TOT COURSE ON

“SELECTED-IRRIGATION EXTENSION TRAINING MODULES AND FIELD TEST”

April 2017

Agriteam Canada Consulting Ltd.

In association with
TOT COURSE ON
“SELECTED-IRRIGATION EXTENSION TRAINING MODULES AND FIELD TEST”

Organized by:

_Tigray National Regional State_  
_Bureau of Agriculture and Rural Development, Makele, Ethiopia_

Venue: ‘Sesa’ Small-Scale and ‘Demberkay’ Micro Irrigation Schemes in Axum of Tigray region  
(24-April to 28-April 2017)
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### ACRONYMS AND ABBREVIATIONS

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<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ADLI</td>
<td>Agricultural Development–Led Industrialization</td>
</tr>
<tr>
<td>ATVET</td>
<td>Agricultural Technical Vocational Educational Training</td>
</tr>
<tr>
<td>BoA</td>
<td>Bureau of Agriculture</td>
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<tr>
<td>BoANR</td>
<td>Bureau of Agriculture and Natural Resource</td>
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<tr>
<td>DAs</td>
<td>Development Agents</td>
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<tr>
<td>FI</td>
<td>Farmer Innovation</td>
</tr>
<tr>
<td>FIFO</td>
<td>First In First Out</td>
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<tr>
<td>FW</td>
<td>Farmers Wisdom</td>
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<tr>
<td>IDA</td>
<td>Irrigation Development Agents</td>
</tr>
<tr>
<td>IIXA</td>
<td>International Irrigation Extension Advisor</td>
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<tr>
<td>IK</td>
<td>Indigenous knowledge</td>
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<tr>
<td>IWUO</td>
<td>Irrigation Water User Organizations</td>
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<td>JES</td>
<td>Job Embedded Support</td>
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<td>MLE</td>
<td>Monitoring, Learning and Evaluation</td>
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<td>NGO</td>
<td>Non-Governmental Organizations</td>
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<td>PID</td>
<td>Participatory Innovation Development</td>
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<td>PTD</td>
<td>Participatory Technology Development</td>
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<td>RIXE</td>
<td>Regional Irrigation Extension Expert</td>
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<td>RTL</td>
<td>Regional Team Leader</td>
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<td>SK</td>
<td>Scientific knowledge</td>
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<td>SMIS</td>
<td>Small Scale and Micro Irrigation Support Project</td>
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<td>SNNPR</td>
<td>Southern Nations, Nationalities and People’s Region</td>
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<td>SSI</td>
<td>Small Scale Irrigation</td>
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<td>TOT</td>
<td>Training of Trainers</td>
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<td>VA</td>
<td>Value Addition</td>
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<td>WUA</td>
<td>Water User’s Associations</td>
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<td>WUG</td>
<td>Water User Group</td>
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<td>PIDM</td>
<td>Participatory Irrigation Development Management</td>
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<tr>
<td>IEAAI</td>
<td>Irrigation Extension Actual Achievement Index</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring &amp; Evaluation</td>
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<tr>
<td>ICT</td>
<td>Information Communication Technology</td>
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<td>BoARD</td>
<td>Bureau of Agriculture and Rural Development</td>
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<tr>
<td>CBO</td>
<td>Community Based Organization</td>
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<td>FREG</td>
<td>Farmer-Research-Extension Group</td>
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<tr>
<td>FTC</td>
<td>Farmer Training Center</td>
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<td>MI</td>
<td>Micro Irrigation</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>SSIS</td>
<td>Small Scale Irrigation Scheme</td>
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<tr>
<td>PRA</td>
<td>Participatory Rural Appraisal</td>
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<td>HHMI</td>
<td>Household Micro Irrigation</td>
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<tr>
<td>EIA</td>
<td>Environment Impact Assessment</td>
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<td>FFG</td>
<td>Farmer Focus Group</td>
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<td>IADP</td>
<td>Irrigation Agricultural Development Process</td>
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<tr>
<td>O &amp; M</td>
<td>Operation and Maintenance</td>
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1. INTRODUCTION

The TOT course on above topic has been prepared based on the feedback from training needs assessment conducted in SMIS-supported four regions and from TOT training during March 2016 in Amhara region. Following the findings of assessment, the regions and TOT trainees recommended for development of important training modules on following topics pertinent to offering irrigation-extension service to farmers for development of SSI and MI schemes:

- Irrigation extension knowledge and innovation management tools and techniques,
- Promoting irrigated crops value-chain using agricultural commodity cluster approach,
- Techniques of promoting gender-sensitive participatory technology development (PTD), and
- Irrigation extension monitoring, learning and evaluation (MLE) tools and techniques

In view of the above, the above training modules has been prepared but requires field testing to shaping into a final version as we get recommendations and results from the field test. During TOT event in Axum, the trainees will undertake both in-class evaluation and field test of these modules in two pilot irrigation schemes (‘Sesa’ and ‘Demberkay’), supported by SMIS project.

Moreover, the TOT will enable trainees gain practical learning skills on four modules through practical exercises in pilot irrigation schemes, and strengthen their technical capacity. The trainees will also learn the art of cascading these modules to Zones, Woreda and DAs those persuading farmers for adoption of improved irrigation technologies.

Purpose of Field Test

- Evaluate the quality of test questions and tasks,
- Evaluate assessment training materials and its cascading procedures,
- Evaluate both in-class and scheme-based practical delivery platforms, and
- Conduct discussions/exercises with DAs and farmers to get their perception about modules

Overall objective of TOT course

- To increase the knowledge and skills of irrigation extension experts on above four training modules so as to make them responsible to efficiently guide Woredas and DAs for promoting improved SSI and MI technologies,
- To increase the capacity of irrigation extension experts to learn the art of training on four modules by which they will be able to cascade their training skills to Zones, Woredas and DAs thru job-embedded-support (JES).

Trainer/facilitator Goals

The general objective or goal of training facilitators is:

- Help trainees get to know each other and share their experiences among them
- Identify what trainees want to get out of the training modules.
- Facilitate discussion of how they perceive their own role, and the roles of others
- Increase trainees’ understanding of communication skills in each respective thematic area
Transfer new ideas and practices

Overall learning outcomes, trainees will be able to:

- Express their training needs in regards to the four training modules.
- Describe their current role in the area of the training program and cascading procedures.
- Better understand the roles others play in the area of the cascading training events.
- Understand now what they had been lacking
- Use new communication tools.

2. SMIS PROJECT - AT A GLANCE

The Small and Micro Irrigation Support (SMIS) Project is envisioned as a capacity development initiative; it is designed to support Government organizations, private institutions, irrigation water user organizations (IWUO) and farmers to develop sustainable SSI schemes in accordance with an integration. The SMIS project has three components aimed at supporting (i) Small-Scale Irrigation, (ii) Agricultural Technical Vocational Education and training colleges and (iii) Micro (or Household) Irrigation.

Enhancing capacities to apply water efficiently as well as to apply technologies and improvements in the value chain for the supply of inputs and in the marketing of produce will not only increase yields and quality of produce, but provide the farmers and communities with necessary incentives to adopt irrigation.

This comprehensive approach to water use for agriculture brings together the government sector at all levels, educational institutions, users (male and female farmers) and the private sector that supplies them and purchase their produce.

Within this context, the SMIS is designed to support the Ministry of Agriculture and regional partners in their efforts to achieve gender equitable and environmentally sustainable development of SSI and micro irrigation schemes in an integrated watershed-based and participatory manner that enhance irrigated agricultural productivity and food security for smallholder farmers.

Goal:
To contribute to increased food security and agricultural growth together with better access to more nutritious food through sustainable development of SSI and micro irrigation.

Development Objectives:
To ensure that all concerned public and private institutions within each of the four regions have the necessary capacity required for gender-responsive identification, planning design, construction and management of sustainable SSI system and micro irrigation schemes in a coordinated manner and according to adopted integrated watershed-based approach.

Outputs:
- Improved planning, design and construction of gender equitable and sustainable small-scale and micro irrigation scheme by public and private institutions,
- Improved management of gender equitable and sustainable small-scaled and micro irrigation schemes by irrigation water users' organizations (IWUO) and individual users respectively, with support from key public institutions,
- Improved water, soil and crop management practices for irrigated crops adopted by (male and female) farmers.

3. TOT COURSE PROGRAMME/AGENDA

1. Training Venues
   - Conference /Training room, Sabian Hotel in Axum (Mon, 24-April to Wed, 26 April 2017)
   - Field test of training modules/practical field exercise at ‘Sesa’ SSI scheme in Adwa Woreda on Thursday, 27-April 2017 from 9.00 am to 4.30 pm
   - Field test of training modules/practical field exercise at ‘Demberkay’ MI scheme in Medebay Zana on Friday, 28-April 2017 from 8.30 am to 12.00 pm
   - Closing session at Sabian Hotel in Axum on Friday, 28-April 2017 from 2:30 pm to 5.30 pm

2. Course Coordinator
   - BoARD Tigray Extension Process Owner

3. Facilitators:
   - Melaku Tefera, RIXE of SMIS Amhara region
   - Duressa Chibsa, RIXE of SMIS SNNPR
   - Tatek Gebreab, RIXE of SMIS Oromia region
   - Kifile Bekele, Extension Process Owner, OIDA Oromia region
   - Abadi Haileselassie, RIXE of Tigray region
   - Dr Abadi Girmay, Director, TARI, Tigray region
   - Sajjad Noor, IIXA, Agriteam Canada Consulting

4. Training Support Service
   - Admin Officer/Asst, SMIS Tigray region

5. Participants: Total 30
   - 6-Regional Irrigation Extension Experts/Process Owners of OIDA, Oromia region
   - 6-Regional Irrigation Extension Experts/Process Owners of BoARD/Amhara region
   - 6-Regional Irrigation Extension Experts/Process Owners of BoARD/Tigray region
   - 6-Regional Irrigation Extension Experts/Process Owners of BoFRND/SNNPR
   - 2-Federal Irrigation Extension Experts, Directorate of Agriculture Extension, Addis Ababa
   - 4-RIXEs of SMIS Project, Amhara, Oromia, Tigray and SNNPR
### Day-1, Monday, 24-April 2017

<table>
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<tr>
<th>Time</th>
<th>Topics</th>
<th>Resource Facilitator/Trainer</th>
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<tbody>
<tr>
<td>0830-0845</td>
<td>Registration</td>
<td>Admin Asst, SMIS</td>
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<tr>
<td>0845-0855</td>
<td>Trainees take their seats</td>
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<tr>
<td><strong>Inaugural session</strong></td>
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<tr>
<td>0900-0915</td>
<td>Welcome Address</td>
<td>1. Bureau Head, Tigray region</td>
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<td></td>
<td>2. Hailu/Jalal, RTL/SMIS</td>
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<tr>
<td>0915-0930</td>
<td>Training objectives and outputs</td>
<td>Course Coordinator, BoA Tigray</td>
</tr>
<tr>
<td>0930-1030</td>
<td>Trainee’s credentials, expectation from course, group formation</td>
<td>Abadi/Sajjad Noor, SMIS</td>
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<tr>
<td>1030-1045</td>
<td><strong>Tea/Coffee break</strong></td>
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<tr>
<td>1045-11:15</td>
<td><strong>Pre-Test/Evaluation of Module-1</strong></td>
<td>Abadi Haile and Sajjad (SMIS)</td>
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<tr>
<td>11:15-12:45</td>
<td><strong>Module-1: Irrigation Extension Knowledge and Innovation Management Tools and Techniques</strong> (includes group work)</td>
<td>Dr. Abadi Girmay, Director, TARI and Abadi Haile, SMIS</td>
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<tr>
<td>1245-1400</td>
<td><strong>Lunch break</strong></td>
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<tr>
<td>1400-1600</td>
<td><strong>Continuation</strong></td>
<td>Dr. Abadi Girmay, Director, TARI and Abadi Haile, SMIS</td>
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<tr>
<td>1600-1615</td>
<td><strong>Tea/Coffee break</strong></td>
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<tr>
<td>1615-1700</td>
<td>-Group presentation</td>
<td>Abadi/Sajjad</td>
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<tr>
<td>1700-1715</td>
<td>General discussions/evaluation of the day training</td>
<td>Course Coordinator/ Facilitator</td>
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### Day-2, Tuesday, 25-April 2017

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<td>0830-0900</td>
<td><strong>Pre-Test/Evaluation of Module-2</strong></td>
<td>Tatek and Sajjad (SMIS)</td>
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<tr>
<td>0900-1030</td>
<td><strong>Module-2: Promoting Irrigated Crops Value-Chain Using Market-Oriented Commodity Approach</strong></td>
<td>Ato Kifile Bekele, Extension Process Owner, OIDA, Oromia region and Tatek SMIS/RIXE</td>
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<tr>
<td>1030-1045</td>
<td><strong>Tea/Coffee break</strong></td>
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<tr>
<td>1045-1245</td>
<td><strong>Continuation</strong></td>
<td>Ato Kifile (OIDA) and Tatek (SMIS)</td>
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<tr>
<td>1245-1400</td>
<td><strong>Lunch break</strong></td>
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<tr>
<td>1400-1430</td>
<td><strong>Pre-Test/Evaluation of Module-3</strong></td>
<td>Melaku and Sajjad (SMIS)</td>
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<tr>
<td>1430-1600</td>
<td><strong>Module-3: Techniques of Promoting Gender-Sensitive Participatory Technology Development in Schemes</strong></td>
<td>Melaku Tefera, SMIS/RIXE and Sajjad Noor, SMIS/IIXA</td>
</tr>
<tr>
<td>1600-1615</td>
<td><strong>Tea/Coffee break</strong></td>
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<tr>
<td>1615-1700</td>
<td>Group discussion</td>
<td>Melaku/Sajjad</td>
</tr>
<tr>
<td>1700-1715</td>
<td>General discussion and evaluation of the day training</td>
<td>Course Coordinator/ Facilitators</td>
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### Day-3, Wednesday, 26-April 2017

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<th>Topics</th>
<th>Resource Facilitator/Trainer</th>
</tr>
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<tbody>
<tr>
<td>0830-1030</td>
<td><strong>Module-3: Continuation</strong></td>
<td>Melaku, Sajjad and Duresa</td>
</tr>
<tr>
<td>1030-1045</td>
<td><strong>Tea/Coffee break</strong></td>
<td></td>
</tr>
<tr>
<td>1045-1245</td>
<td><strong>Pre-Test/Evaluation of Module-4</strong></td>
<td>Tatek and Sajjad (SMIS)</td>
</tr>
<tr>
<td></td>
<td><strong>Module-4: Irrigation Extension Monitoring, Learning and Evaluation (MLE) Tools and Techniques</strong></td>
<td>Tatek Gebreab, SMIS/RIXE and Duressa Chibsa, (SMIS/RIXE)</td>
</tr>
</tbody>
</table>
1245-1400 **Lunch break**

1400-1600 **Continuation**  
- Group discussion  
- Group exercise and presentation  
  
  Melaku Tefera, SMIS/RIXE and Sajjad Noor, SMIS/IIXA

1600-1615 **Tea/Coffee break**

1615-1700 Discussion on planning and conducting field test of four TOT modules in the pilot SSI and MI schemes  
**The primary purpose of field test is to**  
- Evaluate the quality of test questions and tasks,  
- Evaluate training materials and its cascading procedures  
- Evaluate both in-class and scheme-based practical delivery  
  - Conduct discussions/exercises with DAs and farmers in the pilot schemes for their perceptions on modules  
**The field tasks**  
- Selection and discussion with farmers and DAs  
- Data/assessment questionnaires  
- Recording and analysis  
- Using irrigation extension tools/approaches  
- Field test report writing and presentation on 28-April 2017  
  
  Sajjad, Abadi and BoA Course Coordinator

1700-1715 General discussion and evaluation of the day training  
  
  Course Coordinator/ Facilitators

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**Day-4, Thursday, 27-April 2017 (Field test of TOT modules in pilot schemes)**

