mungwi	10	14	24	5	12	17	12	14	26	27	40	67
Nsama	-	-	-	4	10	14	2	2	4	6	12	18
Total of Norther P.	58	68	126	52	73	125	52	64	116	162	205	367
Isoka	6	9	15	7	8	15	5	16	21	18	33	51
Mafinga	-	-	0	9	7	16	6	7	13	15	14	29

District/Province	2014			2015			2016			Total for 3 Years		
	New	Imp	Total	New	Imp	Total	New	Imp	Total	New	Imp	Total
Mpika	13	10	23	9	5	14	14	13	27	36	28	64
Nakonde	13	7	20	8	3	11	14	1	15	35	11	46
Shiwang'andu	8	0	8	10	6	16	5	5	10	23	11	34
Chama	0	0	0	0	0	0	0	0	0	0	0	0
Total of Muchinga P.	40	26	66	43	29	72	44	42	86	127	97	224
Chembe	1	1	2	10	2	12	7	6	13	18	9	27
Chipili	7	5	12	9	0	9	8	10	18	24	15	39
Kawambwa	18	24	42	7	14	21	14	7	21	39	45	84
Mansa	19	25	44	13	5	18	11	10	21	43	40	83
Milenge	8	4	12	10	4	14	9	0	9	27	8	35
Mwansabombwe	8	0	8	9	4	13	10	8	18	27	12	39
Mwense	5	13	18	12	8	20	8	4	12	25	25	50
Nchelenge	5	6	11	10	0	10	6	4	10	21	10	31
Total of Luapula P.	71	78	149	80	37	117	73	49	122	224	164	388
<b>3 Provinces</b>	<b>169</b>	<b>172</b>	<b>341</b>	<b>175</b>	<b>139</b>	<b>314</b>	<b>169</b>	<b>155</b>	<b>324</b>	<b>513</b>	<b>466</b>	<b>979</b>

Source: JICA T-COBSI Project Team (2017)

## 2) Achievement in Simple Scheme Development

The achievement in the simple irrigation scheme development was confirmed through the final evaluation workshop held in November 2016. The result is summarized as Table 3.4.2 shown below.

**Table 3.4.2 Achievement in Simple Irrigation Scheme Development by Province**

Province	Nos. of Sites Developed						Nos. of HH	Nos. of Member Farmers			Canal Length dug newly km	Area Irrigated ha	Nos. of Fish Pond
	New Development			Improvement				Male	Fem'e	Total			
	Ta't	Ac't	%	Ta't	Ac't	%	Nos.	Nos.	Nos.	Nos.	km	ha	Nos.
Northern	162	174	107	205	193	94	6,372	6,156	4,330	10,486	343.6	461.9	209
Muchinga	127	85	67	97	74	76	2,619	2,845	2,429	5,274	108.3	225.6	41
Luapula	224	138	62	164	110	67	2,865	2,937	2,040	4,977	171.9	188.4	474
<b>3 Provi's</b>	<b>513</b>	<b>397</b>	<b>77</b>	<b>466</b>	<b>377</b>	<b>81</b>	<b>11,856</b>	<b>11,938</b>	<b>8,799</b>	<b>20,737</b>	<b>623.8</b>	<b>875.9</b>	<b>724</b>
<b>Per Dis't</b>		<b>20</b>			<b>19</b>		<b>593</b>	<b>597</b>	<b>440</b>	<b>1,037</b>	<b>31.2</b>	<b>43.8</b>	<b>36</b>
<b>Per Site</b>							<b>15</b>	<b>15.4</b>	<b>11.4</b>	<b>26.8</b>	<b>0.8</b>	<b>1.1</b>	<b>1</b>
<b>Per Offi'r</b>		<b>2.1</b>			<b>2.0</b>		<b>64</b>	<b>64.5</b>	<b>47.6</b>	<b>112.1</b>	<b>3.4</b>	<b>4.7</b>	<b>4</b>

Source: JICA T-COBSI Project Team (2017)

The table above indicates the number in terms of irrigation schemes developed both as target and achievement. The total number of simple irrigation scheme targeted for three times of dry season from 2014 to 2016 was 979 sites, consisting 513 new development sites and 466 improvement sites. Since the completion of Kick-off Training, the officers have implemented the simple weir irrigation scheme development in each year. By the time of the annual evaluation workshop held in November 2016, a total of 774 simple weir irrigation schemes had been established, of which 397 sites are for new development and 377 sites are for improvement. They are 77% and 81% of the targeted number of sites.

It is concluded that on average, 20 sites were developed per district for new development and 19 sites for improvement, resulting in 39 sites per district. Number of households who are the member of the irrigation scheme reached as much as 11,856 households in the three provinces, which is equivalent to 593 households per districts and 15 households per site. In terms of the number of individual member farmers, total number reached 20,737 members, composed of 11,938 male and 8,799 female. Roughly 40% of the member farmers are female.

Furthermore, canal length dug newly during three years reached 623.8 km in total, which is about 31.2 km per district and 0.8 km per site. As a matter of area irrigated, total area reached 875.9 ha with a

total of 774 sites of both new and improvement sites. This is interpreted to 43.8 ha per district and 1.1 ha per site; Area irrigated at new development site and improvement site is 0.7 ha and 1.6 ha, respectively. New development site has usually smaller size of area irrigated as it is in most case at an initial stage of the irrigation development. Sometimes, area irrigated is even zero especially if the site was developed at the later stage of dry season. It is expected area irrigated can be further expanded in the following years.

In addition, number of fish ponds benefited from the simple diversion weir constructed/ improved during dry seasons from 2014 to 2016 was resulted in 724 fish ponds, which is 36 fish ponds per district and one pond per site. To be sure, however, this result largely attribute to some particular sites that maintain quite many number of fish ponds in its site mostly in improved sites in Northern and Luapula province. It implies that diversion weir with primary objective for irrigation can even benefit the fish farmers.

As per the results reported during the final evaluation workshop, some challenging and comments by reviewing the T-COBSI activity for whole three years since 2014 were raised by the participants as follows, most of which are the same issues claimed by the participants in every training opportunity and workshop:

- Overriding with other programs/activities made it difficult to continue working on simple weir development activity.
- The number of motorbike available for CEO is in short and some are in bad condition because shortage of budget for maintenance;
- The amount of the fuel is not enough for the provincial officers and district TSB officers to fully supervise T-COBSI activity;
- There were confusions in terms of fuel distribution system so that some officers could not get the fuel timely.
- District management such as DACO and SAO should be also given the fuel for monitoring.
- There were officers who suspended the activity due to schooling, transferred, etc.
- Potential sites are located far;
- Fellow officers are located far.
- Especially, general election carried out in August, 2016 made T-COBSI activity difficult.
- Water shortage, particularly in 2015, made it difficult to find potential sites for the construction of simple weir, which result in the smaller number of sites.

The achievement by district is summarized in Table 3.4.3.

**Table 3.4.3 Achievement in Simple Irrigation Scheme Development by District**

Province	Nos. of Sites Developed						Nos. of HH	Nos. of Member Farmers			Canal Length dug newly km	Area Irrigated ha	Nos. of Fish Pond Nos.
	New Development			Improvement				Male	Fem'e	Total			
	Ta't	Ac't	%	Ta't	Ac't	%	Nos.	Nos.	Nos.	Nos.	km	ha	Nos.
Kasama	43	49	114	33	21	64	1,554	922	849	1,771	112.9	533.8	15
Luwingu	27	22	81	31	22	71	776	692	646	1,338	20.5	100.8	4
Mbala	39	38	97	47	52	111	1,476	1,501	932	2,433	94.5	489.2	68
Mporo'so	20	25	125	42	44	105	1,375	1,322	884	2,206	42.2	256.2	64
Mungwi	27	24	89	40	38	95	911	1,424	873	2,297	62.0	406.4	56
Nsama	6	16	267	12	16	133	280	295	146	441	11.6	61.3	2
<b>Northern</b>	<b>162</b>	<b>174</b>	<b>107</b>	<b>205</b>	<b>193</b>	<b>94</b>	<b>6,372</b>	<b>6,156</b>	<b>4,330</b>	<b>10,486</b>	<b>343.6</b>	<b>1847.6</b>	<b>209</b>
Isoka	18	21	117	33	18	55	671	645	429	1,074	19.9	376.3	11
Mafinga	15	14	93	14	12	86	475	565	634	1,199	7.9	73.7	0
Mpika	36	22	61	28	23	82	795	817	701	1,518	57.0	340.9	22
Nakonde	35	19	54	11	13	118	365	497	406	903	19.1	63.7	1



