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| FINLAND | Finnish Environment Institute (SIKE) |
| ITALY | Centro Internazionale di Alti Studi Agronomici Mediterranei di Bari (CIHEAM-Bari) |
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| KENYA | Kenya Agricultural & Livestock Research Organization (KALRO) |
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Table of Contents

| | |
|---|----|
| Executive Summary | 6 |
| 1. Introduction..... | 7 |
| 1.1 Background..... | 7 |
| 1.2 Purpose, Context and Scope of this Deliverable | 8 |
| 1.3 Structure and Content of the Deliverable | 8 |
| 2. Context | 9 |
| 2.1 Project Objectives and Impacts | 9 |
| 2.2 Target Audience..... | 9 |
| 3. Methodology | 10 |
| 3.1 Methodological Framework | 10 |
| 3.2 Workshop Methodology..... | 11 |
| 3.3 Stakeholders | 11 |
| 4. Key Outcomes from Local Stakeholder Meetings | 13 |
| 4.1 Exploitation of Water Resources | 13 |
| 4.2 Soil Management..... | 13 |
| 4.3 Crop Management..... | 14 |
| 4.3 Climate Change..... | 14 |
| 4.4 Policy..... | 15 |
| 4.5 Multi-stakeholder Partnerships..... | 15 |
| 4.6 Knowledge Sharing | 15 |
| 5. Conclusions..... | 16 |
| References..... | 17 |
| 6. ANNEXES..... | 18 |
| 6.1. Annex 1 – Egypt Local Stakeholder Meeting Report | 19 |
| 6.2. Annex 2 - Kenya Local Stakeholder Meeting Report | 20 |
| 6.3. Annex 3 - Sudan Local Stakeholder Report | 21 |
| 6.4. Annex 4 - Ethiopia Local Stakeholder Meeting Report..... | 22 |

Index of Figures

| | |
|--|----|
| Figure 1 - Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors’ Regional meeting (3) and beyond (4)..... | 10 |
| Figure 2 - Spider graphs displaying examples of Group evaluation (a) and Needs evaluation (b)..... | 11 |
| Figure 3 - Crop destroyed by Hail storm..... | 14 |

Index of Tables

| | |
|---|----|
| Table 1 - Target stakeholders consulted during the local meetings. | 12 |
| Table 2 - Calendar for local meetings held in 2022. | 12 |

Acronyms and Abbreviations

| | |
|----------|--|
| AICS | Italian Agency for Development Cooperation |
| ASARECA | Association for Strengthening Agricultural Research in Eastern and Central Africa, Uganda |
| AU-EU | Africa-Europe |
| CIHEAM | Centre International de Hautes Etudes Agronomiques Méditerranéennes, Italy |
| CNR- | Consiglio Nazionale delle Ricerche, Italy |
| DG DEVCO | The Commission's Directorate-General for International Cooperation and Development |
| EARI | Ethiopian Institute of Agricultural Research, Ethiopia |
| EU | European Union |
| FAO | Food and Agricultural Organization of the United Nations |
| HRC | Hydraulics Research Center- Ministry of Water and Irrigation- Gezira, Sudan. |
| HU | Heliopolis University, Egypt |
| ISRIC | International Soil Reference Center, The Netherlands |
| IWUA | Irrigation Water Users Association |
| KALRO | Kenya Agricultural & Livestock Research Organization, Kenya |
| KU | Khartoum University, Sudan |
| NRC | National Research Council, Sudan |
| R&I | Research and Innovation |
| WRC | Water Research Centre, Sudan |
| SACCO | Savings Credit and Cooperative Organizations |
| STI | Science, Technology and Innovation |
| SYKE | Finnish Environment Institute, Finland |
| WATDEV | Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in North and East Africa |
| WLRC | Water and Land Resources Center, Ethiopia |

Executive Summary

East African region has great potential to feed itself and play a strategic role in global food systems due to its large natural resource base, expanding population engaged in agricultural sector and emergence of new markets. The agricultural sector can boost investment, provide opportunities for employment, contribute to poverty eradication and foster food security and human well-being within the region. However, food security and agricultural development in East Africa are constrained by increased incidences of more extreme and erratic climatic conditions associated with erratic rainfall, large inter-annual variability, and frequent droughts due to climate change.