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<thead>
<tr>
<th>Time</th>
<th>Topics</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>0900-1630</td>
<td><strong>Field test (practical work in SSI scheme – 50 kms from Axum)</strong></td>
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</tr>
<tr>
<td>0900-1630</td>
<td>Field visit to ‘Sesa’ SSI scheme in Adwa Woreda to undertake field test of training modules by interacting with DAs and scheme farmers</td>
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<tr>
<td>0900-1630</td>
<td><strong>Module-1: Irrigation Extension Knowledge and Innovation Management</strong></td>
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<tr>
<td>0900-1630</td>
<td><strong>Tools and Techniques</strong></td>
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<tr>
<td>0900-1630</td>
<td>– View and discuss practical applications of irrigation extension for farmers</td>
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<tr>
<td>0900-1630</td>
<td>- Discuss essential-features of irrigation extension with IDAs and farmers</td>
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<td>0900-1630</td>
<td>- In regard to irrigation extension knowledge outputs, apply the tools:</td>
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<tr>
<td>0900-1630</td>
<td>- On how to create awareness on the existing situation of SSI scheme</td>
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<tr>
<td>0900-1630</td>
<td>- On what criteria to be followed to invite the farmers and DAs to</td>
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<tr>
<td>0900-1630</td>
<td>participate in field training and demonstration,</td>
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<tr>
<td>0900-1630</td>
<td>- Identify whether if the farmers de-linked themselves from their current irrigation practices and apply extension-knowledge tools to bring behavioral change to accept new ideas (list them)</td>
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<tr>
<td>0900-1630</td>
<td>- Identify specific skill required to achieve the intended development goal of scheme farmers</td>
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<tr>
<td>0900-1630</td>
<td>- Demonstrate the Participatory Innovation Development (PID) management practices to farmers and DAs and show how farmers’ innovation are documented and PID process</td>
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<tr>
<td>0900-1630</td>
<td>- On-farm water management — Explain Das/farmers on how critically extension knowledge plays an effective role to farmers in regard to deciding water balancing, scheduling and distribution to irrigate.</td>
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<tr>
<td>0900-1630</td>
<td>- Marketing options for farmers – how extension knowledge linked with market outlets and forecasting</td>
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<td></td>
<td><strong>GROUP-1</strong> (Tigray Irrigation Extension Team)</td>
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<tr>
<td></td>
<td>Dr. Abadi Girmay (TARI) and Abadi Haile (SMIS)</td>
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**Day-5, Friday, 28-April 2017**

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<tr>
<th>Time</th>
<th>Topics</th>
<th>Facilitator</th>
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<tr>
<td>0900-1200</td>
<td><strong>Field test (practical work in MI scheme – 30 kms from Axum)</strong></td>
<td><strong>GROUP-3</strong> (Amhara Irrigation Extension Team) With Groups 1, 2, and 4</td>
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<td></td>
<td>Field visit to ‘Demberkay’ MI scheme in Medebay Zana to undertake field testing of training modules by interacting with DAs irrigated households</td>
<td>Melaku Tefera, Duressa Chibsa and Sajjad Noor (SMIS)</td>
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<td><strong>Module-3: Techniques of Promoting Gender Sensitive Participatory Technology Development (PTD) in the irrigation scheme</strong></td>
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<td>– View and discuss practical applications of irrigation extension for farmers</td>
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<td></td>
<td>• Explain the importance of gender sensitive PTD to DAs, experts and scheme farmers for development and adoption of irrigation technologies</td>
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<td></td>
<td>• Apply on-farm participatory testing model in MI scheme with farmers, DAs, researchers, experts and explain the procedure &amp; advantages of PTD</td>
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<td>• Create a simple monitoring and evaluation format and carry out an assessment process on PTD experimentation in the scheme to demonstrate how efficiently monitoring of PTD experimentation is conducted</td>
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<td>• Develop a simple technical audit checklist for PTD monitoring</td>
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<tr>
<td>1200-1430</td>
<td><strong>Lunch break and travel to Axum</strong></td>
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<td>1430-1530</td>
<td><strong>Action Plan: Preparation of a Learning Paper on the outcome of TOT course</strong> that includes lessons learned, skills &amp; knowledge gained from field testing of modules and a Way Forward (Action Plan) to cascade TOT course to SMIS-supported zones and Woredas (trainees will deliver slide presentation)</td>
<td>Course Coordinator SMIS RIXEs</td>
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<td>1530-1545</td>
<td><strong>Tea break</strong></td>
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<td>1545-1630</td>
<td>Presentation on Action Plan by FOUR groups</td>
<td>BoA/RIXEs-SMIS</td>
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4. MODULE-1: IRRIGATION-EXTENSION KNOWLEDGE AND INNOVATION MANAGEMENT TOOLS AND TECHNIQUES

Module Outline
1. Learning Objectives of the module
2. Introduction and justification
3. Extension and delivery of agricultural extension service
4. Features of Irrigation Extension System
5. Irrigation Extension Outputs
6. Innovation management system
7. Strengthen agricultural knowledge management
8. Participatory Innovation Development (PID)
9. References

4.1 Learning Objectives of the Module

By the end of this session, participants will be able to:

- Understand the delivery of extension in respect of broader understanding of farmers’ features of irrigation extension outputs, perception, attitude and behavior toward adoption of improved irrigation technologies and to establish mechanisms for farmers to influence and share control over SSI and MI development initiatives and resource decisions that affect them.
- Learn the skills on strengthening agricultural knowledge management within the framework of irrigation extension while building congenial relationships with the farmers and farming communities in SSI and MI schemes.
- Describe the role of participatory innovation development (PID) in respect of promoting local innovations, farmer’s innovation and documentation of innovation to influence farmers participating in innovative activities in the SSI and MI schemes.

4.2 Introduction and Justification

Irrigation development in Ethiopia is in its infancy stage and not contributing its share to the growth of the agriculture sector accordingly. But the country has the potential for its development both in terms of vast suitable land and availability of fresh water resources suitable for irrigation purpose. However, currently limited land is being cultivated under irrigated agriculture and therefore, crop production is predominantly based on rain fed agriculture.
Despite, the huge potential that the country has in terms of water availability and land, which are in most cases suitable for irrigation development, irrigation development is in its infancy stage and the country is not benefiting from the sub-sector accordingly.

The existing irrigation development in Ethiopia, as compared to the resources the country has, is not significant. In order to ensure food security at household level for the fast growing population of the country the irrigation potential has to be developed to ensure optimum productivity of irrigated agriculture. Such development could also generate externally marketable surpluses that could contribute to earn the required foreign exchange and provide required raw materials to the local industries. To this effect, the situation calls for the unreserved dedication and commitment of the relevant institutions to work towards creating enabling environment for the planning and implementation of efficient and sustainable irrigation system.

The major limitations that constrained the development of irrigation sub-sector, among others are:
- predominantly based on traditional farming systems,
- inadequate improved agricultural inputs,
- limited access to improved irrigation technologies,
- inadequate trained human power,
- inadequate extension services and capital,
- absence of appropriate institutions at different levels responsible for the promotion, planning and development of irrigated agriculture
- Inadequate information system on agricultural water management and irrigation development.

The other major constraints and challenges identified in the area of irrigation water and crop management practices are:
- Improper crop and varietal selection;
- improper crop rotation cycle;
- inappropriate cropping pattern and cropping intensity;
- inappropriate crop calendar; inadequate availability of hand tools and farm implements;
- poor land preparation and leveling; poor soil fertility management;
- poor irrigation scheduling/crop-water-requirement balance; and
- Inappropriate irrigation methods; and inadequate crop pest management practices.

4.2.1 Objectives of the Irrigation Policy

The overall objective of the irrigation policy is to develop the huge irrigated potential for the production of food crops and raw materials needed for agro-industries, on efficient and sustainable basis and without degrading the fertility of the production fields and water resources base. The policy sets the following detailed objectives:

- Development and enhancement of small scale irrigated agriculture and grazing lands for food self-sufficiency at household level
- Development and enhancement of small, medium and large-scale irrigated agriculture for food security and food self-sufficiency at national level including export earnings and to satisfy local agro-industrial demand.
Promotion of irrigation study, planning and implementation on economically viable, socially equitable, technically efficient, environmentally sounds basis as well as development of sustainable, productive and affordable irrigation farms.

Promotion of water use efficiency, control wastage, protection of irrigation structures and appropriate drainage systems

Ensuring that small-scale, medium-scale and large-scale irrigation potential projects are studied and designed to stage ready for immediate implementation by private and/or the government at any time

The above objectives are consistent with the objectives of Ethiopian Agricultural Development–Led Industrialization (ADLI) economic development strategy. The ADLI strategy is essentially based on initially fostering the rapid development of small holder’s agriculture, including irrigated agriculture with a view to creating demands for industrial goods and thereby fueling the growth of industry. Thus ADLI meant to create the foundation for a virtuous cycle of mutual and parallel growth of the agricultural and industrial sectors.

4.2.2 Irrigation development strategy

The irrigation development strategy is one of the sub-sectors dealt in the water sector strategy. The principal objective of the irrigation development strategy is to exploit the agricultural production potential of the country to achieve food self-sufficiency at the national level, including export earnings, and to satisfy the raw material demand of local industries, but without degrading the fertility and productivity of country's land and water resources base. More specific objectives of the strategy is to:

- Expand irrigated agriculture
- Improve irrigation water-use efficiency and thus the agricultural production efficiency
- Develop irrigation systems that are technically and financially sustainable
- Address water logging problems in irrigated area

4.3 Extension and Delivery of Agricultural Extension Service

There is no single definition of extension, which is universally accepted or which is applicable to all situations. Extension is an informal educational process directed toward the rural population. This process offers advice and information to help them solve their problems. Extension also aims to increase the efficiency of the family farm, increase production and generally increase the standard of living of the farm family.

The objectives of extension are to:

- assist farmers increase and diversify agricultural production and Productivity through the adoption of proven technological innovations;
- provide strong linkages between agricultural research and farmers;
- provide strong linkages between agricultural research and farmers;
- provide strong liaison between farmers and farm support organizations responsible for credit, marketing and farm input supplies,
- help farmers gain managerial and marketing skills and appreciate farming as a business operating in a market driven economic environment
- promote the conservation of natural resources especially soil, vegetation and water.
The objective of extension is to change farmers' outlook toward their difficulties. Extension is concerned not just with physical and economic achievements but also with the development of the rural people themselves. Extension agents, therefore, discuss matters with the rural people; help them to gain a clearer insight into their problems and to decide how to overcome these problems.

Extension is a process of working with rural people in order to improve their livelihoods. This involves helping farmers to improve the productivity of their agriculture and developing their abilities to direct their own future development. The above statements are presented to illustrate the range of interpretations that can be found about extension. They contain a number of common points. They all stress that extension is a process, which occurs over a period of time, and not a single, one-time activity. They all underline extension as an educational process, which works with rural people, supports them and prepares them to confront their problems more successfully. If statements such as those above are examined more carefully, and if the current ideas and practice of extension are considered, four main elements can be identified within the process of extension:

- knowledge and skills,
- technical advice and information,
- farmers' organization,
- motivation and self-confidence

The extension system of delivering services is very weak. The primary team member in Ethiopian extension service is the DA. He/she serves over 600 farmers which is too big for proper discharge of the DA’s responsibility, especially in the absence of any means of transportation. There exist no clearly developed irrigation extension methods under practice currently. The farmers do not know how to build proper furrows or control water flows in the channels and in the fields. No clear policy was put in place with regard to introduction of more sophisticated irrigation methods. The extension skills of DAs are very variable such that in some places there are very skilled and motivated DA’s and in other places rather not so much. The research system commonly follows on-station research approach with little or no involvement of the extension works and most importantly the farmers. Hence, the research agenda or topics are by and large selected based on the researchers’ interest without reflecting the farmers’ true problems or needs. There is currently emerging on-farm research approach which needs to be further expanded. Most research works are in rain fed agriculture and there is currently no significant research work in irrigated agriculture. A major gap observed include: the lack of seed sources for high-value and improved crop varieties. This has forced farmers to use very low productive seeds. There is a dire need for research institutions to work on high-value and improved variety seed testing and verification works. A general limitation is that the collaborative working relations between the research and extension workers are very low. Very little research works in irrigation agronomy were noticed in research institutes beside those of IWMI. On farm research activity was not found at all, nor development of technology dissemination mechanisms.

### 4.3.1 Understanding irrigation extension

Irrigation extension is a part of an agricultural extension system that advises water user farmers in all aspects of irrigation water development and management, including the formation of water users associations. It persuades them getting information, knowledge and skill development to enhance
adoption of improved irrigation technologies, and also facilitation of linkages with other institutional support services (input supply, output marketing and credit) that lead to a more efficient and better performing of irrigated crop production and productivity.

**4.4 Features of Irrigation Extension System**

The basic irrigation extension technique depends on the effectiveness of an irrigation extension system on how the water users are deriving extension information for adoption of improved irrigation technologies. In the system, the usual point of contact between water users and HIMP is through Irrigation Development Agents (IDA) that develops effective relationships for successful irrigation extension. This means the irrigation extension approaches will largely depend on IDAs. The important ingredients of irrigation extension system are:

a) The IDAs,
b) Water user farmer,
c) Identifiable package of improved irrigation practices (impact points),
d) Support training program, and
e) Linkage between extension-institutional support-service provider (research, inputs and markets)

**4.4.1 Essential features of irrigation extension system**

The following are the essential features of irrigation extension system for promoting improved irrigation technologies, especially by the IDAs and other irrigation development agencies:

- **Devoting time to irrigation extension and allied duties.** IDAs must be devoted and be in close liaison with water users they serve. They should devote all their time to irrigation extension and allied duties. Building mutual trust and confidence of water users is achieved by well-planned and gradual introduction of proven new technology and its rate of adoption,

- **Ensuring equitable water distribution.** IDAs with the assistance of HIMP experts participates and provide judicial advice to the WUAs and more importantly to the irrigation team leaders those responsible for their irrigation blocks on the provision of equal water distribution, water sharing and scheduling, and respecting the water law;

- **Ensuring canal cleaning and rehabilitation.** The water users are encouraged by IDAs to undertake maintenance and cleaning of the canals on a routine basis at primary, secondary and tertiary canal levels, and minor physical rehabilitation of the canals preferably within their irrigation blocks to enable smooth conveyance of water to other irrigation blocks without prejudice and anticipated conflicts with the adjoining blocks;

- **Assisting in the formation and management of water user’s associations (WUA).** The major contributory factor for successful operation of irrigation scheme is the ‘institution’ that efficiently guides and effectively manages schemes with the participation of water users, called WUA. In this respect, IDAs have an important role to facilitate in the formation and management of WUA among the water users through democratic processes;

- **Regular visit by IDAs at traditional and modern scheme sites.** This is an extension communication of a “two-way traffic” in delivering technological information to the water users for adoption and at the same time taking farmers’ problems and adoption experience to extension and research;

- **Mobilizing irrigation community for catchment protection.** In irrigation schemes, mobilization of community with kebele administration is very important for safe retention of catchment sites. IDAs
need to help mobilize the community, provide technical support on soil conservation techniques thus preventing silts and flooding to irrigation dams. This could be training to the community on forestation practices using species of forest and grass plants and linking them with the Woreda forest nurseries or private nurseries to obtain improved forest seedlings and farm implements that can help protect catchment sites;

- **Group Building for the irrigation blocks water user group (WUG).** Group building is an effort in which the team works together that encourages and values the contributions of team members. Here, the beneficiary-water user members’ energies is directed toward problem solving, task effectiveness, and maximizing the use of all members' resources to achieve the irrigation objectives. IDA’s role is to work with the WUG on routine basis, participate in the planning and facilitate the group on adoption of irrigation technologies;

- **Resolving water disputes.** In case of water dispute, WUA should be encouraged to come forward to provide solution to the problem. However, with the help of kebele administration and with WUA or irrigation block team leaders, IDA takes initiative as a mediator to resolving water distribution conflicts among the water users;

- **Facilitating water users in accessing to irrigation inputs.** The role of IDAs in this activity is to create inputs demand of water users for planned irrigated farming in collaboration with the irrigation block team leaders, and facilitate the water users and WUAs to get access to inputs which mean linking them with the dealers/suppliers for improved seeds, fertilizers, pesticides and also linking for credit facilities;

- **Linking water users to market opportunities.** Irrigation extension is successful when it is linked to specific market opportunities for the producers, the water users. Therefore, IDA needs to maintain a constant link with market outlets, multipurpose cooperatives and importantly with Woreda AISMP for collecting market information and conveying those to water users, and linking them to fetch good markets for sale of produces;

- **Participation of water users in irrigation planning process.** Water users are encouraged to make spontaneous participation in planning and in decision-making starting for design up to smooth operation of the irrigation schemes. This will give them a sense of ownership and sustainability of schemes;

- **Training and extension messages.** On a regular basis, IDAs receive monthly training and checklist on current activities on irrigation extension messages (impact points) relevant to the anticipated needs and activities of water users. The training and checklist are provided by Woreda offices. The extension messages are important for technology adoption, technical guidance to water users and continuous follow-up of improvement in irrigation practices. IDAs relates messages to the water users on a weekly basis;

- **Major linkage with research institutions.** Research institutions undertake studies on farming issues and problems of water users and develop suitable improved irrigation practices for adoption. Therefore, extension-research linkage is important.

- **Demonstrating new irrigation technologies.** Irrigation extension is successful when suitable technologies are demonstrated according to local conditions. Here, the IDA promotes improved irrigation technologies by various methods of result demonstrations.

