



GUIDELINES FOR PROMOTION OF IRRIGATED AGRICULTURE MODEL IN TERAI (PIAT-MODEL)

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**PROJECT FOR THE PROMOTION OF IRRIGATED
AGRICULTURE IN TERAİ PLAIN**

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Abbreviations

ABPSTC	Agribusiness Promotion Support and Training Centre
ADB	Asian Development Bank
ADS	Agriculture Development Section
AKC	Agriculture Knowledge Centre
BC	Box Culvert
CA	Command Area
CADF	Chandradangi Agriculture Development Farm
CAP	Commercial Agriculture Promotion
CAP-BLS	Participatory Baseline Survey under the CAP activities
CCAP	Conventional Commercial Agriculture Approach
CHSC	Custom Hiring Service Center
C/P	Counterpart
CR	Cross Regulator
DAP	Detail Activity Plan
DAR	Directorate of Agriculture Research
DDG	Deputy Director General
DG	Director General
DOA	Department of Agriculture
DOI	Department of Irrigation
DTO	Direct Tertiary Offtake
DTOC	Direct Tertiary Offtake Committees
DWRI	Department of Water Resources and Irrigation
FC	Field Channel/Canal
FG	Farmer's Group
GOJ	Government of Japan
GON	Government of Nepal
HH	Household
H-Q curve	Height-Quantity curve
HR	Head Regulator
ICWMP	Integrated Crop Water Management Program
IMD	Irrigation Management Division
IMO	Irrigation Management Office
ISF	Irrigation Service Fee
IWRMP	Integrated Water Resources Management Project
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JT / JTA	Junior Technician / Junior Technical Assistant
KIMO	Kankai Irrigation Management Office
KIS	Kankai Irrigation Scheme
LG	Local Government
LOA	Letter of Agreement
LRO	Land Revenue Office
MAFF	Ministry of Agriculture, Forestry and Fisheries
MC	Main Canal
MCC	Main Canal Committee

MoA	Market-oriented Agriculture
MOALD	Ministry of Agriculture and Livestock Development
MOEWRI	Ministry of Energy, Water Resources and Irrigation, Province No.1
MOIAC	Ministry of Industry, Agriculture and Cooperatives, Koshi Province (Former Ministry of Land Management, Agriculture and Cooperatives, MOLMAC)
MOLMAC	Ministry of Land Management, Agriculture and Cooperatives
MOPID	Ministry of Public Infrastructure Development
MOU	Minute of Understanding
MOWSIE	Ministry of Water Supply, Irrigation and Energy, Province 1 (Former Ministry of Public Infrastructure Development, MOPID)
MPUCAF	Multi-purpose United Cooperative Agriculture Farm
M/S	Monitoring Sheet
NARC	Nepal Agriculture Research Council
NARS	National Agricultural Research System
NKC	Nepal Krishi Care
OFD	On Farm Development
O&M	Operation and Maintenance
PC	Pipe Culvert
PD	Project Director
PDM	Project Design Matrix
PF	Parshall Flume
PM	Project Manager
PMAMP	Prime Minister Agriculture Modernization Project
PMC	Project Monitoring Committee
QQT	Quality, Quantity, Time
RM	Rural Municipality
SC	Secondary Canal
SCC	Secondary Canal Committee
SFAC	Small Farmer Agriculture Cooperative
SHEP	Smallholder Horticulture Empowerment & Promotion
SRC-CAP	Sindhuli Road Corridor Commercial Agriculture Promotion Project
STW	Shallow Tube Well
TC	Tertiary Canal
TCC	Tertiary Canal Committee
TCP-PIAT	Technical Cooperation Project for Promotion of Irrigated Agriculture in Terai
TOT	Training of Trainers
TTAP	Top-down Transfer of Technology Approach
VDC	Village Development Committee
WDC	Water Distribution Committee
WDP	Water Distribution Plan
W/P	Work Plan
WUA	Water Users Association

Measurement Units and Currency

Area	Volume
cm ² = Square-centimetre(s) m ² = Square-metre(s) km ² = Square-kilometre(s) (1,000,000 m ²) in ² = Square-inch(s) (645.16 mm ²) ft ² = Square-feet (929.0304 cm ²) ha = Hectare(s) (10,000 m ²) acre = Acre(s) (4,046.8 m ² or 0.40468 ha.)	cm ³ = Cubic-centimetre(s) m ³ = Cubic-metre(s) km ³ = Cubic- kilometre(s) in ³ = Cubic- inch(s) ft ³ = Cubic- feet L = Litre(s) (1,000 cm ³) MCM = Million Cubic Metre (s)
Length	Weight
mm = Millimetre(s) cm = Centimetre(s) m = Metre(s) km = Kilometre(s) (1,000 m) in = Inch(s) (25.4 mm) ft = Feet (30.48 cm)	g = Gram(s) kg = Kilogram(s) (1,000 gr.) ton = Metric Tonne(s) (1,000 kg)
Currency	Time
US\$ = United State Dollar NPR = Nepalese Rupee	s = Second(s) min = Minute(s) (60 sec.) hr = Hour(s) (60 min.)

CHAPTER 1 INTRODUCTION

1.1 General

(1) Current Situation of Irrigation and Agriculture in Nepal

In Nepal, agriculture is a key economic sector that engages about 62% of the total population and accounts for about 24.09% of the gross domestic product (GDP)¹. Out of Nepal's 29.16 million population, 20.23%² or almost 6 million are poor, of which 33.8% live in rural areas. The incidence of poverty is higher in rural areas (24.66%) than urban areas (18.34%). Agricultural and rural development has a great role to play in terms of economic development, poverty reduction and domestic disparity correction in Nepal³. It is approximately 68% of the farmers in Nepal produced solely for domestic consumption, while 1.1%, 24.7% and 5.4% produced solely for sale, mainly for domestic consumption and some sale, and mainly for sale and some for the domestic consumption, respectively⁴. This reveals that Nepalese agriculture is predominantly subsistence.

The Terai Plain (elevation 60 m to 300 m), which stretches from east to west on the plains of southern Nepal, is Nepal's breadbasket that is blessed with fertile soil, occupies 53% of the total cultivated area and 81% of the total irrigated area of 1.473 million ha. Rice, maize, wheat, vegetables, etc. are produced under rain-fed conditions or partial irrigation. The share of cereals, cash crops and vegetables in the national production is high, which is 45.0%, 15.2%, and 17.4%, respectively⁵. Improving productivity in the Terai will greatly enhance domestic food security, as the region's agricultural products in the Terai Plain are distributed to the northern hills.

The Government of Nepal (GoN) has promoted irrigation development for over 50 years in different parts of the country with the support of development partners, including Irrigation Management Transfer (IMT) to improve operation and maintenance (O&M) of irrigation facilities. The GoN expects water users associations (WUA) to play a key role in the IMT. Despite these efforts, significant outcomes have yet to be realized. Consequently, strengthening the management capacity of WUA's and government support agencies has become an important issue in Nepal.⁶

(2) Background of the Irrigated Agriculture Promotion

Government initiatives and programmes including several projects have been undertaken in Nepal to promote irrigated agriculture for the sustainable O&M of irrigation facilities, including the Irrigation and Water Resources Management Project (IWRMP) from 2008 to 2018 and the Community Managed Irrigated Agriculture Sector Project + Additional Financing (CMIASP-AF) from 2014 to 2022. In addition, Government of Nepal has collaborated with Government of Japan (GOJ) to implement the Technical Cooperation Project for Promotion of Irrigated Agriculture in the Terai Plain (hereinafter referred to as the "TCP-PIAT") in Kankai Irrigation Scheme located in Jhapa District of

¹ Economic Survey 2023/2024, Ministry of Finance, the Government of Nepal

² National Living Standard Survey 2022-23, National Statistics Office, 2024. This data is based on the new poverty line computed by NLSS IV, which is NRs 72,908.00

³ International Labour Organization 2019

⁴ National Sample Census of Agriculture 2021/22, National Statistics Office Government of Nepal

⁵ Same as above 1

⁶ Fifteenth Plan (2019/20-2023/24), National Planning Commission, the Government of Nepal

Koshi Province. The project intended to form “the Model of Irrigated Agriculture” by the collaboration among the Federal, Provincial, Local Governments and Water Users Associations (WUAs).

This model facilitates the implementation of the long-term vision, goal, and objective of the National Irrigation Policy, 2023, through its full internalization and assisting in resolving the problems as identified by it. It is mainly related to that objective of the policy, which refers to the protection of available water resources and sustainable development and scaling out to increase agricultural production and productivity. The model is fully consistent with the Irrigation Master Plan, 2019 (updated 2024). It contributes to the objective, strategies and working policy of the 16th Plan (2024/25-2029/30).

This model supports decoding the long-term vision, goals, and objectives of GoN’s Agriculture Development Strategy (2015-35) at the field level. Implementing the model will help respond to the problems identified by this Strategy, optimally utilize the opportunities, and achieve multidimensional results like increasing agricultural business competitive capacity and agricultural commercialization. Out of 13 outcomes in this strategy, one is related to irrigation. The strategy has clarified that irrigation and agricultural policy should not be implemented in isolation - irrigation is an input to profitable agriculture, not an end in itself.

Implementation of this model will help to achieve sustainable development strategy (SDG) targets, specifically SDG1: End poverty (End poverty in all its forms everywhere); SDG 2: Zero hunger (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), specifically, SDG 2.3: Doubling agricultural productivity and incomes.

1.2 Introduction to the Guidelines

The Guidelines are designed to assist major irrigation and agriculture agencies engaged in providing integrated irrigation and agricultural services by applying the model formed through the joint collaborative efforts of federal, provincial, and local level agencies from public, private, and cooperative sectors. The model proposed in this “Guidelines” is called the “Promotion of Irrigated Agriculture in Terai”, referred to as the “PIAT model”. This name reflects its origins, as the model was initially piloted, refined, and evolved from the successful results of the Kankai Irrigation Scheme, which spreads in the four local government constituencies- Shivasatakshi, Kamal, Gauriganj, and Gauradaha- in Jhapa, a Terai district. The development of the PIAT model involved the collaborative efforts from the Kankai Irrigation Management Office (KIMO), the Kankai Canal Water Users Association (KCWUA), the Agriculture Knowledge Centre (AKC) Jhapa, and above four local governments with technical assistance from the JICA funded Technical Cooperation Project for Irrigated Agriculture in Terai Plain of Nepal (TCP-PIAT)⁷.

The Guidelines provides "basic policies for market-oriented agriculture and sustainable O&M of irrigation facilities for the stakeholders", and "irrigated agriculture technologies and their implementation procedures necessary for promoting irrigated agriculture".

This Guideline is divided into two parts, corresponding to the intended users:

<Guidelines for the Implementation of PIAT-Model at the Government Level>

⁷, The GoN handed over the KIS to the Kankai Water Users Association on 9th December 2009.

This is the main part of the Guidelines. The Guidelines is intended to provide the principles and general procedures for the proper implementation of the PIAT-Model by federal, provincial, and local government officials.

<Field Practitioners' Manual for the PIAT-Model>

This is a separate volume of the Guidelines. It provides detailed implementation methods for each activity, aimed at practitioners engaged in promoting irrigated agriculture at the field level, including water users' associations, irrigation management offices, and local government officials.

The Guidelines suggests the users to review contemporary irrigation policies, plans, the Irrigation Act, agricultural development policies and strategies, as well as pertinent work procedures, guidelines, directives, and manuals prepared and promulgated by federal, provincial, and local governments before replicating the model. This will further help to adapt the PIAT-Model in the local situation.

1.3 Objective of the Guidelines

The overall objective of the Guidelines is to assist the key stakeholders, especially government agencies and WUA in replicating the PIAT-Model in Nepal's other irrigation schemes in Terai. The specific objectives of the Guidelines are to deliberate:

- i) process of action planning for the key stakeholders using logical frameworks;
- ii) implementation process of sustainable irrigation O&M using participatory irrigation management approach; and
- iii) implementation process of market-oriented agriculture using PIAT-CAP approach.

1.4 Target Irrigation Schemes and Users

The Guidelines is generally applicable in the settings of Terai Irrigated Agriculture in Surface Irrigation Schemes. However, considering unrestrained use of groundwater irrigation in Terai, the Guidelines can be adapted to the areas irrigated through groundwater as well, with some modifications and adjustments. Of the three types of irrigation management systems in use in Nepal: Agency Managed Irrigation Systems (AMIS), Joint Managed Irrigation Systems (JMIS) and Farmers Managed Irrigation Systems (FMIS), this Guidelines is specifically prepared considering Joint Managed Irrigation Systems. However, it might be adapted to other two management systems as well.

The target users of the Guidelines are federal, provincial, and local government officials, water users' associations, development partners, and other stakeholders involved in the promotion of irrigated agriculture in the irrigation schemes of the Terai Plain. The Guidelines provide process and technical guidance for the O&M of sustainable irrigated agriculture appropriate to the natural and social conditions in the Terai Plain. This will contribute to the sustainable development of the local communities and the promotion of commercial agriculture in irrigated agriculture in the Terai Plain.

1.5 Structure of the Guidelines

The Guidelines is prepared for implementing PIAT-Model by correctly understanding and practicing the market-oriented irrigated agriculture, applying, devising and further developing it as a guide. Structure of the Guidelines is as shown in Figure 1.

The Guidelines are expected to be continuously updated through piloting, feedback, and evidence in irrigation schemes after replication of the model as discussed. This will enhance the productivity of

irrigation schemes and assist farmers / water users in increasing agricultural income. This will further add value to the model by improving its applicability, practicality, and appropriateness in the future.

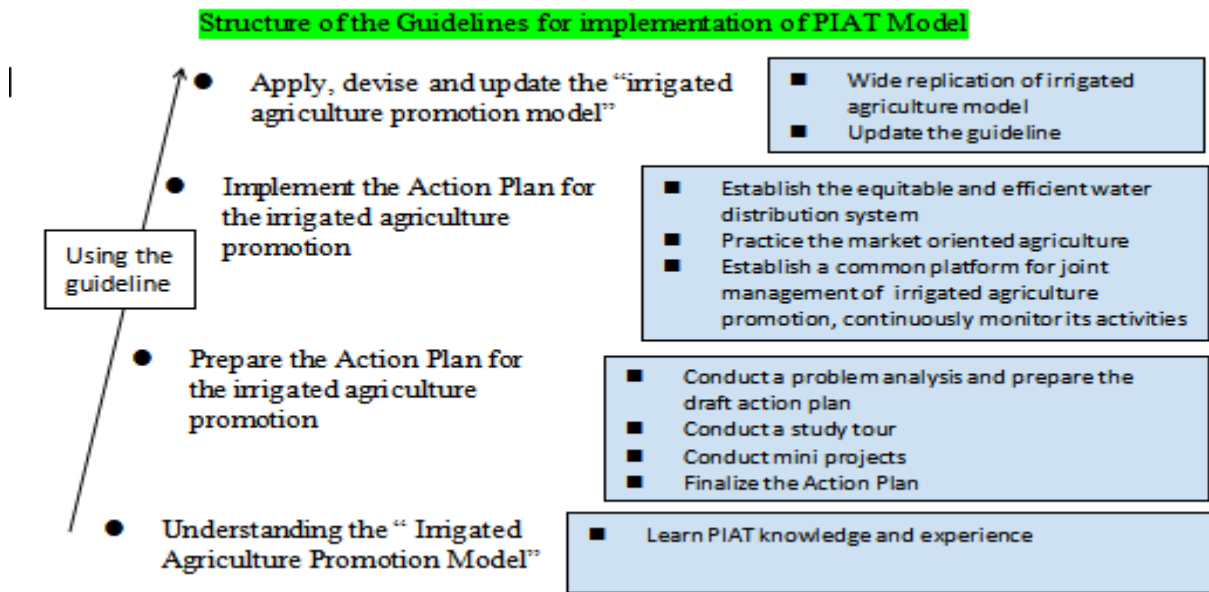


Figure 1: Structure of the Guidelines for Implementation of PIAT-Model

CHAPTER 2 PROMOTION OF IRRIGATED AGRICULTURE TERAII MODEL

1.2 General

2.1.1 Concept of Promotion of Irrigated Agriculture Model in Terai

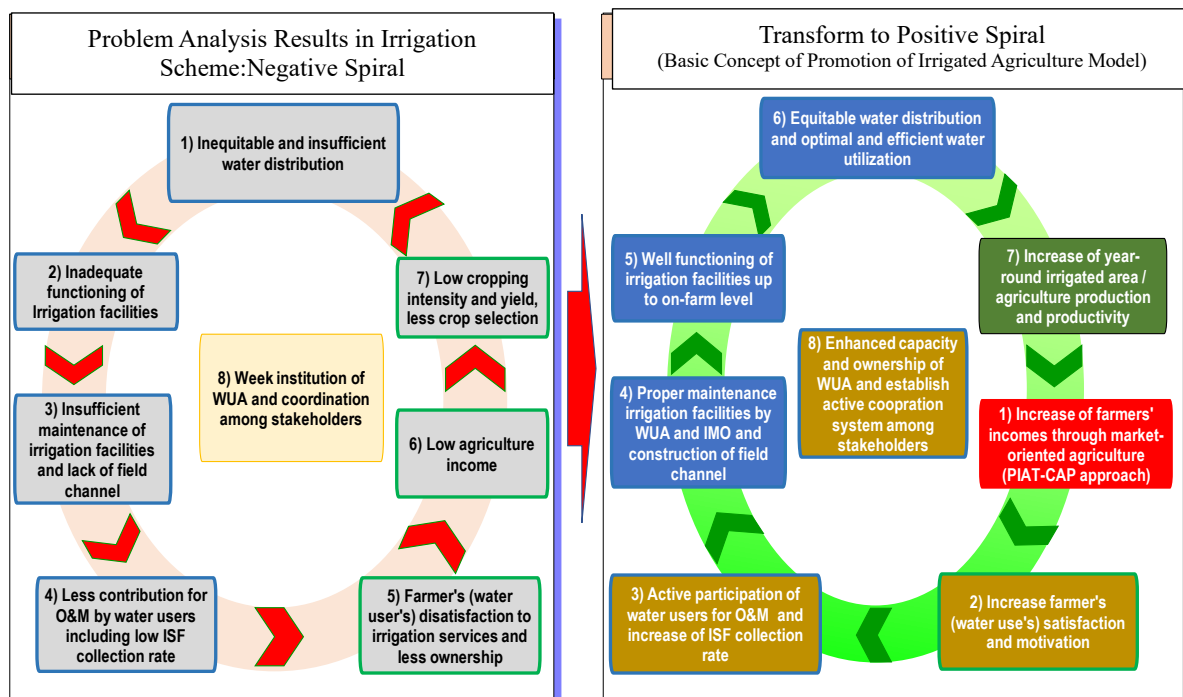
The nation-wide issues in the irrigation schemes of the Terai Plain include:

- poor functioning irrigation facilities,
- inequitable and inadequate water distribution,
- weak activities of water users' association (WUA),
- low agricultural productivity, and dominance of subsistence farming,
- agricultural labour shortage and
- weak collaboration between irrigation and agriculture sectors.

As a result of problem analysis in Irrigation Scheme, as shown in Figure 2, a negative spiral was observed starting with inequitable and inadequate water distribution which results in low cropping intensity and yield, limited crop diversification. As indicated in the figure the core issue of the negative spiral is weak activity of WUA and limited coordination among stakeholders.