Province	Nos. of Sites Developed						Nos. of HH	Nos. of Member Farmers			Canal Length dug newly	Area Irrigated	Nos. of Fish Pond
	New Development			Improvement				Male	Fem'e	Total			
	Ta't	Ac't	%	Ta't	Ac't	%	Nos.	Nos.	Nos.	Nos.	km	ha	Nos.
Shiwang'	23	7	30	11	8	73	215	197	177	374	4.0	45.5	7
Chama	0	2	-	0	0	-	98	124	82	206	0.5	2.5	0
<b>Muchin'a</b>	<b>127</b>	<b>85</b>	<b>67</b>	<b>97</b>	<b>74</b>	<b>76</b>	<b>2,619</b>	<b>2,845</b>	<b>2,429</b>	<b>5,274</b>	<b>108.3</b>	<b>902.6</b>	<b>41</b>
Chembe	18	13	72	9	12	133	287	295	174	469	23.4	121.3	4
Chipili	24	14	58	15	10	67	306	315	194	509	15.7	47.1	20
Kawa'wa	39	26	67	45	27	60	599	642	504	1,146	27.6	75.1	314
Mansa	43	20	47	40	29	73	458	494	249	743	47.9	155.2	48
Milenge	27	15	56	8	6	75	243	250	176	426	4.1	29.4	7
Mwans'e	27	21	78	12	7	58	334	414	307	721	25.1	108.4	27
Mwense	25	17	68	25	15	60	400	353	314	667	25.2	187.4	52
Nchele'e	21	12	57	10	4	40	238	174	122	296	2.7	29.5	2
<b>Luapula</b>	<b>224</b>	<b>138</b>	<b>62</b>	<b>164</b>	<b>110</b>	<b>67</b>	<b>2,865</b>	<b>2,937</b>	<b>2,040</b>	<b>4,977</b>	<b>171.9</b>	<b>753.4</b>	<b>474</b>
<b>3 Provi's</b>	<b>513</b>	<b>397</b>	<b>77</b>	<b>466</b>	<b>377</b>	<b>81</b>	<b>11,856</b>	<b>11,938</b>	<b>8,799</b>	<b>20,737</b>	<b>623.8</b>	<b>857.9</b>	<b>724</b>
<b>Per Dis't</b>		<b>20</b>			<b>19</b>		<b>593</b>	<b>597</b>	<b>440</b>	<b>1,037</b>	<b>31.2</b>	<b>43.8</b>	<b>36</b>
<b>Per Site</b>							<b>15.3</b>	<b>15.4</b>	<b>11.4</b>	<b>26.8</b>	<b>0.8</b>	<b>1.1</b>	<b>1</b>
<b>Per Offi'r</b>		<b>2.1</b>			<b>2.0</b>		<b>64.1</b>	<b>64.5</b>	<b>47.6</b>	<b>112.1</b>	<b>3.4</b>	<b>4.7</b>	<b>4</b>

Source: JICA T-COBSI Project Team (2017)

### 3) Changes of the Sites developed in 2014 and 2015

This section confirms the current situation as of November 2016 of the simple weir irrigation sites which were developed in 2014 and 2015. Prior to holding the final evaluation workshop, the project requested SAOs of each district to monitor the sites of both year in 2014 and 2015 to know how they have been changed in terms of area irrigated, length of canal, number of household, and so on. As a result of data analysis, the following was clarified.

**Table 3.4.4 Summary of the Achievement in Simple Irrigation Scheme Development**

Province	Current Status as of November 2016 of the Sites developed as New Site in 2014 and 2015					Current Status as of November 2016 of the Sites developed as Improve't Site in 2014 & 2015					Total (Balance)				
	Nos. of Site	Nos. of member HH	Nos. of member farmers	Length of Canal Dug	Area Irrigated	Nos. of Site	No. of member HH	No. of member farmers	Length of Canal Dug	Area Irrigated	Nos. of Site	No. of member HH	No. of member farmers	Length of Canal Dug	Area Irrigated
	No.	No.	No.	km	ha	No.	No.	No.	km	ha	No.	No.	No.	km	ha
Northern	0	1	-22	80.7	32.0	0	119	44	23.8	25.5	0	118	22	104.4	59.2
Muchinga	-1	27	115	23.1	19.6	-8	-71	-111	9.3	-16.1	-9	-44	4	32.4	3.5
Luapula	-1	28	1	-4.3	21.6	-2	87	43	18.2	11.5	-3	115	44	13.9	33.1
<b>3 Prov.</b>	<b>-2</b>	<b>54</b>	<b>94</b>	<b>99.4</b>	<b>73.2</b>	<b>-10</b>	<b>135</b>	<b>-24</b>	<b>51.3</b>	<b>22.6</b>	<b>-12</b>	<b>189</b>	<b>70</b>	<b>150.8</b>	<b>95.8</b>

Source: JICA T-COBSI Project Team (2017)

As per the number of site, a total of 12 sites have been decreased due mainly to deficit of river/ stream water at the point of simple weir. This situation was remarkable especially in 2015. Although the farmers did not practice irrigation farming in such time, it does not mean they have completely abandoned their simple weir irrigation sites, according to the CEOs in charge. The balance of the number of sites is shown in the table below.

**Table 3.4.5 Change (Balance) of the Number of Simple Weir Irrigation Sites**

Year developed	New/ Imp.	Increased (Nos.)	Decreased (Nos.)	Balance (Nos.)	Remarks (Breakdown)
2014	New	+3	-	+3	- Muwense: +3
	Imp	+2	-4	-2	- Muwense: +2, Mansa: -4
2015	New	-	-5	-5	- Nakonde: -1, Chipili: -2, Mansa: -2
	Imp	-	-8	-8	- Mansa: -8
<b>Balance</b>		+5	-17	-12	

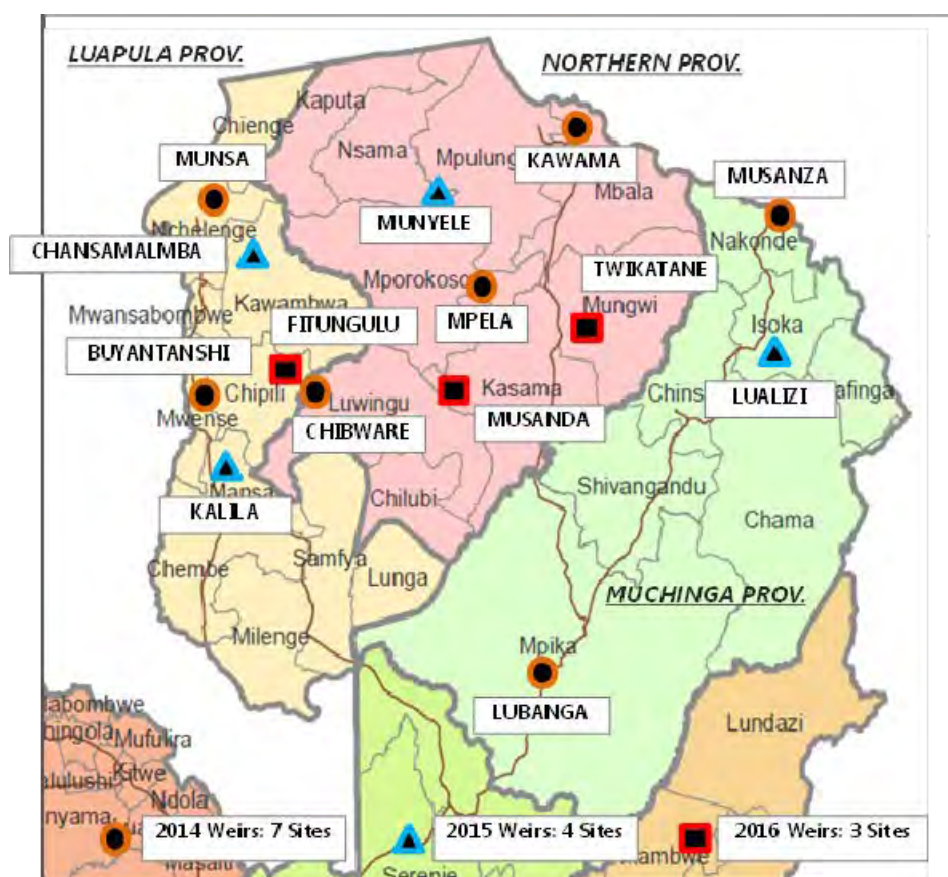
Source: JICA T-COBSI Project Team (2017)

The number of member household has, on the other hand, increased as many as 189 HHs. The number of member farmers has increased as many as 70 members. It should be noted that, while the number of sites has decreased due to inadequate water in some sites, situation has improved in the remaining sites. For example, a total of 150.8 km of canal has been newly dug after the first monitoring in 2014 and 2015. As a result, 95.8 ha of land have been expanded as irrigated areas. Thus, smallholder irrigation can be concluded self-sustained where natural condition permits.

### 3.4.2 PERMANENT-WEIR SCHEME DEVELOPMENT

#### 1) Plan of the Permanent Irrigation Scheme Development

In the T-COBSI project, permanent-diversion-weir irrigation scheme is introduced based on the concept that weir structure is upgraded/ reinforced to concrete or wet masonry structure where existing simple weir irrigation scheme is well functioning and well maintained by the users. By doing so, the upgraded irrigation system can be more sustainable. Under this concept, candidate sites of permanent weir construction were selected from the existing simple weir irrigation schemes that had been constructed during and after the pilot project of the COBSI Study and during T-COBSI. The selection process of the candidate districts and particular sites is summarized as follows:



**Figure 3.4.1 Location Map of Permanent Weir Constructed**

Source: JICA T-COBSI Project Team (2017)

### a) Selection of Candidate Districts

Total number of permanent weir constructed is fourteen. One permanent weir in one district, Mporokoso, Mbala, Luwingu, Nakonde, Mpika, Mwense and Nchelenge in 2014, Nsama, Isoka, Mansa and Kawambwa in 2015 and Kasama, Mungwi and Chipili in 2016, respectively was constructed. Shiwang'ndu and MwansaBombwe were candidate districts and site survey was conducted. However, we could not find suitable sites for up-grading. Mafinga district and Millenge district were not included because difficulty of access makes close supervision by TSB officers and Japanese experts difficult.

### b) Selection of Candidate Sites

The candidate sites were selected by TSB officers and CEOs of each candidate districts according to selection criteria explained in KOT. Each candidate site was investigated by the TSB officers together with JICA experts to confirm topographic, environmental and social condition of the site in details. On the survey at the candidate sites, the cross-section survey of the river was done; river condition and topographic condition upper and lower sides of the intake point were examined; cropping pattern, area irrigated, and number of beneficiaries were confirmed.