The purpose of the project is to promote sustainable agricultural water management innovative solutions and resilience of agro-ecosystems to climate change in Egypt and Eastern Africa. To achieve this the project carried out inventory of BMPs and intends to deploy agricultural water related BMPs and Innovations (innovative technical and non-technical solutions) in the selected study areas. It's anticipated that, the project will deliver five (5) specific deliverables.

The overall objective of these local meetings was to carry out community needs assessment and conduct a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices. Based outcome of the local meetings, the key conclusions were: (i) smallholder farmers across all the target countries are currently organized in formal groupings which enhances collaboration; (ii) smallholder farmers are willing to adopt new best management practices as long as they have knowledge and information about the innovative solutions; (iii) there is need to raise awareness about innovative technical solutions that are available for sustainable management of soil and water and this should be accompanied by targeted training on how to use the BMPs for wider adoption; (iv) it's important to address market constraints along specific value chains targeted by the project as this will catalyze the adoption of the BMPs; and (vi) there are plausible policy issues that need to addressed through introduction of specific policy measures as a means of promoting sustainable management of soil and water resources in the project countries.

1. Introduction

1.1 Background

The East African region undoubtedly has great potential to feed itself and play a strategic role in global food systems due to its large natural resource base, expanding population engaged in agricultural sector and emergence of new markets. The agricultural sector can boost investment, provide opportunities for employment, contribute to poverty eradication and foster food security and human well-being within the region. However, food security and agricultural development in East Africa are constrained by increased incidences of more extreme and erratic climatic conditions associated with erratic rainfall, large inter-annual variability, and frequent droughts due to climate change. On the other-hand, soil, land, water, and ecosystems degradation further limits the sector's productivity. Furthermore, economic barriers such as lack of access to inputs, markets, capital, credit, and finance, coupled with poor infrastructure, significantly constrain the transformation of the agricultural sector.

Agriculture accounts for 70% of total global freshwater withdrawals, making it the largest user of water. Simultaneously, food production and supply chains consume about 30% of total energy consumed globally. This situation is expected to worsen in the near future as 60% more food will be required to be produced in order to feed the world population by 2050. To mitigate against this development challenge, it's critically important to accelerate and scale up innovations that foster sustainable water and energy use in agriculture sector so as to trigger transformation in the water-agriculture and energy nexus. Managing water utilization in East African will entail a well-coordinated action aimed at promoting sustainable use of agricultural water resources. Yet, the benefits accruing from such interventions are threatened by high population pressure, unplanned rural developments and lack of alternative livelihood opportunities leading to un-sustainable actions like deforestation, overgrazing, soil, and water degradation ultimately translating to reduction in agricultural productivity. Limited resilience and innovation as well as management gaps in management of water, soil and land resources are some of the concerns that need to be addressed and call for increased multi-country and multi-actor joint efforts towards agricultural water research, innovation and capacity building at different levels and scales.

CIHEAM-BARI in collaboration with other European (SKYKE, CNR and ISRIC) and African partners (KALRO, WRLC, WRC, and HU) are implementing the Climate Smart WATER Management and Sustainable Development for Food and Agriculture in East Africa (WATDEV) program to promote innovation at the water, energy and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project aims to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. This report details activities and events undertaken to select a list of BMPs that can be deployed in the target countries (Egypt, Sudan, Ethiopia and Kenya) to facilitate sustainable management of water and agricultural resources in Eastern Africa. The activities implemented included: (i) meeting with local stakeholders on BMPs evaluation process, (ii) identification and constitution of stakeholder forum platform; and (iii) site specific brokerage meetings. Activities implemented will contribute to R1 on "Best fitting MBPs and innovations in project countries selected".