- **Identification of major problems in irrigation schemes.** A major role of IDAs is to identify major problems in the operation of schemes in cooperation with IWUGs and suggest remedies or bring the attention of problems to relevant agencies for solution if beyond the capacity of the farmers.
The key point in the irrigation extension system is the regular fixed schedule of visits by IDAs to water user groups so that the group knows when IDA should be with them. In each visit IDA meets the Contact-water user of the irrigation block group. Also, IDA makes efforts to meet other farmers.

There are various approaches which can be followed in establishing contact with as large a number of water users as possible. IDA must use Contact-water user as the main channel of communication to other water users. The ultimate objective is to induce majority of water users to adopt improved irrigation practices. The success of irrigation extension largely depends on the following factors:

- Proper selection of Contact-water user farmers;
- Timely and regular visits by IDA to Contact farmers and other water users;
- Identification of clear cut irrigation extension messages (impact points) suited to water users’ requirements and their diffusion through contact-water user and ‘water user groups’ to others;
- Feedback of water users’ problems and their experience in adopting extension messages;
- Well organized monthly training program for irrigation technicians;
- Close monitoring and supervision of irrigation extension activities by supervisory staff;
- A competent research staff and facilities to respond to technical issues and come out with location-specific recommendations on improved irrigation practices.

4.5 Irrigation Extension Outputs

**Awareness creation** - people need to get timely, relevant and adequate information before their behavioral change is acquired to reach at the level of changing themselves. Awareness creation should be arranged to deliver necessary information to beneficiaries so that they will bring behavioral and attitudinal changes among themselves.

**Improving knowledge** - When extension message is complex, getting understanding about it may not be easy. Under such conditions, it needs the beneficiaries to learn some basic principles about the specific practices incorporated in the message.

**Improving skill** - When the beneficiary is being aware of something, but unable to perform the required tasks as the results of lack of adequate skills, it needs to equip them with necessary skills through demonstration, farm-to-farm visits or training course.

**Behavioral change** - When the issue under consideration is needed to be understood and agreed upon, the beneficiaries have to be convinced. The alternative extension method is related with group methods and demonstration, allowing a strong information exchange between people. Experiences show that by elaborating and demonstrating the economic advantages of the new ideas/techniques to the beneficiaries will convince them very easily.

To increase irrigation production and productivity, first awareness on the appropriateness of current production system has to be raised through community information meetings. This is even necessary when the problem is not understood by the community, but identified by DAs. After beneficiaries got necessary awareness and developed interest, training may be delivered training and workshop. The next step will be inviting the clients to be involved in demonstration, followed by a discussion. During the
discussion, a study group could be initiated to encourage the participation of the beneficiaries in a demonstration or visit a place where improved technologies and best practices are already practiced. Members of the group initiated to adopt the new practices/innovations, could then participate in demonstrating the new idea in their group. Thus, the following steps can be used:

- Create awareness on their existing situation
- Invite them to participate in training and demonstration
- Identify whether if the beneficiaries de-linked themselves from their current practices and bring behavioral change to accept the new practices
- Identify specific skill required to achieve the intended development goal by the beneficiaries

4.6 Innovation Management System

An innovation is a broad terminology that can refer to a completely different way of doing something or to modification of an existing technology. Farmer innovation has to be started within the lifetime of the farmer and not something inherited.

Farmer innovation may arise from indigenous knowledge or modern scientific knowledge. The unique characteristic of farmer innovation is that the innovator is adding value to the body of knowledge, which its origin might be modern scientific knowledge or local wisdom of farmers. In this connection the innovation, process is the effort made by farmers to make the technology fit to own reality or improve effectiveness, efficiency, productivity, profitability, durability, marketability, palatability, adoptability, sustainability etc. In brief, farmer innovation as a process is all about conducting informal experimentation by farmers and the innovation, as a product is the value change that may take place in the middle or at the end of the process.

Innovative irrigation practices can enhance water efficiency, gaining an economic advantage for farmers while also reducing environmental burdens. Water-efficient methods and better irrigation scheduling could also integrate water and nutrient management, thus minimizing agrochemical runoff and leaching problems. According to a study of most farmers’ irrigation practices, there were often mismatches between crops’ water demand and irrigation applications on several occasions during the season. Although the overall seasonal applied irrigation depths may match a crop’s water demand, farmers often under-irrigate during the early crop stages and over-irrigate during later stages; many choose inadequate timings and application depths.

4.6.1 Role of Innovation in Extension

Innovative farmers play a key role in innovating by demonstrating how to intensify and/or diversify current farming systems. These farmers are often successful; in Ethiopia, some have become “farmer millionaires.” These innovative farmers play a strategic role grounded in their interest in pursuing new high-value crops, livestock, or other enterprises to increase their farm income. They do this first by
assessing emerging markets for these new crops or products vis-à-vis their specific agro-ecological conditions, land, and labor resources, as well as their access to these markets. Second, on a small-scale trial basis, they attempt to successfully produce and market these crops or products. Once successful, they begin to scale up their own production. In extension system, these innovative farmers are considered as “farmer professor” roles—where they share and disseminate their learnings and promote the scale-up of successful innovations across farming communities.

Many small-scale farmers within these communities are aware that innovative farmers are trying something new, but few are willing to learn more about these new enterprises or are able to handle the potential risk unless markets exist to absorb the different crops and products. As markets expand for these crops and products, many of these enterprises become scalable.4 Here, as shown in Figure below, is where an innovative extension system can first identify these innovative farmers and their respective enterprises, and then begin the process of engaging other farmers in scaling up the enterprises among different groups of farmers, given land and labor availability, gender of the farmer, and farmer interest. In most rural communities, small-scale and women farmers are generally unaware of these emerging markets, but once they learn more, especially through farmer-to-farmer assessment, they are soon ready to learn how to produce and market these products on a small-scale basis to minimize household risk. Again, innovative farmers and “farmer professors” can play a strategic role in this process by helping extension organize these interested farmers into producer groups so they can begin working together to produce and market these crops and products. These start-up producer groups usually begin by supplying local markets, but as they gain experience and expand their production, they begin serving larger urban markets (meaning developing value chains) and, in some cases, global markets.

While the field-level extension staff can facilitate this process, they need strong back-up support from research and the private sector because in most cases even innovative farmers do not have the most up-to-date information and technology relating to these crops or products. The key linkage mechanism in helping DAs gain access to this information and technology is the SMSs at the woreda level. First, however, they need to become aware of these emerging markets and then to learn more about how to produce and market these crops and products. In addition, as they become aware of these emerging enterprises, the SMSs can facilitate the training of DA (by research staff and/or the private sector) and then help the local producer groups link together into woreda-level producer associations that can eventually supply larger urban markets. Finance also plays a critical role at this stage of development. As more farmers become interested in the new opportunities, finance can act as a catalyst to growth by providing new farmers with the capital required to participate in new market opportunities.
4.7 Strengthen Agricultural Knowledge Management within Extension System at Various Levels

Knowledge management is a process that includes knowledge creation, identification, and utilization, storage, sharing and learning. Knowledge is developed through experimentation, adaptation, confrontation and other learning settings which result in knowledge products. In knowledge management, farmers, researchers, extension agents, policy makers, and others are considered key actors in influencing the knowledge process and its ultimate utilization. For the circular flow of knowledge management to happen, both knowledge that is sufficiently better than the existing knowledge and means for transmitting it must be available. In knowledge management, the synchronization of scientific knowledge with indigenous knowledge is critical for reinforcing and developing applicable and re-refined knowledge. To improve the effectiveness of agricultural knowledge, it is essential to develop a mechanism that generates captures and disseminates knowledge and information through the use of effective processes and institutional arrangements as well as effective utilization of information and communication technology (ICT).

Hence, following key interventions are proposed. This strategy intends to enable the integration of traditional knowledge of farmers with modern knowledge (generated from research, universities and extension), and to further enhance the utilization of knowledge disseminated to small farmers.

- Strengthen/establish vibrant synergies for knowledge management and networking among key development actors.
- Use information and communication technology (ICT) to facilitate rapid, efficient and cost effective knowledge management. The experiences of most countries indicate that rapid development of ICT, which facilitates the flow of data and information, has tremendously enhanced the knowledge management practice in agriculture (e.g. eChoupal and M-Krishi initiatives in India, M-Farm limited in Kenya, etc.).
- Strengthen and better network FTCs to be used as a source of agricultural knowledge and information exchange among researchers, extension workers, and farmers and also as an input for policy.
- Establish working online and offline platforms using the ICT tools to easily connect and facilitate collaboration among the various agricultural development actors (including extension workers, researchers, etc.).
- Involve male and female farmers in the knowledge management process and generate knowledge in a participatory process to increase the chances of its adoption. This also enables the integration of indigenous knowledge of farmers with recent research findings and further enhances the utilization of knowledge disseminated to smallholder farmers.

4.7.1 Local/Farmer Innovation

Local innovation refers to the dynamics of indigenous knowledge, which is the knowledge that grows within a social group, incorporating learning from own experience over generations but also knowledge that was gained at some time from other sources but has been completely internalized within the local ways of thinking and doing. Local innovation is the process through which individuals or groups discover or develop new and better ways of managing resources, building on and expanding the boundaries of their indigenous knowledge. The innovations may be not only in the technical but also in the socio-institutional sphere. Especially in drier areas where livelihood systems are highly vulnerable to climatic...
risks, successful local innovations often involve new ways of gaining access to or regulating use of the natural resources, new ways of community organization, or new ways of stakeholder interaction. Local innovation through informal experimentation has always been taking place in all parts of the world, but it is only recently that increased attention has been given to identifying and documenting the innovation process and the innovations.

4.7.2 Promoting Local Innovation

In the past, mainstream rural development efforts were focused on technical interventions aimed mainly at controlling or manipulating nature using external inputs. In the South, these efforts generally failed to give poor families more secure access to food and to improve their livelihoods. While there were some successes, these were limited to specific agricultural enterprises such as coffee, tea and dairy farming in more humid areas. The dominant approach to research, extension, and education for rural development still follows the pattern of “transfer-of-technology”. This is based on the assumption that scientists create knowledge that would be packaged and spread by extension services to farmers. This approach effectively squelches local creativity and innovation. They promote participatory action learning by resource users and supporting agencies in order to develop the local innovations and complementary techniques further. A positive approach that starts from local ideas that focuses on local people’s strengths and explore the particular opportunities open to them – rather than dwelling on their weaknesses and problems – is key to stimulating innovation.

4.7.3 Who are innovators?

Those farmers who are in the front line to take up new technologies introduced by extension workers are regarded as innovators. Nevertheless, in reality are these same people; the farmer innovation approach is concerned about? No, they are not. Farmer innovators are not the classical adopters of technologies, which are brought in to the system by extension workers. They in fact sometimes adopt but they always try to adopt the technology to their own reality, through making essential changes that deem necessary. They have the courage and commitment to make changes on what so ever they learn from others and make it more realistic to fit in to own situations. This is indeed only one manifestation of who innovators are but the other and most important characteristics of innovators is, that they do work on Indigenous knowledge (IK) and make it more responsive to their problem situations. In short, they are not relying only on scientific knowledge as a point of departure and inspiration but also on Indigenous knowledge, which they have adopted from their ancestors.

Farmer innovation as an approach is not referring at all to new ‘practices’ of farmers that may come in to picture as a result of application of “transfer of technology approach”, which involves number of training activities and extension services. However, the approach duly recognizes the wisdom of farmers to adopt technologies through putting it in to a series of transformational processes so that to make it fit to own realities. From the perspective of technology adoption, this approach is therefore an alternative to help extension workers and researchers overcome the limitation of technology transfer model, which is most often blamed for being not responsive to the reality of farmers living in diverse and complex environment. Therefore, though it recognizes farmers who are keen to learn from extension workers and adopt technologies as it is, the main trust of the approach is to focus on farmers who are consciously practicing agriculture to come up with something new or testing the incoming technologies using their own wisdom and experiences to make it fit to own realities.
The following equation may help to explain farmer innovation in a very comprehensive way. It should however not be considered as a model that exclusively explains what farmer innovation is Farmer Innovation (FI) = Farmers Wisdom (FW) + [-] Indigenous knowledge (IK) + [-] Scientific knowledge (SK) + Value Addition (VA)

\[ FI = FW + [-] IK + [-] SK + VA \]

The mathematical singe + [-] indicates that farmers are making changes on the IK or SK and this changes could be explained in terms of eliminating some ideas/practices or putting new elements to the body of knowledge under consideration. Value addition is indeed the emergent property of the innovation process. In this process, completely new values could be 'made' or added to the pre-existing ones. This may depend on the type and complexity of the innovation.

### 4.8 Participatory Innovation Development (PID)

PID is based on the notion that for rural development the local informal knowledge of villagers is equally important as any scientifically generated, formal knowledge. However, the two types of knowledge are different. In PID the systemic – often unreflected knowledge of villagers about their own complex situation is combined with external knowledge, which includes scientific knowledge, as well as the knowledge of farmers from other areas, extensionists etc. The challenge in PID is to arrange for creative interaction between the knowledge, experiences, and skills of villagers with those of scientifically-trained researchers and of extensionists. The emphasis then is on conducting practical experiments together in villages. The objective is to find new things and ways that work. Of course, in most cases these are just the clever recombination of elements of familiar technologies, or the combination of known elements with new elements, which are brought into an area. New things and ways should be compatible with and embedded in the local knowledge systems. New things and ways work when they are practical and applicable for the concerned farmers without major outside support. Means of production must be available and affordable, and markets accessible. Processes and organization must be manageable with the locally available capacity. Although PID often deals with experimentation on agricultural practices, “new things and ways that work” are by far not limited to what is usually called “technology.” Many problems of, and opportunities for, farming families are not technological ones.

![Fig-3: Creation, accumulation and dissemination of agricultural knowledge using different methods (adopted from UNDP, 2012)](image-url)
4.8.1 Local innovation
Is the process by which a given locality discovers or develops new and better ways of doing things – using the locally available resources and on their own initiative, without the pressure or direct support from formal research or development agent.

4.8.2 Local innovations
The outcomes of this process, for example, farming techniques or organizing work that is new for that particular locality. It refers to outcomes of the process.

4.8.3 Farmer Innovators
The innovators are those who are doing something outstanding to improve their lives, their communities and/or their environment. They are local people who develop new ways of farming or managing natural resources, building on local knowledge but using new ideas from various sources, including their own creativity.

4.8.4 Documenting Farmers’ Innovation
Documentation refers to the process of providing evidence (“to document something”). Documentation in the case of local innovations or PID refers to capturing evidences about local innovations, experiments, and PID process. Gathering evidences of local innovations in documented form is a good starting point for promotion of PID. By documenting innovations one gets closer to farmers, understand their ideas.
Innovations can be documented by making photographs, in video, and audio like radio recording. Information about a certain innovation can be collected using various methodologies such as observation, questionnaire, case or research studies. In the documentation process, one has to answer the following:

- for whom – seeking identity of the user;
- why – the internal and external needs;
- where – the location, the innovation is going to be operated/placed; and
- what – the product that is visualized and eventually promoted

4.8.5 Formats to document Innovations
- Type of innovation
- Reasons for the innovation
- When was the innovations started?
- Where did the idea come from? New External (Modified Traditional (IK)
- How much time have you spent so far in developing your innovation?
- Labor used for innovation
- What is required for use in the innovation?
- Problem experienced with the innovation
- Any ideas on potential solution?
- How many other farmers have copied the innovation?
- How did they find out about the innovations and when?
- Does anything make adoption more difficult (experience?)
- What are the innovations costing the rest of the community?
- Any other innovations?
4.9 References

- IFRI (2010). *IFRI discussion Paper 01041*, Published by International Food Policy Research Institute, December 2010
- Kristin Davis, Burton Swanson, David Amudavi, Daniel Ayalew Mekonnen Aaron Flohrs and Elias Zerfu (2010). *In-Depth Assessment of the Public Agricultural Extension System of Ethiopia and Recommendations for Improvement*, published by IFRI, 2010
5. **MODULE-2: PROMOTING IRRIGATED CROPS VALUE-CHAINS USING MARKET-ORIENTED COMMODITY APPROACH**

**Module Outline**

1. Learning Objectives of the Module
2. Introduction and Justification
3. Value Chain Analysis of Irrigated Crop Commodities
4. Value Chain Strategy in Irrigated Agriculture
5. Facilitating Services
6. References

**5.1 Learning Objectives of the Module**

By the end of this session, participants will be able to:

- Facilitate the identification, targeting and promotion of improved technologies to develop the value chains of selected high-value irrigated crop commodities.
- Improve the capacity of the value chain actors and the support services at the region, zonal and woreda levels to develop the selected irrigated crops value chains and respond to emerging challenges and opportunities.
- Improve the delivery of extension messages, access, flow and use of knowledge relevant to the value chains within and amongst the value-chain actors and irrigated farmers.
- Generate knowledge through action-oriented extension service on and value-chain analysis of lessons learnt about, irrigated crop value-chain development.
- Apply appropriate extension techniques for promotion and dissemination of principles and good practices for the development of irrigated crop value chains.