The key concept underlying the PIAT model is to break free from the negative spiral often observed in many irrigation schemes and transform it into a positive spiral, as illustrated in Figure 2

Figure 2: Concept of Promotion of Irrigated Agriculture Model



The positive spiral is a result of an intensive study and understanding, followed by an objective analysis carried out by all the key stakeholders, particularly IMO; incumbent officials of the WUA's main canal committee (MCC), secondary canal committees (SCCs), and tertiary canal committees (TCCs);

experienced farmers/water users, local government officials (LGO), AKC, agricultural cooperatives, including experts.

The model's ultimate purpose is to increase farmers' incomes through the adoption of market-oriented agriculture suitable to the Terai and surface irrigation context. The PIAT concept includes seven cyclic steps which support farmers to change their behaviour from Grow and Sale Approach to Grow to Sale Approach. Core target of this positive spiral is an enhanced capacity and institutional development of WUA and implementation of active cooperation system among stakeholders.

To transform the negative spiral to the positive spiral, the Guidelines suggests the followings. This guidelines aligns seamlessly with the Irrigation Policy 2023, which aims to promotes a collaborative approach among various stakeholders involved in agricultural development. By integrating their efforts, this policy aims to maximize the benefits and efficiency of investments made in the irrigation sector, driving impactful and sustainable growth.

(1) Establishment of water users centred activity cooperation system

The Model requires the implementation of government service delivery systems for irrigation and agriculture in an integrated manner, though by default, they fall under two different government ministries in Nepal. The task team formed to plan, coordinate, and monitoring the results will identify the activity cooperation system, placing the WUA at the centre. In the Model, The WUA will take the lead role in creating an action plan to promote irrigated agriculture in collaboration with the concerned Irrigation Management Office (IMO) in irrigation and local governments and Agriculture Knowledge Centre (AKC) in agriculture. The LG/AKC will implement the activities identified in the action plan with mutual collaboration. While AKC will provide technical support and guidance to the LGs and WUA, IMO will do the same to the WUA. To ensure the cooperation system, the Guidelines suggests the IMO assist the WUA and other collaborating partners/counterpart agencies to form a task team, which in turn be instrumental in instituting an activity cooperation system.

This will enhance the capacity of the WUA to receive and utilize necessary technical and financial support to implement activities envisaged through activity cooperation system.

(2) Strengthening the organizational capacity of the WUA

The WUA will be a leading actor in the model among the major stakeholders, considering that the government's policy is to hand over the irrigation system to the WUA. This "Guidelines" confirms the Irrigation Policy 2023. The policy aims to provide necessary facilities and services to marginalized, poor, and large numbers of farmers through irrigation development and institutional development of the WUA, internalizing social justice, gender equality, and social inclusion in the irrigation development process. In the Model, capacity development priority will be put in order on main canal committee (MCC), secondary canal committee (SCC) and tertiary canal committee (TCC). It is no exaggeration to say that the success of the Model depends on the initiative, leadership and sense of responsibility of the WUA executives.

(3) Successful experience with market-oriented agriculture

Irrigation is one of important farm inputs to ensure stable agriculture production, and thus to increase the agricultural incomes of beneficiary farmers. Going back to this starting point, it will develop the activities, with a priority, to increase agricultural incomes adopting PIAT-CAP approach (market-oriented agriculture), targeting the members of WUA. Encouraged by the successful practice of market-

oriented agriculture and its subsequent results, WUA will continue to increase its efforts for equitable water distribution and irrigation facility maintenance.

2.2 Objectives of the Model

2.2.1 Overall Objective

The overall objective of PIAT model is to increase farm income and agricultural production in the Terai irrigation schemes by assisting water users in practicing market-oriented agriculture, fostering the optimal and efficient utilization of the water available in the scheme and empowering the stakeholders.

2.2.2 Specific Objectives

The specific objectives of the model are to:

- i) Promote irrigated agriculture initiatives by engaging key stakeholders of the irrigation, agriculture and allied sectors to improve irrigation management system
- ii) Assist the members of the water user's association (farmers) to increase their farm income by applying location-specific market-oriented agriculture practices;
- iii) Transform the WUA into a user-centred, innovative and professional association; and
- iv) Engage key stakeholders -such as government agencies, cooperatives, and private sector partners- in collaborative efforts to advance irrigated agriculture initiatives.

2.3 Results and Outputs

Table 1 below shows interrelationships among specific objectives, expected outcomes and outputs of the PIAT-model.

Table 1: Specific Objective, Outcomes and Corresponding Outputs

Specific Objective	Outcomes	Outputs
1. Promote irrigated agriculture initiatives by engaging key stakeholders of the irrigation, agriculture and allied sectors to improve irrigation management system	- Water use efficiency enhanced due to reliable and sufficient water supply - Reduced water waste and improved overall canal management system - Agricultural production and productivity increased - Sustainability prospect of the irrigation system high	- Regular operation and maintenance of irrigation system through users' initiatives - Equitable water distribution system established through joint efforts of the IMO and WUA - Maximum and efficient utilization of irrigation water by water users/farmers - Modern technologies for efficient water management are introduced.
2. Assist the members of the water user's association (farmers) to increase their farm income by applying location-specific market-oriented agriculture practices	- Farmers practice for grow to sell approach increased from the traditional grow and sell approach - Crop diversification improved including adoption of high-value crops, - Farmers' access to local and regional markets increased	- Profitable and high value crop production based on market's demand and supply - Receptiveness of farmers towards new technologies and innovations, specifically to reduce cost of production and receiving a fair price for their products - Farming based on business plan (agriculture viewed as business)
3. Transform the WUA into a professional, user-centred, and innovative association	- Higher satisfaction and better relationships between the association and its members - Credibility of the WUA improved - Improvement of financial stability and sustainability of the WUA	- Capacity of the WUA improved to coordinate activity cooperation system - Increased WUA's accountability and ownership by the users - Irrigation Service Fee collection rate improved
4. Engage key stakeholders-such as government agencies,	- Increased information sharing and collaboration among members and	- Increased engagement with government agencies, NGOs, research institutions,

Specific Objective	Outcomes	Outputs
cooperatives, and private sector partners- in collaborative efforts to advance irrigated agriculture initiatives.	with external partners	and other stakeholders to access resources, expertise, and support. - Increased support, resources, and partnerships from government bodies, NGOs, and private sector entities - Increased number of collaborative projects

2.4 Core Components

The four following components proposed in this Guidelines together create a comprehensive framework for promoting irrigated agriculture. These components cover essential aspects such as resource integration, system management, local governance, and market orientation. By addressing both technical and socio-economic factors, the model aims to create a sustainable and profitable agricultural system that benefits all stakeholders involved.

Irrigation System Improvement: The model requires the key government agency at the field level, to become responsive and accountable to the model. In agency managed or joint management system, the government has delegated the responsibility for headworks, operation and maintenance of the main canal, and overseeing regular elections for the WUAs to maintain their functionality and representation. Therefore, the effectiveness and commitment of the IMO are crucial for the success of this model. The IMO must be proactive in its duties, ensuring that all components of the irrigation system are managed efficiently and sustainably, while also fostering active participation and accountability within the WUAs. This collaborative and structured approach is essential for improving the irrigation system and achieving the desired outcomes of the model.

Promotion of market-oriented agriculture: By focusing on the optimal and efficient use of water in irrigation channels, this component is designed to significantly boost agricultural production and productivity. But at its core is the innovative "Grow to Sale" concept, which fundamentally differs from the traditional "grow and sale" approach. Rather than merely producing crops and selling them at market prices, the "Grow to Sale" strategy empowers farmers/water users to maximize profits by strategically adjusting their sowing and planting times to align with the most lucrative market opportunities, and establish relationships with the market actors, specifically traders.

This concept is not just about growing crops; it's about making informed decisions that enhance market access and profitability. By understanding market behaviors and trends before planting, farmers are better positioned to capitalize on demand and price fluctuations, ensuring their efforts translate into greater economic gains.

Moreover, this component enhances the overall agricultural framework by promoting economic viability and encouraging the adoption of modern, improved agricultural practices. It complements the other three components by driving a market-oriented mindset among farmers, fostering resilience, and ultimately leading to sustainable agricultural growth. Sponsors will find this approach not only innovative but also transformative, as it supports farmers in becoming more competitive and successful in the marketplace.

WUA institutional development: The development and strengthening of WUAs are crucial for the model's success. While all actors and stakeholders play vital roles in the model, its success hinges on their collective commitment and accountability. The Water User Association (WUA) must ensure

equitable water distribution and conduct regular maintenance and repairs from the secondary/branch level down to the tertiary and farm levels. The existing Water Resources Act, Irrigation Regulations, and Irrigation Policy well-positioned WUA to collaborate effectively with key parties: water users (who are also the farmers), the IMO, the AKC, and local governments, particularly the Agriculture Development Sections. Additionally, the WUA can engage with private entities, cooperatives, and voluntary organizations to enhance their efforts. Therefore, the model emphasizes the institutional development and capacity strengthening of the WUA. By focusing on their institutional development, the model empowers farmers to take ownership of water management, encourages collaboration among stakeholders, and enhances the overall effectiveness of the irrigation system.

Integration of irrigation and agriculture through activity cooperation system: The core component of the model is the integration of irrigation and agriculture. Rather than prioritizing one sector over the other—irrigation first or agriculture first—this model considers both as integral parts of a cohesive system. To function properly, the model emphasizes that both irrigation and agriculture are essential for the system to operate effectively.

Table 2 presents the relationship between specific objectives and core components to ensure coordinated efforts and efficient resource use.

Table 2: Relationship between Specific Objectives and Core Components

Specific Objectives	Components	Stage
1. Promote irrigated agriculture initiatives by engaging key stakeholders of the irrigation, agriculture and allied sectors to improve irrigation management system	Irrigation system improvement	Implementation stage
2. Assist the members of the water user's association (farmers) to increase their farm income by applying location-specific market-oriented agriculture practices	Promotion of Market-oriented Agriculture	Implementation stage
3. Transform the WUA into a professional, user-centred, and innovative association	Institutional development of WUA	Implementation stage
4. Engage key stakeholders-such as government agencies, cooperatives, and private sector partners- in collaborative efforts to advance irrigated agriculture initiatives.	Integration of irrigation and agriculture through activity cooperation system	Implementation stage

2.5 Proposed Activities of the PIAT-Model

The standard activities associated with each component are listed below. It is noted that these activities will be customized or adjusted according to the local conditions.

The key activities in the planning stage such as problem analysis, objective setting and action plan formation, and task team formation are very important to replicate the model (Refer to Chapter 3.3 for the detail process of action plan formulation). However, before carrying out these three activities, final selection of the scheme by the government is necessary, for which concerned agencies may carry out (a)

reconnaissance visit of the scheme, (b) focus group discussion (FGD) with concerned water users and (d) understand the concerned LGs' perspective and plans as well.

2.5.1 Planning Stage

(1) Selection of the irrigation scheme for replication of PIAT model

First of all, the ministry (federal or province) or local government as appropriate depending on the management system of irrigation scheme will select the irrigation schemes for replication of PIAT model through reconnaissance visit/a short and quick study/focus group discussion and LG's perspective and plans.

(2) Formulation of action plan by stakeholders

Collect basic data and information of the irrigation scheme including WUA and agriculture,

Undertake introductory workshop (Stakeholder Analysis, Problem Analysis and Objective Setting), with the same set of participants, representing different components and service sectors,

Assist stakeholders in drafting the action plan based on their understanding of the system/irrigation scheme, with no compromise to (a) efficient and maximum utilization of water within the framework of equitable water distribution and (b) grow to sale concept,

- 1) Implement the mini-projects (optional)
- 2) Arrange the study tour to Reference Irrigation System (optional)
- 3) Finalize the action plan and organize it into a Project Design Matric (PDM) format
- 4) Activities towards implementation of the action plan
- 5) Scheme-based rapid joint visit of key officials of both the ministries (federal, provincial) or local level (as applicable depending on the command area of the scheme)
- 6) Determination of the implementation modality (project vs additional financing or incremental approach)
- 7) Commitment/receipt of Minutes of Understandings (MoU) from the concerned stakeholders with defined roles and responsibilities
- 8) Formation of monitoring committee at the federal, provincial or local level as applicable depending on the command area of the scheme
- 9) Formation of the task team at the field level and appointment/designation of project/program manager

2.5.2 Implementation Stage

Component-1: Irrigation system improvement

Formulation and implementation of irrigation facility maintenance plan

- i) Confirmation and/or updating of irrigation command area,
- ii) Preparation and/or updating of irrigation facility ledger with facility evaluation,
- iii) Preparation of maintenance plan,
- iv) Training of WUA on maintenance for irrigation facilities,
- v) Maintenance of irrigation facilities by IMO and WUA, and
- vi) Canal protection campaign.

Formulation and implementation of water distribution plan

- i) Technical water distribution planning and institutional set-up,
- ii) Calibration and installation of water measuring devices,
- iii) Formulation of water distribution plan for monsoon season,
- iv) Formulation of water distribution plan for post monsoon season,
- v) Implementation of water distribution plan, and
- vi) Monitoring and evaluation of the water distribution plan

Component-2: Promotion of market-oriented agriculture

- i) Training on 4 Steps of PIAT CAP to agriculture extension officers for market-oriented agriculture, and
- ii) Training on market-oriented agriculture to farmers in field practice

Component-3: Institutional development of WUA

- i) Review of by-law and awareness among members,
- ii) Implementation of regular election,
- iii) Implementation of regular meeting,
- iv) Establishment of sub-committee for specific task,
- v) Support for financial record keeping,
- vi) ISF collection and mobilization,
- vii) Fund raising for O&M other than ISF, and
- viii) Coordination with other organizations.

Component-4: Integration of irrigation and agriculture through Activity Cooperation System

- i) Establishment of activity cooperation system centred by WUA with relevant agencies,
- ii) Selection of model sites for integration of on-farm development and market-oriented agriculture activities,
- iii) Field channel construction,
- iv) On-farm development, and
- v) Land levelling,

(Notes: Carry out the Core Component 1 to 4 simultaneously as regular activities as per the letter and spirit of the integrated irrigated agriculture concept.)

2.6 Major Stakeholders for Implementation of the Model

The Model is designed for more efficient management of irrigated agriculture by incorporating government services from both the irrigation and agricultural sectors. To ensure this integrated approach, the implementation structures among the stakeholders at field level (IMO, AKC, LG, WUA) as well as management level (Federal or Province) shall be established and operated through implementation of various activities. WUA, who will play as a main actor among the stakeholders, will proactively approach the government support agencies to receive the necessary technical and financial support at various levels, as depicted in the table 3 below.

Table 3: Implementation Structure and Major Stakeholders of the Model

Hierarchy	Meeting Frequency	Organizations involved	Roles & Responsibilities
Field Level (Task Team)	Quarterly	⊙ WUA ○ Irrigation Management Office ○ AKC ○ Local government	• Prepare action plan for irrigated agriculture promotion (organize activities to be undertaken in the three areas of institution, irrigation, and agriculture) • Implementation of the Action Plan

Hierarchy	Meeting Frequency	Organizations involved	Roles & Responsibilities
			Monitoring and evaluation of activities
Federal/ Provincial/ Local Level (Monitoring Committee)	Semi-Annually	○ Federal government (DWRI/MOEWR, DOA/MOALD) ○ Provincial government (MOWSIE, MOIAC) ○ Local government (Municipality)	- Technical/financial support - Monitoring and evaluation of activities

(Notes: TT: Task Team, MC: Monitoring Committee, ◎Key responsibility (Leadership), ○Cooperating Agency)

For the implementation of the Model, it is recommended that the government agency overseeing the irrigation scheme should engage personnel who possess extensive knowledge and experience in irrigated agriculture within the Terai Plain to act as coordinators.

2.7 Implementation Period of the Model

The standard implementation period for the Model shall be 1 year for planning, and 4 years for implementation and M&E as shown below in Table 4. However, it should be adjusted according to various conditions, such as the size of the irrigation command area, the number of beneficiary farmers, the management and technical capacity of the WUA, and cooperation and support from IMO, AKC, LG, and others.

Table 4: Work Schedule (Model)

Stage	Component	Activity	Time Schedule				
			1st Year	2nd Year	3rd Year	4th Year	5th Year
1. Planning	-	Selection of irrigation scheme	■				
		Formulation of action plan by stakeholders	■				
		Activity toward implementation of the action plan	■				
2. Implementation	1	Irrigation system improvement		■	■	■	■
	2	Promotion of market-oriented agriculture		■	■	■	■
	3	Institutional development of WUA		■	■	■	■
	4	Integration of irrigation and agriculture		■	■	■	■
3. Monitoring and Evaluation	-	Monitoring		■	■	■	■
		Evaluation		■			■

CHAPTER 3 SELECTION OF THE IRRIGATION SCHEME AND PLANNING

3.1 General

The selection of the irrigation scheme and formulation of the action plan by the stakeholders is the first step activity for replication of the model in the planning stage. Action plan formulation is key activities to aware their own problems facing in daily irrigation and agriculture operation, and to find the solutions by themselves. It is expected for the stakeholders to change the paradigm to the maximum use of water and grow to sale concept. The Guidelines suggest the following three process:

- 1) Selection of the irrigation scheme for replication of PIAT-model
- 2) Formulation of action plan by stakeholders, and
- 3) Activities toward the implementation of action plan.

3.2 Selection of the irrigation scheme for the replication of the PIAT-model

The Ministry (federal or province depending on the size of command area) will select the irrigation schemes for the replication of the PIAT-model considering the following data and information collected by reconnaissance visit, short or quick study in the command area.

- Size of the irrigation scheme (command area)
- Type of the irrigation management system (AMIS, JIMS, FMIS)
- Condition and operation of the selected irrigation scheme, especially water availability in the canal, water distribution system, scale of repair and maintenance needs
- Approximate beneficiaries (water users)
- General ethnic composition of the water users
- Socio-economic conditions of the water users
- Current status of the Water Users Association

3.3 Formulation of action plan

(1) Collect basic data and information of the irrigation scheme

The staff of IMO will collect the basic data and information available for the target irrigation scheme not only irrigation but also WUA and agriculture, through interview to the stakeholders, and if necessary, by filed survey. The data and information to be collected are as follows:

Table 5: List of Basic Data and Information to be collected

Sector	Basic Data and Information to be collected
Irrigation (IMO)	• Project layout map, irrigation command area by MC, SC and TC, irrigation requirement and water distribution plan, irrigation facility ledger, annual budget and expenditure, major problems, and difficulties, etc.
WUA	Regulation and by-law of WUA, organization structure of WUA, the number of WUA members by MCC, SCC, TCC, ISF collection, properties of WUA, accounting system and audit reports of WUA, technical and financial support from IMO and LG, major problems and difficulties, etc.
Agriculture	The number of agriculture officers and extension workers of LG, technical and

Sector	Basic Data and Information to be collected
(AKC/LGs)	financial support from AKC and LG, cultivation plan by season, major local markets and marketing system, major problems and difficulties, etc.

If required by the Ministry, additional data and information of the irrigation scheme, such as agriculture production and sale situation will also be surveyed in time.