In accordance with the result of the site investigations, outline design of each site was prepared and the bill of quantities, construction cost, and work period were estimated. Then, based on such technical and economic point of view, coupled with the consideration in environmental and social impact, farming system, and institutional arrangement, candidate sites were finally selected.

### c) Demarcation of the Responsibilities

To properly implement the construction of permanent irrigation schemes, it is essential for the stakeholders to take full responsibility of their own. First, JICA team is to provide technical and some financial assistance for the planning, designing, and supervision of the implementation works. On the other hand, MoA takes charge of supervision of the construction by the TSB officers and CEOs. In terms of demarcation of the construction works, beneficiary farmers play a significant role. They are responsible to gather stones and sand; excavate the trench; and engaged in the masonry works. Around 20 farmers are expected to work on these works every day and during the peak season, more than 30 farmers are required to work on, which will be a significant part of the construction works.

## 2) Profile of the Construction Sites

### a) General Profile

Outline of permanent weir schemes is shown in Table 3.4.6. Detailed profile of permanent weir sites is shown in Attachment F.

**Table 3.4.6 Outline of Permanent Weirs**

Province	No.	District	Site Name	No. of Beneficiaries (HH)	Command Area (ha)		Construction Cost (ZMW)
					Present	Planned	
Northern	1	Mporokoso	Mpela	23	4.0	6.0	93,700
	2	Mbala	Kawama	55	10.0	15.0	61,700
	3	Luwingu	Chibwale	39	5.0	7.0	50,500
	4	Nsama	Munyele	150	2.3	5.0	166,000
	5	Kasama	Musanda	85	4.5	7.0	92,000
	6	Mungwi	Twikatane	25	5.0	15.0	97,000
Muchinga	1	Nakonde	Musanza	30	4.0	8.0	127,000
	2	Mpika	Lubanga	36	5.0	8.0	104,300
	3	Isoka	Lualizi	36	2.5	6.0	85,000
Luapula	1	Mwense	Buyantanshi	40	8.0	10.0	79,400

Province	No.	District	Site Name	No. of Beneficiaries (HH)	Command Area (ha)		Construction Cost (ZMW)
					Present	Planned	
	2	Nchelenge	Munsa	120	11.0	13.0	87,200
	3	Kawambwa	Chansamalamba	37	2.3	7.8	129,000
	4	Mansa	Kalila	42	2.6	7.8	121,000
	5	Chipili	Fitungulu	27	2.5	12.0	68,000
<b>Total</b>				<b>745</b>	<b>68.6</b>	<b>127.6</b>	<b>1,361,800</b>

Source: JICA T-COBSI Project Team (2017)

There are a total of 745 households are to get benefit. Present command area was roughly estimated by the beneficiary farmers. It ranges from 2.3 ha of Munyele site to 11.0 ha of Munsa site, resulting in a total of 68.6 ha, that is, on average 4.9 ha per site.

Based on the observation on utilization of river water flow at each site, it is assumed that amount of water at intake will be increased a lot. According to observation of river water flow, the river water flow quantity in October was 30 to 60% of that of July. The capacity of intake was designed considering maximum river water flow. Considering river water flow and scheme area, it can be expected that a total of 127.6 ha can be irrigated in maximum during April to July. It is thus expected that 59.0 ha of new area is to be irrigated.

Total construction cost is 97,300 ZMW on average, ranging from 50,500 ZMW of Chibwale site to 129,000 ZMW of Chansamalamba site. Based on the planned command area, construction cost per hectare is around 10,700 ZMW/ha, or roughly US\$1,000/ha, excluding the consulting fee for the experts, and labor fee of the farmers.

## b) Irrigation Water Requirement

Irrigation water requirement of each permanent scheme was calculated using FAO-CROPWAT in consideration with meteorological data, cropping pattern, effective rainfall, irrigation efficiency, etc. The process of calculation, database used, and result of the calculation were compiled in a design report which is prepared by TSB offices of each district.

## 3) Construction Process

Construction of permanent weir is implemented through several major steps: 1) detailed design, 2) orientation, 3) distribution of tools, 4) preparation of materials such as stones and sands, 5) excavation of river diversion, 6) construction of coffer dam, 7) excavation of foundation and 8) stone masonry works. Followings briefly explain the process of these major activities.

### a) Detailed Design of Weir Structure

Design, quantity calculation and cost estimation for actual candidate sites were finalized by the JICA experts. Design drawing, bill of quantities (BOQ), and implementation schedule of each permanent irrigation scheme are attached in Appendix.

### b) Orientation

After confirming the feasibility of the candidate sites, orientation was conducted to the potential beneficiary farmers of the candidate sites. In the orientation, terms and conditions for the permanent weir construction were explained,



*Orientation at Twikatane scheme in Mungwi*



which includes the responsibility of farmers in the preparation of construction materials of sand and stone, excavation of trench, and labor works for the masonry works. It was emphasized that the required number of farmers are significant, more than 20 farmers every day, and the amount of materials to be collected is pronouncedly big, like 200 tons of stones. Upon the informed consent of the conditions by farmers, construction of permanent scheme was decided.

#### **c) Distribution of Construction Tools**

Required numbers of construction tools were estimated based on the types and quantities of construction works for each construction site. Based on this estimation, construction tools was procured and distributed by the JICA project team. The types of tools distributed are: 1) wheel barrow, 2) trowel, 3) shovel, 4) handsaw, 5) bucket, 6) hammer (medium), 7) hammer (heavy), 8) hammer (heavy/long), 9) pickaxe, 10) chisel, 11) builders' level, 12) measuring tape (5m), 13) line level, and 14) watering can.



*Breaking rocks and gathering stones in Musanda scheme in Kasama district*

#### **d) Preparation of Stones and Sands**

Preparation of stones and sands are being conducted by the beneficiary farmers.

Beneficiary farmers are required to find a site and dig-up stones and sand by themselves. For the stones, they need to crash big rocks into smaller pieces for the masonry works. On the other hand, transportation of these materials is supported by the JICA budget. According to the work plan of each site, approximately four weeks are, on average, required to complete the preparation of stones and sands.

#### **e) Excavation of River Diversion and Construction of Coffer Dam**

During the construction of apron and spillway, the construction area must be dry. Therefore, coffer dam is constructed and river water is diverted. Instruction on the location of coffer dam and alignment of river diversion was given by the JICA expert together and TSB officers. CEO in charge mobilized the farmers through the construction period. Coffor dam is constructed using simple weir technology.

#### **f) Excavation of Foundation**

Excavation of foundation is carried out by the beneficiary farmers themselves. To begin with, instruction is given by the Japanese expert together with district TSB officers based on the design of the weir on the dimension of the foundation to be excavated. With one or two teams of 20 farmers, excavation is to be completed within two weeks.

#### **g) Stone Masonry Work**

Stone masonry work is carried out by beneficiary farmers with skilled labors under supervision by the experts and TSB officers. Stones and sand are prepared by the farmers and cement is provided by JICA Team. One set of stone masonry work consists of one skilled labor, six unskilled labors and four helpers. One set of mortar mixing work consists of six unskilled labors.

### **4) Issues Identified**

Issues identified as lessons in the course of permanent weir construction are summarized below, which include the issues of material gathering, labor force, officers, JICA expert and schedule.



*Stone masonry work for intake in Musanda scheme in Kasama district. Masonry group, mortar mixing group and stone ferrying group.*



*Excavation for foundation of apron in Musanda scheme in Kasama district. Using buckets for de-watering. There are big stones in the river bed.*

– *Stones and sand*

Stones and sand should be prepared by April so that the construction work can be started immediately after rainy season.

– *Skilled labor*

For some schemes, an experienced skilled labor was employed to facilitate the construction. It was very effective when Japanese expert and provincial TSB officer were not able to visit the site so often.

– *Unskilled labor*

Number of household of the schemes is 23 to 150 and the average is 54. According to the work schedule prepared by the project team, maximum number of required unskilled labor per day is computed from 40 to 50 for gathering stones and excavation and 17 for stone masonry work. The number of available labor per day was declared by the farmers in the orientation.

Generally, enough number of farmers having strong willingness to construct permanent weir was mobilized at the beginning of the construction, however, it had decreased gradually. It is considered that the work was much harder than they expected even if the project team explained in detail on amount, period and toughness of the work.

– *CEO and TSB officers*

Attendance rate of CEO of some sites was satisfactory and some was not. Attendance of CEO and TSB officers considered to affect the progress of the construction and mobilization of farmers. Enough transportation realizes enough activity of CEOs and TSB officers. Provincial TSB officers of Northern province worked well as supervisors for the construction. Without Japanese experts, they can manage the construction.

– *JICA experts*

Japanese experts supervised the construction every week from the beginning to the end of the construction. However, they were sometimes absent for a few weeks due to other assignment schedule and other works. During this time, provincial and district TSB officers and CEOs

supervised the construction but the progress was not so good. Not all the TSB officers are engineers and they need instruction by JICA expert. Therefore, presence of Japanese experts is considered to be effective for progress of construction work.

– *Schedule*

Based on the experience in 2014 and 2015 permanent weir construction, the project team tried to start the construction earlier than 2015 in 2016. Actually, gathering sand and stones was started in January and orientation was held in May, 2016. The progress of Musanda scheme was good and they could change the shift from five days a week to three days a week.

In 2014, working day was assumed 20 days / month, however, according to the work in 2014, 2015 and 2016; the project team considers 15 days / month is appropriate.

### 3.4.3 PREPARATION FOR S3P AND OTHER DONORS

According to recommendation by the terminal evaluation report, JICA decided to assist local communities for application procedure including preparation of application form. Even if the district or the camp is not covered by S3P, design reports were prepared for other donors funded projects. In November and December, 2016, the project team assisted TSB officers to carry-out site surveying. After the site survey, they selected feasible site in each district.