**5.2 Introduction and Justification**

The current National Agricultural Extension Strategy of Government of Ethiopia emphasizes on market-oriented agricultural development strategy to increase agricultural production and improve the livelihoods of smallholders. Though to-date, producers, government, research and extension institutions have been mainly focusing on the generation and promotion of improved technologies and good practices to increase production and productivity, however, there is a low emphasis on value addition and marketing. On the other hand, farmers run subsistent agriculture by largely producing their household consumption in which the scenario shows emphasis on volume of the product. This is because the farmers want to secure annual household feed and settle financial obligation like tax and household clothing, rather than doing value added in each step of production, particularly on irrigated crops commodities that could have fetch high income for farmers.

Demand for irrigated agriculture has been increasing due to government and farmer’s due attention to make agricultural economy resilience’s to natural hazards and increasing crazy nature of global climatic unusual. Being recent increasing nature of irrigated products, their value chain is not well defined and most farmers and agricultural extension experts have limited capacity on which activity of value-chain is adopted at each stage of value chains. Moreover, irrigated crops products have more market surplus at producer’s households compared to rainfed cereals that necessitate well definition of each touch point of
value chain to increase the efficiency of the chain that makes the actors more profitable to increase farm household income. One of the irrigation-extension approaches is scaling out successful approaches and interventions for key high value irrigated crop commodities.

5.2.1 What are Value Chains?
The value chain is a concept, which can be simply described as the entire range of activities required to bring a product from the initial input-supply stage, through various phases of production, to its final market destination. The production stages entail a combination of physical transformation and the participation of various producers and services, and the chain includes the product's disposal after use. As opposed to the traditional exclusive focus on production, the concept stresses the importance of value addition at each stage, thereby treating production as just one of several value-adding components of the chain.

5.2.2 Value Chains Concept and Issues
The macroeconomic landscape, policies, laws, regulations, standards and institutional elements such as research and innovation, human resource development and other support services form the environment in which all activities take place.

Value chains tend to be more complex, to involve numerous interlinked activities and industries with multiple types of firms operating in different regions of one country or in different countries around the globe. For instance, agro-food value chains encompass activities that take place at the farm as well as in rural settlements and urban areas. They require input supplies (seeds, fertilizers, pesticides, etc.), agricultural machinery, irrigation equipment and manufacturing facilities, and continue with handling, storage, processing, packaging and distribution activities. Other elements, such as power generation, logistics, etc., which form the chain environment, are also important factors affecting the performance of value chains.

5.2.3 What is Value Chain Analysis?
Value chain analysis is the process of breaking a chain into its constituent parts in view to better understand its structure and functioning. The analysis consists of identifying chain actors at each stage and discerning their functions and relationships; determining the chain governance, or leadership, to facilitate chain formation and strengthening; and identifying value adding activities in the chain and assigning costs and added value to each of those activities. The flows of goods, information and finance through the various stages of the chain are evaluated in order to detect problems or identify opportunities to improve the contribution of specific actors and the overall performance of the chain.

By going beyond the traditional narrow focus on production, value chain analysis scrutinizes interactions and synergies among actors and between them and the business and policy environment. Thus, it overcomes several important limitations of traditional sector assessments which tend to ignore the dynamic linkages with and among productive activities that occur outside the particular sector under assessment or involve informal operations.
Value chain analysis also reveals the dynamic flow of economic, organizational and coercive activities involving actors within different sectors. It shows that power relations are crucial to understanding how entry barriers are created, and how gain and risks are distributed. It analyses competitiveness in a global perspective. By revealing strengths and weaknesses, value chain analysis helps participating actors to develop a shared vision of how the chain should perform and to identify collaborative relationships which will allow them to keep improving chain performance.

5.2.4 Why Value Chain Analysis
Value chain analysis is a useful analytical tool that helps understand overall trends of industrial reorganization and identify change agents and leverage points for policy and technical interventions. Donors and development assistance agencies to better target their support and investments in various areas are increasingly using value-chain analysis such as trade capacity, enterprise competitiveness, income distribution and equity among value-chain participants.

5.3 Value Chain Analysis of Irrigated Crop Commodities

5.3.1 Enabling Environment of the Chain
Ethiopia has been formulated rural centered economic development policy and strategy that favor and enhance agricultural economic development through intensive land and labor utilization and capital saving mode of production. Economic Policy and strategy has been aimed to realize free economic system in which value chain actors in the production system have the right to produce, reallocate resources in the system of production function, selling the product at any price and anywhere the producers or actors of the chain can realize maximum benefits. Government intervention level in the economic development has created favorable conditions to facilitate and amend probable market failure in input and output market of irrigated agricultural economy. Moreover, irrigation infrastructure development investment where private partnership is not willing to intervene has been carried by the government. Strategic inputs supply such as fertilizers and research services has been supported by government. Generally, fiscal policy that favors exporters of agricultural products and monitory policy, which prioritize agricultural investments of the nation, is favoring well-functioning of value chain of irrigated crop commodities, in particular horticultural products of the regions.

Concerning regulation, ministry of agriculture and standard authority and conformity is institutional set up favors irrigated crop commodities investment inputs regulation to make irrigated products fit with the compliance. Quarantine services and plant health clinics, are those institutional setups to provide phytosanitary services, which enables efficient and effective function of value chains.

5.3.2 Facilitating Institutions
The regional government in Ethiopia has established Irrigation Process unit to provide irrigation extension services, irrigation infrastructure development and scheme administration. In the process of irrigated crop production, the regions are facilitating irrigation development through planning, input demand collection,
supply and distribution facilitation. The regional cooperative agency’s institutional setup that stretch from region to district is responsible in coordinating, managing and controlling input demand and supply through unions and distributive service cooperatives.

The regional Bureau of Agriculture is an institution, which create enabling environment for smooth delivery of extension services at grass root level and input supply and distribution coordination. Plant health clinics and different agricultural laboratory centers are institutional setup, which have a greater role in efficient and effective functioning of irrigated crop production.

Trade and market development is an institution working on provision of commercial service that enables free entry and withdrawals of actors in trading of irrigated crop products. Such freedom motivates innovation for value chain actors to maximize the values of irrigated crop commodities through promotion and efficient production system that leads to maximum earning. Irrigation resource property right like land right, and other irrigation investment right is encouraging in irrigation development to make the chain more efficient.

Farmer’s organizational setup such as development team and one to five arrangements are important institutions, which enhance demand for irrigation development, capacitate farmers in operation, and make value chain more efficient as experience of model farmers easily transferred to non-model farmers through production function.

5.3.3 Development of value-chain irrigated crop products - production and mobilization

The first touch point on irrigated crops value chain starts with mobilizing the farmers for development of irrigated agriculture. At this stage, farmers become aware about how to utilize their resources for irrigation development. After they have motivated to produce irrigated agriculture product they made to plan to produce crops that enables them to earn high revenue. Moreover, input required to produce the irrigated crop product at each stage needs prior planning of which included:

1. **Input supply and distribution**
   Demand for input which is based on each farmer’s willingness and ability to pay is collected and compiled to be supplied and delivered for farmers in preparation phase of irrigation developments.

2. **Training of farmers**
   Based on the training need assessment of farmers during pre-production or preparation phase, training events are conducted both on-farm and FTCs. At this stage farmers are trained on how to solve development constraints based on the following procedure.

   - Farmers identify systematic problems that understate irrigation development or systematic bottleneck that hinder effective and efficient operation of value chains.
   - Farmers are exposed to explore cause of the systematic bottleneck that hinder irrigation development operation.
   - Impact of the systematic bottleneck in the value chain of that revealed itself in the form of economic, social and governance is supposed to be explored by farmers at the time of training.
   - Lastly farmers need to be suggest appropriate solution that could be applied by farmers.
Based on the above identified problems farmers are need to set solution for all constraints so as to make value chain in production system so efficient and effective.

3. Irrigation development planning
Irrigation development planning is undertaken after farmers are trained and demand for irrigation has been created. Farmers demand driven irrigation planning is prepared by each individual farmer and it is presented to one in five and development team forum so as to make the plan participatory and ease evaluation and monitoring of its performance through the course of implementation.

4. Current weak link of chains that need intervention
This chain is base for effective and efficient operation of other rest part of value chain of irrigated crop products. As it has been known irrigation product quality and volume that determine the value created at each step is a function of labor and other resources mobilizations, level of farmers training to make them capable of solving production constraints, level of efficient system of input supply and distribution and the way irrigation development planned and owned by implementers. The weak link of this chain which has negative impact on the other rest of value adding chain has been identified to be intervened as follows.

- Resource mobilization by governance has not been given enough due attention so as to maximize the number of farmer’s participant in irrigation development.
- Demand data of inputs of irrigation is not emanate from the individual farmer’s demand so as to make effective supply and distribution.
- Input supply system is not so responsive to farmer’s effective demand in time place and price. This makes farmers to look for black market as an alternative that ultimately leads to undesired and under standard of inputs that result in poor function of value chain production.
- Training of farmers is not so effective enough to make farmers solvers of production constrains such as attitude, skills and supply problems. This situation makes the value chain engine part much weaker.
- Individual farmers planning of irrigation development, which is aggregate part of the general plan, is not well emanating from individual irrigation development demand. Such circumstances make implementation part much weaker and understate the value created through the production chain.

5. Post-Production Chains
Collection of harvested product is the initial stage at which chain of post-harvest begins. Method and time of collection of harvested product has significant effect on the value and volume of the product. Collection method significantly determines post-harvest loss of irrigated products. Post-harvest operations in the chain are as follows:

- Determine time of collection of harvested products
- Determine method of appropriate collection methods and instrument for collection
- Sorting of the product based on desired criteria
- Transporting to the site of sorting and grading
- Grading of the product
- Scaling the product
- Storing in appropriate place
- Packing in desired size for trading

6. **Current Weak link of this chain in irrigated agriculture production**

This chain is an area where excess pot harvest loss has been occurring. The reason why a lion share of lose has been occurred is that producers and professional advisers have not been give due attention to the operations done in this part of value chain. Most researchers, policy makers, producers and development supporting institutions have been giving much more due attention on pre-production and production chains while a huge lose has been occurring at this post-harvest stage. Therefore, areas at which attention should be given so as to enhance value gained in the entire value chain of horticultural product. The weak link which needs attention of stakeholders are the following.

- Method and time of harvested product collection is not well scheduled so as to get good quality harvest.
- Collection materials such as sacks, creates, etc. are not appropriate material to safe products from damage at the time of collection.
- Sanitation of a place at which product is collected on the farm gate is not well standardized so as to communicate with the producers through extension system.
- There is no standardized quality for sorting and grading harvest at farm gate so as to level the price based on the agreed quality.
- Loading and unloading method has been lead the product to damage.
- Product scaling at farm gate is not well accustomed so as to incentivize producers.
- Infrastructures and market facilities are not well developed.
- Farm gate product selling is not well supported with scaling and bulk product has been bought by estimation which favors buyer.
- Grading and sorting is not accustomed by producers so as to price the value of product based on the quality of the product.
- As different facilities are not in the rural area there is no institution or private sectors which provide packing and semi processing services to add value on the products.

5.3.4 **Industrial Processing**

The chain at which value addition of irrigated crop product is taking place is this chain. All value adding operation has been carried out in this stage. Some operations carried out in industrial processing are as follows.

- Bulk Purchase of raw materials from whole sellers and retailors.
- Transportation of the product to the industrial site.
- storing of the product based on first in first out /FIFO/ systems.
- Regrading of the product based on the standard quality set by the industry.
- Let the product to be processed in the industry.
- Grading and classification of the product based on the standard set.
- Packing and promoting the product.
1. **Current weak link of this chain**

Agro-processing industries are at the infant stage here in this country. Agro processing industries have limited capacity to adding values on irrigated crop commodities. The reason behind is that Ethiopian agriculture is still at subsistence stage and agricultural market surplus is not enough to attract agricultural industries to further processing. In irrigated crop product, there are peak and off-season for irrigation product to supply to the market. At peak harvest season, there exist a situation at which excess supply over existing demand which leads horticultural product price even below break-even points. Due to absence, of developed agricultural industries surplus product supplied in excess of existing demand at peak harvest season will be either sold with discouraging price or disposed on the farm land and this situation extremely discourage the producers.

However, at the time of off-season supply of irrigated crop product has gone down extremely compared to the market demand which in turn rise the price per unit of the product and this situation in turn discourage consumers of the product. The perishability nature of the product which cannot enables farmers to manage the crisis through storage exacerbates the problem of unsustainable supply and unstable price prevalence in the market. This situation leads to unsustainable irrigation development as farmers engaged in irrigation determine to be involved in irrigation based on the previous price per unit of irrigated horticulture product. The previous price per unit is either low which discourage irrigation development or high and encourage development which leads low price currently and leads next year fall in production. This cyclical problem in irrigation development occurs due to lack of irrigated crop product processing industries that help to process the product and supply it to the market at time of off-season.

The other constraint of this chain is which should come first. If potential irrigated crop product comes, first the producer will suffer in losing the market for their product. If, agro-processing industries comes first they will lose raw material period. Therefore, this mismatch situation should be solved by value chain actors.

### 5.3.5 Distribution and Marketing

1. **Distribution**

Demand for irrigated horticulture product is not uniformly distributed all over the nation of the country. Production or farm site of irrigated product is located far away somewhere from urban settlement where demand for horticulture product such as home consumers, hotels universities, hospitals, prison houses etc. are highly concentrated. This situation necessitates installation of distribution services as important operation in the value chain of horticulture production system. Distribution of horticultural product needs to know market demand information for horticultural products. Therefore, information where to distribute the product is very precondition for the product to be transported from where it is produced to where it is consumed. Broker services has major considerable role in facilitating distribution services in linking potential buyers with potential suppliers like whole sellers and whole buyers. The major activities done in distribution of horticultural product have been configured in the chain as follows.

- Information about potential buyers will be assessed and given to the whole buyers of the product
- Which product? At what amount? By who? Where and when? Is required should be known by distributors
- Loading unloading site is arranged at product collection site
2. Marketing

Irrigated crop product marketing is carried at different level such as on farm site before harvest, farm gate after harvest, at temporary storage site, after sorting and grading, whole sell at central market, supermarket, roadside marketing in the form of retailers. Some of the operation in marketing value chain are configured as follows.

- Potential buyer or whole buyer go to farm gate and negotiate for price in mass to buy horticultural product before harvest in mass.
- After buying the product potential buyer harvest the product.
- Sorting is done at farm site.
- Transporting the product to the central market where retailers buy from the whole sellers.
- Some of the product is sold to supper market where supper market is the last outlet and sold to the consumers.

Weak link of the chain

The weak link of this chain is exacerbated by horticulture product market distorting middle men or brokers. Normal market operation is prevailing when demand and supply of market operated properly set fair price that enables to encourage production and realize consumer’s welfare. Some of the current drawbacks of irrigated crops marketing problems are listed as follows.

- In horticultural product marketing, there is not well-agreed standard of product to set fair price that encourage producers and realize consumer welfare
- There is not well established scale in rural market of horticulture
- Price information flow problems
- Broker’s service is not well mannered
- Suppliers and consumers are not well aware of each other to so as to create market competition
- Promotional and advertisement service is not common
- There are not well-standardized public market facilities where daily auctions are taking place to set fair price
- There are no systems that govern export of irrigated crop commodities to the neighboring countries such as Djibouti, Somalia and South Sudan
- Transportation and marketing facilities are not found every where

5.4 Value-Chain Strategy in Irrigated Agriculture

In irrigation extension approach, due emphasis is given on a value chain framework to develop targeted irrigated crop commodities. Such a framework recognizes that value chain actors add value at different stages of the value chain and that individuals and organizations provide inputs/services to the value chain actors. Concerning irrigated agriculture, the key value chain actors are producers of agricultural inputs and outputs as well as traders and processors at village, district, regional and national levels. Important service providers include the public research and extension sector that does technology development, capacity building, and knowledge generation and dissemination.
Bureaus of Agriculture are also involved in input supply and services e.g. supply of seeds, irrigation equipment, and other agricultural crop inputs. The involvement of communities, cooperatives, irrigated farmers and the private sector in producing inputs and providing services is also emerging. SMIS project focuses on the need to improve the effectiveness of research and irrigation extension system to support the development of market-oriented irrigated crop commodity, and irrigation extension experts can carry out by:

- Promoting the use of participatory, market driven, gender sensitive and sustainable irrigation-extension approaches for value-chain development
- Promoting the involvement of value chain actors and suppliers of inputs and services in the development process
- Promoting improved knowledge management approaches for capturing, storing and sharing knowledge
- Supporting schemes, village and district level development of community, cooperative, farmer and private sector production and supply of inputs and provision of services
- Promoting linkages/dealership networks with value chain actors and service providers at regional, zonal and woreda level
- Promoting diagnostic, action, impact studies on value chain interventions of irrigated crop commodities and documenting of results and lessons learned to use for learning within the SMIS project areas and to scale out beyond the project areas.