(2) Undertake introductory workshop (problem analysis, stakeholder analysis and objective setting)

The introductory workshop will be organized by IMO to understand the current situation surrounding each organization, problems and difficulties, and possible solution for the improvement, inviting key members of the major stakeholders. Facilitators will be appointed and well trained in advance to support the participants for the issues analysis. The proposed agenda will include the follow items among others:

Table 6: List of Basic Data and Information to be collected

Objective	i) To introduce the main objectives and activities of PIAT-model ii) To identify the main actors and understand their actions, opportunities, and challenges and capacity needs for the implementation of the PIAT-model iii) To analyse the current status of water distribution, irrigation facility maintenance, on-farm development, ISF collection, market-oriented agriculture issues with the stakeholders iv) To discuss the concrete actions resulting the desired situations for improving irrigated agriculture in the project area
Organizer	IMO
Participant	Local level: WUA, IMO, AKC, LG
Program	Day 1: Introduction of Project, Group Discussions on Stakeholder Analysis and Problem Analysis regarding irrigation and agricultural issues Day 2: Workshop on Objective Analysis

The problem analysis and objective analysis will be reworked at the first session of the draft action plan workshop.

(3) Assist stakeholders in drafting the action plan

Action plan drafting must be acquainted with their understanding of the system/irrigation scheme without compromising; (a) efficient and maximum utilization of water within the framework of equitable water distribution and (b) grow to sale concept

The same participants will review and modify the analysis from the previous introductory workshop to draft an action plan. Facilitators will examine the prior analysis results before this workshop and offer comments and suggestions, particularly from a logical perspective, to support the preparation of the draft action plan. The proposed agenda will include the following items among others:

Table 7: Agenda for Drafting the Action Plan

Objective	1. To share the results of the baseline survey to develop an effective Action Plan 2. To rework the Problem Analysis prepared in the introductory workshop with additional analysis and inputs 3. To prepare a draft Action Plan for the implementation of Irrigated Agriculture Promotion Model
Organizer	IMO
Participant	WUA, IMO, AKC, LG
Program	Day 1: Review and amendment of the problem analysis/ objective setting Day 2: Presentation of problem analysis, group work on Action Planning Day 3: Review of prepared Action Plan

Implement the mini-projects (optional)

The mini-project is an option in the action planning process. While the full-scale operation of the Action Plan is expected from the second year onwards, the PIAT-Model intends to make a trial project in a small scale for a short period. It is so called “Mini-Projects”, the small projects are selected from the draft action plan and implemented for the period of three to five months as a trial.

The experience and lessons learnt from the implementation of the mini-project will be reflected into the final action plan.

(4) Arrange the study tour (optional)

The study tour is also an option in the action planning process. The study tour to reference Irrigation System, where PIAT model is already successfully implemented, will be arranged to learn about the PIAT-model with task team members from the irrigation system. The participants who prepared the draft action plan will be selected with priority for the study tour. The proposed plan of the study tour is as follows.

Table 8: Sample Plan for Study Tour

Objective	1. To learn about model from task team 2. To learn about participatory irrigation O&M improved by the Model 3. To learn about market-oriented agriculture through PIAT-CAP approach
Organizer	IMO
Participant	WUA, IMO, AKC, LG
Program	Day 1: Sharing of the experiences and activities of PIAT by the task team members Day 2: Field visit and discussion with WUA/farmers for irrigation O&M and market-oriented agriculture activities in the selected model sites Day 3: Presentation of the draft action plan by the study tour team and free discussion for the improvement.

The experience and lessons learned from the study tour will be reflected in the final action plan.

(5) Finalize the action plan and organize into a Project Design Matrix (PDM) format

After the completion of mini-projects and/or study tour, the workshop for finalization of the draft action plan will be organized, inviting the representatives and key members of the task team. The proposed agenda of the workshop will be as follows:

Table 9: Sample Agenda for Finalization of Action Plan

Objective	1. To improve the action plan by reflecting the updated information and knowledge; 2. To ensure that the plan be more realistic, implementable and achievable; and 3. To increase clarity and deepen the action plan process
Organizer	IMO
Participant	Federal government: DWRI/MOEWRI, DOA/MOALD, or Provincial government: MOWSIE, AKC Local level: WUA, IMO, LG
Program	Day 1: Sharing the findings and lessons from the study tour, and sharing the experiences and lessons from the mini-project Day 2: Finalization and presentation of the final action plan to the participants including guest.

The representative of major stakeholders including the Federal, Provincial or Local government will be invited as main guest on Day 2 program for building their consensus and commitment.

Once the action plan is committed by the participants in the workshop, it deems to be the final action plan, and will be organized into a Project Design Matrix (PDM) format. The tentative PDM is shown in Annex 3.

3.4 Activities for implementation of action plan

(1) Scheme-based rapid joint visit of key officials of the ministries (federal, provincial) or local level

Key officials of the ministries (federal, provincial) or local level (as applicable depending on the command area of the scheme) will carry out a scheme-based rapid joint visit in order to appraise the final action plan submitted by the irrigation management office.

(2) Decision on the implementation modality (project vs additional financing or incremental approach)

Once the final action plan is accepted, the implementation modality is determined by the Ministry (federal or province) in consultation with DWRI, IMO, WUA, AKC and LGs. The details of the modality are described in Section 5.2.

- Project components
- Financial planning and resource mobilization
- Time-bound
- Human resources
- Provision of a task team
- Budget arrangement
- Monitoring and evaluation

(3) Commitment/Undertaking Minutes of Understandings (MoU) from the concerned stakeholders with defined roles and responsibilities

To make sure the involvement of concerned key stakeholders, the Minutes of Understanding (MoU) with defined roles and responsibilities will be agreed and then signed by a representative of the key stakeholders.

(4) Formation of Monitoring Committee at the federal, provincial or local level as applicable; depending on the command area of the scheme

The monitoring committee (MC) will be established at the federal, provincial or local government depending on the management system of irrigation scheme. The proposed composition of the monitoring committee is shown in the table 10 below:

Table 10: Proposed composition of the monitoring committee

SN	Irrigation scheme (jurisdiction)	Composition of the committee
1	Local (Farmer-managed irrigation scheme)	Mayor/Chairperson- Chairman President, WUA- Member Ward chairman (related to the irrigation scheme/command area)- Member Chief, Agriculture Development Section, Municipality/Rural Municipality- Member Officer, Local government - Member-secretary Invitee members- Chief IMO or District level Irrigation Division Office and Chief of AKC
2	Province Level	Secretary, Ministry of Irrigation Chairman Representative (Under-secretary level) Member Chief Administrative Officer (Related local level) Member Chief, Agriculture Knowledge Centre Member Representative (Under -secretary level) DOAD Member Chief, Irrigation Management Office- Member-Secretary Concerned Mayor and Chairpersons of the local level will act as advisor to this committee Invitee-member- Secretary, Ministry of Agriculture Chief, NAMP
3	Federal Level	Director General, DWRI, or Deputy Director General nominated by him responsible for Irrigation Management- Chairperson Representative DoA (Joint-secretary level)- Member Secretary or Representative (Under-secretary level), Ministry related to Irrigation (Province)- Member Secretary or Representative (Under-secretary level), Ministry related to Agriculture (Province)- Member Chief, Irrigation Management Office- Member-Secretary

The monitoring committee will carry out the following tasks:

- Holding a monitoring committee meeting every six months inviting the members,
- Technical and financial support to the task team for implementation of the PIAT model,
- Monitoring and evaluation of the progress report submitted by the task team,
- Review of annual activity plan with budget proposal submitted by the task team, and
- Discussion on any other issues pertinent to the smooth implementation of the PIAT model.

(5) Formation of the project/programme task team and appointment/designation of Project/Program Manager

The monitoring committee will set up a task team (TT) at field level and appoint the chairperson, co-chairperson and other members. The proposed composition of the task team is shown in the table below:

Table 11: Proposed composition of the task team at field level

Position	Official Title
Chairperson	Chief of irrigation management office (IMO)
Member	President of WUA
	Chief of agriculture knowledge center (AKC)
	Chief of agriculture development section of local government (LG)
	Engineer of irrigation management office (IMO)
Member-Secretary	Secretary of WUA main committee

(6) Responsibilities of the Task Team (Terms of Reference for the Task Team)

The task team will carry out the following tasks:

Holding a task team meeting every three months inviting the members,

- a) Technical and financial support to the WUA by the task team members for implementation of the PIAT model,
- b) Preparation of the progress report every three months and submission to the monitoring committee,
- c) Preparation of annual activity plan with budget proposal and submission to the monitoring committee, and
- d) Discussion on any other issues pertinent to the smooth implementation of the PIAT model.

CHAPTER 4 DESCRIPTION OF CORE COMPONENTS

4.1 General

As discussed in Chapter 2, PIAT model comprises the following four components to achieving four outcomes- (1) Irrigation System Improvement (2) Market-oriented agriculture (3) Institutional development of water users' association and (4) Activity cooperation system for integrated irrigation and agriculture activities.

4.2 Irrigation System Improvement

The following two activities are to be carried out under the irrigation system improvement:

- 1) Formulation and implementation of the irrigation facility maintenance plan
- 2) Formulation and implementation of water distribution plan

4.2.1 Formulation and implementation of the irrigation facility maintenance plan

The key steps in the irrigation facility maintenance include follows.

- 1) Orientation from IMO to WUA members regarding the irrigation facility maintenance
- 2) Confirmation and / or updating command area
- 3) Preparation of irrigation facility ledger through walk-through survey (WTS) including diagnosis for irrigation facilities.
- 4) Preparation of maintenance plan
- 5) Training on maintenance
- 6) Implementation of maintenance

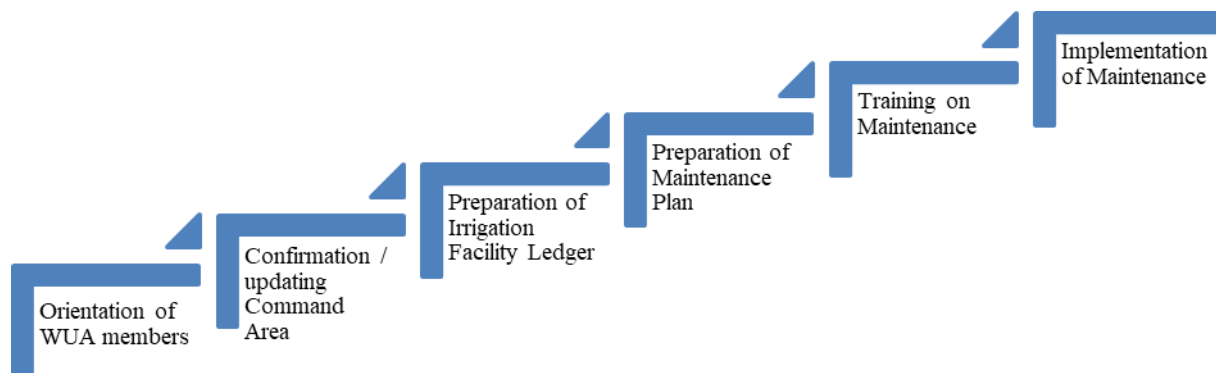


Figure 3: Key Steps in Irrigation Facility Maintenance

Of the above six steps, this section describes the major steps. All steps are crucial for ownership, consensus building and successful implementation of the model.

(1) Orientation of the WUA Members

Before initiating the replication of the PIAT model, Irrigation Management Office should orient all the members of the main canal committee (MCC), secondary (branch) canal committees(SCC), tertiary canal committees(TCC) on the objectives of the model, implementation modality, expected activities, model components and detailed expected results. This activity should be considered as a prerequisite or a covenant for replicating the model.

(2) Confirmation and updating of command area

For appropriate maintenance of irrigation facility, it is important and essential to confirm basic information of target irrigation area. Therefore, following activities will be conducted. Summary for these activities is shown in following.

- i) To confirm / update current irrigation area (ha)
- ii) To confirm / update current irrigation and / or drainage canal network and alignment
- iii) To prepare / update command area map based on above i) and ii)

Table 12: Summary of Activity: Confirmation of Command Area

Objective	To prepare basic information / data (Command Area) for planning of maintenance
Target	Whole area of target irrigation area is recommended.
Implementer	Irrigation Management Office (IMO) & WUA Following demarcation will be practicable depending on the relevant IMT agreement. <u>1) For major canal:</u> IMO take initiative. <u>2) For minor canal:</u> WUA take initiative.
Recommended Activity	1) To confirm / update current irrigation area (ha) 2) To confirm / update current irrigation and / or drainage canal network and alignment 3) To prepare / update command area map based on above 1) and 2)
Recommended / Necessary Input	1) GIS software 2) GPS 3) Digital Camera 4) Measuring tools (e.g., Measuring Tape (Nylon, Long), etc.) 5) Human resource from IMO and WUA 6) Stationery

Command area updating activities is a very time-consuming and costly activity that may not be necessary for all the schemes. The judgement should be based on the complexity of irrigation system and availability of resources.

(3) Preparation and/or updating of irrigation facility ledger with facility evaluation

For appropriate maintenance of irrigation facility, it is important and essential to confirm existing structures and its condition. Therefore, following activities shall be conducted. Summary for these activities is shown in following table.

- a) To confirm existing canals and structures
- b) To prepare / update Irrigation Facility Ledger

Table 13: Summary of Activity: Irrigation Facility Ledger

Objective	To prepare basic information / data (Irrigation Facility Ledger) for planning of maintenance
Target	Whole area of target irrigation area is recommended.
Implementer	IMO & WUA Following demarcation will be practicable depending on the relevant IMT agreement. <u>1) For major canal:</u> IMO take initiative. <u>2) For minor canal:</u> WUA take initiative.
Recommended Activity	1) To confirm existing canals and structures 2) To evaluate existing canals and structures

	3)	To prepare / update Irrigation Facility Ledger based on above 1) and 2)
Recommended / Necessary Input	1)	GIS software
	2)	GPS
	3)	Excel
	4)	Digital Camera
	5)	Measuring tools (e.g., Measuring Tape (Nylon, Long), Measuring Tape (Metal, Short), etc.)
	6)	Human resource from IMO and WUA
	7)	Stationery

Sample form of Irrigation Facility Ledger is shown in Annex 4, Following informations should be included while preparing irrigation facility ledger.

Table 14: Information required in Irrigation Facility Ledger

Item		Information
Location		Chainage, Distance
Canal Status	Basic Information	BP / EP, Canal Type, Shape, Length of canal,
	Functional Diagnosis	General Evaluation, Size, Observation
Damage Section of Canal		Evaluation, Observation, Length, Size
Structure Status	Basic Information	Structure, Paint Indication
	Functional Diagnosis	Evaluation of Structure, Observation Evaluation of Gate, Observation, Size

(4) Preparation of maintenance plan

Maintenance plan should be implemented escaping the major critical irrigation stage of crops. For appropriate maintenance of irrigation facility, it is important to prepare maintenance plan and implement it based on Irrigation Facility Ledger as shown in the table below:

Table 15: Summary of Activity: Preparation of Maintenance Plan and its implementation

Objective	To assure implementation of maintenance clarified with 5W2H for maintenance (5W2H: Where, Why, What, When, Who, How, How much)
Target	Irrigation canal / structure which is confirmed and recorded in Irrigation Facility Ledger (Obviously, regular maintenance is recommendable without preparation of Irrigation Facility Ledger and/or Maintenance Plan.)
Implementer	IMO & WUA Main canal by IMO, SC and tertiary (minor canal) by WUA depending on IMT agreement
Recommended Activity	To prepare Maintenance Plan based on prepared Irrigation Facility Ledger. Sample format for maintenance preparation is shown in Annex 5.
Recommended / Necessary Input	1) Prepared Irrigation Facility Ledger 2) Map showing information and condition of irrigation canals and facilities 3) PC to show photo of current canal / structure condition <i>Note: To prepare above 2), PC is necessary to prepare map based on satellite image and/or map data. And GIS software may be necessary too. GIS is not a mandatory. The GPS data collected during WTS may be sufficient.</i>

(5) Training of WUA for Irrigation Facility Maintenance

It is essential to enhance the capacity of the WUA members to ensure regular maintenance of the irrigation facility under their self-initiatives and enable them to monitor and supervise the works of contractors if recruited by the IMO. The activities to be conducted for the training of WUA on the maintenance of the irrigation facility are summarised below:

Table 16: Summary of Activity: Training of WUA for Irrigation Facility Maintenance

Objective	To enhance the capacity and motivate WUA member to undertake maintenance activities regularly by themselves on their self-initiatives.
Target	Whole command area of irrigation scheme: SCC member, community member, local school students inside irrigation scheme
Implementer	IMO & WUA, Municipality
Further follow-up activities	1) Training for strengthening the capacity of monitoring/supervision 2) Canal protection campaign to encourage and motivate WUA member and community member to have regular action by themselves.

(6) Maintenance of irrigation facilities by IMO and WUA

Based on activities described above, IMO and WUA will repair and maintain the respective irrigation facilities and keep them operating, clean, sustainable. Summary for this activity is shown in following table.

Table 17: Summary of Activity: Maintenance of Irrigation Facility

Objective	To keep appropriate function of irrigation facility
Target	Irrigation facility for which maintenance plan was prepared. (Obviously, regular maintenance is recommendable without preparation of Irrigation Facility Ledger and/or Maintenance Plan.)
Implementer	IMO & WUA. Ideally, following demarcation is recommendable. <u>WUA:</u> 1) To take initiative for maintenance with financial burden from WUA budget 2) To apply financial support to some organization (e.g., IMO, LG, etc.), if necessary <u>IMO:</u> 1) To provide technical support (e.g., survey, planning, design, etc.) to WUA 2) To take initiative for maintenance for technical / critical irrigation facilities (e.g., headworks, siphon, aqueduct, large scale division works, large scale road crossing, etc.) with financial burden based on IMO budget
Further support	1) Necessary budget for maintenance 2) Human resources

(7) Canal Protection Campaign

In Nepal, many irrigation schemes frequently engage in harmful practices, such as dumping garbage into canals and placing private assets like rice straw on canal banks, which directly block water flow (Figure 13). As a result, members of the Water User Associations (WUA) become reluctant to clean the canals, leading to sediment buildup on the canal bed and the growth of weeds that cover the canal surface and banks, further hindering the water flow.

To change the above behaviors, the awareness rising activity, namely canal protection campaign is necessary as shown in the following table:

Table 18: Summary of Activity: Canal Protection Campaign

S/N	Campaign Activity
1	Installing notice boards in public areas and key locations along the canal to stop harmful practices and assist the WUA in keeping the canal free of debris for equitable water distribution.
2	Frequent SMS messages to WUA members and some users which may have been engaged in harmful practices but no evidence to stop them.
3	Posting messages in the WUA, LG and IMO Facebook
4	Classroom lecture and essay competition to raise awareness of school children, teachers and local communities
5	Getting support from the local governments to display notice boards in public places with possibility of monetary punishment

The manual further provides detailed methods and procedures. This will be required during the implementation of the plan.