In January and February, they prepared design report assisted by JICA experts. In February and March, they finalized design report and prepared application form. Throughout this procedure, all the TSB officers experienced site survey and design of permanent weir. Finally, application form for S3P for 8 sites in Northern and 7 sites in Muchinga province were prepared. And also, 3 sites in Northern, 2 sites in Muchinga and 4 sites in Luapula province are ready for implementation by other donors.

**Table 3.4.7 Schedule of Preparation S3P and other donors**

Date	Training item
November- December, 2016	Site survey
January-February, 2017	Design report
February-March, 2017	Finalizing design report and preparation of allocation form

Source: JICA T-COBSI Project Team (2017)

List of S3P candidate sites and candidate sites for other donors is attached in Attachment G.

### 3.4.4 TSB WRAP-UP TRAINING

According to recommendation by the terminal evaluation report, TSB wrap-up training was conducted on March 9 at Kasama Farm Institute (KFI). The training was conducted to confirm and share the achievement and the experience of the officers in preparation of permanent weir projects. Number of participants is 11 provincial TSB officers and 33 district TSB officers, total number of participants is 44 TSB officers.

#### 1) Program

Training program is composed of four main topics: design of permanent weir, lessons learnt, recommendation to phase 2 project and self-evaluation of design and construction of permanent weir. The workshop started with presentation on design of permanent weir by each district by using power-point material which was prepared by participant in advance. After the presentation, participants discussed lessons learnt and recommendation to phase 2 project. After the discussion, participants evaluated their achievement under a series of TSB training by themselves. Result of self-evaluation is shown in Attachment H

## 2) Challenges

Major challenges on design of permanent weir are:

- Designing of permanent weir especially on excavation and material calculation was difficult
- The time for design training and practice was not enough.
- The department had no transport making it difficulties in the collection of data and site selection.
- Most site which were recommended for survey by CEOs/BEOs were not suitable for permanent weir

## 3) Recommendations

The participants gave recommendations as follows:

- T-COBSI to procure transport for phase II programs
- Need to have enough training time in the designs of permanent weirs.
- Collection of data on potential sites should be continuous.
- More training on weir designs should be conducted to enable TSB officers thoroughly understand the all concept.

## 4) Self-evaluation

The result of self-evaluation is shown in Attachment H. Below explains the outline of the self-evaluation of the TSB officers on their own capacity in permanent weir scheme development.

### 1) Survey

Average score of survey was 3.98 and it is the third highest in 8 items. However, that high score is because of the high score 4.45 of socio-economic survey. Socio-economic survey is done with survey sheet and it is not difficult at all. Some of the officers who have background of engineering have experience of surveying with dumpy level. For some officers, drawing of cross section is challenging.

### 2) Irrigation water requirement

Training on irrigation water requirement was done in the TSB training 2015 and also in the preparation of design report for S3P. Generally, they need more practice to calculate irrigation water requirement using FAO CROPWAT. Only a few officers can prepare a report of irrigation water requirement. More training on irrigation water requirement and irrigation efficiency is required. Comments from the officers were also “need more time” or “need more training”.

### 3) Design of permanent weir

Only a few officers understand major item of design such as flood water area, high water level and various dimensions. Especially, most important item, flood water area, was not understood by the officers yet. Need more training on design of permanent weir.

### 4) Drawing

Average score is 3.14 and it is lowest in 8 items. Many of the officers do not have experience of making any drawings. Even the officers who have the background of engineering, only a few officers can make drawings. Need more training on making drawings.

### 5) BOQ

Average score is the second lowest in 8 items. Generally, officers are not good at calculation. Especially they are not good at calculate volume. They are not good at operating “Excel” as well.



Need more training.

6) Work plan

Work plan is based on BOQ. Therefore, it is not so difficult if BOQ is calculated. Excel format of work plan is already prepared by the expert. However, many of them don't understand how to use the format because they are not used to "Excel". Their self-evaluation is average 3.58 but actual score is considered less than 3.0. Need more training.

7) Cost estimation

Cost estimation is not difficult if there is BOQ. Therefore, average score should be higher. It is a question. Probably they are not used to operation of "Excel".

8) Supervision

The average score is the highest 4.12. Most of the officers experienced many days for construction work and they understood how to mix mortar and how to construct stone masonry structure. Many of them can construct permanent weir according to the drawings.

**5) Comments from the officers**

The participants gave comments as follows;

- It was very educative although time for training was not adequate. Designing of permanent weir is interesting and very important. Even if have not learnt fully, at least I had a feel of how to do it.
- Trainings to be intensified, small groups to be under one trainer unlike large groups, trainings in surveying, designs and implementation to be considered, extension of training period to be considered, speed during training to be reduced, not too fast, Assessment on whether officers grasped the technologies by following up the officers and offer training
- Technically the training has been awesome from site selection, surveys, construction including the coming up with BOQs, work plan, and irrigation schedules. I for one can come up with a proper project proposal of a permanent weir, secondly capacity has been built in almost all TSB, CEO and BEO in all project areas under T-COBSI. Muchinga has always had no defined irrigation system and or schemes so taking statistics of irrigation schemes, area under irrigation, type of crop grown but with T-COBSI in place, order and sanity in irrigation circles has incredibly increased and formation of a data base on irrigation is in order and it is even easier to note of interventions needed in irrigation.
- The training was good but the time was short for full comprehension of everything. Somethings were familiar with my previous experience while others were new and needed more time for me to understand fully.
- TSB trainings were a very good experience on the practical part. I feel these should continue even in phase II. Design of permanent weirs needs more trainings. At the moment we have basic information on design and we still need more detailed trainings in calculations and drawings
- There is need for more practical trainings and the time allocated to the trainings to be enough especially on the design of permanent weir, allocation of more fuel, transport and other logistics should also be considered
- TSB training was very essential for the officers but time allocated for the training was not enough especially us with background of agriculture. On the same training - language barrier was also

experienced where experts with all the knowledge and experience could not express themselves well. I suggest maybe if local engineers can be used on explanation.

- This has been a wonder - type of design and construction methods involved. These have to be promoted as they are very stable
- Construction of permanent weirs will enable our farmers utilize our water resource to the maximum. More training on the following is required: Design of structure (weir) and translating surveyed data
- TSB trainings should not come to an end it should continue to acquire more knowledge.
- I could not acquire enough knowledge because I joined the project in the last two years. I so much I appreciate the knowledge imparted to me and am willing to learn more if given an opportunity. However, I would request that a more formal training be availed so apple time is given to the trainers.
- I have learnt designing and construction of permanent weirs. The new masonry weirs learnt under T-COBSI are different from old weirs we were constructing under RIF in that these new weirs are constructed with the upstream and side downstream aprons and side slope protections reducing on scouring, percolation and side slope erosion making the structure stable and lasting a long time with minimum O and M
- I have been empowered technically in simple and permanent weir construction. In the same way I have gained skills in irrigation techniques like basin, flood irrigation. As TSB officer I wish the program can continue for the benefit of our farmers and the nation at large.
- The training for TSB was intensive and has helped us a lot by opening our minds on how to activate on various issues in irrigation. Design of permanent weirs was good despite a short period of training courses like design at CROPWAT. We needed more time on this.

## 6) Evaluation by the team

TSB officers include the officers who have the background of general agriculture and that of engineering. Twenty four officers out of fifty nine TSB officers have background of engineering. For those who do not have the background of engineering, design of permanent weir was difficult. Even those who have background of engineering, the project team considers less than ten officers fully or almost understood the design of permanent weir. Generally, the level of officers is not so high as the project team expected. Therefore, they need more training on design of permanent weir. Actually, many of the participants commented that time was not enough and they need more training. Regarding design of permanent weir, the training should concentrate to the officers who have background of engineering.

## 3.5 DELIVERABLES AND TRAINING MATERIALS

As the official deliverables of the project, a series of reports have been formulated. Table 3.5.1 summarizes the official deliverables.

**Table 3.5.1 Deliverables of the Project**

No.	Title	Month	Main Contents
1	Inception Report	May 2013	Plan of the project implementation
2	Inception Report (rev)	Sep 2013	Revised plan of the project implementation
3	Progress Report No.1	Mar 2014	Result of the follow-up survey Survey on existing eight permanent weirs

No.	Title	Month	Main Contents
4	Progress Report No.2	Aug 2014	Progress of Kick-off Training and Mid-term Training
5	Project Description Report for Mid-term Review	Nov 2014	Project progress and concerns associated with project activities
6	Annual Report (2014)	Dec 2014	Project progress from the inception of the project up to November 2014.
7	Work Plan of the Second Phase	May 2014	Plan of the project implementation during phase II
8	Progress Report No.3	Sep 2015	Progress of Kick-off Training, TSB Training, and Mid-term Training.
9	Progress Report No.4	Dec 2015	Project progress from the inception of the project up to November 2014; compiled as a form of annual report.
10	Project Description Report for the terminal evaluation	Jun 2016	Project progress and concerns associated with project activities
11	Progress Report No.5 (Provisional)	Sep 2016	Progress of Kick-off Training, TSB Training, and Mid-term Training.
12	Progress Report No.5	Jan 2017	Progress of Kick-off Training, TSB Training, Mid-term Training, and Annual Evaluation Workshop.

Source: JICA T-COBSI Project Team (2017)

In addition, manuals, poster, leaflet, and guidelines have been also prepared and distributed to the officers who have participated in the Kick-off Training, TSB Training, and Mid-term Training. The list of these extension materials is shown below. In addition to these listed, PPT presentation materials of some training contents, such as gender mainstreaming, environmental consideration, appropriate farming technology, and on-farm irrigation, are distributed to the officers attended to these trainings.