5.4.1 Potential irrigated crop value chain interventions

Irrigation extension experts will need to promote value chain in irrigated agriculture by using innovation systems and value chain approaches, and maintain linkages with relevant stakeholders and value-chain actors in the regions. Innovations may consist of organizational, institutional and technological interventions. Following are potential irrigated crop value-chain interventions for commodity value-chain development:

- Selected value chains
  - Vegetables – onions, tomato, cabbages, carrots, potatoes
  - Fruits – mango, avocado, papaya, banana, apple, plums, citrus
  - Fodder – Grasses, legumes
- Producers/markets
  - Producers – Individually irrigated farms (self-selected) – Farmers in irrigation SSI and MI schemes (not preselected)
  - Markets – Individual households – Traders – Large scale fruit and vegetable growers – Supermarkets – Juice factories
- Potential irrigated crop interventions
  - On - farm – Crop production, water use
  - Input supply and services – Crops – Water
  - Marketing/processing
- Production interventions
  - Increasing production, productivity and income of irrigated crop commodities –
  - Distinguish between different farm types/systems and production interventions –
Improved/marketed demanded varieties – Improved crop and water husbandry practices, including use of improved inputs/irrigation equipment, planting schedules, post-harvest, quality – Increased irrigated area and percentage high value crops

- **Crop varieties**
  - Fruits – Flesh/seed ratio - mango, avocado – Taste - all fruits – Productivity – all fruits – Early maturing – all fruits
  - Vegetables – Onion vs shallot – Productivity – all vegetables
  - Fodder – High value - protein rich – Productivity

- **Improved crop/water husbandry practices**
  - Crop rotation – including annual fodder crops
  - Pest control• Staggered planting
  - Irrigation equipment/methods
  - Post-harvest

- **Water source/storage**

- **Irrigation lifting equipment**

- **Irrigation water distribution system**

- **Crop Input/service production interventions by groups and individuals**
  - Seed multiplication – Onion seed – Potato seed – Forage seed• Seedling multiplication – Fruit nurseries – grafting and mother trees – Banana - suckers – Vegetable seedlings – onion, pepper

- **Fruit seedling nurseries**

- **Onion seed multiplication**

- **Crop Input/service supply interventions**
  - Linkages between federal/regional agribusiness with village/district/zonal level agribusinesses – Irrigation equipment – Agro-chemicals
  - Linkages between federal/regional level suppliers of improved varieties with District level multipliers – Certification of producers of seed/seedlings

- **Processing and marketing interventions**
  - Improved marketing and processing of crop products by district/zonal cooperatives and private entrepreneurs – Introduction small scale processing and storage equipment – Bulking produce for marketing – Formation of collective structures marketing for producers (formal and informal) – Contract farming thru linkages

- **Processing and marketing interventions**
  - Linkages between federal/regional agribusinesses with district level processors and traders – Fruit and vegetable whole sale – Selected supermarkets
  - Linkages between district/village level service providers and federal level service institutions – Crop prices (internet) – Information – Associations (horticulture) and projects – Quality – Bureau of quality and standards/EIAR

- **Storage**

- **Bulking produce**

- **Post-harvest**
5.5 Facilitating Services

Service facilities are the major important factors to access irrigated crop product to the ultimate consumers. The most important services needed access crop product to the final consumers is:

5.5.1 Transport facility
Transport is a means by which product is transported from where it is produced to the market and then to the consumers table. Most common transport of irrigated product from farm site to the local market is animal transport like donkey and horse and sometimes transported by labor. From local market to the central market it is transported by trucks.

5.5.2 Storage
Most irrigated crop products are perishable in nature. Shelf life of most crop product is not conducive for storage. However, time between harvest and consumption of these products needs to have appropriate storage to keep the product natural qualities not lose its value. The most common way of storage of these products at farm site for a short period of time are that storing on farm gate under temporary shelf, storing in hole and covering with soil in case of potatoes etc. are common practice to elongate shelf life of the product. In central market the product are stored at central market store based on first come first out system to shorten the time the product stay in market shelf. In general, the most pressing issues that hinder product quality are storage services.

5.5.3 Processing
Irrigated crop (horticulture and cereals) Processing service industries are the most infant services rendered here in this country. The most important operations which increase value of irrigated crop commodities and ensure sustainable supply of these product prevails here in these chains are missed due to non-appearance of agro processing industries in Ethiopia.

5.5.4 Packing
Packing and labeling of processed goods is the most important operation to add value to irrigated horticultural and cereal products. Since there is no significant processed product here in this country this service is not well matured to add values of this product.

5.5.5 Exporting
Export of horticultural and cereal products are not significant and operation needed to add values in the chain are limited. However, some form of Ethiopia produced rice from Asosa has started exportation to Middle East countries, which is encouraging.

5.5.6 Dealers
Agro-dealers are providing the most important information services for both potential buyers and supplies. They provide information of what kind of product with what amount and where it found. They do have non-substitutable role in linking buyer versus sellers so as to lubricate marketing process.

5.5.7 Communication
Communication is the very important service required to link buyers with potential sellers. This activity is carried mostly by brokers and agro dealers in the rural areas. Market-oriented extension system is emphasized for communication to potential buyers using mobile phone, TV and radios.
5.6 References

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6. MODULE-3: TECHNIQUES OF PROMOTING GENDER-SENSITIVE PARTICIPATORY TECHNOLOGY DEVELOPMENT (PTD)

Module outline
1. Learning Objectives of the module
2. Introduction and justification
3. Application of gender sensitive PTD model, advantages and disadvantages
4. Procedures in PTD approaches and its basic phases
5. PTD technology testing its advantages, disadvantages, location and steps for testing procedures
6. Monitoring, Evaluation and Reporting in the process of PTD

6.1 Learning Objectives of the Module

By the end of this session, participants will be able to:
- Realize the broad understanding of PTD in which DAs and the outside facilitators will be able to identify, develop, test and apply new irrigation technologies and practices.
- Understand the objective of PTD while building congenial relationships with the farmers and farming communities in SSI and MI schemes.
- Know how to apply PTD approaches to establish mechanisms for farmers to help build the farmers' confidence, tapping their potential for innovation and initiative.
- Know their specific roles and functions in transferring PTD approaches.

6.2 Introduction and Justification

Gender sensitive Participatory technology development, or PTD, is an approach in extension system and importantly in irrigation extension, which involves farmers in developing agricultural technologies that are appropriate to their particular situation. It is a practical process: farmers, as "insiders", bring their knowledge and practical abilities to test technologies, and interact with researchers and extension workers—the "outsiders". In this way, farmers and the outside facilitators are able to identify, develop, test and apply new technologies and practices. PTD seeks to reinforce the existing creativity and experimental capacity of farmers, and to help them keep control over the process of generating innovations. It can be an integral part of community-based extension approaches. Therefore, in our broad understanding of PTD, it is a process of developing technology in which farmers lead. The purpose of the PTD is to:

- Testing farmer’s technology ideas;
- Testing, under local conditions, a technology that has been successful under local conditions;
- Trying out a modification to an existing or recommended technology to see if it can be more successful under local conditions;
- Developing farmer’s capacity to solve their own problems through experimenting with ideas

PTD differs from demonstrations, as:
- It does not involve showing a farmer a proven or recommended technology;
It is conducted in a participatory manner and farmers are full partners;
- It cannot be predicted as nothing can be promised, and nothing is guaranteed.

Conducting PTD is a learning process for everyone, with extension and research staff acting as facilitators. Farmers have always been active developers of irrigation practices. PTD builds on, supports and encourages this capacity. Farmers work directly with researchers, NGO/CBOs to design and monitor trials. PTD process helps farmers to identify and overcome production problems at the farm level through the exchange of information among farmers, extension staff and researchers. Since PTD is an on-going exchange of information, it creates opportunities or situations in which farmer gain the abilities and skills necessary to meet their needs and interests in such a way as to attain continuous improvement and self-satisfaction. It helps farmers to gain a clear vision of what can/ or should be done, and encourages them to develop the necessary skills to do so. PTD also provides information directly to agricultural researchers on farmer’s production constraints so that appropriate basic, applied or adaptive research can be carried out to address them.

6.3 Application of Gender-Sensitive PTD Models in SMIS Project

The project has participatory irrigation extension intervention in three different components:
- Small-Scale Irrigation (SSI) Capacity development
- Capacity development of selected ATVETs, and
- Promotion of household Micro Irrigation (MI)

In all the three components, it involves irrigation farmers in the development and application of technologies that will affect them. Each intervention will emphasize the multidisciplinary nature of change processes and the necessity of involving those affected change. In all three components of SMIS Project, a participatory on-farm testing model would be used.

Essential linkages are developed with complementary projects to strengthen important capacities such as gender responsive PTD management skills and systems, to help PTD partners become gender sensitive and in the longer-term apply more gender transformative approaches and interventions in the SSI and MI sectors. To ensure integration of gender responsiveness into all PTD activities, all elements of the PTD trials & demonstrations will include sex-disaggregated data.

6.3.1 Advantages
- PTD builds trust between farmers and outsiders. This helps to build the farmers' confidence, tapping their potential for innovation and initiative.
- It strengthens the links between indigenous and scientific knowledge.
- It builds human capacity for self-reliance.

6.4 Procedure in PTD Approaches and Its Basic Phases

The PTD approach has five basic phases: (I) building trust, (II) identifying alternatives and setting priorities, (III) designing the experiment, (IV) conducting the experiment, (V) sharing the experience.

I. Building trust
- Develop and strengthen relationship with water users/farmers, aiming to go beyond that of a professional with a client. These extension managers should listen and try to understand the
farmers' views, and try to help them become comfortable making suggestions and expressing their opinions.

- Help the farmers identify the problems they want to solve, and should consider the situation from the farmers' perspective, and looking at issues in a holistic manner considering various aspects of SSI and MI schemes. As far as possible, extension managers should involve all of the members of the farm household: men, women, and children.

II. Identifying alternatives and set priorities

- Identify indigenous knowledge & skills that may be relevant to the problems selected.
- Help the farmers identify several different ways they might solve the problems. Ideas for the alternatives may come from the farmers themselves. Link these alternatives to the farmers' situation and experiences.
- With farmers, PTD team examines the advantages and disadvantages of each of the alternatives.
- PTD team assist the farmers to choose one or more of the alternatives for testing in the field.

III. Designing the experiment

- Help the farmers decide how to test the alternatives they have chosen. The experiment should involve both farmers and other PTD members (researchers and extension experts). The experiment design should show the difference between the various alternatives, as well as with the current practice.
- Help farmers decide how to measure the results, so they can tell which alternative is best.
- Both farmers and PTD team should be involved in evaluating the results and assessing the impacts.
- Train farmers how to conduct the experiment and manage the research process.

IV. Conducting the experiment

- Help the farmers do the experiment, following the agreed design.
- Measure and record the results of the various alternatives, as well as the current practice.
- Evaluate the results from the alternatives by comparing them with the current practice.
- Modify the alternatives as needed, and if needed, test them again in the next season.

V. Sharing the experience

- Organize ways of sharing the experiences (technologies, successes, failures and constraints) of the experiment. These can include field visits, discussions, training sessions and study trips. Make it clear whose experiences are being shared. Put the farmers' experiences in the forefront. Let the individual farmer (or the group) say, "I have done it. It is mine". Ensure that experiences and views on what contributed to success (or caused a failure) is shared.
- Recognize unique situations (such as land, soils, socio-economic and political situations) which may exist, as these determine how a technology might be improved or modified.
According to the National agricultural extension strategy of Ethiopia, the government put emphasis on increasing active participation of farmers, research and extension, and this may be achieved by:

- **Farmer-focused research agenda to have demand-driven research.** Steps need to be intensified for adapting, the research agenda to reflect farmers’ needs through improving their participation from problem identification up to planning to monitoring and evaluation. This can be affected through developing farmers, voices diagnostic feedback tools and technology tracking tools that clearly show the pros and cons of each specific technology under farmers’ conditions.

- **Promote active participation.** Build the capacity of farmers on concept of participatory technology development verification, and dissemination in collaboration with research, extension and other actors.

- **Establish working and sustainable platforms among key actors.** Establish and strengthen annual platforms to debate the benefits and challenges of improved technologies taking farmers, women and youth into consideration.

- **Promote agro-ecology and cluster-based technology development and dissemination:** New technologies/innovations should be promoted and disseminated within different agro-ecologies and farming conditions to enhance their adoption. Technologies should be integrated with the existing indigenous knowledge and farming practices through on-farm trails and demonstrations to be more innovative. Farmers need to be convinced about the effectiveness of new agricultural technologies if they are to make use of them (Berga et al., 2013).

### 6.5 On-Farm Participatory Technology Testing

PTD approach involves farmers in testing and selecting technologies, in case of SMIS it is mainly the high value crops or soil and water conservation methods. This section describes how to do trials of crop varieties. A similar approach can be used for other types of trials, for example testing pest-control measures or fertilizer applications. PTD trials are conducted with involvement of researchers, DAs and farmers (FREG). With assistance of DA, the farmers will take initiative and responsibility for the trials: for example, they may decide that they wish to test varieties, select the varieties to test, design and implement the experiment, and evaluate the results. Respective pilot Woredas and DAs are responsible to provide guidance throughout the PTD process.

#### 6.5.1 Advantages

- PTD helps in developing and testing the most suitable technologies for the community. For this reason, these technologies are likely to be adopted quickly by other farmers.

- Farmer participation in on-farm trials enables them to be involved in evaluating and selecting farm technologies right from the beginning.

- It develops farmers’ analytical skills. After conducting one such trial with the guidance of outsiders, they will be encouraged to do further tests on their own.

- It enables farmers to develop a sense of ownership of the technologies, since they can select for its
promotion.

- It provides researchers with valuable information about farmers’ preferences and problems.

6.5.2 Disadvantages

- Farmers’ organizations may find it difficult to get sufficient support from research stations and extension services to enable them to use this approach.
- On-farm trials require considerable organizational skills, and may require literacy and numeracy. Considerable guidance be given by respective PIT
- Planting material is sometimes not available on time.
- Crop pests and unreliable weather may disrupt her.

6.5.3 Location

PTD approach is useful in almost all SMIS-selected pilot schemes of Woredas. However, concerning SMISs objectives, the trials can be conducted in the SSI and MI schemes.

6.5.4 Procedure

In pursuant to the Plan of PTD activities drawn at the annual work-planning workshop held in the Woredas, the testing of technologies relating to SMIS’s interventions in irrigated agriculture is undertaken. Though these interventions are pre-determined, however, the farmers may also express through participatory appraisal methods (PRA) or during long-term work with the community the need for undertaking other relevant trials relating to these interventions. Following are the steps or procedure in testing procedure:

- Inform and motivate the scheme farmers of the wish to test crop varieties, soil and water conservation, irrigations devices, and seek their agreement and help in this.
- Assess the local environment, farming systems, natural resources and the characteristics of the local crop varieties or water harvesting structures or irrigation devices.
- Undertake initial environmental impact assessment of the trail sites and its feasibility.
- Decide which crop varieties to test in the SSI and MI schemes. The local farmers may suggest the ones they are familiar with, the FREG may suggest others. FREG should test at least two local varieties as well as the introduced ones.
- Obtain recommended variety of seeds from research centers and the community to put on in the irrigation schemes. Avoid hybrid varieties of cross-pollinated crops, because after the first generation of seed, their performance goes down and they produce low yields.
- Motivate farmers to take part in the trials. Their plots should be representative of the local soils and land types on which you want to test the varieties.
- Identify at least three separate sites for the trials, so FREG can replicate the trial four times. FREG need to do this to make sure that the results from one site are not because of chance (such as the soil in one plot being more fertile than pests or a flood is destroying other plots or the crop in one plot). An easy way to do this is to ask four different farmers to run the trials on their fields.
- Lay out the trial plots. Each plot should measure 20mX10m as shown in the above picture. At each of the three sites, FREG will need as many plots as there are varieties to test. It is recommended to plant one-crop variety in each plot. DA should assist the farmers in laying out the plots.
- Train the farmers how to manage the varieties: planting time, seeding rates, weeding, or the maintenance of water harvesting structure and the irrigation scheduling, etc.
- Plant the crop varieties in the plots in the SSI schemes or at household MI structure sites (homestead gardening especially on vegetables).
- Maintain the plots according to plan, as far as possible, treat all the plots the same, the same amount of irrigation water, weeding pest control, and so forth. This will mean that the results from the different plots can be compared directly with each other.
- Together with the farmers, decide how to evaluate the varieties. The things to measure will depend on the type of crop or irrigation devices being tested, but might include the germination percentage, resistance to drought and pests, flowering time, maturity, yield, thresh-ability and harvest-ability. After harvest, they may include the cooking quality, taste, and quality of by-products. Note that farmers may choose different criteria and may put different weights on the same criteria. For example, the farmers may put more emphasis on drought-tolerance, while FREG may stress total yield.
- Monitor the varieties throughout the growing season. Organize field days at the different stages of crop growth and the use of water from the HHMI so the farmers can see for themselves how the varieties are performing.
- Harvest the plots and weigh the yield.
- After harvest, evaluate how the varieties have performed, using the criteria agreed on earlier. FREG can use PRA methods such as matrices to do this as shown in picture.
- Based on evaluation, reach agreement with farmers on which crop varieties or irrigation device be promoted. FREG may decide to test some varieties further in next season.
- Organize seed-growers' groups of 10-12 farmers each. Train them how to manage the new varieties and grow seeds for distribution to their neighbors. Provide them with extension support so they can produce enough seeds to supply the local needs.
- Report the results of tests to the research institution.
6.6 Monitoring, Evaluation and Reporting

In PTD activities, monitoring is conducted during implementation while evaluation is usually conducted after implementation. Monitoring comes first because without collecting information a valid evaluation cannot be made. However, monitoring will only produce its full benefits if the collected information is reviewed to learn lessons. This is evaluation. Information for planning PTD activities comes from both evaluation and Farmer Information Needs Assessment (FINA), the absence of either source of information will lead to low quality planning. In PTD planning process, monitoring and evaluation are tools to help TDTs improve their performance. Extension monitoring and evaluation of PTD activities are self-assessment processes carried out by FREG members. Broadly, there are two kinds of monitoring and evaluation those important in ensuring effective participatory irrigation extension: assessment of process and assessment of outcome.