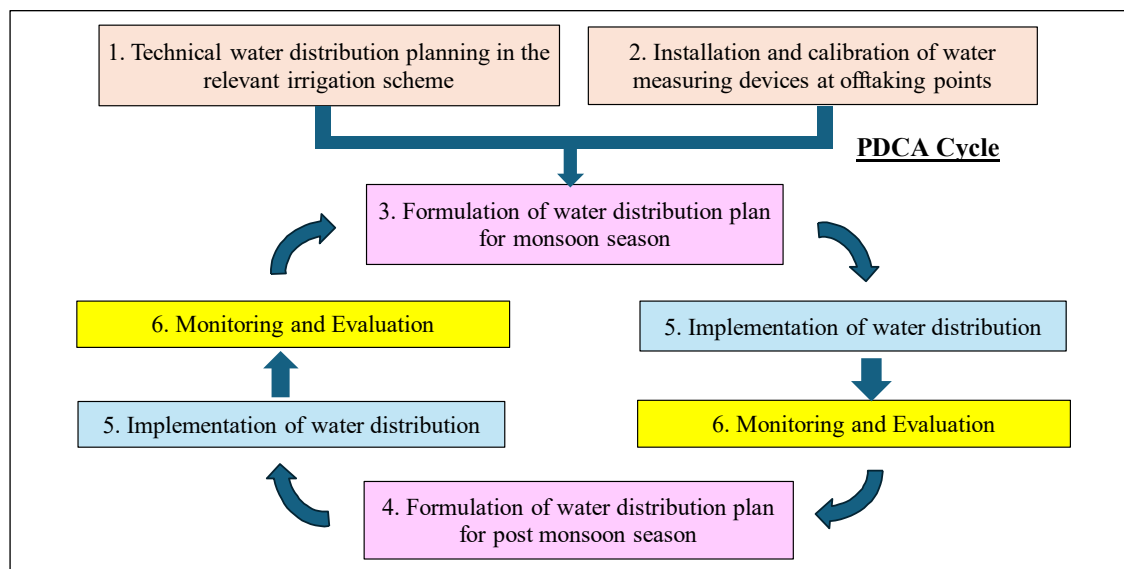
4.2.2 Formulation and Implementation of Water Distribution Plan

Equitable water distribution is one of the most essential activities not only for fairness in the distribution of water among the different categories and types of water users but also for increasing crop production through the right, maximum, and efficient use of water. The goal of water distribution for crop production is “sufficient and timely water supply for crop production based on the demand”.

The detail activity plan recommended for water distribution is as follows.

- 1) Technical water distribution planning and institutional set-up
- 2) Calibration and installation of water measuring devices
- 3) Formulation of water distribution plan for monsoon season
- 4) Formulation of water distribution plan for post monsoon season
- 5) Implementation of water distribution
- 6) Monitoring and evaluation of water distribution

The figure below shows the workflow of water distribution activities:

**Figure 4: Workflow of Water Distribution Activities**

Each activity and step are described in the following Sections. The detail method and procedures are shown in the Manual.

(1) Technical water distribution planning

IMO is responsible for the planning and implementing water distribution from the MC to SCs in coordination with the WUA, and WUA is responsible from the SC to the TCs. For undisturbed water distribution and to avoid any likely conflicts and misunderstanding, WUA will also need to coordinate with IMO and keep the latter updated about the water distribution situation from the SC to the TCs. The coordination between the IMO and WUA ensures that the distribution process is transparent and that both parties are aligned on water management across the different canal levels. Furthermore, IMO and WUA are expected to coordinate with the agriculture development section of the LGs (Palika) to harmonize water supply and demand. This approach ensures that water management is integrated with local agricultural priorities, creating a collaborative framework for sustainable resource use. Table 20 summarizes water distribution planning and institutional arrangement.

Table 19: Summary of Technical Water Distribution Planning and Institutional Arrangements

Objective	To prepare a water distribution plan as a basic resource based on the technical factors such as scheme layout, command area, water requirements, and availability of water resources for efficient and equitable allocation of water across the system, preventing shortages, and ensuring that the system meets the agricultural demands within the command area.
Target Area	Whole command area of irrigation scheme
Implementer	IMO with involvement of WUA and LG
Activities	i) Preparation of annual cropping schedule through the collaborations among IMO, WUA, and ADS/LG ii) Estimation of crop water requirements and water balance analysis by IMO iii) Preparation of water distribution plan in the scheme iv) Confirmation of the division of role for water distribution between IMO and WUA
Output	i) Annual cropping calendar by SC/TC command area ii) Crop water requirement and water balance estimation iii) Irrigation flow diagram iv) Water distribution plan v) Demarcation table on water distribution between IMO and WUA
Input	<Necessary Data> i) Irrigation command area ii) Irrigation system layout iii) As built drawings of irrigation scheme iv) Irrigation facility ledger v) Meteorological and hydrological data vi) Soil type vii) Percolation rate (if available)

(2) Preparation of general annual cropping schedule among IMO, WUA and LG

Preparation of the cropping schedule in the irrigation scheme is essential to share the current agriculture activities and production among the stakeholders and preparation for water distribution plan. IMO, WUA members and LG agriculture technicians should prepare the cropping calendar jointly. A model of cropping schedule is given in Annex 6:

(3) Estimation of crop water requirements and water balance analysis

The IMO should estimate water requirement based on the annual cropping schedule to obtain the irrigation discharge at intake from river / water resources and each offtake point at head of secondary system. The detail calculation method is presented in the Manual.

(4) Preparation of technical water distribution plan in the scheme

The IMO will prepare an irrigation flow diagram for the main system and secondary system in coordination with WUA showing i) canal name (main, secondary, tertiary system), ii) canal command area, iii) location of offtake structure, iv) water distribution discharge, v) canal flow discharge. This is a basic resource for understanding the overall irrigation flow system. The IMO will use this flow diagram while formulating, implementing, and monitoring of water distribution by cropping season. Likewise, the MCC will prepare technical water distribution plan for separately as per the number of SCs and TCs. Sample of irrigation flow diagram is shown in Annex 7.

(5) Confirmation of the division of role for water distribution between IMO and WUA and institutional arrangements

The model is based on the assumption that WUA is already established and functioning. Therefore, there may be a need to confirm the division or re-distribute roles and responsibilities for the preparation and implementation of water distribution plan between IMO and WUA.

Table 20: Proposed division of roles and responsibilities between IMO and WUA

Distribution	Formulation of Water Distribution Plan	Gate Operation	Monitoring
Intake Gate	WUA and IMO jointly	IMO Gate Operator	WUA and IMO
Main Canal to Secondary Canals	IMO and WUA jointly	IMO Gate Operator	IMO and WUA
Main Canal to Direct Tertiary	IMO and WUA jointly	WUA	IMO and WUA
Secondary Canal to Tertiary Canal	WUA	WUA	WUA
Tertiary Canal to Field Channel	WUA	WUA	WUA

The WUA should form the water distribution committee to formulate the water distribution plan. The SC chairperson will need to chair the water distribution committee (WDC), and other members will be identified by the SCC in consultation with the MCC. A model institutional arrangement for the WDP

4.2.3 Calibration and installation of water measuring devices

Measurement devices at the offtake point are required to measure and control water distribution discharge by gate operators and water users. Water measuring devices, like Parshall Flume, Rectangular Weir, and Triangular Weir, will need to be installed to prepare the H-Q curve. Table below provides a summary of activities for the calibration and installation of water measuring devices.

Table 21: Calibration and Installation of Water Measuring Devices

Objective	To set-up facility for measurement of water distribution discharge
Implementer	IMO with involvement of WUA
Activities	i) Calibration of water discharge measuring device at intake and head regulator ii) Marking of water level at measuring device and providing training to gate operator and WUA iii) Installation of measuring device at required water distribution point
Output	i) H-Q Curve (Rating Curve) at water measuring device ii) Water marking for required water distribution iii) Installation of new water measuring device

(1) Calibration of water discharge measuring device at offtake points

Water discharge and water level will be measured using the H-Q curve formula given below. shown below in the Box. Detail field measurement method and calculation of H-Q curve are explained in Manual.

Formula for preparing H-Q Curves (rating curve)

$$Q = C \times (H - a)^n$$

Where,

Q: Discharge (m³/s)

H: Reading water depth at the gauge of measuring devices (m)

C, n: Coefficient (decided based on water discharge measurement)

a: initial water level at gauge of measuring devices due to siltation or structure at downstream (m)

After water discharge measurement, H-Q curves (rating curve) will be prepared as follows:

(2) Marking of water level at measuring device and providing training to gate operator and WUA

Based on the calculated H-Q Curve, the required water level for planned water discharge will be calculated. A sample of calculation is shown in Annex 9:

The required water level will be marked at the measuring device and water level will be controlled using water level mark. The IMO gate operator controls the water discharge based on Marking.

If there are no water measurement devices, it is very important that such devices be installed.

4.2.4 Preparation of water distribution plan for monsoon season

Main crop for monsoon season in Terai area is rice. Most of farmland will be covered by rice during monsoon season. On the other hand, crops during winter and spring season vary and type and area of crop will be decided by individual farmers. Therefore, water distribution plan should be prepared separately for monsoon season (mainly rice) and winter / spring season.

The following table shows the summary of activities for formulation of water distribution plan for monsoon season:

Table 22: Preparation of Water Distribution Plan for Monsoon Season

Objective	1. To make consensus of water distribution schedule and method between IMO and WUA for monsoon season 2. To formulate water distribution plan from main system to secondary system 3. To formulate water distribution plan from secondary system to tertiary system by WUA
Implementer	IMO and WUA
Recommended Activity	i) Crop planning meeting among IMO, WUA and LG ii) Preparation of water distribution plan from main canal to secondary canal by IMO iii) Preparation of water distribution plan from secondary canal to tertiary canal by WUA
Output	i) Confirmed cropping calendar for monsoon season ii) Water distribution plan from MC to SC iii) Water distribution plan from SC to TC

The summary of work contents and procedure are shown in the following tables. Details are shown in the following sections.

(1) Crop planning meeting among IMO, WUA and LG

IMO, WUA and ADS/LG should organize a crop planning meeting to confirm the cropping calendar and carry out necessary preparatory works. The proposed agenda is shown in the following table:

Table 23: Sample Agenda of Crop Planning Meeting

Objective	1. To make aware of necessity of water distribution rule and formation of water distribution committee 2. To discuss and confirm water distribution rule and method, 3. To form water distribution committee and select person in charge of gate control in secondary canal level
Participant	WUA with involvement of IMO
Facilitator	Executive Committee of WUA
Timing of Meeting	One month before starting monsoon crop season (April)
Agenda	1. To identify current water distribution condition, constraints and challenges 2. To identify measures/processes to improve the current water distribution system 3. To undertake preparing cropping calendar in the secondary canal command area 4. To discuss among WUA member about water distribution rule and method 5. To prepare water distribution plan 6. To form water distribution committee in the secondary canal level 7. To select person in charge of gate control for water distribution at secondary canal level 8. To discuss how to monitor and evaluate water distribution based on the plan

4.2.5 Preparation of water distribution plan for post-monsoon season

The type of crop and area and irrigation method should be different between monsoon season and post monsoon season (winter / spring). Following Table compared the water distribution plan between monsoon and post-monsoon (winter/spring) seasons:

Table 24: Comparison of Water Distribution Plan of Monsoon Season

Items	Monsoon Season	Post Monsoon Season
Target area for irrigation	Whole Scheme in most scheme	Based on cropping plan and water availability
Major target crop for irrigation	Monsoon Paddy	Varied Spring Paddy, Winter & Spring Maize

Items	Monsoon Season	Post Monsoon Season
		Vegetable Another cereal crop
Main Irrigation period	June to October	February to May
Irrigation Method	Continuous irrigation	Rotational irrigation

Prior to prepare water distribution plan, cropping schedule with area and crop type shall be prepared by WUA with farmers. The water distribution committee in each secondary system will collect data from water users and report to WUA executive committee.

The activities of formulation of water distribution plan for post monsoon season are summarized below:

Table 25: Preparation of Water Distribution Plan for Post Monsoon Season

Objective	1. To prepare cropping calendar for winter and spring season by WUA 2. To prepare water distribution plan based on cropping calendar
Implementer	IMO and WUA
Recommended Activity	i) Crop planning meeting among IMO, WUA and LG ii) Preparation of water distribution plan
Output	i) Confirmed cropping calendar for post monsoon season ii) Water distribution plan

4.2.6 Implementation of Water Distribution Plan (WDP)

The IMO and WUA should implement water distribution plan.

The gate operators/ IMO will ensure the implementation of the plan along main canal system and distribute water to the SCs based on water discharge mark at measuring devices.

At secondary canal system, the WUA through the WDC or a member assigned by the WDC, will distribute based on water discharge mark at measuring device.

The IMO and WUA will need to coordinate to ensure smooth and effective implementation of WDP for avoiding any emerging conflicts, misunderstanding and challenges.

4.2.7 Monitoring and Evaluation of the Water Distribution Plan

The gate operators will monitor water distribution along the main canal two times a day and record the following information in the register provided by IMO.

- 1) Date and time of monitoring
- 2) Water level at main system and secondary system
- 3) Gate opening height

However, the gate keeper will submit the report to the IMO as per IMO's instruction. Generally, the report can be submitted on weekly basis.

Overall responsibility of monitoring and evaluation of water distribution plan implementation is that of IMO and WUA. Annex 10 shows the model schematic monitoring sheet to be prepared by IMO (percentage of actual discharge against design discharge to each secondary canal).

4.3 Market-oriented Agriculture

4.3.1 Rationality

Considering the dominance of the subsistence farming system and need to transform Nepalese agriculture into a commercial agriculture as stressed by the government's national agriculture policy and

Agriculture Development Strategy (2015-2035), the PIAT model promotes a market-oriented agriculture (MoA). The purpose of this model is to help farmers to increase their income by selling agricultural products considering market demands. This approach envisages to change farmers' general practice from **“Grow and Sale” to “Grow to Sale”**. The model expects the farmers to manage their farming as a business with their own initiatives. The model puts small farmers and their needs at the centre while promoting MoA. This approach starts with the market and ends at the market.

The model aims to strengthen producers' price negotiation skills by improving their access to market price information and keeping them updated on market demands, empowering them to become self-reliant, market-oriented farmers. At the same time, this approach will enhance the value of irrigation schemes by ensuring a reliable water supply that boosts agricultural production and productivity. However, increased production must be paired with better market opportunities and fair prices for the products. This will motivate farmers to maximize efficient water use, thereby increasing both production and productivity in a sustainable manner.

4.3.2 The Two pillars of market-oriented agriculture

The MoA comprises two pillars. The first pillar is to build farmers' capacity to undertake farming as a business in a sustainable manner and second is increasing farmers' market negotiation skills at the market for reasonable profits, together with enhancing production skills, which also means developing and motivating people by effective activity designs. In the process, MoA attaches a special emphasis on the supporting farmers' autonomous motivation as it is an essential ingredient for achieving farmers' self-reliance and sustainable outcome that PIAT envisions.

- Promoting “Farming as a Business”
- Developing and motivating people by effective activity designs

Both pillars, which are the backbone of MoA, are supported by academic discourse and research: the former by an economic theory called “Markets with asymmetric information” and the latter by a psychological theory called “Self-Determination Theory”.

4.3.3 Four Essential Steps of market-oriented agriculture

With reference to the Self-Determination Theory, MoA offers a series of capacity development training to the target farmers in such a way that the farmers' motivation is raised through supporting their three psychological needs and minimizing the information asymmetry.

Table 26: Four Steps in MoA (Stage-1)

Four Steps	Activities	Responsibility
Farmers understand the goal	Explanatory workshop	ADS/LG
Farmers' awareness is raised	(Optional) Matching Forum Market Survey by Farmers (Optional) Farmer Supplier Interaction Workshop Participatory Baseline Survey Study Tour	ADS/LG, Selected farmers/water users
Farmers make decisions	Action Plan Making (Crop Selection, Crop Calendar Making and Resource Mobilization)	Participant farmers with the support of the ADS/LG
Farmers acquire skills	On-site Coaching	ADS/LG

4.3.4 Interrelationship between motivation and skills development

As shown in the diagram below, if the farmers are not motivated, it will be difficult for them to learn something new. On the other hand, if they can feel their skills are improving, their self-confidence will be strengthened, and they become motivated to take further action.

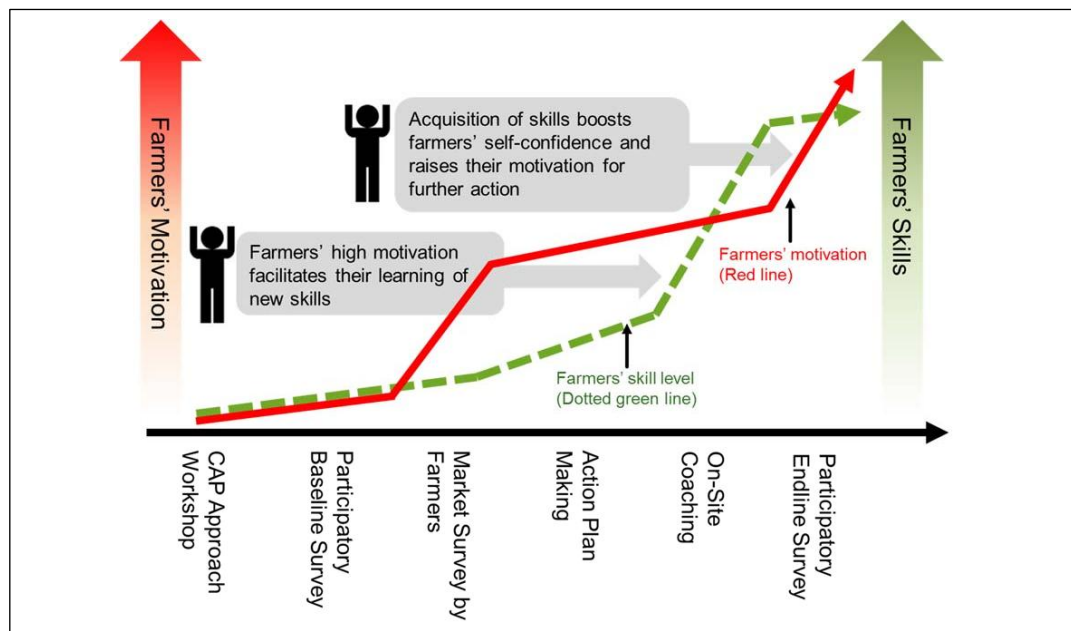


Figure 5: Interlinkage between motivation and skills development

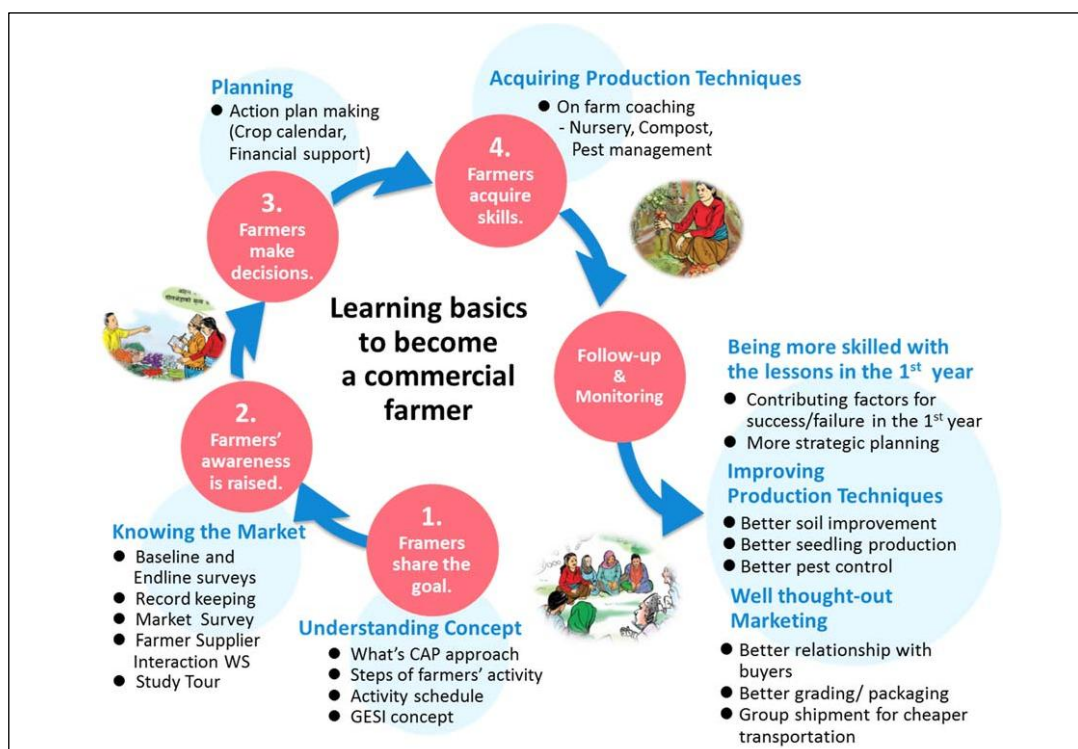


Figure 6: Implementation Steps of PIAT CAP

4.3.5 Implementation steps

The figure below is the illustration of the implementation steps. As stated, above PIAT-CAP has four basic steps. After farmers receive assistance on these four steps in the first crop season, they continue some of these four steps in the second season in the first year. With the lessons learned from the first year, farmers can become more strategic in production and marketing in the second year.