**Table 3.5.2 List of Guidelines and Manuals Distributed**

No.	Title/ Contents	Set per Officer
1	T-COBSI Project Brochure on T-COBSI	1
2	Engineering Manual on Irrigation Development	1
3	Technical guideline for implementation of permanent weir project	1
4	Picture Stories Poster (4 sheets per set with A3 paper)	3
5	Poster for Nutrition Improvement with Smallholder Irrigation	3
6	Leaflet (Starting Irrigation in Our Local Context)	3
7	Leaflet (Starting Irrigation Agriculture)	3
8	Textbook for Marketing Training	1

Source: JICA T-COBSI Project Team (2015)/ PPT presentation materials of major subjects are also provided.

## 3.6 SURVEYS

### 3.6.1 FOLLOW-UP SURVEY

The follow-up survey was conducted in the later dry season of 2013 using a pre-determined questionnaire form. The survey, which targeted the simple irrigation schemes constructed during the COBSI Study, was done by the extension officers as a part of the on-the-job training in social research. A total of 413 sites have been surveyed and encoded for the analysis from a total of 133 agricultural camps. The survey covered a series of topics such as general condition of the site, irrigation facility, institution, operation and maintenance, farming, and marketing. Here summarizes some important findings relating to the impact of COBSI approach and also existence of potential sites for permanent weir construction.

#### 1) Impact of COBSI Approach Implied by the Survey Result

The result of the follow-up survey provided some implications as discussed below.

##### a) Durability of Simple Weirs

Durability of the simple, wooden and light-weight structure was verified. Against the original anticipation that the weir is washed away during rainy season, it was found that about 80% of

the weirs endure even during rainy season, of which 15% of the weirs “remain as it is”. This result may attribute to the typical topography of the target areas—flat and thus water flow is relatively gentle especially where simple schemes are applicable.

b) Increase in Irrigated Area

It was found that an average size of area per site has increased from 1.4 ha to 1.9 ha (36% of increment), suggesting that farmers can manage and even increase the size of irrigated area without any particular assistance from outside. The water potential of the water source in most of areas still surpasses the actual use. Thus, further development of irrigated area is possible.

c) Water Shortage at the End of Dry Season

In contrast, some challenges and limitation were also found. Even though the water potential is high enough at the diversion point, water shortage appeared to be a problem at the end of dry season. In fact, 35% of the responses regarding the problems in irrigated agriculture were associated with “water shortage”. As a result, the length of furrow had decreased at 13% of the total number of sites and irrigated area had decreased at about 24% of the sites. Obviously, water leakage was one of the causes of the water shortage at the farm plots. Thus, introduction of some countermeasures is required, i.e. use of lining.

d) Sense of Ownership

It was believed that the farmers’ sense of ownership or self-help attitude would show the institutional readiness toward upgrading of irrigation facilities. In this regard, implementation status of maintenance works may represent the ownership. Farmers were conducting maintenance works, such as cleaning, weeding and de-silting of furrow, at roughly 80% of the sites, except for the de-silting of the diversion point (58%).

It was learned that there were many variations among the sites, having problems of water shortage for example. As a whole picture, however, quite positive outcomes were drawn from the result of the follow-up survey. Most importantly, it was implied that simple irrigation scheme inherits two pronouncing advantages as stated below.

First, simple irrigation scheme provides an opportunity for farmers to develop their institutional capacity in O&M and irrigated agriculture, which is to be a preparatory stage toward more advanced irrigation development using permanent structure. For those who are in a position of assisting farmers, it is also a good procedure to identifying potential sites especially from a social point of view.

Second, simple scheme is applicable even in such a location where permanent structure is not applicable from the beginning (i.e., too flat, foundation is soft and river flow moves). In reality, such unfavorable areas—essentially represented by “*dambo*”—shares most of the land in the target provinces of Northern, Luapula and Muchinga. Thus, simple weir technology is quite appropriate in the project areas.

## 2) Potential Sites for the Upgrading the Weir

### Evaluation Procedure and Criteria

There are various factors to be considered in identifying potential sites for upgrading the weirs. Considering the type (concrete or stone masonry) and scale (up to 20 m in length and up to 5 m in height) of the weir as well as the typical topography and hydrology in the area, such locations are not suitable where 1) streamline of the river tends to move; 2) terrain is in dambo, 3) and farmland is influenced by flood during rainy season. To prioritize the sites for upgrading as an initial screening, the project team proposed making scores of all the sites based on 10 criteria: 1) slope of riverbank, 2)



river shape, 3) streamline, 4) terrain, 5) influence of flood, 6) riverbed, 7) potential area (difference between potential and actual), 8) farmers' association, 9) number of household, and 10) length of weir.

### Result of Preliminary Prioritization of Potential Sites

All the 413 sites have been evaluated. First, those which are absolutely not applicable to the upgrading were excluded from the list, resulting in a total of 144 sites (35%) remained for further evaluation. Of a total of 144 sites, the score was calculated based on the formula predetermined. The score was then converted to a percentage to the full score: 35 points to be 100%. The number of sites by score range is summarized in Table 3.6.1.

As shown in the table, there were only 3 sites that exceeded 60%: one each in Mpika, Mwense, and Nchelenge. As far as the data obtained through the questionnaire survey is concerned, 12 sites were relatively preferable conditions for upgrading. There were other 89 sites which can still be candidates for further analysis. However, 43 sites were most likely not suitable for upgrading. Overall, out of a total of 413 sites, only 3% were found "better," 22% were "moderate" and 75% of the sites were judged "not suitable." Thus, selection of upgrading sites was found not so easy than initially expected.

**Table 3.6.1 Number of Potential Sites by Score Range**

District	Percentage to the Full Score (35 Points)						Total
	Not Suitable		Moderate		Better		
	0%-20%	20%-30%	30%-40%	40%-50%	50%-60%	60%-70%	
Kasama	3	3	1	2			9
Luwingu		3	8	1	1		13
Mbala	2	3	3	2	1		11
Mporokoso	1	2	3	1			7
Mungwi	1	3	9	1			14
Isoka			4	3	1		8
Mpika		2	8	6	2	1	19
Nakonde	2	4	12	2			20
Kawambwa		3	3	2	2		10
Mansa	2	4	4	3			13
Milenge	2	1		1			4
Mwense		1	3	5	1	1	11
Nchelenge		1	1	1	1	1	5
Total	13	30	59	30	9	3	144
	43		89		12		
	30%		62%		8%		100%
	10%		22%		3%		413
							100%

Source: JICA T-COBSI Project Team (Feb 2014)

Note: 269 sites were "rejected" from the analysis as they did not satisfy indispensable requirements, i.e. streamline moves.

### 3.6.2 IMPACT SURVEY

In June 2016, the terminal evaluation was conducted by the joint team between MOA and JICA. Based on positive finding of the project, the evaluation team recommended the project team to conduct impact assessment of the project so that impact of the project can be well understood. As a result, the project conducted impact survey, from October to December 2016, to clarify several impacts quantitatively and qualitatively as to justify T-COBSI's contribution to the livelihood of farmer households in the target areas. Outline and result of the impact survey is discussed in Chapter 4.1.

### 3.7 MEETINGS

As an official occasion of coordination between expert team and the counterpart agency, the Joint Coordinating Committee (JCC) meeting had been held five times. The first JCC meeting was held on November 7, 2013, as a joint meeting among the three JICA projects in the agriculture sector: Food Crop Diversification Support Project Focusing on Rice Production (FoDiS-R) and Rural Extension

Services Advancement Project (RESCAP) and T-COBSI, in which, the project was officially launched.

Thereafter, progress of the project had been reported time to time in the JCC meetings. The minutes of the meetings of these JCC meetings are attached as Attachment E. In addition, informal communication and exchange of opinions had been done occasionally when the member of Japanese expert team visited Lusaka.

**Table 3.7.1 Joint Coordination Committee (JCC) Meeting**

Meeting	Date	Venue	Participants	Remarks
1 <sup>st</sup> JCC	November 7, 2013	Grand Palace Hotel	44	- JCC was jointly conducted with two other JICA projects (FoDis-R and RESCAP)
2 <sup>nd</sup> JCC	December 10, 2014	Christmar Hotel	27	- Presentation on the results of Mid-term Review
3 <sup>rd</sup> JCC	June 22, 2016	Christmar Hotel	26	- Presentation on the results of Joint Terminal Evaluation
4 <sup>th</sup> JCC	April 4, 2017	Pamodzi Hotel	31	- Presentation on the achievement of the Project and discussion on the way forward

Source: JICA T-COBSI Project Team (2017)

### 3.8 PUBLIC RELATION ACTIVITIES

Public relations activities have been done through various means of communications and occasions. One type of public relation activities was to organize field visit by various stakeholders such as government high officials. Also conducted was reporting of project activities at academic journals, one of which received an award from the institute. In addition, attendance and presentation in the meetings with NGOs and other stakeholders have done. Also, one of the team members had an honor to receive audience of royal family in Japan for explanation of the project outline. Newsletter and other materials such as pop-up banner (9 kinds) and flyers were produced and distributed at provincial officers and other places. The list below summarizes major PR activities conducted throughout the project period.