6.6.1 Assessment of Process

In case of PTD, the assessment of process is carried out during implementation of PTD experimentation for collection of information on PTD activities and about technology development. The process is generally a formative in nature, but can also be summative, for example, when the farmers and researchers need to know about the actual performance and successes to technology development in line with work planning. This assessment process of monitoring and evaluation is accomplished through the conduct of Technical Audits that include,

- FINA
- Annual PTD experimentation planning
- PTD trials and farmer training register
- Monthly work schedules and DAs extension diaries
- Monitoring reports

Strength of the Process

Following are some points on the strengths of process monitoring and evaluation is:

- Knowledge gained about the process that led to desired or undesired outcomes can feed into future PTD experimentation programs
- It is preferable to identify that a PTD trial is not achieving its desired outcomes before the PTD trial end, to give the potential of refining, re-defining or clarifying the PTD model, however, this requires considerable flexibility
- Process can incorporate and cater for unexpected happenings or intermediate outcomes
- Process can inform FFG and relevant stakeholders what is going on at ground level, as it is common for plans to change considerably on PTD implementation
- Process can build in flexibility and iteration into a PTD model from the onset
- Process monitoring, if done collaboratively, can lead to team building, as it can strengthen a common understanding of PTD program aims, objectives and purpose.

The Technical Audit:

The purpose of Technical Audit is to monitor the implementation of all PTD activities undertaken in the respective SSI and MI schemes of the pilot Woredas. In this regard, SMIS RIXEs and FREGs will undertake Technical Audits to monitor on fortnightly basis:

- How the PTD activities have been planned
- How they are being implemented
- Whether progress is being monitored by DAs and FREGs

A Technical Audit has main two aims:

- To identify any misunderstandings and uncertainties among participating farmers or DAs regarding the processes of PTD approach,
- To ensure that FREGs are discharging their responsibilities assigned to them.

The Technical Audit Checklist is designed to help SMIS, FREGs and Woredas to get an impression on quality of PTD implementation. These are not exhaustive and SMIS extension teams, FREGs or Woreda are free to add any further enquiries that they consider are necessary to get an accurate and comprehensive picture about PTD experimentations. The following is the summary of technical audit that needs to be conducted on fortnightly basis in the pilot Woredas:

<table>
<thead>
<tr>
<th>Area</th>
<th>Item to be discussed</th>
<th>Comments/suggestions for future improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINA and Extension Diary Results</td>
<td>Does Woreda Irrigation office has a copy of Master list of PTD trials</td>
<td></td>
</tr>
<tr>
<td>Woreda Annual Plan and Review Meetings</td>
<td>Does DAs listed the follow-up action of PTD trials in their extension diaries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are the PTD activities based on irrigation-extension monthly work plan</td>
<td></td>
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<tr>
<td></td>
<td>Does it conforms to the needs of the target farmers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the PTD sites conforms to the initial EIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are the PTD activities gender sensitive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the DA have a copy of minutes of monthly meetings</td>
<td></td>
</tr>
<tr>
<td>Scheme Farmers Training Events</td>
<td>How many training events on OFWM have been planned and completed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How many training events on Irrigation schemes (crops and irrigation management) have been planned and completed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How many training events on Soil &amp; Water conservation have been planned and completed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How many training events on cross-cutting themes have been planned and completed</td>
<td></td>
</tr>
<tr>
<td>PTD Projects Inspection and Solution to the Problems</td>
<td>What type of problems, if any, was encountered at SSI or MI sites, and what remedial measures was given by DA/FREG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What type of problems, if any, encountered at MI sites, and what remedial measures was given by DA/ FREG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What opinions were given by farmers/DAs on the problems</td>
<td></td>
</tr>
<tr>
<td>Farmer Participation and Experience Sharing</td>
<td>How many field days/ or visits by farmers and stakeholders at SSI and MI sites were organized, and what was the total number of participation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How many field days/ or visits by farmers and stakeholders at SSI and MI schemes were organized, and what was the total number of participation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How many experience sharing visits/ or motivational tours have been conducted for FREGs</td>
<td></td>
</tr>
</tbody>
</table>

Fig-1: Fortnightly Technical Audit Checklist – PTD Monitoring Checklist
How many farmers have access to ICT or listen to farm broadcasting programs?
Which topic of farm broadcast is inspiring them most?
Is progress report of completed training events for FREGs/DAs up-to-date?
Is monthly PTD progress reports being sent to SMIS and BoA/BoFNDRD?
Was there any follow-up action on the progress reports?

6.6.2 Assessment of Outcome
The assessment of outcome is carried out toward the end of each PTD experiment and is aimed at assessing the usefulness and effectiveness of the appropriate technologies generated and demonstrated on homestead farming, OFWM and introduction of new crop cultivars. Such assessment is undertaken to know the performance of PTD experimentations to establish whether the desired outcomes have been reached. The findings are used to improve future PTD approaches.

6.6.3 Framework for Planning PTD Evaluation
The evaluation of PTD approach can employ more than one form. The following figure shows an evaluation strategy for a PTD event, which includes four different forms of evaluation. This section underpins on more PTD ‘approach-focused’ view of evaluation, and reviews some of frameworks that can be used to form an integrated evaluation plan for all PTD activities.

6.6.4 Performance Indicators
In developing an overall framework for the evaluation strategy, the key role for SMIS and PIs is to assist FREGs to undertake PTD trials and demonstrations in accordance with SMIS’s interventions and to identify those goals to develop indicators for PTD progress towards desired outcomes. Fig-3 depicts Performance Indicators of FREGs:
### MISSION STATEMENT
Through FREGs all PTD events should be undertaken in pilot SSI and MI schemes

### OBJECTIVE
FREG will work with farm families in each SSI and MI scheme to provide guidance and technical assistance for undertaking PTD trials & demonstrations for irrigation technology generation and adoption

<table>
<thead>
<tr>
<th>#</th>
<th>MAIN JOB TASKS</th>
<th>PERFORMANCE INDICATORS</th>
<th>UNIT # or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prepare annual work plan on PTD irrigation extension activities and incorporate in Woreda annual work plan</td>
<td>Annual work plans of respective Woredas are reviewed and PTD events verified</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Within the job description (TOR), conduct monthly meetings and develop monthly action plans</td>
<td>Performance of last month reviewed and next month’s PTD tasks agreed</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Given the TOR, organize quarterly meetings with participation from research, Woreda and Bureaus</td>
<td>PTD trials reviewed and evaluated. Proposed PTD plans validated and agreed</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Select appropriate PTD trial and demonstration sites in the SSI and MI schemes with DAs followed by initial EIA</td>
<td>Assessment reports reviewed and proposed PTD sites evaluated by physical verification</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Identify and organize FREGs in respect of undertaking PTD trials in SSI and MI schemes</td>
<td>Number of FREGs identified and organized for PTD events</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Manage the exercise of assessing the training needs of FREGs and DAs in line with the PTD activities</td>
<td>Training Needs assessments (TNA) undertaken annually for planning phase</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Prepare draft on-the-job specific technical training plan for FREGs and DAs on irrigation interventions</td>
<td>Draft on-the-job specific technical training plan submitted to Woreda for approval</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Implement job-embedded on-the-job technical training program for DAs/FREGs and conduct training evaluation</td>
<td>Training events documented and evaluated, and training reports prepared for SMIS/Woreda</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Organize experience sharing visits to other Woredas/ or regions</td>
<td>Draft experience sharing plan submitted to region/woreda and implemented</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Prepare and conduct the follow-up of Woreda TOT irrigation- extension training for DAs</td>
<td>Draft follow-up TOT plan and budget submitted to Woreda and implemented</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Participate in PRA and feasibility studies</td>
<td>PRA undertaken and feasibility reports prepared</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Organize and undertake PTD trials on SSI and MI scheme development</td>
<td>Number of PTD trials undertaken, sites visited</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Provide technical guidance to farmers on PTD events of on-farm irrigation, crop demonstrations, SWC, etc</td>
<td>Guidance provided as required, and follow-up actions monitored</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Organize and conduct farmers field days and meetings</td>
<td>Number of farmer field days and meetings implemented and evaluated</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Evaluate PTD results for future adoption</td>
<td>Evaluation study conducted on the adoption rate and opinion sought from farmers/FREGs</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Produce progress reports and other documents</td>
<td>Progress reports submitted and reviewed</td>
<td></td>
</tr>
</tbody>
</table>

### 6.6.5 Data Collection
The adaptive-research farmers for PTD are responsible for managing and monitoring of the trials. Woreda Irrigation office will help guide participating farmers/FREG members to keep records and collect data, and make sure that no data are lost. In this regard, Woreda will follow and adopt similar data collection process of Agricultural Research Centers (ARC). Researchers will train FREGs on data collection and documentation process using ARC’s template sheets by which the FREGs will apply for PTD events. Likewise, Woreda will also maintain all records of data collection. Materials for use in the trials can be contributed by farmers or by SMIS. Commercial seed companies sometimes donate seeds for variety screening, inputs dealers sometime donates for testing fertilizers, pesticides or other irrigation equipment. However, the following point needs to be taken into consideration while monitoring and evaluation of PTD trials and demonstrations are undertaken at the given specific sites:

- Conduct self-evaluation of FREG members.
- The information obtained through FREG self-evaluation illustrates the effectiveness and contribution of each member in a FREG group.
- FREG members evaluate their overall success in meeting the objectives and goals.
6.6.6 Reporting System

In this section, a guiding template is presented for reporting the progress of FREG work. This template is to be used when reviewing and reporting on the progress of PTD events, and other extension activities. The template is designed to comply with the concepts and terminology of PTD methodology following SMIS’s irrigation extension approaches. In line with these approaches, FREGs are expected to analyze their progress regularly, write their analysis down, and use the analysis for the benefit of PTD and irrigation extension activities and of SMIS’s objectives. Such analysis on regular basis will provide support to PTD adaptive management, impact assessment, and generating and sharing knowledge for the development and dissemination of appropriate technologies.

The report should be compiled from regular monitoring information and after an analysis of PTD progress and other irrigation extension activities it should be undertaken with the involvement of FREG members, DAs and other relevant stakeholders because of the importance of associating closely the operational side of FREG with the PTD events. The analysis carried out during each phases of the PTD experimentation and its dissemination throughout the process will help prepare a comprehensive report that will be extremely helpful for Annual Irrigation-Extension Work planning.

It is recommended that the progress report contain two parts: Part 1, the general narrative version, and, Part 2, the activities versus outcome version. Progress report should be prepared on monthly basis and submitted to respective Woreda.

6.6.7 Guiding General Narrative Version (Part 1)

- Work Plan Framework: State how the PTD and other extension activities relate to the planned work plan framework and contribute to any New Initiatives or community reactions.
- Project Successes: Highlight at least three successes for this reporting period, such as progress towards the PTD goal and objectives. For example, improvements relating to introducing new crop cultivars, irrigation scheduling and maintenance, women’s role in vegetable production, or behavioral changes.
- Progress on Activities and related financial issues: Provide a brief overview of progress at the main activity level, highlighting any areas that are well behind plan. Explain any financial consequences related to activities (e.g. any major deviations in budget or expenditure).
- Problems and Constraints: Highlight any failures, problems or constraints that have affected PTD progress, and describe the measures taken to respond to them.
- Unexpected effects: Describe any unexpected (positive or negative) consequences that have occurred because of the PTD events and/ or any new opportunities that present.
- Learning and Sharing: Describe key lessons learned, that are important to FREG or that may be of use to others outside of SMIS’s intervention areas. They may relate to any of the following: successes, extension strategies adopted, challenges FREG is facing, surprise results, FREG management processes, or technical understanding of PTD and irrigation extension interventions.
- Communications/Stories: Highlight any actions or successes meriting rural communications attention, e.g. positive ICT in extension, farm radio coverage, and major events.
- Future Issues/Challenges: Highlight the most significant issues/challenges ahead for the PTD project, focusing on the next month, and explain how they will be addressed.
Overall Assessment of progress: Assess whether the PTD has made the expected progress against the action plan, and whether planned objectives will be achieved (As the PTD activity progresses, this should be based on an assessment of progress against goals and objectives and the associated indicators)

6.7 References

- Tchawa, Paul et al (2010), *Participatory Technology Development in Cameroon, the route and milestones in the process of its institutionalization*. The article published by SNV Netherlands in Cameroon.
7. **MODULE-4 IRRIGATION-EXTENSION MONITORING, LEARNING AND EVALUATION TOOLS AND TECHNIQUES**

Module outline
1. Learning Objectives of the module
2. Introduction and justification
3. Measuring irrigation-extension services and changes
4. Choosing suitable evaluation criteria and indicators
5. References

### 7.1 Learning Objectives of the Module

By the end of this session, participants will be able to:
- Understand the concepts, methods and tools for conducting monitoring, learning and evaluation of irrigation-extension activities of SSI and MI schemes
- Describe the extension performance indicators, and will learn the suitable tools for evaluating irrigation-extension impacts
- Learn on selecting extension progress and impact indicators, data collection, compilation and analysis using suitable statistical packages
- Know how to measuring and report irrigation extension monitoring, learning and evaluation objectively and write evaluation reports

### 7.2 Introduction and Justification

This chapter describes the tools and techniques of monitoring and evaluation related to conducting monitoring and evaluation of irrigation-extension activities in the pilot SSI and MI schemes. The M&E tools also set for improving the quality of measuring impacts of irrigation extension services. It provides guidelines for reporting extension outputs, satisfaction with extension services, and some outcomes. It also describes strategies for improving evaluation practice across numerous facets of irrigation extension evaluation. The chapter concludes by reiterating the importance of building local extension evaluation capacity and re-emphasizing the need for disseminating and using results to improve extension programs/services and their impacts.

#### 7.2.1 Relevance of irrigation Extension Monitoring

Monitoring helps to ensure that extension programs are implemented in accordance with its design and objectives. It answers questions such as “Are we doing the right thing?”, and “Are we doing it right?”. Development agents, Extension supervisors, extension experts and/or extension managers use monitoring to track progress by gathering periodic information on intervention inputs and activities based on data. They generally, track resources and processes e.g., occurrence of meetings, demonstrations, field days, experience sharing visits etc.
Extension Process Owners and extension cohort are supposed to undertake monitoring and evaluation. These units gather periodic data on several general output variables, including number of female and male participants, types of extension activities implemented, irrigation crop pattern, cropping calendar, and irrigation input demand, input distribution, irrigation land, market information, and ongoing and emerging irrigation training needs of farmers. However, public extension services have not been able to make full use of monitoring data for specific program improvement and personnel management purposes. Monitoring of program performance and impact evaluation are related, but they require different methods and levels of rigor. Monitoring tracks key indicators of progress over the course of a program to provide contextual descriptions as a basis on which to evaluate outcomes of the.