4.3.6 Modality of the market-oriented agriculture

For promoting the MoA at the targeted irrigation schemes, capacity building of extension officers of each local government is important for ensuring the sustainability of the approach. The model requires first providing Training of Trainers (TOT) for the extension officers (Stage-1) and after the TOT, on-the-job Training (OJT) from the extension officers to farmers (Stage-2).

“Leader farmers” are leaders of the target group, whose roles are the liaison between the extension officers and the target farmers and complementing the OJT by supporting the extension officers. For example, if a TOT could accept additional participants of leader farmers, they may become assistant trainers in the OJT.

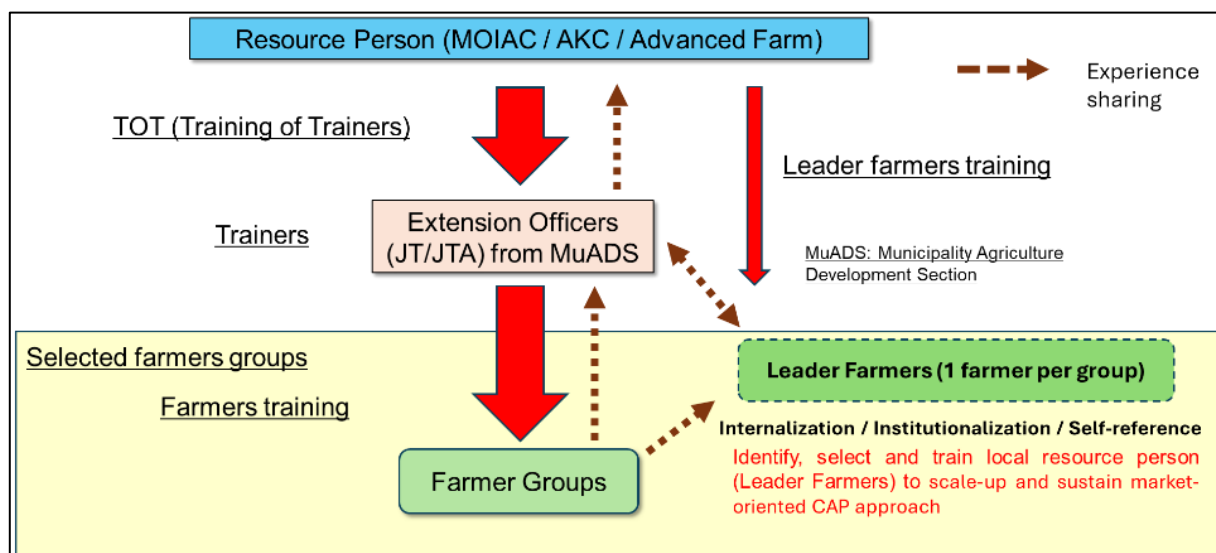


Figure 7: Implementation Structure of the PIAT-CAP

<Activities related to market-oriented agriculture>

The guideline recommends conducting the following activities for the MOA:

Table 27: Summary of TOT for Extension Officers (Stage-1)

Objective	To make the extension officers the trainers of PIAT-CAP for the target farmers
Implementor	Resource persons, mainly AKC
Participant	Extension officers of LGs in the command areas of the target irrigation system Leader farmers selected from each farmer group
Program	Group Selection, Farmer's Understanding of the Goal, Farmer's Awareness, Farmer's Decision Making, Farmer's Acquiring Skills, Follow Up and Monitoring

Table 28: Summary of On-the Job Training to Farmers (Stage-2)

Objective	To enhance farmers' awareness on the PIAT-CAP
Implementor	Extension officers of the LGs
Participant	Target farmers of the target irrigation system
Program	Group Selection, Understanding of the Goal, Raising Awareness, Decision Making on Farming plan, Acquiring Farming Skills, Recording and Review

Table 29: Summary of Rice Mill Approach for Strengthening Rice Marketing

Objective	To strengthen rice marketing through cooperative paddy sales
Target	Rice farmers in the model SCs of the target irrigation system
Implementer / Facilitator	WUA / Extension officers of the LGs
Recommended Activity	Collecting Paddy Market Information, Consideration of Cooperative Sales Policy, Raising Awareness of the Target Farmers, Discussion/ Negotiation with the Target Mill/ Dealer, Exchanging MOU, Recording and Review
Necessary Input	Training of Nursing Seedling / Post-harvest by the extension officers of LGs

Table 30: Program of Study Tour to Advanced Practices

Objective	To encourage the target farmers to scale up market-oriented agriculture, to provide opportunities to the participants for observing advanced experiences of commercial farming, and to learn how the advanced farmers have been benefiting from the commercial agriculture promotion activities in other districts
Target	Target farmers of the PIAT-CAP / WUA officials / Extension officers of LGs / AKC
Implementer / Facilitator	WUA / Extension officers of LGs, AKC
Recommended Destinations to Visit	Small Farmers' Agriculture Cooperative (SFAC), Agriculture Training / Research Centre, PMAMP / AKC Office, Organic Agriculture Farm
Necessary Input	Field guides at each destination

Table 31: Introduction of New Skill on Vegetable and Rice Cultivation

Objective	To introduce new farming skills to the model farmers / water users in collaboration with relevant government agency and private company, led by extension officers of the LGs.
Target	Target farmers of the PIAT-CAP / WUA officials / Extension officers of LGs / AKC
Implementer / Facilitator	WUA / Extension officers of LGs, AKC
Recommended Activity	Vegetable: Field trials of ridging and ditching, sticking and stringing, plastic house, plastic mulch, soil solarization, introduction on new drought-tolerant varieties, crop diversification against climate shocks etc. Rice: Field trials of Plastic tunnel, laser land leveling, direct sowing, rice transplanter, etc.
Necessary Input	Agricultural input, technical guidance

4.4 Institutional Development of Water Users Association

4.4.1 Relevance

The institutional development of WUA is one of the core components of the PIAT model. For WUAs, institutional development plays a critical role in ensuring their sustainability, efficiency, and

effectiveness in managing water resources. The PIAT envisages to strengthen capacity, structure, and effectiveness of WUA to assist them to become more accountable and responsive to users so that WUAs could achieve their objectives, which, among others, include taking the responsibility of distributing water received from the main canal to the users through the existing canal network comprised of secondary, tertiary and field channels, keeping clean, operating and maintaining secondary canals under their mandates, and collecting irrigation service fee (ISF) to be shared with the government as revenue, and the SCCs and TCCs for the repair and maintenance. This means that institutional development for WUAs means creating a well-organized, knowledgeable, and accountable group that can effectively manage these responsibilities to a greater extent.

The PIAT model reiterates institutional development of the WUA because well-developed WUAs are better equipped to manage water resources equitably, ensuring that all members receive a fair share of water based on their needs. The institutional development of the WUA largely depends on its ability to collect Irrigation Service Fees (ISF) from users. However, the WUA lacks the legal authority to enforce penalties on users who fail to pay ISF on time. Instead, their options are limited to following up with users and encouraging timely payments by ensuring that water is delivered according to the users' needs and expectations.

Therefore, the model has provided a special importance to the ISF collection, apart from training, workshops and activity cooperation system. The two components, described earlier, will also contribute to enhance capacity of the WUA directly or indirectly. Hence, the model keeps at the centre. The overall purpose of the institutional development component is to make the WUA self-reliant as envisaged by the National Irrigation Policy 2023.

Table 32: Possible Needs for Institutional Development

Possible Needs	Details for irrigation scheme
(1) Review of WUA By-law	Periodic review of WUA by-law for the sustainable organization setup and institutionalism
(2) Implementation of timely election	The by-law set a rule to conduct election on periodic basis for the member of General assembly, MCC, SCC, TCC, DTOC. Each role and responsibility are mentioned in the by-law.
(3) Implementation of regular meeting in General Assembly and subordinate committee (inclusive of agenda clarification)	General Assembly must be conducted at least once in a year by MCC, and other meetings shall be conducted as per necessary (not regularly).
(4) Establishment of sub-committee for specific task	Establishment of several official committees (internal audit committee, budget draft committee, Mechanical equipment operation sub-committee). ISF collection sub-committee, water distribution sub-committee may also be established.
(5) Support on financial record keeping	Financial record must be recorded with digitalized format in MCC office and taken regular audit.
(6) ISF collection and mobilization	Preparatory work such as receipt pats and list of water users) shall be undertaken by MCC and ISF collection training is conducted by IMO.
(7) Fund raising for O&M other than ISF	Some SCCs may collect O&M fee from the members for repair and maintenance of the secondary and tertiary canals.
(8) Coordination with other organization (IMO, Municipality, AKC, Federal/ Provincial government)	Monthly meeting shall be conducted among WUA, IMO, municipalities, AKC, etc.

Table 33: Activities proposed for Institutional Development

Stage	Activity	Remarks
Planning	Conduct the problem analysis and institutional (Stakeholder) analysis	Identify the training needs for institutional development
Implementation	1. Establish the following sub-committees in WUA as per the needs (a) Water distribution sub-committee (b) Canal repair and maintenance (c) Market-oriented agriculture (d) ISF collection (e) Coordination with other organizations (IMO, AKC, LGs and private sectors) 2. Other activities if any	Appoint the chief and members of sub-committee OJT under component 1 OJT under component 1 OJT under component 2 OJT under component 3 (* Details shown below) OJT under all components Depend on the training needs

4.4.2 Activities for Improving Irrigation Service Fee Collection

ISF is one of major income sources for all WUA in Nepal for O&M of canal system. Typical flow of ISF collection and distribution in JMIS is shown in Annex 12. Due to several reasons, the ISF collection amount/rate stands at low level against the full target in many irrigation schemes.

For the improvement of ISF collection amount/rate, the guidelines suggest the following activities: .

- 1) WUA should encourage water users to pay ISF on-time by improving the water distribution system, processes, and methods and following up in a timely manner (**increasing the willingness to pay rate**).
- 2) Improvement in the ISF collection system: to set appropriate ISF rates and institute a user-friendly collection system, including a transparent account system with the ISF payer and non-payee record system.

4.4.3 Activities proposed for the improvement of ISF Collection

The activities to be conducted for improvement on ISF collection system is summarized as follows:

Table 34: Summary of ISF Collection Activity

Objective	To support WUA to encourage water users to pay / collect ISF To improve Irrigation Service Fee (ISF) collection system
Target	Whole command area of irrigation scheme
Implementer	WUA and support of IMO
Activities	(i) Situation analysis: To review of ISF collection system (ii) Action plan preparation: To finalize action plan by WUA and IMO as main actors (iii) Implementation: To conduct possible solutions with available resources and budget

4.5 Activity Cooperation System for the Integration of Irrigation and Agriculture

As discussed in Chapter 2, one of the specific objectives of the PIAT model is to facilitate integration of irrigation and agriculture through establishment of activity cooperation system. There could be several activities that enhances the integration of irrigation and agriculture. In Terai setting, the Guidelines proposes the following activities for integrating irrigation and agriculture.

4.5.1 Establishment of Activity Cooperation System

As described in Chapter 2, in the Model, the WUA will take the lead role in creating an action plan to promote irrigated agriculture in collaboration with the concerned IMO in irrigation and local governments and Agriculture Knowledge Centre (AKC) in agriculture. The following illustration describes the activity cooperation system at Task Team centred by WUA.

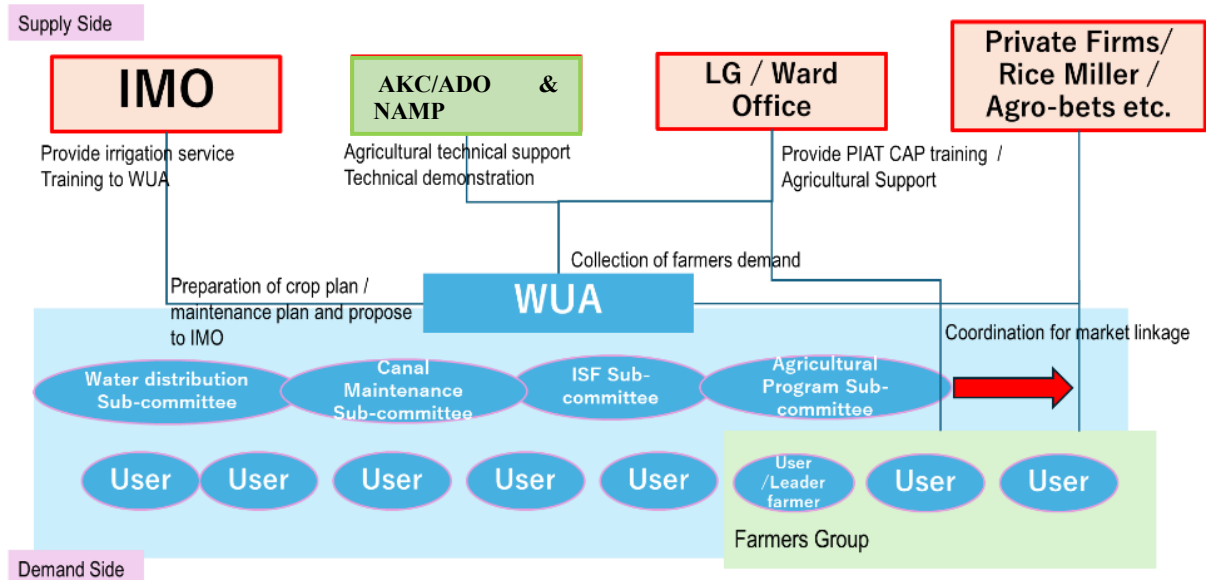


Figure 8: Activity Cooperation System centred by WUA

4.5.2 Selection of Model Site for Integration of On-farm development and Market-oriented agriculture activities

(1) Introduction

In the case that JMIS is selected as the irrigation scheme, due to the large irrigation command area and the number of beneficiary farmers, it is necessary to select an active water users' group that can lead market-oriented agricultural activities in the scheme. In parallel, to improve on-farm level water management, it is essential to improve / construct a tertiary canal, on-farm irrigation facilities such as field outlet, division box and field channels to be used by the selected water users' group.

The guidelines, therefore, recommend selecting target water user groups as well as tertiary canal command area as a model site to implement 1) market-oriented agriculture and 2) on-farm development including field channel construction.

If there are several local governments inside the irrigation scheme, the guideline proposes to select model site from each local government, taking into consideration the involvement of agriculture extension officers of each local government and the demonstration for the farmers within the area.

The concept representing the activities and target areas is shown below:

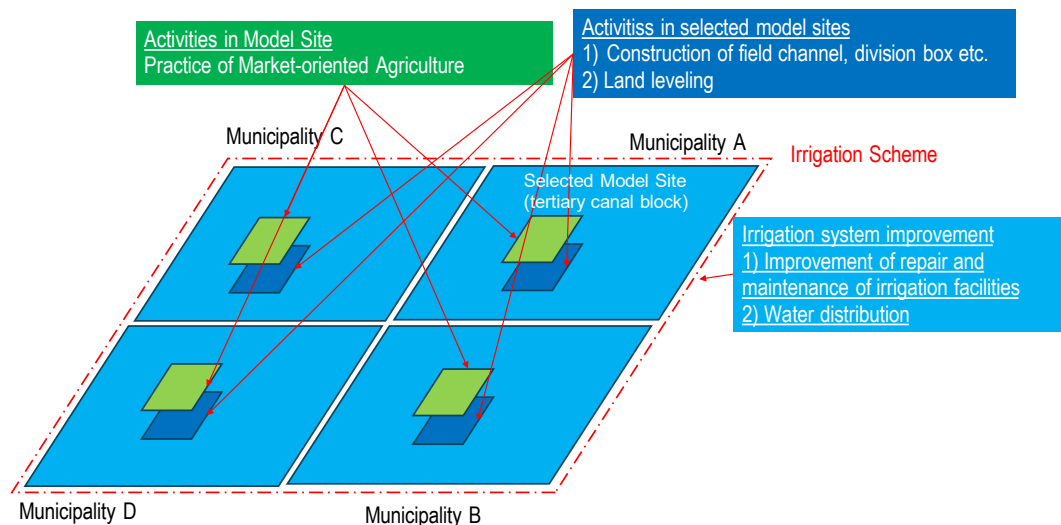


Figure 9: Concept of selection of model sites and related activities

To achieve synergistic effects between irrigation and agricultural activities, the target areas and farmers for the construction of On-Farm Development, Field Channels, and the implementation of market-oriented agriculture shall be selected at the tertiary canal block level, and the activities must be carried out. As a result of implementation of On-Farm Development and other measures to support increased motivation of farmers' through market-oriented agricultural practices, improved water distribution and management at the field level, leading to an increase in cultivated area and production volume. Selected target areas and farmers should focused not only to on farm development but need their attention towards production and marketing of agriculture products as well.

In the selection process, local governments must select the farmer groups to be targeted for the activities. After consultations with the WUA and SCC, the proposal is submitted to the IMO. The activities will initiated under a framework where all three parties—local governments, WUA, and IMO—reached an agreement. This process fosters a sense of ownership among the stakeholders and enables collaborative work.

(2) Selection Criteria and Method

Below are the selection criteria and methods for target model sites. Modification may be made according to the size of the irrigation area and the number of local governments covering the irrigation area.

Table 35: Selection Method and Criteria for Model TCC for On-Farm Development and Market-oriented Agriculture

Item	Description
Model Tertiary Canal Committee	Selection Criteria 1) TCC is motivated highly to improve their capacity of irrigation operation and to learn agricultural skill for spreading to other TCC. 2) TCC locates upstream of its secondary canal. There is no problem to take Irrigation water from secondary canal. 3) Active farmer is the member of TCC.

Item	Description
	4) TCC is willing to pay the necessary cost for establish and operation of the demo farm. 5) Demo farm is adjacent to farm road.
	Selection Method 1) Municipality selects target farmers group and relevant TCC in consultation with WUA. 2) Municipality submits a proposal to IMO. 3) IMO will examine and accept the proposal. 4) MOU will be signed among three parties.

(3) General Meeting among Stakeholders after Selection of Model Site

After selection and signing of MOU, a general meeting will be held among IMO, WUA, municipality for implementation of agriculture and on-farm development activities in integrated manner.