#### <Organizing Site Visit>

- Members of National Union for Small-Scale Farmers in Zambia (NUSFAZ) with director of the department of Agriculture (June 24-26, 2014)
- Ambassador of Japan (December 18, 2014)
- President of Sanyu Consultants Inc. (June 14 to 20, 2015)
- Deputy Minister of MAL (June 28, 2015)
- Press tour by embassy of Japan, JICA and MAL (August 18, 2015)
- Deputy Director of Technical Service Branch of MOA (January 18, 2017)

#### < Reporting at Journals>

- Reporting at the journal of Japanese Society of Irrigation, Drainage and Rural Engineering (Awarded on June 2016)
- Reporting at the journal of the International Commission on Irrigation and Drainage (March 2016) and presentation at the conference held in Egypt (April 27, 2016)

#### <Others>

- NGO consultative meeting (September 25, 2013)
- Meeting with the World Fish (November 8, 2013)
- Audience with their imperial highnesses prince and princesses Akishino (August 26 2016)
- JICA internship (October 4 to 31, 2015)
- JICA internship (October 4 to 27, 2016)
- Newsletters
- Creation of pop-up banners/ flyers
- Dissemination seminar (April 3, 2017)

## CHAPTER 4 IMPACT OF THE PROJECT

### 4.1 IMPACT SURVEY

#### 4.1.1 BACKGROUND AND OBJECTIVE OF THE IMPACT SURVEY

On June 2016, JICA Terminal Evaluation Team arrived at Zambia and formed the joint evaluation team (referred to as “the evaluation team”) with the officers of Zambian side to clarify the effects from T-COBSI. The evaluation team conducted interview survey along with Five Evaluation Criteria. At the conclusion, they mentioned that T-COBSI has possibility to effect several impacts as mentioned below.

The project team was recommended to conduct impact assessment of the project based on the findings of evaluation team. Therefore the project conducted “Impact Survey” for clarify several impacts quantitatively and qualitatively to justify T-COBSI’s contribution to changes of farmers’ life such as impact on household economy, impact on dietary diversity and impact on nutrition improvement etc.

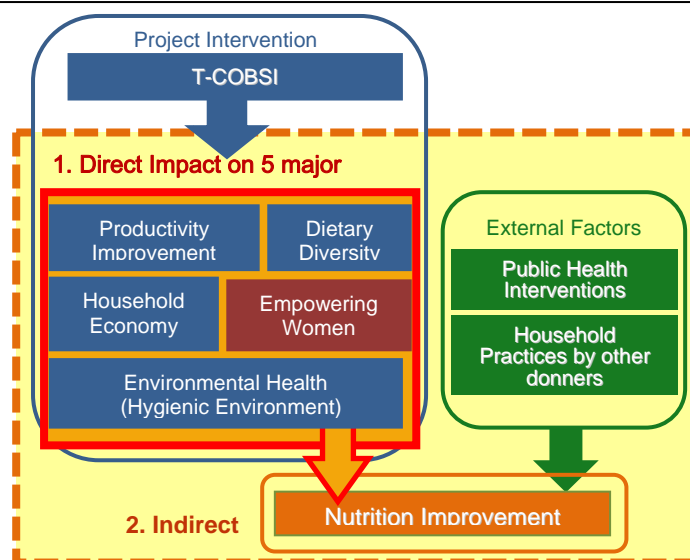
**Table 4.1.1 Summary of Terminal Evaluation by Five Evaluation Criteria**

Evaluation Criteria	Evaluation Results	Reasons/Remarks
Relevance	High	(+) Relevance with Zambian policies (+) Relevance with the needs of local communities to reduce poverty through irrigated agriculture (+) Relevance with Japan's aid strategy
Effectiveness	Relatively High	(+) Project Purpose has been reasonably achieved (-) Capacity of TSB officers in terms of permanent weirs construction(planning, design, construction and O&M) needs to be further enhanced
Efficiency	Relatively High	(+) Input by the Japanese side was reasonable (-) Input by the Zambia side was not made as planned (Capacity development of TSB officers on permanent weir construction has not been made as expected due to budget limitation of GRZ) (+) Output has been reasonably generated. More than 500 weirs were constructed during the past 3 years. (-) Inconsistent implementation strategy of the Project: removal of activities related to simple weir irrigation scheme in the 1st half of the cooperation period
Impacts	Positive Impacts are observed	<ul style="list-style-type: none"> <li>● Overall Goals is expected will be achieved as long as the current level of budget and human resources are maintained</li> <li>● Various positive impacts are observes and no negative impacts observed so far</li> </ul>
Sustainability	Relatively High	(+) High relevance with Zambian policies (-) More than 10 TSB officers are considered to have capacity to design permanent weirs (±) Concern about budget arrangement by the Zambian side to continue the smallholder irrigation schemes in the long term, particularly in terms of permanent weir construction

Source: JICA Terminal Evaluation Team (2016) The Joint Terminal Evaluation Report On The T-COBSI

#### 4.1.2 OUTLINE OF THE IMPACT SURVEY

The outline of impact survey is mentioned right side (Figure 4.1.1). As mentioned above, the evaluation team suggested there are several impacts are affected by T-COBSI. For evaluating those several impacts, the project built a hypothesis that there 2 stages, 5 major components are affected by T-COBSI directly, and after that it should be connect to nutrition improvement effect. In addition, there many projects conducted by domestic and international organization in Zambia, so the project had taken these intervention into consideration before analyzing.



**Figure 4.1.1 Outline of the Impact Survey**

Source: JICA T-COBSI Project Team (2017)

### 4.1.3 METHOD OF THE IMPACT SURVEY

Method of impact survey is summarized below.

**Table 4.1.2 Method of Impact Survey**

Title	Contents	Detail/Remarks
Target area	3provinces	<ul style="list-style-type: none"> <li>Northern province, Muchinga province and Luapula province</li> <li>3 districts from each provinces</li> </ul>
Condition	2conditions	<ul style="list-style-type: none"> <li>Condition 1. Non irrigated area</li> <li>Condition 2. Irrigated area (both of target site from 2009 to2011 as COBSI and from 2013 to now as T-COBSI)</li> </ul>
<u>1. 5major impacts</u> a) Productivity b) Dietary Diversity c) Household Economy d) Empowering Women e) Environmental Health	Interview with Questionnaire	<ul style="list-style-type: none"> <li>Index for productivity improvement Cultivated area, Yield etc.</li> <li>Index for household economy , improvement Net income from agriculture, Expenditure for food etc.</li> <li>Index for dietary diversity Food Consumption Score (FCS), Coping Strategies Index (CSI) etc.</li> <li>Index for environmental health Time to access the safety water, Plague infected etc.</li> </ul>
<u>2. Indirect impact</u> f) Nutrition improvement	Anthropometries' measurement	<ul style="list-style-type: none"> <li>Target: Children in farmers, 20-59 months after birth and breast feeding.</li> <li>Measure height and weight (for calculating WAZ, HAZ and HWZ )</li> </ul>
	Observations	<ul style="list-style-type: none"> <li>Check "Under 5 years card" and copy writing by hand below</li> <li>Date of birth</li> <li>Ingest Vitamin</li> </ul>

Source: JICA T-COBSI Project Team (2017)

Basically the project conducted interview with original questionnaire made by project team. Especially for dietary diversity and nutrition improvement, those questions were made by official indexes which are known in international organization for measuring food security and nutritional situation.

There 3 steps for conducting the survey. The project team started asking community's climate characteristic, social accessibility and investigation from some organization. Then the surveyors separated and conducted household interview individually. Finally, surveyors measured child's height and weight (refer to the photo right side). It is needed parent's cooperation when children want crying.



#### 4.1.4 RESULTS AND DISCUSSION

##### 1) Results and Key Findings

While the beneficial effects of irrigation scheme on agriculture such as crop production is well known, there are a few evidences of effect on dietary diversity and moreover on the nutritional status of villagers. In this survey, project impact assessment was carried out using statistical procedures. Based on the assessment, beneficial effects (project impacts) by the introduction of T-COBSI irrigation scheme were revealed. The beneficial effects were associated with the agricultural production, household economy, dietary diversity and also villagers' nutrition status. Besides, the results of survey suggested these effects depend on the site characteristics including climate conditions and accessibility to socio-economic services. Results of statistical analysis are listed on the Table 4.1.4 and the key findings are below:



*Child looks at mother during measuring height*

- Improvement of agricultural production was achieved by the expansion of agricultural field (e.g. vegetable fields in dry season) and its effect appeared irrespective of site characteristics. In a numerical value, the introduction of irrigation scheme has increased agricultural field and agricultural production in 1.7 and 2.2 times, respectively as compared with non-irrigated area.
- Improvement of household economy was improved by increasing agricultural income, and its effect also appeared irrespective of site characteristics. The introduction of irrigation scheme has increased agricultural income 2.2 times of non-irrigated. It has become clear that the increase in agricultural income tends to induce increase of food expenditure on dry season in such areas which are vulnerable to climate change. In contrast, agricultural income does not induce increasing food expenditure on dry season in areas with poor access to socio-economic services.
- Improvement of dietary diversification has been improved in both dry and rainy seasons. While the food diversification in rainy season was promoted irrespective of site characteristics, it has become clear that diversification in dry season was promoted more by the introduction of irrigation scheme in vulnerable areas against climate change. In terms of the accessibility of socio-economic services, diversification was promoted in both progressed and poor access areas. This result shows the difference in the promoting process of dietary diversification in respond to site characteristics. It can be represented by an increase in food expenditure (in other word, increase in food purchase) in areas with progressed access, and in areas with poor access it can be represented by an increase in in-house consumption of dry season crops.
- Women's working hours (especially in dry season) were significantly increased by the introduction of irrigation scheme. The increase in working hours was more prominent in areas with poor access to socio-economic services. It can be assumed that this increase in working hours is due mainly to the additional labor for the agricultural production during dry season for in-house consumption.
- Improvement of nutritional status has been achieved by the introduction of irrigation scheme. In terms of site characteristics, the effect was observed irrespective of climatic condition, and it was revealed that the improvement effect was higher in the areas with poor access to socio-economic services. This result suggests that improving dietary habits by in-house consumption during dry season directly leads to improvement of nutrition. The effect was not on the improvement of chronic malnutrition such as growth inhibition, but on the improvement of short to medium term

malnutrition. Since chronic malnutrition is caused by the lack of essential elements such as proteins and minerals, etc., and drastic change in diet is necessary, improving chronic malnutrition is difficult to be achieved by the introduction of irrigation alone.