There are ten principles for successful and effective irrigation extension monitoring, those are:

- **Irrigation extension monitoring must be simple** - a complex or complicated monitoring system is self-defeating.
- **Irrigation extension monitoring must be timely** - timeliness is critical so that appropriate modifications in irrigation extension can be made soon enough to increase chances for success. E.g. demonstration site selection, FTC training need assessment, demonstration, field day etc
- **Irrigation extension monitoring must be relevant** - monitoring must match objectives, generate useful information.
- **Irrigation extension monitoring information should be dependable** - management/researchers, extension experts will rely on monitoring findings only if the information is believed to be reasonably accurate. E.g. data collected on demonstration sites, technology fair feedbacks, scaling up practices etc
- **Irrigation extension monitoring efforts should be participatory** - it should include all stakeholders concerned with extension (e.g., Farmers(women/men/youths, DAs, subject-matter specialists, etc)
- **Irrigation extension monitoring must be flexible** - it is iterative in nature, and becomes routine over time.
- **Irrigation extension monitoring should be action-oriented** - it should follow pragmatic approaches, keeping requirements of extension’s beneficiaries uppermost in consideration.
- **Irrigation extension monitoring must be cost-effective**.
- **Irrigation extension monitoring efforts should be policy/decision makers oriented** - monitoring units should keep in mind requirements of policy/decision makings when designing and operating a monitoring system.
- **Irrigation extension monitoring units represent specialized undertakings** - monitoring is not merely concerned with the collection and analysis of data, but with diagnosing problems and suggesting alternative practical solutions. E.g. community need, scheme design, input provision, marketing etc
7.2.2 Relevance of Irrigation Extension Evaluation

Evaluation is not a new concept; it is something we all do, informally or formally. Evaluation is a process of systematically assessing the operation and/or outcomes and impacts of a program or project by collecting evidence to determine if certain acceptable standards have been met and to answer other relevant questions. This implies that there must be clear, measurable objectives for irrigation extension prior to its implementation. Evaluation results based on these predetermined objectives, as well as assessments of unintended consequences, are used to improve. Informal and formal evaluations can anchor two ends of a continuum. At one end of the continuum, informal evaluations are unsystematic; criteria and evidence used in making judgments are implicit and often personal. They can be biased and misleading. At the other end, formal evaluations are systematic and use explicit criteria and evidence to make judgments about a program’s relevance, effectiveness, efficiency, and/or impacts. Findings are made public, a policy makers to design irrigation extension strategies or review and validate the existing.

Irrigation Extension evaluation focus is on effectiveness of an interventions i.e. extension approaches, FTC training, technology packages, demonstrations, educational tours, projects, or policy in meeting objectives. Resource Effectiveness- analysis of benefits and costs of an intervention, including cost per beneficiary(farmer), extension services delivery, etc on which programs, policies, and practices are most effective with different target groups (e.g., women, youths, IWUA/nonmembers, etc). It also measure how users of irrigation extension services perceive service quality, or their intention to use new information and/or technology. Extension evaluation is therefore both an art and a science. The art of evaluation involves identifying purposes and audiences, creating appropriate designs, and interpreting data about an intervention program or policy. The science of evaluation involves systematically gathering and analyzing evidence about the outcomes and impacts.

7.2.3 Extension is complex and evaluation is messy

It is difficult to attribute specific impacts at the farm level to extension services because many factors affect the performance of irrigation extension services. Such factors include irrigation land relocation, irrigation input provision & timely availability, IWUA functionality, farmers awareness level, market infrastructures, DA and extension staff motivation etc.

Irrigation-extension intervention evaluators should be able to identify cause-and-effect relationships between an activity designed to induce change (such as a demonstration of home garden) and a particular desired outcome (such as increased vegetable consumption resulting in improved nutrition of family members). Understanding of such relationship/Cause and effect requires good evaluation design and statistical knowledge to analyze impact data. Absolute accuracy is neither necessary nor attainable. Therefore, extension evaluation should be structured to serve as a learning process. Extension evaluation is useful only to provide credible evidence to inform real decision-making at extension intervention policy, strategy and approach level.

Determining cause-and-effect relationships may require experimental or quasi-experimental research designs in which an experimental group(s) receives a specific treatment(s) while the control group receives no treatment. Use of a control group (also termed a comparison group) enables evaluators to discount many alternative explanations for the effect of the treatment. So, comparisons are essential in scientific investigations. In the case of irrigation extension, comparing farmers receiving extension
services with an equivalent group receiving no extension services makes it possible to draw well supported conclusions. However, to guide such evaluative studies, the extension staffs and policy makers must understand basic research designs, gather sound data, and use statistical tests to determine if changes are due to extension intervention. However, irrigation extension evaluation does not inevitably ensure that results will be used for intervention improvement. Thus, policy makers may consider many factors that influence the use of evaluation results through triangulating information about an extension program from advisors, colleagues, farmer organizations, interest groups, and/or the media.

7.3 Measuring Irrigation-Extension Services and Changes

Evaluators of agricultural extension services and programs have a variety of methodological approaches from which to choose, depending on the context, the length of implementation, purpose of the evaluation, and logistical constraints. A pre- and post-program evaluation can explain whether the program has had any effect on the participants. Two sample evaluation questions for a pre-/post-program assessment could be: Do irrigation farmers who attend training adopt irrigation full package than those who do not? Do farmers who attend extension training generate a higher net income per hectare than those who do not?

7.3.1 Extension Performance indicators

When objectives are met, and indicators are used to help determine the level of success. Monitoring is the process of recording these indicators, while evaluation is analyzing the recorded indicators and determining how to improve performance in the future. Using monitoring and evaluation tools is able to ensure that the implementation of irrigation extension programs follows their design and takes into account the interests of farmers. Effective monitoring and evaluation should provide relevant and accurate information, to the right people, at the right time, in the right format, to enable them to take timely decisions and action.

Extension performance indicators are measures of extension impacts, outcome, output and inputs that are monitored during extension activity implementation. Indicators are used later to evaluate extension impact success. Organize information in a way that clarifies the relationships between extension intervention impacts, outcomes, outputs and inputs that help to identify problems along the way that can impede the achievement of the intended objectives. There are various extension monitoring and evaluation indicators. However, following are the most common irrigation extension monitoring and evaluation indicators.

7.3.2 Indicators and Tools for evaluating irrigation extension impacts

Adoption of new technology and practices: this indicators shows the improvement of knowledge, skill and change in attitude of a farmer to learn, understand and apply new way of doing things to improve his/her production and productivity at any form. For example, improving produce quality/quantity, post-harvest etc.

Reduced Cost: This indicator measures the money saved by a participant due to irrigation-extension technology application. The cost could be in time, labor and other types of resource.

Savings: Similar to reduced cost, this indicator identifies the amount of savings or increased savings attributable to implementation of an irrigation farming or other practice learned from an extension program.
**Increased Income**: This indicator compares the income of an individual farmer/family due to extension intervention that participants earn before and after the program. For example, a farmer’s income may increase because of full package application i.e. planting improved variety of Potato or Tomato that has a higher yield per hectare, or because of value-added practices such as use of implementation of organic farming practices implemented because of extension information or training.

**Increased Productivity**: This indicator is derived by computing economic value by measuring the increase in productivity by the same amount of land or units of production due to adoption of a new practice learned from an extension program or demonstration. For example, extension programs teach farmers how to use a new technology. The higher profits from use of the new technology minus the cost of buying the technology equals increased productivity.

**Value added**: This indicator refers to the additional profit, or value, assigned to an irrigation crop or product that is used in a new way, or processed in a way that adds value beyond the cost of the processing. For example, an irrigation extension program that teaches horticulture producer farmers to use improved seed enables farmers to add value to his/her produce quality.

**Alternative Opportunity Cost of Capital**: irrigation extension programs can teach participants how to optimize/make more money by using existing capital (land, labor & management) in different or more efficient ways. For example, land could be used to grow a higher value crop. The income from the higher value crop is compared to the income from the lower value crop to estimate the economic worth of the extension program that made farmers aware of and assisted them in changing to the new, higher value crop. During this, the extension program may provide market information; assist farmers to prepared business plan etc.

**Willingness to Pay**: farmer’s willingness to pay to new technology/skill sprang from understanding of economic value of adopting and application of new technologies, knowledge, skills. Some item or service may be considered an economic benefit when this willingness exceeds what would be considered a standard norm for a product or service. If the price of a product is marketed more effectively, is a value-added product, or reaches a new niche business because of extension training or assistance, this willingness to pay can be considered the value of the extension services.

In general, the monitoring of irrigation-extension activities are conducted during implementation while evaluation is usually conducted after implementation. Monitoring comes first because without collecting information a valid evaluation is not possible. However, monitoring will only produce its full benefits if the collected information reviewed to learn lessons. This is evaluation. Information for planning irrigation extension activities comes from both evaluation and Irrigation Water Users Information Needs Assessment (IWUINA), the absence of either source of information will lead to low quality planning. In irrigation extension planning process, monitoring and evaluation are tools to help Woredas improve their performance. Extension monitoring and evaluation of irrigation activities are self-assessment processes, which need to be carried out by irrigation extension experts. There are two kinds of monitoring and evaluation important in ensuring effective participatory irrigation extension: assessment of process and assessment of outcome.

### 7.3.3 Assessment of process

The assessment of process is usually conducted during pre-feasibility stage of Participatory Irrigation Development Management (PIDM) for implementation of irrigation schemes for information collection of extension activities and about technology adoption. The process is generally a formative in nature, but can also be summative, for example, when the water users and extension experts need to know about
the actual performance and successes on technology adoption in line with work planning. This assessment
process of monitoring and evaluation is accomplished by conducting Technical Audits, these included:

- Scheme feasibility assessment and recommendation document
- IWUINA
- Annual irrigation extension planning
- Demonstrations and water user training register
- FTC trainee registration and graduation documents
- Monthly work schedules and DAs extension diaries
- Monitoring reports

Strength of the Process
Following are the some points on the strengths of process monitoring and evaluation is:

- Knowledge gained about the process that led to desired or undesired outcomes can feed into future adoption of irrigated crop production technology;
- Process can incorporate and cater for unexpected happenings,
- Process can inform WUA and relevant stakeholders what is going-on at scheme level, as it is common for plans to change considerably;
- Process monitoring, if done collaboratively, can strengthen a common understanding of irrigation extension program aims, objectives and purpose.

The Technical Audit
The purpose of Technical Audit is to monitor the implementation of all irrigation extension activities undertaken in SSI and HHMI schemes. In this regard, IADP experts and DAs will undertake Technical Audits to monitor on fortnightly basis:

- How the irrigation activities have been planned;
- How they are being implemented;
- Whether progress is being monitored by DAs and WUA (FFG leaders).

A Technical Audit has main two aims:

- To identify any misunderstandings and uncertainties amongst the water users, FFGs, or DAs regarding the processes of irrigation extension approach.
- To ensure that IADP experts are discharging their responsibilities assigned to them.

The Technical Audit Checklist is designed to help irrigation-extension experts to get an impression of the quality of implementation of SSI & HHMI schemes. These are not exhaustive and irrigation-extension expert or DA is free to add any further enquiries that they consider are necessary to get an accurate and comprehensive picture of various scheme’s implementation. The following is the summary of technical audit that needs to be conducted on fortnightly basis:
### 7.3.4 Assessment of Outcome

The assessment of outcome needs to be carried out toward the end of each SSI & MI schemes that is aimed at assessing the usefulness and effectiveness of the appropriate technologies generated and demonstrated on SSI&MI structures and homestead farming, management of irrigation schemes and introduction of improved crop cultivars and water management. Such assessment of outcome is undertaken to know the performance of irrigation extension approaches to establish whether the desired outcomes have been reached. The outcome is generally summative, but may be formative when the findings are used to improve future irrigated agricultural farming.
The above indicator (Process indicators) shows merely events and is not such detail. Composite indicators are developing to understand the event & its outcome/results. Arithmetic average of selected extension effectiveness indicators, say, awareness indicator (know the DAs), visit indicator (number of visits twice a month), IWUA indicator (meeting place at farmers’ fields), and regularity indicator (visit on the same day) can show the impact of the events. Hereunder are some critical irrigation extension impact/outcome evaluation indicators.

### Irrigation Extension Services Efficiency Monitoring Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Extension Performance Index (IEPI) in %</td>
<td>Actual number of farmers reached (Z) out of the target number (Y) which should be reached IEPI. i.e., ( \frac{Z}{Y} \times 100 = \text{IEPI} ) Where: Y is the total # target farmers, Z is actual # of farmers reached &amp; IEPI irrigation extension services performance index in percent</td>
</tr>
<tr>
<td>Irrigation Extension Diffusion Index (IEDI) in %</td>
<td># of farmers adopted recommended practice (A) out of the actual # of farmers reached (Z) in percent. i.e. ( \frac{A}{Z} \times 100 = \text{IEDI} ) where: Z is the actual farmers reached, A is # of farmers adopted recommended practices and IEDI is irrigation extension diffusion index in percent</td>
</tr>
<tr>
<td>Irrigation Extension Actual Achievement Index (IEAAI) in %</td>
<td>Number of farmers adopted recommended practice (IEDI) out of target number of farmers (Y). i.e. ( \frac{\text{IEDI}}{Y} \times 100 = \text{IEAAI} ) Where: IEDI is irrigation extension diffusion index, Y is the total # target farmers and Irrigation Extension Actual Achievement Index (IEAAI)</td>
</tr>
</tbody>
</table>

#### 7.3.5 Framework for irrigation extension evaluation

Evaluation of irrigation extension approach can employ more than one form. An evaluation strategy for irrigation extension includes four different forms of evaluation. This section underpins on more irrigation extension ‘approach-focused’ view of evaluation, and reviews some of frameworks to use to form an integrated evaluation plan for all irrigation extension activities.

#### 7.3.6 Irrigation extension evaluation Indicator (impact evaluation)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>Yield per hectare for high value irrigated crops (average)</td>
</tr>
<tr>
<td>Productivity index</td>
<td>Increase in yield over base year compared with base year(percentage)</td>
</tr>
</tbody>
</table>

#### 7.3.7 Who should do extension M&E

The Extension Process Unit (irrigation-extension experts and DAs) will need to take a major responsibility for conducting monitoring and evaluation of irrigation extension programs in SSI and MI schemes. The prime task delegated with M&E section may include:

**Baseline Surveys:** Under baseline surveys, data as to agricultural and socio-economic characteristics of beneficiary farmers are collected before the implementation of the scheme to facilitate future monitoring and evaluation. The beneficiary water-users should be selected based on a systematic stratified random sampling procedure. A requisite number of sample beneficiaries (respondents) should be selected for baseline survey in each scheme area.
The sampling procedure should be designed to have a representative sample of the farm households benefiting from the schemes to provide reasonable estimates of the various agricultural and socio-economic characteristics of the farm population. Baseline investigations should include all relevant cropping seasons related to particular agriculture levels and irrigation system. This is because the investigations on SSI/MI productivity needs to be undertaken in a single year may result in distorted impact, particularly in areas where annual climatic features are highly erratic. Therefore, emphasis should be given to estimate crop production and water usage. The survey needs to be concentrated on key variables in the development of the scheme viz. agricultural, engineering, socio-economic and institutional factors. The key performance indicators for baseline surveys could be:

<table>
<thead>
<tr>
<th>Agriculture</th>
<th>Type of Land Use; Cropped Area; Seed, Fertilizer &amp; Pesticide Use; Yield, Consumption and Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Water User Association</td>
<td>Committee effectiveness, Monthly Meetings and Annual Meetings</td>
</tr>
<tr>
<td>Availability of Irrigation Extension Services and Training</td>
<td>Extension Visits-frequency and context Comments on Training</td>
</tr>
<tr>
<td>Present Level of Operation &amp; Maintenance</td>
<td>Tank full of water; Present Irrigation Practices; Pumped periods &amp; Standard of maintenance</td>
</tr>
</tbody>
</table>

**Crop Cutting Surveys:** Crop cutting surveys are done as part of baseline and seasonal surveys for those crops planted in irrigation and water harvesting schemes to ascertain the actual productivity. This will enable the crop yield comparison before and after the implementation of the schemes.

**Cropping-Pattern:** Cropping pattern refers to the proportion of area under different crops at any given point of time in a unit area, or the yearly sequence or spatial arrangement of crops on a given area. Cropping activities may run all the year round, provided water is available for crops. It may be of different types such as inter cropping, mixed cropping & crop rotation.

**Cropping-Calender:** Mapping of crop calendar is a method of interpretation of agricultural practices at local level. Crop calendar shows the raising of crops in an area throughout the year. A cropping calendar is a schedule of the growing season from the fallow period and land preparation, to crop establishment and maintenance, to harvest and storage.

It allows a farmer to plan for input purchase and use, develop cash flow budget for the year, determine need credit and period requirement, determine labor requirements and plan for peak usage times, organize contractors for land preparation etc. This is because different crops grown in different season according to fluctuation in the physical, cultural & ecological conditions, particularly the socio-economic constraints. The long practice of canal irrigation raises some problems that disturbed the crop calendar.