Table 36: Sample Agenda of General Meeting

Objective	1. To make a consensus and understanding of the followings among the concerned stakeholders 1) Objectives and activities to be implemented at Model Site 2) Role & responsibility of selected water users, WUA 3) To confirm necessary support from IMO and Municipality 2. To confirm procedure and schedule of activities 3. To confirm the status of command area and irrigation facilities
Facilitator	- Agriculture Extension Officer
Participant	- Target Water Users - IMO: Chief or Representative - WUA: Main Canal Committee, Chairman of Secondary Canal Committee and Tertiary Committee - Municipality: Ward Chairman, Agriculture Extension Officer
Program	i) Orientation of the activities to be implemented (MoA and OFD) ii) Confirmation of role and responsibilities of each stakeholder iii) Confirmation of procedure and schedule of activities iv) Joint site visit to tertiary canal command area and irrigation facilities
Further Activities	<On Farm Development (OFD) works> Joint site inspection for planning of OFD works by IMO, WUA and target water users. Discussion and finalizing scope of OFD works considering the available budget, necessity of the works and participation of works by water users. Design work, quantity calculation, cost estimate. Contract agreement for OFD work between IMO and WUA (if necessary, some works will be done by the contractor) Commencement of OFD Work and field channel construction. <Market Oriented Agriculture> Identification of model farmers, who will participate in the activities. Identification of leader farmers Orientation of PIAT CAP to farmers (On the Job Training (OJT)) Conduct series of CAP activities

4.5.3 Field channel construction

Field channel construction is essential for optimizing irrigation schemes and ensuring efficient water distribution to agricultural fields. Field channels ensures that water is delivered to field in a controlled manner and reduces water wastage. These channels help to deliver water from canal to individual farm plots and helps to increasing crop productivity. Summary for these activities is shown in following table.

Table 37: Summary of Activity (Field Channel Construction)

Objective	To improve irrigation efficiency in each irrigation block.
Target	In each irrigation block in target irrigation scheme
Implementer	WUA
Recommended Activity	To construct Field Channel by WUA
Resources required	1) Human resource 2) Financial resources 3) Equipment for earth work (e.g., shovel, mattock, spade, pick, etc.)

4.5.4 On-farm development

For improvement of irrigation efficiency below TC, it is recommendable to construct newly and / or improve small scale irrigation facilities, hereinafter called “on-farm development (OFD)”. The OFD includes not just water management but also land development, crop management and other irrigation infrastructure development activities as well. Hence land levelling can also be considered as a part of on-farm development. However, owing to the importance of land levelling in Terai, this guideline recommends taking land levelling as a separate activity but under the integrated irrigation and agriculture. Summary for these activities is shown in following table.

Table 38: Summary of Activity (OFD)

Objective	To improve irrigation efficiency below TC.	
Target	Small canal / structure below TC.	
Implementer	IMO & WUA. Following is a sample of demarcation.	
	Work Step	Demarcation
	Survey	IMO and WUA
	Planning	IMO referring to WUA's opinion
	Design	IMO
	Procurement of contractor for construction	IMO
	Construction	Procured contractor
	Supervision for construction	WUA
Recommended Activity	1) To conduct survey, planning, design for OFD 2) To conduct construction work of OFD	
Resources required	1) Topographic Survey Equipment 2) GPS 3) Digital Camera 4) Measuring Devices (e.g., Measuring Tape (Nylon, Long), etc.) 5) Human resource from IMO and WUA 6) Stationery	

4.5.5 Land levelling

For improvement of irrigation efficiency in farm plot, it is recommendable to level land using machines like laser land leveller. Summary for these activities is shown in following table.

Table 39: Summary of Activity (Land Levelling)

Objective	To improve irrigation efficiency for cultivation in farm plot.
Target	In farm plot in target irrigation scheme
Implementer	WUA, Individual Farmer, Machine Operator
Recommended Activity	1) To implement Land Levelling 2) To implement consolidation and expansion of farmland parcels together with Land Levelling, if possible (for improvement of efficiency of machine use)
Resources required	1) Tractor and Land Leveller^{*1} 2) Budget for usage charge of Tactor and Land Leveller 3) Person in charge to manage renting system and / or rule of Tactor and Land Leveller 4) Budget for maintenance / repair of Tactor and Land Leveller ^{*1}: Land Leveller is useful and recommendable. In TCP-PIAT, Laser Land Leveller was procured and introduced. Laser Land Leveller also can be recommendable because it can provide high accuracy of Land Levelling.

CHAPTER 5 MONITORING AND EVALUATION

5.1 General

The PIAT model underscores the critical role of monitoring and evaluation (M&E) in achieving the results envisaged by the PIAT model and tracking the initiative towards sustainability. However, the model recognizes the distinct roles of monitoring and evaluation while emphasizing their complementarity. Monitoring provides the continuous oversight to track progress against defined targets, ensuring that activities stay aligned with the project's objectives. In contrast, evaluation has two interlinked objectives, accountability and learning.

5.2 Monitoring

Regular monitoring helps ensure that resources are used effectively and efficiently. This increases the accountability and transparency of stakeholders in delivering the planned outputs and outcomes. This transparency builds trust and ownership among stakeholders, a critical factor in ensuring that activities continue beyond the project period. For effective monitoring, a project must have a comprehensive and clear result framework based on a theory of change. This result framework provides a mechanism for the evaluation. Annex 3 provides project design matrix for the PIAT-model. The Life of Project (LoP) target values are not provided because they depend on the scheme and the baseline survey results. Therefore, a quick participatory baseline survey should be carried out in the first year of the project period. The project task team will need to set LoP targets in the second year of the project implementation. This section uses the term project even if an additional financing strategy is followed to replicate the model as discussed in Chapter 6.

To ensure effective monitoring, a project monitoring committee (PMC) will be established at the province level, chaired by the Secretary of the Ministry responsible for irrigation and with the representation of at least an under-secretary-level officer of the Ministry responsible for agriculture. The Secretary of the Agriculture Ministry will also be an invitee member, and elected chiefs (Mayors/Chairpersons) of the concerned local governments will represent the committee as advisors.

For the irrigation scheme under the jurisdiction of the federal government, the Director General or the Deputy Director General responsible for irrigation management division will chair the PMC and at least a joint-secretary level officer from the DoA will represent the committee, as nominated by its Director General. Table 37 shows the composition of the monitoring committees at the local, provincial and federal level.

Table 40: Composition of the project monitoring committee

SN	Irrigation scheme (jurisdiction)	Composition of the committee
1	Local (Farmer-managed irrigation scheme)	Mayor/Chairperson- Chairman President, WUA- Member Ward chairman (related to the irrigation scheme/command area)- Member Chief, Agriculture Development Section, Municipality/Rural Municipality- Member Secretary, WUA- Member-secretary Invitee members- Chief IMO or District level Irrigation Division Office and Chief of AKC

SN	Irrigation scheme (jurisdiction)	Composition of the committee
2	Province Government	Secretary, Ministry of Irrigation Chairman Representative (Under-secretary level) Member Chief Administrative Officer (Related local level) Member Chief, Agriculture Knowledge Centre Member Chief, Irrigation Management Office- Member-Secretary Concerned Mayor and Chairpersons of the local level will act as advisor to this committee Invitee-member- Secretary, Ministry of Agriculture
3	Federal Level	Director General, DWRI, or Deputy Director General nominated by him responsible for Irrigation Management- Chairperson Representative DoA (Joint-secretary level)- Member Secretary, Ministry of Irrigation (Province)- Member Chief, Irrigation Management Office- Member-Secretary

If foreign assistance or a technical cooperation project is available to any irrigation scheme, the chairperson of the PMC will be the Director General or the Deputy Director General nominated by him responsible for Irrigation Management of the Department of Water Resources and Irrigation as to the capacity of the Project Director, irrespective of whether the scheme is under the jurisdiction of local or provincial governments.

The detail activity plan recommended for monitoring and evaluation is as follows.

- 1) Regular progress monitoring meeting
- 2) Periodic monitoring report

Description of each activity and step are shown in the following Sections. The detail method and procedure are shown in the Manual. Besides the above, the Province Ministry in charge of the province-level irrigation schemes and local governments will maintain close contact and work with the Department of Water Resources and Irrigation to receive necessary technical assistance and support required for replicating the model in their respective province and local governments constituencies, as necessary even in the absence of the technical cooperation, and may invite to attend in the meetings of the project monitoring committees.

5.2.1 Regular Progress Monitoring Meetings

The monitoring and evaluation of activity progress will be conducted through regular meetings, as outlined in the table below. The Task Team will schedule these meetings. The agenda for the meetings will include, but not be limited to, the following items:

Table 41: Outlines of Regular Progress Monitoring Meetings

Meeting	Frequency	Members	Meeting agenda (sample)
Task Team (TT) meeting	Quarterly	WUA/IMO/LG/ AKC/CT	Review project performance and activities Identify problems and solutions Approve Work plan for the upcoming months. Any other issues proposed by the members
Monitoring Committee (MC) meeting	Semi-annually	TT members + Federal, Province or LG members depending on the	Progress and achievement in this quarter Work plan in the next quarter Technical and financial support from the provincial government,

		irrigation scheme	Any other issues proposed by the members.
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5.2.2 Monitoring Report

Following the initiation of the implementation stage, the Task Team will evaluate the progress and pertinent details biannually and compile a monitoring report. The Project Design Matrix (PDM) and Project Outline (PO) will accompany this report. The MC will then assess the monitoring report and provide guidance on any required adjustments to the Model activities.

5.2.3 Completion report

Upon completion of the Model activity, the Task Team will compile a project completion report. This document will summarize the activities and outcomes of the irrigated agriculture promotion model. It will detail lessons learned, recommendations for any challenges encountered during the activity implementation, actions taken to resolve these issues, as well as innovations and improvements adapted to local conditions. The report will also suggest effective future activities.

5.3 Evaluation

Given that the project will be implemented for a period of upto 5 years, only the final evaluation will be carried out at the end of the project period or just after the completion of the project. Based on the Monitoring and Evaluation Act 2023, the evaluation will assess the relevance, coherence, effectiveness, efficiency, impact, and sustainability of the project. Apart from these criteria, the “Guidelines” recommends to include gender equality and women empowerment (GEWE) issues in all the criteria during the final evaluation as a cross-cutting agenda.

5.3.1 Endline Evaluation

For final evaluation, the IMO will carry out baseline survey through the support of AKC. LG and WUA or outsource to a service provider. The baseline survey will be carried out within three months following the commencement of Model activities. Similarly, the endline survey will be conducted about three months prior to the conclusion of Model activities.

The surveys are aimed at irrigation management offices, water users' associations (MCCs/SCCs), individual farmers, local governments, and AKC. Both surveys will be carried out in the same area and in a similar method, with the outcomes being compared and analyzed to assess the Model's impact. The PIAT-CAP results will be assessed using a straightforward form designed for completion by the target farmers.

CHAPTER 6 TOWARDS IMPLEMENTATION OF THE MODEL

6.1 General

This chapter provides the framework, structure, and method for executing PIAT. It outlines how a specific intervention or development initiative will be carried out, including the roles and responsibilities of key stakeholders, the flow of resources, and the processes and mechanisms for achieving desired outcomes. Basically, this chapter complements chapters 2 to 5 and should not be viewed as a stand-alone chapter.

6.2 Implementation Modality

The PIAT model does not automatically result in success in all regions and irrigation schemes. Hence, the "Guidelines" suggest adapting the model, specifically related to market-oriented agriculture, based on elements such as crop selection, growing season, market opportunities, and technologies based on local geography, climate, cultural practices, socioeconomic conditions, and also the conditions of the selected irrigation scheme. These factors need to be taken into account. Customizing the model to fit the specific needs of new areas ensures greater relevance and effectiveness.

The first step in replicating the model is to develop a clear financial strategy to ensure that replication efforts do not stall. Hence, this Guidelines suggests to select either a project-based or incremental/additional financing-based strategy based on the irrigation command area.

Box 1: Implementation Modality

In a project-based strategy, implementations are carried out as a distinct project with a defined scope, timeline, and resources. Each project is planned, executed, and completed as a standalone activity.

Additional financing/incremental funding strategy focuses on making small, continuous changes or improvements over time. Rather than a single project, changes are implemented in phases or increments. The model is flexible. It emphasizes on-going development, rather than a time-bound project with separate resources (human, managerial and financial resources).

While the selection of the strategy depends on the key stakeholder and implementing agencies, particularly the ministry responsible for overseeing irrigation and agriculture, this "Guidelines" suggests to select a project-based strategy when the following conditions apply:

- The area irrigated by an irrigation scheme (Command area)
- Number of water users
- Activities and actions of the water users association (activeness and good-governance)
- Water distribution status/process
- Availability and activities of irrigation and agriculture service providers
- Farming system in the command area of the related irrigation scheme
- Engagement/participation status if farmers in commercial agriculture (status of the agriculture commercialization in the command area)

- The command area of the scheme spread over more than 1 LG constituency

This Guidelines suggests selecting an additional financing strategy when a system is farmer- managed and spread over upto 3,000 ha as shown in Table 39 due to excessive overhead expenditures in the beginning.

Table 42: Basis for Selecting Implementation Modality

SN	Basis	Project-based modality	Additional financing modality
1	Irrigation scheme command area	More than 3,000 Ha	Upto 3,000 Ha
2	Number of local levels under the irrigation scheme	More than 4	Less than 4
3	Administrative jurisdiction	Federal or provincial level	Provincial and local level
4	Water Users Association	Active/semi-active and registered organization under the Nepal government legislation	Active/semi-active and registered organization under the Nepal government legislation
5	Irrigation Service Fee Collection Rate	Below 50 percent	Below 50 percent
6	Irrigation scheme management	Agency or Joint Management System	Joint Management or Farmer-managed

6.3 Implementation Period

The implementation period for a project-based modality should be set for a maximum period of five years, and additional financing modality could be flexible. The latter depends on the willingness of the concerned parties to continue with additional financing.

When a project-based model is selected, the Guidelines suggest adhering to a maximum period of 5 years, including a maximum a one-year period of problem analysis, objective setting and action plan formulation. However, after the completion of the project-based modality, this Guidelines suggests continuing the model by providing additional financing for an additional three fiscal years to ensure the sustainability of the results achieved under the project-based model. This is to suggest that a three-year period might provide a cushion for effectively taking over the project activities, and continuity to the technologies and innovations by the project's beneficiaries.

Regardless of the implementation modality chosen, the Water Users Association (WUA) must demonstrate strong commitment, proactive engagement, and sustained motivation, as it is ultimately responsible for taking ownership of the replication initiative.

6.4 Human Resources

If irrigated area of the selected scheme is equivalent to or less than 3,000 Ha, the Guidelines suggests to follow an additional financing modality, as discussed in section 6.2 above. However, the Guidelines strongly reiterates to follow a project-based model by providing additional human resources, housed at IMO, with a clear mandate, fund and, expected results.

6.5 Provision of Project Task Team

Whether a project-based or additional financing strategy is applied, forming a project task team is mandatory at the scheme/system level. The model's foundation is the activity cooperation system, which the task team members are required to implement in coordination with one another. The Guidelines proposes to establish a secretariat of the task team at the WUA in conformity with the WUA's

institutional development, and ensure sustainability of the project activities. The formation of the task team is proposed as follows (Box 2):

Box 2: Composition of the Task Team^s

- Chairperson: Chief, IMO
- Member: Chief. AKC
- Member: WUA President
- Member: LG Agriculture Development Section Chief (located within the irrigation scheme command area)
- Member: One reliable buyer
- Member Secretary: Secretary: WUA

\$- To be decided; *- When project model is scaled up in the second stage, the structure of the task team could be revised based on the Memorandum of Understanding reached among the agencies indicated above.

If project based, members of the expert group will also be members in the task team).

The task team may invite WUA members like vice-president and other officials as members.

The roles and responsibilities of the task team will be as follows:

- To formulate yearly activity plan
- To implement and monitor the activities
- To share the good practices, lessons learned and keep each other updated regarding ongoing activities
- To prepare activity progress reports, monitoring reports and submit to the project monitoring committee
- To identify countermeasures for issues related to activities and ensure they are addressed by the concerned authorities.

6.6 Budget Management

Irrespective of whether a project-based or additional-financing strategy is followed, the “Guidelines” suggests to mainstream/allocate within the regular budgeting system, with a separate budget code for identification, accountability and monitoring. The PIAT model, as has been clear, by now that it does not subscribe to creating additional institutional structure or agencies, but to adjust within the already functioning agencies, such as IMO, AKC, WUA, ADS/LGs. The budget will be released to them as per the on-going arrangements but simply to collaborate with each other based on activity cooperation system through the formation of a task team.

CHAPTER 7 COST BENEFIT ASSESSMENT

7.1 General

This chapter provides basis for tentative costs and assesses the benefits based on the end-line survey results compared with the baseline survey values. As discussed in this Guidelines, the project costs and benefits are estimated separately for the two implementation modalities- (a) the project-based and (b) additional financing/incremental modalities, as proposed in Chapter 6. The cost-benefit assessment is tentative, and the costs shown in this chapter are not the government's norms. These are indicative and reflects experience from implemented project. Hence, the Guidelines expect the respective irrigation schemes and governments to formulate and approve norms and standards harmonizing with their other existing rules, norms, and directives. The analysis here serves more as a reference or illustration rather than a definitive financial framework for implementation.

Before presenting the cost estimates to replicate the PIAT-model, the following shows the assumptions that the guidelines followed while assessing cost-benefit. These assumptions presented in this Guidelines are indicative which should be adjusted based on several key elements factors such as the nature of the selected irrigation scheme/system, nature and conditions of the headworks, type of river supplying water for irrigation (perennial/seasonal), number of water users, length of the main canal, numbers and lengths of the SCs and TCs, systems for

Table 43 Minimum number of experts required for the project-based modality

S.N.	Experts and Support Staff	Number
1	Project Chief Advisor (Team Leader)	1
2	Irrigation Scheme Improvement Expert	1
3	Agriculture Expert	1
4	WUA Expert (Sociologist)	1
5	Office Manager	1

releasing water from the SCs and TCs to the farmers' fields, irrigation command area. These variables are essential to tailor the cost-benefit assessment to the specific characteristics of each irrigation scheme.

Since larger irrigation schemes often present greater challenges and constraints, making their management more complex, the Guidelines suggests to apply additional financing modality in the irrigation scheme, up to 3,000 ha threshold. These challenges might arise from the complexity of managing larger infrastructures, coordinating a greater number of stakeholders, and addressing governance or operational difficulties, which tend to increase as the size of the irrigation scheme increases.

7.2 Cost Estimate

Before assessing the cost-benefit of the model, Table 41 presents assumptions based on which the two modalities—project-based and additional financing-based—are analyzed.

Regardless of the selected implementation modality—whether project-based or through additional financing—this Guidelines strongly recommends allocating sufficient time, almost a full year, for building understanding and raising awareness among key stakeholders. These stakeholders include the Water User Association (WUA), Irrigation Management Organization (IMO), water users, agricultural cooperatives, leader farmers, subsistence farmers, semi-commercial farmers, and commercial farmers. The primary objective of this preparatory phase is to foster a sense of ownership over the system, along

with its challenges and potential issues. Investment requirement for the implementation of PIAT-model is estimated based on the experience.

The Guidelines suggest starting to implement the following four core components/strategies simultaneously from the second year onwards.