## 2) Technical Implications from Lesson Learned

This survey clarified the project effect using statistical procedures and found statistical significance of several T-COBSI project impacts. In particular, the nutritional improvement effect measured based on the on-site data is considered to be very valuable for subsequent projects and/or studies in Zambia and also other neighbor countries. Meanwhile, in this survey, there are many trial parts such as methods, items and procedures, and leaving much room for improvement in the future. So, it is expected that the survey results will be the basis for further discussion on the future projects and/or studies related to agriculture even in irrigation sub-sector, health and nutrition.

**Table 4.1.3 Survey Implementation and Lessons Learnt**

Protocol and Procedures	Lessons Learnt
Baseline data	In this survey, the impact of irrigation was evaluated by comparing the current status between irrigated and non-irrigated areas. It is desirable to compare the amount of changes from the baseline.
Comparison between simple and permanent weirs	In this survey, the impact of introducing the irrigation scheme was evaluated without distinguishing the simple weir and the permanent weir constructed by the project (assuming that there is no difference in effect on individual households). However, even if there is no difference in the effect, it is better to distinguish and evaluate it in order to clarify the cost effectiveness of the simple weir compared with the permanent weir which requires higher cost.
Assessment of negative impact	The working hours of women villagers were significantly increased by the introduction of irrigation scheme. Further investigation is required if there is not only positive also negative impact on their livelihood.
Interaction effect of health related projects	The survey results showed lower nutritional status at the areas on which the health related project is on-going. In this survey, these projects were sorted out without distinguishing the type (e.g. health, sanitation and nutrition) and duration of projects. These factors should be taken into consideration.
Coverage areas	The survey covered only a part of target areas of T-COBSI project. If it is available for the resources it is highly recommended to conduct all target areas to clarify the project effects.
Role of health related facilities	Health posts and rural health centers are playing an important role in rural areas. Focusing on their activities and evaluating their impact on rural areas is also important in understanding nutrition improvement.
Multi-sectoral approaches	The survey revealed that the introduction of irrigation is not as effective as on the improvement of chronic malnutrition. Multi-sectoral approaches in collaboration with health and nutrition programs emphasizing more on diet should be conducted to solve the chronic malnutrition

Source: JICA T-COBSI Project Team (2017)

**Table 4.1.4 Survey Result of Impact by the Introduction of T-COBSI Irrigation Scheme**

Impact Item	Index	Factor: Irrigation Scheme(I)		Factor: Climatic Condition(C)		Factor: Accessibility of Socio-Economic Services(SE)		External Factor: Public Health Intervention(PI)	
		Effect	Type of Site: Not Irrigated area, Irrigated area	Interaction	Type: Vulnerable Area, Toughness Area	Interaction	Type: Remote, Intermediate, and Extension area	Interaction	Type: With Intervention, Without intervention
① Productivity Improvement	Cultivated area (ha)	○	Irrigated area is significantly higher than not irrigated area. (5% level) In a numerical value, the irrigation scheme has increased agricultural field and agricultural production in 1.7 and 2.2 times, respectively as compared with non-irrigated.	—	Cultivated area in vulnerable area is 1.1times larger than toughness area (10% level)	—	Not significantly different. Maximum value in remote area.		
	Agricultural output (ZMW)	○	Irrigated area is significantly higher than not irrigated area. (5% level) The introduction of irrigation scheme has increased agricultural income in 2.0 times as compared with non-irrigated	—	Not significantly different. It is maximum value in vulnerable area.	—	Not significantly different. Maximum value in remote area.		
② Household Economy	Agricultural income (ZMW)	○	Irrigated area is significantly higher than not irrigated area. (5% level) The introduction of irrigation scheme has increased agricultural income in 2.2 times as compared with non-irrigated	—	Not significantly different. It is maximum value in toughness area.	—	Not significantly different. Maximum value in intermediate area.		
	Food Expenditure (ZMW)	○	Irrigated area is significantly higher than not irrigated area both of dry and rainy season. (5% level)	○	Not significantly different between area type. About food expenditure in dry season, vulnerable area is more effective for introduction of irrigation.	—	Significant difference at the 5% level of food expenditure in dry season Minimum value in remote area.		
③ Dietary Diversity and Food Security	Dietary Diversity (FCS)	○	Irrigated area is significantly higher than not irrigated area. (5% level) It was confirmed diversification by irrigation.	○	Not significantly different between area type. About interaction of FCS in dry season, vulnerable area is more effective for introduction of irrigation.	○	Not different between area type. There is interaction of FCS in dry season. It is better score in remote area and extension area.		
	Food Security (CSI)	○	Irrigated area is significantly higher than not irrigated area in both dry and rainy seasons. (5% level)	○	Not significantly different between area type About interaction of CSI, vulnerable area is more effective for introduction of irrigation.	—	Not significantly different. It is better score in intermediate area and extension area.		
④ Environmental Health	Duration for water source (km)	△	Not significantly different.. Relatively, the duration for accessing water source is shorter in irrigated area.	—	Not significantly different.	—	Not significantly different.		
	Times of diaries (times/year)	—	Not significantly different.	—	Not significantly different.	—	Not significantly different. Relatively low at extension area.		
⑤ Empowering Women	Cultivated area (ha)	—	Not significantly different.	—	Not significantly different.	—	Significant difference at the 5% Cultivate area in extension area is larger than others.		
	Working time (hrs./day)	—	Irrigated area is significantly higher than not irrigated area in dry season. Relatively, working time in irrigated area is longer than in not irrigated area.	—	In rainy season, working time in vulnerable area is longer than working time in toughness area (10% level)	○	Not significantly different between Accessibility of Socio-Economic Services type. There are interaction in dry season (10% level)		
⑥ Nutrition Improvement	HAZ (Stunting: Chronic malnutrition)	—	Not significantly different.	—	Not significantly different.	—	Not significantly different.	—	Not significantly different.
	WAZ (Underweight: Mid-term malnutrition)	○	Irrigated area is significantly higher than not irrigated area. (5% level) It was confirmed impact by irrigation.	—	Not significantly different.	—	Not significantly different in multiple comparison. Minimum value in remote area.	—	Without intervention is significantly higher than with intervention (5% level).
	WHZ (Wasting: Acute Malnutrition)	○	Irrigated area is significantly higher than not irrigated area. (5% level) It was confirmed impact by irrigation.	—	Not significantly different.	○	Not significantly different. in multiple comparison. Minimum value in remote area. There are interaction in intermediate and extension area	—	Without intervention is significantly higher than with intervention (5% level).

Remark: Meaning of mark in Effect : "○"=Effective, "△"=Tendency,"—"=Not effective

Meaning of mark in Interaction : "○"=Significant difference,"—"=Not significantly different.

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## CHAPTER 5 LESSONS LEARNED AND RECOMMENDATION

### 5.1 MEASURES TAKEN FOR THE BETTER PROJECT IMPLEMENTATION

This section overviews some measures which were taken for the better implementation of the project activities throughout the project period.

#### *1) Selection of Participants in Accordance with the Contents of the Training*

T-COBSI disseminated some different categories of technologies such as simple-weir irrigation development, permanent-weir irrigation development, and market-oriented farming. At the beginning, same lectures were provided for TSB officers and extension officers, and the, it was found inappropriate. From the second implementation year, therefore, different set of trainings were provided for TSB officers and extension officers so that they can play different role during the project.

Similarly, from the second implementing year, district Marketing Officer were invited for the Mid-term Training instead of TSB officer as the marketing addressed in the MTT is not a responsibility of district TSB officers. In addition, Senior Agricultural Officer (SAO) was invited several occasions because their understanding on this project was essential especially for the supervision of extension officers. As such, involvement of various stakeholders was ensured.

#### *2) Sequential Implementation of Trainings/ Workshops*

For the trainees of each year, trainings were implemented step-wise so that trainees can learn the contents one by one and also to keep the sense of participation throughout the season. That is, training of trainers, kick-off training (irrigation and irrigated farming), mid-term training (marketing), and evaluation workshop (monitoring and evaluation). Although repeated trainings make the participants busy, it had some effect to remind them of the project activities.

#### *3) Introduction of Market-oriented Agriculture*

There was a tendency that stakeholders focused too much on water resource development. But irrigation is a means for farming and thus for business where applicable. In this concern, mid-term training was provided covering market-oriented agriculture.

#### *4) Technical Dissemination through Existing Agricultural Extension Structure*

It was planned to achieve the project purposes by disseminating simple irrigation technologies through the existing extension system. Rather than creating a new and stand-alone implementation structure, it was concluded much effective and sustainable for the implementation of the project activities because the technologies and experiences can remain in the system.

#### *5) Support on Mobilization of Extension Officers*

This project was purely for technical cooperation on smallholder irrigation; however, it also envisaged achieving an ambitious target of developing 700 ha in irrigated area. Considering the fact that Zambian government has a financial challenge in mobilizing officers on the ground, JICA team provided them DSA and transportation refund for the attendance in a series of training as well as fuel necessary for the extension work on the field. Although provision of such is always an issue for sustainability after the completion of the project, some level of support needs to be considered as to move the project activities forward especially when additional works are required to the officers.