**Irrigation scheduling:** Irrigation scheduling is the decision of when and how much water to apply to a field. The purpose of irrigation scheduling is to determine the exact amount of water to apply to the field and the exact timing for application. The amount of water applied is determined by using a criterion to determine irrigation need and a strategy to prescribe how much water to apply in any situation. Furthermore, irrigation extension assistance on this will help the farmers. It enables the farmer to schedule water rotation among the various fields to minimize crop water stress, maximize yields, and
hence improve IWUA effectiveness. It also reduces the farmer's cost of water and labor through less irrigation, thereby making maximum use of soil moisture storage, lowers fertilizer costs by holding surface runoff and deep percolation (leaching) to a minimum, increases net returns by increasing crop yields and crop quality. It minimizes water logging problems by reducing the drainage requirements and assists in controlling root zone salinity problems through controlled leaching and results in additional returns by using the saved water to irrigate non-cash crops that otherwise would not be irrigated during water-short periods.

**Monitoring/ Seasonal Surveys:** Monitoring/seasonal surveys are usually conducted for multiple cropping seasons in the areas of selected schemes with the objective of gathering information on a range of agricultural, institutional and hydrological characteristics, which are expected/tend to change, with a view to assess the performance of schemes.

<table>
<thead>
<tr>
<th>Agriculture</th>
<th>Water Availability for Field Crops Extension using Irrigation in the Area that Changes in Cropping Pattern Improvement in Productivity of Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Practices</td>
<td>Membership; Participation; Leadership Quality; Resource Mobilization; Collective Activity and its Achievements</td>
</tr>
<tr>
<td>Cropped Area and Cropping Intensity Crop yields</td>
<td>Irrigation Extension and Farmers Training</td>
</tr>
<tr>
<td>Frequency of visits; Type of advice and Method of Training; Number and Type of Demonstration Trials; and Performance of Irrigation Extension Experts and DAs</td>
<td></td>
</tr>
<tr>
<td>Hydrology and Scheme O &amp; M</td>
<td>Water Availability and Method of Delivery; Water Supply at Field Level; Efficiency and Equity of Water Distribution; Frequency and Standard of Maintenance; Annual O&amp;M, Expenditure and Water Charges, if any</td>
</tr>
</tbody>
</table>

**Hydrological Studies:** Hydrological studies are carried out as part of M&E of the program to relate rainfall in the catchment to changes in the tank levels including those associated with discharge from the tank. Hydrological studies undertaken in the scheme areas generally are of two types:

- Studies in the areas of schemes where baseline surveys completed; and
- In depth and periodical studies in the representative schemes areas where rain gauges, gauge plates, notches etc. installed.

It is recommended to consider model irrigation schemes for evaluation with other randomly selected schemes to get a comparison of performances. However, the following points should be taken into account while conducting detailed studies/surveys:

- Surveys are required to determine water users’ competence in irrigation practices and the need for training. Extension surveys are also needed to assess the possibilities of involving the water users in the improvements to be made and the organizational aspects relating to future O&M of watercourse. Special care should be taken that extension surveys result in practical and viable application.
- Evaluating the physical improvements (tertiary canal improvements, small hydraulic structures, land leveling, irrigation methods, etc.) is relatively easy, when suitable technical information exists but even when such information is not available, a survey can be made in a reasonably short time.
- Much more complex and time-consuming are surveys to determine the efficiency of water use at
the farm level. They should be undertaken for a complete irrigation season at least (under the assumption that it is climatologically representative of the average conditions). In order to know the amounts of water consumed annually, it is indispensable to set measuring devices at the farm intake. Installing them and checking on consumption is a time-consuming operation. The problem is obviously simplified in schemes where such devices are part of the irrigation network.

### 7.4 Choosing Suitable Evaluation Criteria and Indicators

In view to make an evaluation valid and useful to the results users, we must employ sound indicators to measure change. Indicators are observable phenomena that point toward the intended and/or actual condition of situations, programs, or outcomes. They are markers that can be observed to show that something has changed or improved. Indicators, when incorporated into an appropriate extension monitoring system, can help people notice changes at an early stage of a program’s implementation. Quality indicators of an evaluation process are that it must be relevant to extension objectives; simple and unambiguous; realizable given logistical, time, technical, or other constraints; conceptually well grounded; and can be updated at regular intervals.

Good evaluations start with baseline data to establish benchmarks. Baseline data are gathered before the start of intervention. Thus, having indicators identified early in a project planning process is critical. This helps to identify truly needed projects as well as to frame effective, efficient evaluations. Also critical to effective evaluation is selection of indicators that are appropriate to the project goals, objectives, and intended impacts. Examples of indicators to evaluate the effectiveness of extension programs focusing on agricultural production would be fundamentally different from programs intended to improve nutrition, even if planting of a new high yield, healthier variety of potato or rice might result in both types of impacts.

**The Results Chain**

- **Input**: The financial, human & material resources required to implement the operation.
- **Activity**: Actions taken or work performed through which inputs are mobilised to produce specific outputs.
- **Output**: The products, capital goods and services which result from implementation/operation.
- **Outcome**: The medium-term results of an operation’s outputs.
- **Impact/Goal**: The positive & negative, intended or unintended long-term results produced by an I operation, or national society, either directly or indirectly.
Impact to activity result chain indicate what the operation will do and what it seeks to achieve. Performance indicator and means of verification allow understanding how performance will be measured. Assumption and risk tell us; factors outside management control that may affect project performance.

<table>
<thead>
<tr>
<th><strong>Impact/Goal</strong></th>
<th>Performance indicators</th>
<th>Means of verification</th>
<th>Assumptions &amp; risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher objective to which this operation, along with others, is intended to contribute.</td>
<td>Impact - Indicators to measure irrigation extension programme performance.</td>
<td>Irrigation extension programme evaluation system</td>
<td>Risks regarding strategic Impact.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Outcome/Purpose</strong></th>
<th>Performance indicators</th>
<th>Means of verification</th>
<th>Assumptions &amp; risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>The outcome of an operation i.e. the change in beneficiary behavior, systems or institutional performance because of the combined output strategy &amp; key assumptions.</td>
<td>Outcomes- measures that describe the accomplishment of the Purpose. The value, benefit &amp; return on the Investment.</td>
<td>People, events, processes, sources of data for organizing the operation’s Evaluation system.</td>
<td>Risk regarding extension programme outcome</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Outcomes</strong></th>
<th>Performance indicators</th>
<th>Means of verification</th>
<th>Assumptions &amp; risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual deliverables. What the operation can be held accountable for producing.</td>
<td>Output indicators that measure the goods &amp; Services finally delivered by the operation.</td>
<td>People, processes, events, sources of data supervision &amp; monitoring system for validating the Operation’s design.</td>
<td>Risks regarding design Effectiveness.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Activities</strong></th>
<th>Performance indicators</th>
<th>Means of verification</th>
<th>Assumptions &amp; risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>The main activity clusters that must be undertaken in order to accomplish the Outputs.</td>
<td>Inputs/Resources Budget by activity. Monetary, physical &amp; human resources required to Produce the outputs.</td>
<td>People, events, processes, sources of data – monitoring system for validating Implementation progress.</td>
<td>Risks regarding Implementation &amp; efficiency.</td>
</tr>
</tbody>
</table>

### 7.4.1 How to Select Extension Progress and Impact Indicators

The following are major (not limited to) criteria to select extension monitoring and evaluation indicators.

An appropriate, effective indicator must:

- be measurable
- be relevant to the impact being evaluated
- be easy to use
- result in representative results
- be easy to interpret
- be responsive to changing inputs
- have a reference against which to compare it
be measurable at a reasonable cost; and
be updateable.

7.4.2 Measuring and reporting irrigation extension M&E objectively

Extension evaluation essentially involves measurement of indicators by collecting quantitative and qualitative data. Quantitative methods measure a finite number of pre-specified outcomes and are appropriate for a wider range of extension interventions programs that intend to judge effects, attribute cause, compare or rank, classify, and generalize results. For example, impact of FTC training and demonstration, IWUA effectiveness, irrigation input provision and distribution system. These methods are accepted as credible and applicable to large populations, particularly when generalizing is important. Qualitative methods take many forms, including rich descriptions of people, places, conversations, and behavior. The open-ended nature of qualitative methods allows farmers to answer questions from his/her own experience and perspective. Qualitative methods yield good evaluation data as long as they are collected objectively and reported as unbiased way as possible.

Using mixed methods, quantitative data can be complemented with qualitative information to provide a richer description of extension intervention impacts. Validity and reliability of data collection instruments are related directly to objective measurement. Validation and reliability of the extension assessments can be improved through:

- Use a panel of experts consisting of persons who are knowledgeable of the extension intervention
- Panel members review the instrument in terms of its content, format, and audience appropriateness.
- Check whether the extension assessment instrument consistently yield the same results with the same group of people under the same conditions
- Reliability looks for consistency, accuracy, and dependability of an instrument.
- Usually, reliability is established by conducting a pilot test or pre-test. Pre-testing can prevent costly errors and wasted effort.

Fig-3: Various techniques and tools used for evaluation at three stages in irrigation extension

<table>
<thead>
<tr>
<th>Stage</th>
<th>Types of Studies</th>
<th>Technical Questions</th>
<th>Examples of Evaluation Tools and Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Extension Planning Stage</td>
<td>Needs Assessment</td>
<td>What are farmers felt and unfelt needs? Can extension address these needs? Do they fit with irrigation extension’s mission? Is the intervention socially, economically, environmentally feasible?</td>
<td>Surveys, Focus Groups, Observation, Content Analysis (e.g., of office records), Economic Analysis (e.g., benefit/cost analysis)</td>
</tr>
<tr>
<td></td>
<td>Feasibility Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baseline Study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Implementation Stage

<table>
<thead>
<tr>
<th>Extension Intervention Monitoring Evaluation</th>
<th>Is the irrigation-extension intervention meeting its objectives of intended outcomes? Are the farmers satisfied with the intervention? Are the media delivering program messages?</th>
<th>Annual Monitoring Reports (e.g., staff time and activity reports, irrigation crop yield, seed &amp; fertilizer cost) Adoption patterns for new irrigation technology Evaluative assessments of Knowledge, Attitude, and Behavior Change Farmers satisfaction surveys Content Analysis of News Releases</th>
</tr>
</thead>
</table>

### Impact/Results Stage

<table>
<thead>
<tr>
<th>Impact Assessment Summative Evaluation</th>
<th>Has the irrigation-extension program intervention addressed the needs or gaps identified? Is the irrigation-extension program intervention achieved desired outcomes? Is the irrigation-extension program intervention cost-effective?</th>
<th>Pre- and Post- extension intervention data analysis Cohort Studies Panel Studies Surveys (e.g., personal interviews, online surveys) Economic Analysis</th>
</tr>
</thead>
</table>

#### 7.4.3 Selecting Appropriate Data Sources

Extension monitoring and evaluation data sources also are important. Monitoring and evaluation data can be gathered from primary or secondary sources. Primary sources include original policy and strategic documents. Secondary sources are materials that combine and synthesize data from multiple primary sources. There is no one best method. Selecting appropriate data sources is based on the relative merits of each source and influenced by the type of information desired, time availability, and resources available to conduct monitoring and evaluation.

#### 7.4.4 Carefully Selecting, Training, and Monitoring Data Collectors

Surveys and personal interviews are popular forms of data collection for monitoring and evaluating extension intervention programs. Evaluation, generally utilize more than one person to collect data. Although many factors may affect data quality, minimizing interviewer variance is critical for acquiring valid and reliable data. In addition to potential diversity among interviewers, there exists a variety of factors reflecting interviewers’ interactions, and this is with interviewees, the instrument, and the interview context that might affect quality of data. Careful selection and training of interviewers can help ensure data quality and consistency. If possible, extension intervention should identify and select data collectors at the time of finalizing data collection instruments and plans.

They must understand the local culture and should have good reading and writing skills, good listening skills, and the ability to build rapport quickly. Training of data collectors is essential prior to actual data collection. Training topics should include, as relevant to a specific evaluation, an introduction to the study, role of the interviewer, confidentiality procedures, and review of the questionnaire and interview protocols, standardized interviewing techniques, probing, recording responses, gaining cooperation, and
presentation of scenarios. Pre-testing or pilot testing of instruments offers an opportunity for hands-on training for data collectors.

### 7.4.5 Selecting Randomized and/or Representative Samples

Evaluation of extension intervention programs usually involves first-hand collection of data from people. Thus, the evaluator must make numerous decisions about the sample population then develop an appropriate sampling plan. Rather than surveying every person in a given population (census), evaluators often survey or interview a sample of the population. Using samples is less costly in terms of time, money, materials, human resources, and effort than surveying or interviewing an entire population. Sample size and type depends on what extension intervention is to be evaluated and whether the selected methodological approach is quantitative or qualitative.

Sampling methods usually are categorized in two types: random (probability) sampling and purposeful (non-probability) sampling.

#### 7.4.6 Selecting a Sample Using Random (Probability) Sampling

Random, or probability, sampling is based on random selection of units (farmers) from the identified target population. This sampling method eliminates subjectivity in choosing a sample and provides a statistical basis for claiming that a sample is representative of the target population. Every member of the target population has a known probability of being included in the sample. Several types of random/probability sampling techniques are available to evaluators most common are simple random sampling, stratified random sampling and cluster random sampling.

#### 7.4.7 Appropriately Analyzing Data

Sound design and sampling of extension evaluation is necessary, but not sufficient, to ensure a quality evaluation appropriate and robust statistical analysis is critical to credible results. Choice of analytical technique depends, in part, on whether the data are quantitative or qualitative. But rigor is an essential characteristic for both.

### Steps in the Design of irrigation extension Monitoring and Evaluation System

<table>
<thead>
<tr>
<th>Steps</th>
<th>To do list</th>
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| Check the operation’s design | Review and revise (and if necessary prepare) a framework  
Ensure that objectives for Goal (impact), Purpose (outcome), Outputs and Assumptions are clearly stated and measurable. Ensure that indicators are adequately specified with quantity, quality and time. |
| Assess capacity for M&E    | Identify what human and financial resources are available. Assess training requirements for all monitoring staff, both from International Federation and National Societies and counterpart bodies.  
Specify training requirements |
| Plan for data collection and analysis | Check existing information sources for reliability and accuracy, to determine what data is already available. Decide what additional information should be collected, for baseline purposes, monitoring and for evaluation. Set a timeframe and schedule for data collection and processing, and agree on responsibilities. |
Prepare M&E plan and budget

Summaries agreed information needs data collection, information use, reporting and presentation in a monitoring and evaluation plan. Summaries capacity building and support requirements. Cost all monitoring and evaluation activities, and identify funding sources.

Plan for reporting and feedback

Design the reporting system, specifying formats for reports. Devise a system of feedback and decision taking for management.

7.4.8 Quantitative analysis

Evaluation data usually are collected in the form of numbers. Quantitative data help determine relationships or differences between variables. Correlation statistics measure the relationship between two variables, often between a dependent variable and an independent variable. Correlations are used with questions such as: Do farmers who attend irrigation-extension training on a regular basis adopt more new practices than those who do not? Are female farmers more likely then male farmers will adopt improved seeds for their HHMI schemes?

7.4.9 Qualitative Analysis

Qualitative data are mainly narrative data that come in many forms and from a variety of sources. Sources include personal interviews, focus group interviews, key informant interviews, case studies, daily journals and Development agent diaries, documents, and testimonials or storytelling based on personal accounts of experience. Data collection primarily involves the use of participatory methods. Use of participatory methods enables inclusion in impact evaluations. Extension intervention evaluators who specialize in qualitative analysis use a method called ‘content analysis. Content analysis is a systematic technique for analyzing the substance of a variety of documents, records, and open-ended survey comments. This process includes carefully reading the information, then identifying, coding, and categorizing the main themes, topics, and/or patterns in the information.

7.4.10 Communicating and Utilizing Extension Evaluation Findings

The most challenging task to transform Ethiopia’s agriculture through implementation of pluralistic extension system and by providing demand-driven and market-led extension services to male, female and youth farmers is to develop useful results from the data and then to share the results with its users. Extension Core Process Owners have a responsibility to report evaluation findings to extension staffs and stakeholders who may have an interest in the results. Use of findings means making thoughtful and deliberate decisions based on those results. Thus, communication with stakeholders should occur throughout the evaluation process to help ensure meaningful, acceptable, and useful results. Reports, media, public meetings, workshops, bulletins, and brochures, web pages can be used to communicate the findings and recommendations as required.
Examples of Monitoring and Evaluation Plan Achievement impact, outcome, output, activity and input of Activity Goal Means of Verification

<table>
<thead>
<tr>
<th>Information Requirements</th>
<th>Indicators</th>
<th>Means of verification</th>
<th>use of information</th>
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<tr>
<td></td>
<td></td>
<td>Data source</td>
<td>Frequency of collection</td>
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<td>Impact/ Goal</td>
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<td>Outcome/Purpose</td>
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<td>Output</td>
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<td>Input</td>
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7.5 References

- Noor, Sajjad (2007), Guidelines on Technology Development Team for Amhara region, SWHISA and BoARD, Amhara region, Ethiopia, 2007