(1) Irrigation System Improvement (2) Promotion of Market Oriented Agriculture (3) WUA Institutional Development, and (4) Activity Cooperation System

Table 44: Assumptions for the Cost Estimates

Assumptions for Project-based model	
Irrigation scheme command area – 10,000 Ha	
Irrigation scheme command area coverage- 3 or more LG constituency	
Number of HHs/water users- 12,500 (Rounded- based on NCSA 2021/22 data, 3798 HHs, 0.8 Ha/HH (4 LGs in Jhapa district)	
Target population (4.22 /HH- Population and Housing Census 2021)- 12,000 (Rounded)	
Approximate Number of farmer beneficiary- 7,800 HHs (62% farmer households as per NCSA 2021/22)	
Model site 100 Ha, 100 Farmer HH	
Number of SCs- 25	
Number of TCs- 250	
Number of Water Users (approx.)-7800	
Assumptions for Additional Financing Modality	
Irrigation scheme- 500 Ha	
Irrigation scheme command area coverage- Maximum 2 LG	
Number of HHs/water users- Approx.625	
Model site 50 Ha, 50 farmers HH	
Number of SCs- 2	
Number of TCs- 15	
Number of Water Users - 400	

Tables 45 and 46 present tentative investment requirements for the planning and implementation stages, respectively based on experience.

Table 45: Cost Estimate

SN	Steps and Activities	Project-based, '000 Rs.	Incremental/AF '000 Rs.
1	Step 1: Selection of the irrigation scheme	0	0
2	Step 2: Carry out reconnaissance visit/a short and quick study/participatory workshop	50	50
Planning exercise (Preparatory)			
3	Step 3: Undertake a series of participatory workshops (Problem Analysis, Stakeholder Analysis and Objective Setting Workshop),	180	60
4	Step 4: Implement mini-projects for further understanding the system and other features including opportunities, challenges and constraints (Optional)	100	0
5	Step 5: Carry out baseline survey	1,000	150

SN	Steps and Activities	Project-based, ‘000 Rs.	Incremental/AF ‘000 Rs.
6	Step 6: Drafting the action plan	100	40
7	Step 7: Submit the draft action plan for review by the concerned government agencies	50	25
Towards the finalization of action plan			
8	Step 8: Scheme-based rapid joint visit of key officials (federal, provincial or local level)	50	50
9	Step 9: Determination of the implementation modality (project vs additional financing or incremental approach)	-	-
10	Step 10 Commitment/receipt of Minutes of Understandings (MoU)	-	-
11	Step 11: Formation of the project/programme task team	-	-
	Formation of the Monitoring Committees		
12	Formation of Monitoring Committee at the federal, provincial or local level as applicable depending on the command area of the scheme	-	
Implementation starts			
13	First meeting of the project task team	10	5
14	Project-kick off meeting	200	100
Total ‘000 Rs.		1,740	480
Irrigation command area (estimated), Ha		10,000	500
Number of Water Users, HH		7,800	400
Estimated cost per beneficiary (Water users), Rs./HH ⁸		223	1,200
Estimated cost per ha		174	960

Table 46: Five-Years Investment Structure by Components

S.N	Items	Project-based, Rs.		Additional financing, Rs.	
		Per HH	Per Ha	Per HH	Per Ha
1	Planning (Carried out from table 12)	223	174	1,200	960
2	Project core components				
2.1	Irrigation system improvement	2,265	1,767	5,105	4,084
2.2	Market-oriented agriculture	3,818	2,978	19,127	17,214
2.3	WUA's institutional development	1,263	985	9,818	7,854
2.4	Integration of Irrigation and Agriculture through Activity Cooperation System	2,856	2,228	15,083	12,067
3	Monitoring and Evaluation	230	180	1,578	1,263
4.	Administration Cost	9,979	7,784	9,189	8,791
Total		20,635	16,095	61,100	52,233
Average investment per year		4,127	3,219	12,220	10,447

Annex 11 presents a cost-benefit analysis, demonstrating that when the command area of an irrigation scheme is less than 2,100 hectares, the project-based model is not economically viable. However, when the area exceeds 2,000 hectares, the financial dynamics shift. At this point, the costs required for

⁸ In incremental modality, the cost per beneficiary is high because of the limited number of water users and small size of the irrigation command area.

additional financing under the project-based model decrease, suggesting economies of scale kick in, making larger irrigation schemes more financially sustainable for replication and application of the model. Therefore, the model becomes more favourable in schemes above the 2,000-hectare threshold, but its cost-effectiveness improves significantly as the command area increases beyond 2,100 hectares. The cost comparison includes tentative administration costs as well.

7.3 Economic Benefits

The following table illustrate likely economic benefits water users from the implementation of the model. The guideline presents the income difference with and without project, drawing on the results from the experiences.

Table 47: Benefits Assessment by Modality: Per Household

Modality	Number of Household (HH)			Increase of Income in the Scheme (000 Rs)			Average Increase of Income (Rs/HH)	Cost-Benefit Ratio (times)
	Non-Model	Model Sites	Total	Non-Model	Model Sites	Total		
Project-based Modality	7,400	400	7,800	866,599	98,077	964,676	123,676	30,0
Additional Financing	200	200	400	23,422	49,039	72,460	181,151	14.8

Table 48: Benefits Assessment by Modality: Per Ha

Modality	Command Area (Ha)			Increase of Income ('000 Rs)			Average Increase of Income (Rs/Ha)	Cost-Benefit Ratio (times)
	Non-Model	Model	Total	Non-Model	Model	Total		
Project-based Modality	9,600	400	10,000	780,499	41,278	821,777	82,178	25.5
Additional Financing	300	200	500	24,391	20,639	45,030	90,059	8.6

Since larger irrigation schemes often present greater challenges and constraints, making their management more complex, the Guidelines suggests to apply additional financing modality in the irrigation scheme, up to 3,000 ha threshold. These challenges might arise from the complexity of managing larger infrastructures, coordinating a greater number of stakeholders, and addressing governance or operational difficulties, which tend to increase as the size of the irrigation scheme increases.

CHAPTER 8 WAY FORWARD

8.1 General

The final chapter summaries key elements for consideration while replicating the PIAT model. These include from the selection of the scheme to the implementation and monitoring and evaluation.

8.2 Selection and understanding of the Irrigation Scheme

To ensure the model's rapid success with visible results, selecting a simple, small, and well-functioning irrigation scheme is essential. However, the ultimate objective of the PIAT model goes beyond quick wins; its long-term aim is to achieve sustainability and transformation, shifting the system from a negative to a positive trajectory, as outlined in Chapter 2. For this reason, the “Guidelines” recommends that federal, provincial, and local agencies initially select a scheme on a provisional basis, followed by an intensive field study to finalize the system for replication.

For true change, it is vital that the scheme selected has the capacity to maintain momentum and foster broader impact. To achieve this, the following criteria are critical for selecting the appropriate scheme:

- Willingness of the concerned water users association and their demands
- ISF collection rate in the scheme
- Agriculture potentiality
- Condition of the water head works

8.3 Creating synergy and forming a platform for joint action

While the model may seem straightforward at first glance, its true complexity lies in uniting diverse stakeholders—each with their own objectives—onto a common platform. Creating synergy among these varied interests to drive collective impact is no small feat. It demands strategic coordination, effective communication, and sustained engagement to transform this initial collaboration into meaningful, lasting results. Without planning, the model’s potential for transformative success could be significantly compromised. The planning phase provides a good opportunity to foster collaboration that leverages each stakeholder’s strengths, so their collective efforts produce results greater than the sum of individual contributions. This builds mutual understanding, trust, and cooperation, ensuring all stakeholders work cohesively towards common goals. It’s about turning individual actions into coordinated efforts that generate more impactful and sustainable outcomes.

8.4 Budget management

Implementing a project without adequate fund is simply not possible. However, the cost-estimate presented in the chapter 7 clearly illustrates that the model is not so much demanding from the perspective of financial resources requirements. Like any other development model, its success hinges on robust monitoring and strict adherence to a results-based management system. Therefore, the model calls for effective fund utilization with transparency and accountability.

8.5 Providing a high priority to the water users committee

As a farmers’ organization with a larger membership with involvement in one of the most important commodities, water, the role of WUA is vital in the PIAT model. PIAT initiative highlights the need for adequate support and assistance for the WUA, emphasizing its transformation into a professional,

innovative and users-centred organization. While the WUA is primarily responsible for managing the irrigation system, it should also actively participate in agriculture commercialization-efforts. The PIAT model provides a platform to enhance governance within the WUA, ensuring it is more responsive to the needs of its users.

8.6 Engage cooperatives and private sector

Terai agriculture is private led. Private sector's dominance in the technology development, transfer and utilization, particularly in supply chain management is obvious. This sector can play a significant role in influencing WUA and contributing to agricultural commercialization through mechanisms such as investing in irrigation infrastructures, developing, transferring and utilizing irrigation technologies, collaborating with WUA in introducing high-value crops. Therefore, this Guidelines reiterates the importance not only strengthening the relationship, but also implement collaborative activities between WUA and the private sector in promoting market-oriented agriculture. The PIAT experience suggests that the WUA should be highly proactive in strengthening partnerships with the private sector and cooperatives.

Annex 1: Kankai Irrigation Scheme (KIS)

Surrounded by India in the South, the Kankai River in the east, Krishna River in the west, and main canal in the north, the Kankai Irrigation System (KIS) lies in the eastern Terai (plain) of Nepal, between the latitudes of 26 to 27 degree North and longitude of 87-to-88-degree East. Kankai, a perennial river originating from the Mahabharat mountain, is the water source. The catchment area of the Kankai River at the headworks site is 1,190 square km. The elevation of the system varies from 120 m in the North to 75 m in the South. KIS spreads in two municipalities (Shivasatakshi and Gauradaha) and two rural municipalities (Gauriganj and Kamal). The scheme's construction was initiated in 1971 through the assistance of the Asian Development Bank and completed in two phases from 1971-1981 and 1981 to 1991. The net command area of the scheme was estimated at 8,000 Ha, with approximately 17,000 land owners. The detail GIS survey carried out by the TCP-PIAT in 2020 revealed its command area 8,951 Ha. However, water may not necessarily reach and be available to this area.

The canal system comprises a three tier networks of canals. The main canal (MC) length is 34 km with 74 km of secondary canals (SC) and 110 km of tertiary canals (TC). The system is now under a joint management system of the Kankai Irrigation Management Office under the Koshi Province Government and the Kankai Canal Water Users Association (KCWUA), which the government handed over to KCWUA on December 7, 2009. The KCWUA is registered at the District Administration Office on December 1, 1993, and operates pursuant to its By-law issued in 1993, and amendments thereafter. As per the government policy, KIMO is responsible for the operation and maintenance of the headworks and main canal, and the KCWUA for secondary canals and below, which include tertiary and field channels. KCWUA comprises 1 MCC, 22 SCCs and 181 TCCs, and 2089 water users are directly connected in the management of the KCWUA through these committees.



Annex 2: TCP-PIAT Outline

(1) Overall Goal	The Model developed by the Project is practiced in Terai Irrigation Area.
(2) Project Purpose	The Model of Irrigated Agriculture is formed by the collaboration among the Federal, Provincial, Local Governments and Water Users Associations (WUAs).
(3) Expected Outputs	Output 1: The issues regarding the Irrigated Agriculture in Kankai Irrigation Scheme are analysed and shared by the stakeholders themselves, and the Action Plan for solution to the issues are formulated. Output 2: Equitable and efficient water distribution system is established by the improvement of water distribution planning and its implementation, appropriate operation and maintenance of facilities and construction of field channels, etc. Output 3: The incomes of farmers in target scheme are increased through the practice of market-oriented agriculture Output 4: The Activity Execution Cooperation System for improvement of irrigated agriculture among stakeholders of Kankai Irrigation Scheme is established, and the results of the cooperation activities are diffused to other irrigation schemes in Terai area through the trainings.
(4) Target Area	Kankai Irrigation Scheme (Beneficiary Farmers: 9,200 HH, Irrigation Command Area: 8,951 ha) in Jhapa District in Koshi Province. i) The activities for Output 2 will be implemented in the whole Kankai Irrigation Scheme. ii) The activities for Output 3 will be implemented in the selected Model SCC (Secondary Canal Committee) per each municipality area.
(5) Implementation Agencies	i) Department of Water Resources and Irrigation (DWRI) under Ministry of Energy, Water Resources and Irrigation (MOEWRI) ii) Kankai Irrigation Management Office (KIMO) under Ministry of Water Supply, Irrigation and Energy (MOWSIE) of Koshi Province iii) Kankai Irrigation Water Users Association (WUA) iv) 4 Municipalités (Shivasatakshi, Gauradaha, Gaurigunj, Kamal) v) Department of Agriculture (DOA) under Ministry of Agriculture and Livestock Development (MOALD)
(6) Cooperation Agencies	i) Ministry of Industry, Agriculture and Cooperatives (MOIAC) of Koshi Province Agriculture Knowledge Centre (AKC), Jhapa District Agribusiness Promotion Support and Training Centre (ABPSTC))
(7) Project Period	Total Project period: March 2019 to March 2025 (73 months) The first phase: March 2019 to February 2020 (12 months) The second phase: April 2021 to March 2025 (48 months)

Annex 3: Tentative Project Design Matrix

Target Irrigation Scheme: XX, Implementation Agency: DWRI / MOWSIE, Task Team: IMO / WUA / LG / AKC

Project Period: 5 years

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Key Assumptions
Overall Goal			
Increase farm income of the selected Terai irrigation system water users by applying the PIAT model through the joint efforts of the federal, provincial, and local level stakeholders	Increase in farm income of water users by XX percentage, per Ha and per HH	End line survey result	PIAT model is followed as per the Guidelines and Manuals
Purpose			
Formulate scheme-wide detailed action plan to promote irrigated agriculture	A joint action plan prepared by key stakeholders based on problem analysis and other participatory approaches including stakeholder analysis	Approval of the action plan by the competent authority	IMO provides technical assistance and guidance to the WUA in collaboration with AKC and LG.
Improve the irrigation system by engaging key stakeholders of the irrigation, agriculture, and allied sectors	Formulation and implementation of facility maintenance plan of the main canal and secondary canals and its implementation Formulation and implementation of water distribution plan formulated by the SCCs/TCCs or equivalent based on the irrigation system structure	IMO report WUA report	IMO provides technical and financial assistance to the WUA
Promote location-specific appropriate market-oriented agriculture practices to assist water users/farmers to increase agriculture income	Number of the model sites (TC and farmer group) getting PIAT-CAP training Number of farmers/water users participating in market-oriented agriculture Irrigated area (XX ha) under market-oriented agriculture by crops Amount of agriculture products sold by participating farmers	WUA/AKC/LG report LG/WUA report Snap-survey	AKC and LG provide technical and financial assistance, and guidance to the WUA
Transform the WUA into a user-centred, innovative and professional association	Increase in ISF collection rate by XX %	WUA report	IMO and LG provide technical assistance and guidance to the WUA
Engage key stakeholders-such as government agencies, cooperatives, and private sector partners- in collaborative efforts to scale-up irrigated agriculture initiatives	Number of activity cooperation systems implemented by the joint efforts of the task team members Length of field channels constructed Size of farmland leveled by machine	IMO, WUA, AKC, LG reports	IMO, AKC, LG provide the technical assistance and guidance to the WUA

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Key Assumptions
Activities		Inputs	
<u>Component 0: Action Plan Formulation</u> (1) Selection of the irrigation scheme for replication of PIAT model (2) Formulation of action plan by stakeholders i) Collect basic data and information of the irrigation scheme including WUA and agriculture, ii) Undertake a series of participatory workshops (Stakeholder Analysis, Problem Analysis and Objective Setting), with the same set of participants, representing different components and service sectors, iii) Assist stakeholders in drafting the action plan based on their understanding of the system/irrigation scheme, iv) If possible, implement the mini-projects (optional) v) If possible, arrange the study tour to Kankai Irrigation System (KIS) (optional) vi) Finalize the action plan and organize it into a Project Design Matric (PDM) format (3) Activities towards implementation of the action plan Scheme-based rapid joint visit of key officials of both the ministries (federal, provincial) or local level (as applicable depending on the command area of the scheme) Determination of the implementation modality (project vs additional financing or incremental approach) Commitment/receipt of Minutes of Understandings (MoU) from the concerned stakeholders with defined roles and responsibilities Formation of the project/programme task team and appointment/designation of project/program manager Formation of monitoring committee at the federal, provincial or local level as applicable depending on the command area of the scheme		Human, Technical and Financial Resources (depending on the irrigation scheme by federal, provincial and local governments)	Budget for implementation of model is approved by the stakeholders.
<u>Component 1: Irrigation System Improvement</u> (1) Formulation and implementation of a maintenance plan i) Confirmation and updating of irrigation command area, ii) preparation and updating of irrigation facility ledger with facility evaluation, iii) preparation of maintenance plan and its implementation, iv) Training of WUA on maintenance for irrigation facilities, and v) Maintenance of irrigation facilities.			Precondition

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Key Assumptions
(2) Formulation and implementation of water distribution plan i) Technical water distribution planning and institutional set-up, ii) Calibration and installation of water measuring devices, iii) Formulation of water distribution plan for monsoon season, iv) Formulation of water distribution plan for post monsoon season, v) Implementation of water distribution, and vi) Monitoring and evaluation of water distribution <u>Component 2: Promotion of Market-oriented Agriculture</u> i) Training to agriculture extension officers for market-oriented agriculture, ii) Training on market-oriented agriculture to farmers in field practice, iii) Promotion of rice mill approach for strengthening rice marketing, iv) Study tour to advanced practices, and v) Introduction of new skills on vegetable and rice cultivation, <u>3. Implementation of Institutional Development of WUA</u> i) Review of by-law and awareness among members, ii) Implementation of regular election, iii) Implementation of regular meeting, iv) Establishment of sub-committee for specific tasks, v) Maintenance of record and book keeping, vi) Preparation of WUA member list in the level of secondary and tertiary canal level, vii) Setting a rule of ISF collection including penalty for non-payers, viii) Establishment of ISF collection and reporting system, ix) Development of ISF monitoring and recording system by PC with support by IMO, and x) Fund raising for O&M other than ISF, which can be modified according to the WUA status as well. <u>4. Integration of Irrigation and Agriculture through Activity Cooperation System</u> <u>(On-farm development part)</u> i) Establishment and executing of activity cooperation system centred by WUA with relevant agencies ii) Selection of model sites for integration of on-farm development and market-oriented agriculture activities, iii) Field channel construction, iv) On-farm development, v) Land levelling.			Guidelines and manuals are approved by the Federal Government (MOEWRI) and/or Provincial Government (MOWSIE). There is commitment of the three levels of the government to replicate the mode.