#### *6) Development of Visual-based Extension Materials*

Various types of extension materials were produced, which includes poster, leaflet, manual, guideline, and power point material. More simplified and visualized one was prepared mainly for farmers for quick understanding, while detailed guideline was prepared mainly for TSB officers so that they can refer to the guideline as the construction works progresses.



### 7) *Public Relations*

As the approach in smallholder irrigation development was new for Zambia, it was important to gain an understanding of decision makers. To this end, various public-relation activities had been carried out that include: issuing newsletters, inviting important officers such as minister, deputy minister, director/ deputy director of the department, ambassador of Japanese embassy, media, and university professors. As a result, the once-omitted simple weir technology was re-incorporated into the project framework. Furthermore, dissemination seminar was organized for further extension of the project activities in other areas or to collaborate with other donors.

### 8) *Application of Simple and Easy Technologies*

As to disseminate the technology through the existing extension system, level of technologies was kept as simple as possible. As extension officers are not an expert in irrigation engineering, it was necessary to keep the level of technology suitable for these extension officers so that they can play a major role in technical dissemination.

### 9) *Upgrading Approach*

As the project's main concept, upgrading approach was applied, that is, to select the site for permanent weir construction from the sites where simple-weir irrigation had been carried out. Through this approach, in addition to the suitability of the site from engineering point of view, such as topography, amount of water, slope, readiness of farmers from a social point of view were well confirmed. Through this approach, likelihood of success was increased. On the other hand, however, it made officers difficult to find out the potential area because there were a lot numbers of simple sites in the area even in such area where permanent weir construction is not suitable at all. Thus, understanding of selection criteria was the key to ensure this approach.

### 10) *Seeking for Collaboration with other Donors*

As to cope with inadequate financial resources of the government especially in permanent weir construction, additional trainings were provided to TSB officers so that they can formulate design reports of permanent weirs and thus seek for the financial support from other donors especially S3P. With particular design report, donors can easily invest some funding. In fact, there was a positive reaction from the African Development Bank looking for a dialogue with the ministry on this matter.

## **5.2 LESSONS LEARNED**

There are some lessons learned from the implementation of the project activities. Here are some of important lessons, which include the ones pointed out by the counterpart officers.

### 1) *Simple Weir Scheme*

Simple weir irrigation development has gain a status through the project as a cost-effective entry point of irrigated farming. Different from ordinary structure, simple weir can be constructed even in relatively flat and soft condition, which helps farmers initiate their own irrigation nearby their homestead.

### 2) *Impact on Nutrition Status*

It was implied through household survey and anthropometric survey that the smallholder irrigation development has a positive impact in nutrition status of children as compared to non-irrigation areas. To understand the indirect impact of the project, it is a good way to do survey on nutrition status associated with irrigation development.

### 3) *Fluctuation of the Performance in Each Year*

There was a fluctuation of performance in the development of simple-weir irrigation sites in the past three years: 292 ha (2014), 215 ha (2015) and 369 ha (2016). The participants of the final evaluation

workshop stated the main factors for the fluctuation: 1) some officers dropped out after the KOT due to attending school or something; 2) precipitation in particular year was small and thus amount of discharge was not enough; and 3) the target set at the KOT was, first of all, lower in 2015 especially for improvement sites.

Lower achievement in 2015 may attribute to the lower number of improvement sites. As officers need to find out any particular sites where farmers are doing some irrigation in a primitive mode, it totally depends on the information of the sites extension officers know or actual number of sites. In 2015, number of such existing sites may have been lower.

In any case, it was difficult to predict the output of COBSI activity in each year as it depends on the commitment of officers, disbursement of counterpart funding, water discharge, existence of perennial rivers in the camp, etc.

#### *4) Dissemination of the Technologies through Existing Extension Structure*

Use of existing government extension structure was given credit from the participants as an effective way in this kind of smallholder irrigation development. It is also said that capacitation officers and thus farmers ensures sustainability. As expected, it was an effective way for outreach and prompt initiation of irrigated farming by smallholder farmers, although there still are some challenges in mobilization of extension officers.

#### *5) Workload of Extension Officer*

As same as farmers who have multiple things to do, extension officers also have many assignments to do throughout the year. Example includes conduct of field day, supporting of FISP and marketing of maize under FRA's program, preparation of agricultural show, and data collection for crop forecasting. As a result, it sometimes becomes a heavy workload for the officers to facilitate the smallholder irrigation development in parallel with these activities.

#### *6) Farmer to Farmer Extension*

Similar project was once implemented in Malawi where simple weir irrigation was wide spread through farmer-to-farmer extension. The same was expected in this project; however, not much number of farmer-to-farmer extensions was reported. Possible reason is the lower population density in the project area (22 people/sq. km in Zambia as compared to 183 in Malawi) whereby less chance of seeing irrigation activities nearby villages.

#### *7) Big Variations in TSB's Educational Background*

Big variations in TSB's education made difficult to plan and to carryout training at the same level. TSB officers have different educational background from certificate (2-year college), diploma (3-year college), to graduate (4-year college) or upper. In the case of certificate and/or diploma, most of officers had studied general agriculture and they do not have much knowledge specialized in agricultural engineering. In this case, it is difficult to design the training for all TSB officers who have different background. Thus, for permanent weir construction, trainees should be selected based on the educational background and their work experience.

#### *8) Difficulty of Farmers' Long-term Commitment in Permanent Weir Construction*

As per commencing the permanent weir construction, expected workload and conditions had been well explained to farmers groups. Even so, farmer participation tends to reduce during the construction as it takes so much time from the onset toward the end of the dry season, in which farmers themselves had other things to do such as *Chitememe* cultivation, preparation of rain-fed maize cultivation, and participation in Farm Input Support Program. Thus, for the planning of permanent construction, tapering of workforce should be carefully considered. Or, other measure needs to be taken so as to keep the commitment of farmers, which may include the provision of meals.

9) *Enough Lead Time for Sensitization/ Preparation*

To well organize the farmers in construction of simple and permanent weir, enough time needs to be secured for sensitization. It was found necessary, for example, to avoid land quarrels especially if canal has to pass through non-scheme members' lands. It is also important if the weir is to be upgraded because there are some obligations for farmers and without farmers' commitment, construction will go well. In addition, after the market survey, it was found that farmers found difficulties in accessing farming inputs as they are not readily available in the nearby agro-dealers. In all cases, early planning is vital. For simple weir irrigation, particularly, site selection needs to be done just at the beginning of the dry season to realize the full benefits of irrigation in the first season.

10) *Importance of Counterpart Funding*

Inadequate government commitment in counterpart funding was found demoralizes the officers in charge in continuing project activities on the ground. The project was designed to supplement the government's activities in irrigation development and agricultural extension. However, not as much amount of counterpart funding as expected had been disbursed and some officers claimed they were demoralized.

11) *Reinforcement of Canal*

Main objective of the project was the expansion of irrigated area, for which development of as much number of irrigation sites was pursued. After the construction of the irrigation facilities, however, many farmers' groups stated that leakage from canal was severe. As earth canal is the major type of the canal in COBSI approach, reinforcement of canal may be one of the key points to be considered.

### **5.3 RECOMMENDATIONS**

Following is some recommendations for smallholder irrigation development in the future.

1) *Incorporation of COBSI Approach in the Irrigation Policy*

Now that the effectiveness of COBSI approach in certain condition is confirmed through the project, COBSI approach that pursues the smallholder irrigation with simple technology should be incorporated into the government's irrigation policy, which is now being amended, so that related activities, such as training of extension officers, can be implemented according to the policy and donors can also invest funding accordingly.

2) *Government's Commitment in Supporting Extension Activities*

Without funding for field activities, no outcome can be expected. As the project is ending, the government shall ensure the plan of supporting extension officers' activities on the ground. Provision of means of transportation is, among all, essential. Now that JICA has procured and handed over one motorcycle in each target district, it is the government's responsibility to continue monitoring activities using the motorcycle for ensuring sustainability.

3) *Funding for Development of Permanent Weir Sites*

Unfortunately, it was found that the government has challenges in funding in permanent weir construction. Future plan in permanent weir construction should not be too optimistic. In reality, it is better to seek for the funding from other donors and construct them from the sites where design documents are already prepared by T-COBSI.

4) *Extension to Other Potential Areas*

There are some more provinces which are categorized as Agricultural and Ecological Zone III, same as the project area, which include some districts of Western, Northwestern and Central provinces. As there should be some potential areas in these districts, further extension activities should be implemented by the government in these areas.

#### 5) *Introducing the COBSI Technology into Ordinary Extension Trainings*

As it was confirmed that COBSI technologies are useful tool for famers to initiate irrigated farming, it is recommended for the government to incorporate the training of these technologies into ordinary training, such as in-service training, of extension officers. Equipping the extension officers with knowledge of irrigation development, potential of agricultural development can be enriched. As a supplemental measure, introducing COBSI technology in to agricultural colleges' syllabus may need to be considered as a lot of officers graduate these colleges.

#### 6) *Construction of Permanent Weir as Training*

Permanent weir construction requires significant amount of funding, US\$15,000 or around per site, while increment of irrigated area is not much. Considering the cost-effectiveness of the scheme, it is not necessary to put so much funding into this kind of small-scale permanent weir. Instead, it should be considered as an opportunity to train irrigation engineers who will act as planner, designer and supervisor of the medium to large scale irrigation facilities in the future.

#### 7) *Selection of Trainees*

It was found difficult to design the training contents for the officers who have wider range of educational background and working experiences: some have engineering background, while some do not have. Thus, it is better to profile the potential trainees not just based on their job title, and then provide appropriate training depending on the profile, especially for irrigation engineering. Similarly, it is better to invite extension officers who are from such camps where irrigation potential is high.