Annex 4: Facility Maintenance Ledger (Sample)

Location		Canal Status							Damage section/Portion of Canal				Structure Status						General remarks/ Memo/W UA request
Chainage	Distance	BP/ EP	Type	Shape	Length of Canal (m)	Functional Diagnosis			Evaluation	Remarks/ Observation	Length (m)	Size	Structure	Paint inclusion	Functional Diagnosis				
						General evaluation	Size	Remarks/ Observation							Evaluation	Structure/ Reasons/ Observati on	Size of gate/ outlets		
0	50																		
50	50																		
100	50																		
150	50																		
200	50																		
250	50																		
300	50																		
350	50																		
400	50																		
450	50																		

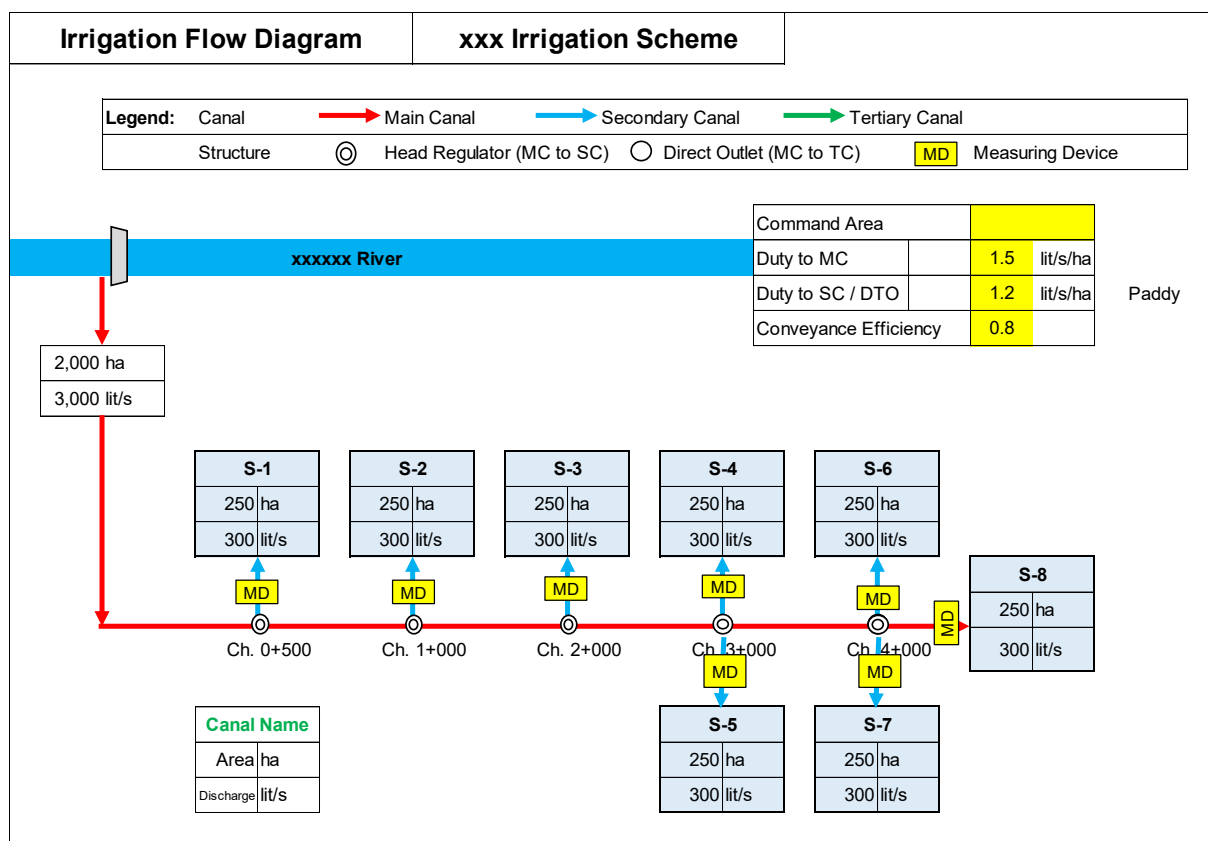
Annex 5: Sample Maintenance Plan

Annual Repair Plan for Secondary Canal				SCC			F/Y	
Where & What Location, Length, Size, Nos, etc. & Current Condition	What Action	When Target Day	Who Person in Charge		How Method	How much		Remarks
			Main & Support	Check		Necessary Input (Cost, Material, Human Resource, etc.)	How prepare Input	
	Step-1							
	Step-2							
	Step-3							
	Step-4							
	Step-5							

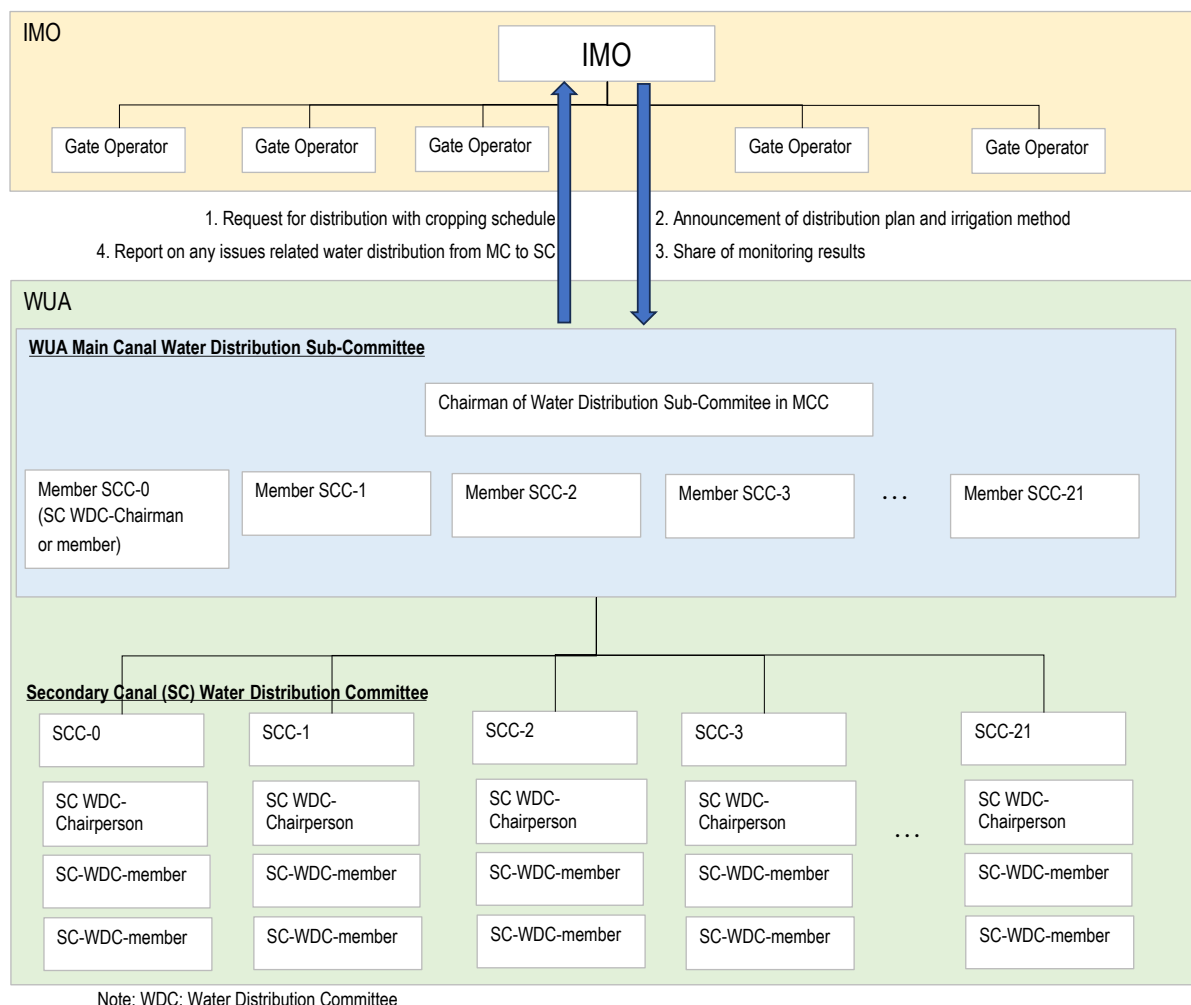
Annex 6: Cropping Calander

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cropping Calendar	Winter		Spring Season			Monsoon Season					Winter	
Monsoon Season												
Monsoon Paddy												
Winter Season												
Mustard												
Wheat												
Buckwheat												
Winter Maize												
Vegetable												
Cauliflower												
Cabbage												
Tomato												
Chili												
Gourds												
Cucumber												
Spring Season												
Spring Paddy												
Spring Maize												
Legend												
Proposed Irrigation Period (सिंचाई अवधि)												
Winter & Spring Irrigation												
Monsoon Irrigation												
Canal Maintenance: MC & SC												
Canal Maintenance: TC & DTO												

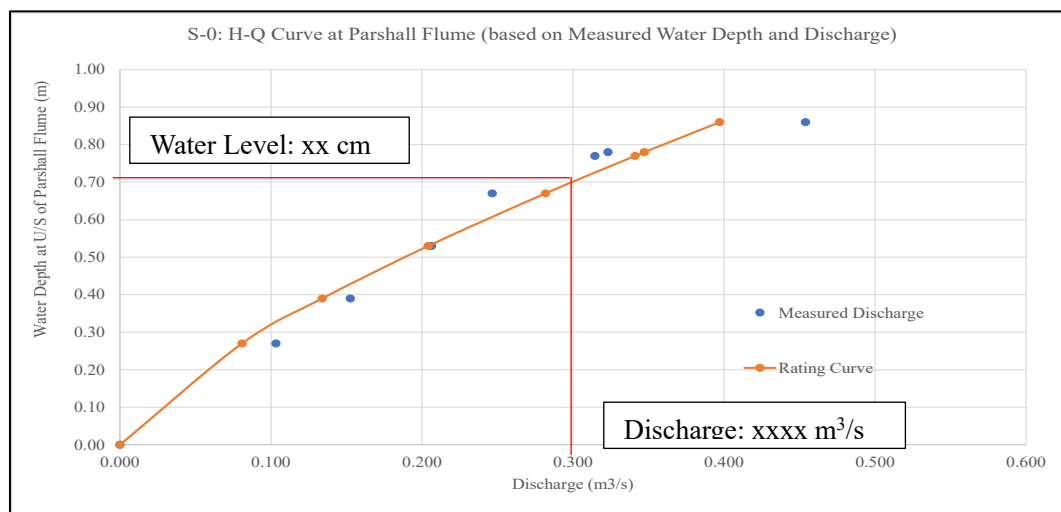
Annex 7: Irrigation Flow Diagram (Sample)



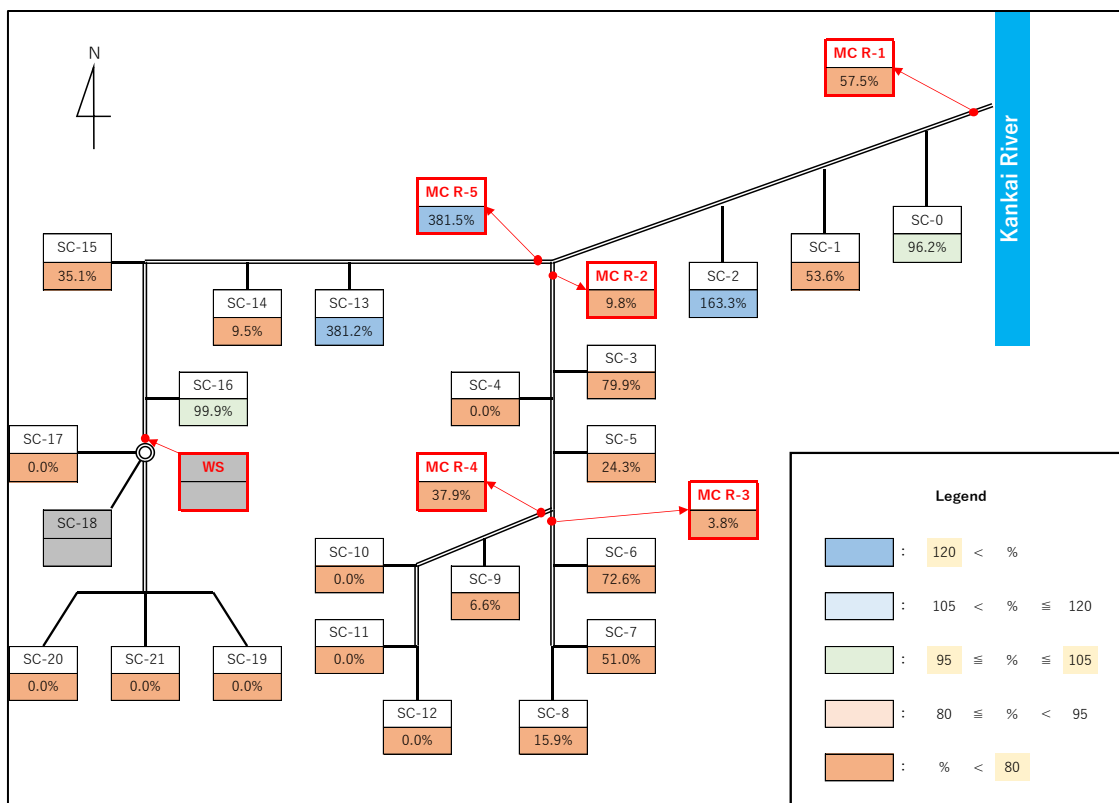
Annex 8: Institutional Arrangement of Irrigation Management Office and Water Distribution Committee (Sample)



Annex 9: H-Q Curve at Parshall Flume and Required Water Level for Distribution Discharge (Sample)



Annex 10: Monitoring Sheet for Water Distribution from MC to SC (Sample)



Annex 11: Cost-Benefit Assessment

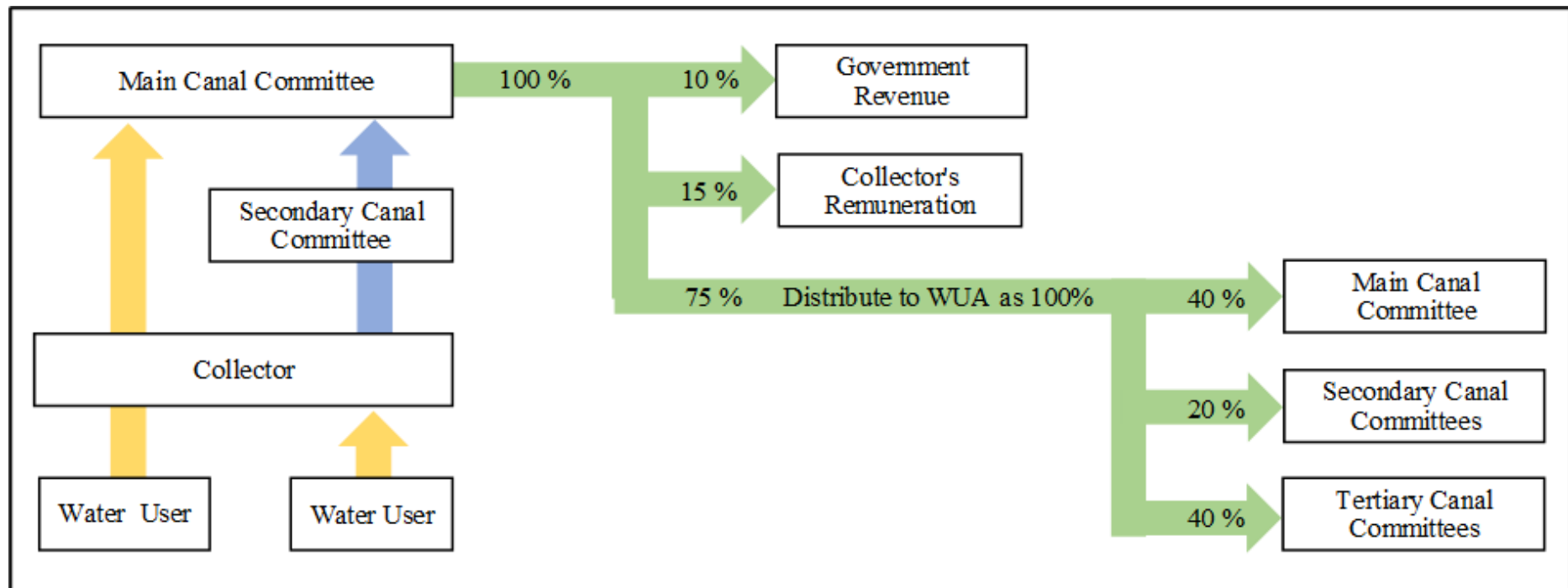
A. Project -based												
	Year 1		Year 2		Year 3		Year 4		Year 5		Overall	
	Total, 000	Per Ben	Total, 000	Per Ben, Rs	Total, 000	Per Ben	Total, 000	Per Ben	Total, 000	Per Ben	Total, 000	Rs. Per Ben
Planning	1,740	223									1,740	223
Comp 1: Irrigation System			7,930	1,017	5,115	656	2,202	282	2,422	311	17,670	2,265
Comp 2: Market Oriented Agriculture			2,450	314	5,380	690	8,910	1,142	13,040	1,672	29,780	3,818
Comp 3: WUA Institutional Development			2,122	272	2,334	299	2,568	329	2,824	362	9,848	1,263
Comp 4: Integrated Irrigation and agriculture dev/Activity Coop System			4,800	2,783	5,280	3,061	5,808	3,367	6,389	3,704	22,277	12,914
M&E			100	58	110	64	121	70	1,464	849	1,795	1,041
Admin cost	12,750		14,025		15,428		16,970		18,667		77,840	77,840
Total	14,490	223	31,427	4,443	33,647	4,769	36,579	5,191	44,807	6,897	160,950	99,364
Per Ha			10,476		11,216		12,193		14,936		53,650	178,244

B. Additional Financing												
	Year 1		Year 2		Year 3		Year 4		Year 5		Overall (5 years)	
	Total, 000	Per Ben	Total, 000	Per Ben, Rs	Total, 000	Per Ben	Total, 000	Per Ben	Total, 000	Per Ben	Total, 000	Rs. Per Ben
Planning	480	1,200									480	1,200
Comp 1: Irrigation System			858	2,144	657	1,643	251	628	276	690	2,042	5,105
Comp 2: Market Oriented Agriculture			1,025	2,278	1,692	3,760	2,480	5,511	3,410	7,578	8,607	19,127
Comp 3: WUA Institutional Development			846	2,115	931	2,328	1,024	2,560	1,126	2,815	3,927	9,818
Comp 4: Integrated irrigation and agriculture dev/Act. Coop System			1,300	2,889	1,430	3,178	1,573	3,496	1,730	3,845	6,033	13,407
M&E			50	125	55	138	61	151	466	1,165	631	1,578
Admin cost	720		792		871		958		1,054		4,396	4,396
Total	1,200	1,200	4,871	9,550	5,636	11,046	6,347	12,346	8,062	16,093	26,116	54,631
Per Ha			4,871		5,636		6,347		8,062		26,116	

5 years investment structure by cost centre				
Cost centre	Project-based		Additional financing	
	Per Ben HH	Per Ha	Per Ben HH	Per Ha
Planning	223	174	1,200	960
Irrigation	2,265	1,767	5,105	4,084
Market	3,818	2,978	19,127	17,214
WUA	1,263	985	9,818	7,854
Integrated	12,914	2,228	13,407	12,067
M&E	1,041	180	1,578	1,263
Admin cost	77,840	77,840	4,396	4,396
Total	99,364	86,151	54,631	47,837
Average investment per year	19,873	17,230	10,926	9,567

Threshold investment analysis (related to para 80)		
Hectar	2100	
Imp Modality	Project-based	Additional financing
Planning	365.4	2016
Irrigation	3710.6202	8576
Market	6253.8	36149
WUA	2068.08	16493
Integrated	4678.128	25340
M&E	376.971	2652
Admin cost	77,840	4396
	95,293	95,622
Break even	2100 Ha	

Annex 12: ISF Collection and Distribution Flow



Source: By-law of Kankai Canal WUA