1.2 Purpose, Context and Scope of this Deliverable

The WATDEV project aims to leverage on the wealth of available data from various research and cooperation projects related to delivery of good agricultural and water management practices and innovative solutions with impacts on small farm scale, which can be scaled up to deliver impacts at large scale (catchment, watershed and basin level) and inform policy decisions at regional level. The project therefore seeks to scale out the innovative solutions and best management practices (BMPs) to wider geographical areas thereby delivering impact at scale.

The purpose of the project is to promote sustainable agricultural water management innovative solutions and resilience of agro-ecosystems to climate change in Egypt and Eastern Africa. To achieve this the project carried out inventory of BMPs and intends to deploy agricultural water-related BMPs and Innovations (innovative technical and non-technical solutions) in the selected study areas. It's anticipated that, the project will deliver five (5) specific deliverables including: **(i)** best fitting BMPs and Innovations in project countries selected **(R1)**; **(ii)** enhanced implementation of BMPs/innovations in study areas **(R2)**; **(iii)** BMPs /Innovations upscale and out scale scenarios performed **(R3)**; **(iv)** A water planning/management toolbox available for Researchers and Institutions **(R4)**; and **(v)** Strengthened knowledge and capacity building and established regional "Water Knowledge" Hub **(R5)**. The current deliverable (D1.3.2) contributes to the R1 on best fitting BMPs and Innovations in project countries selected and provides details on implementation local stakeholder meetings in the four (4) African countries.

The overall objective of these local meetings was to carry out community needs assessment and conduct a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices.

The scope of the deliverable covers the following activities: (i) meeting with local stakeholders on BMPs evaluation process; and (ii) site specific brokerage meetings. The deliverable covers the outcomes of the local stakeholder and brokerage meetings in Kenya, Ethiopia, Sudan and Egypt expected to define the base approach for BMPs' implementation (i.e., farmers or community level) along with BMPs' suitability (need based BMPs selection) thereby defining main factors influencing the BMPs selection at national level. It's anticipated that this process will allow the project team to build an assessment conceptual framework to evaluate BMPs while considering factors and variables at the base of their success or failure.

1.3 Structure and Content of the Deliverable

Deliverable D1.3.2 Consolidated Report on the Local Stakeholder Meetings in Kenya, Ethiopia, Sudan and Egypt

The structure for the D1.3.2 report is as follows: (i) executive summary, (ii) introduction (purpose, context and scope of the deliverable; and structure, content of the deliverable), (iii) context (project objectives and impacts; communication and dissemination, and target audience), (iv) conclusion; (v) references; and (vi) annexes (individual country reports).

The deliverable provides content from the following activities that were implemented during this reporting period:

- a) Meeting with local stakeholders in Kenya, Ethiopia, Sudan and Egypt.
- b) Site specific brokerage meetings.

2. Context

2.1 Project Objectives and Impacts

(a) Project Objectives

The overarching objective of the project is to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. The specific objectives include:

- 1) National Ministries and Research Institutions improve their knowledge and management of water in agriculture; and
- 2) Farmers and local actors, cooperatives and Water User Associations implement innovative/sustainable solutions and skills on water management.

(b) Project Impacts

It's anticipated that the activities under D1.3.2 will contribute to the delivery of the following early and long-term outcomes:

- 1) Farmer associations are aware of and experienced on BMPs and innovations.
- 2) Farmers and local actors implement innovative and sustainable solutions and skills on water management.

2.2 Target Audience

The activities implemented under this deliverable (local stakeholder meetings, and brokerage meetings) targeted audience drawn from the following stakeholder categories:

- (i) Policy,
- (ii) Organization and
- (iii) Financial/Economy.

The audience targeted in each country are summarized in Table 1.

3. Methodology

3.1 Methodological Framework

Implementation of local stakeholder meetings directly contribute to Result R1 on “Best fitting MBPs and innovations in project countries selected”. The local meetings aimed at applying an evaluation framework that would lead to the selection of the BMPs suitable for implementation in the study areas. The BMPs were selected from among those already collected, described, and evaluated – available in the Repository. Figure 1 (below) shows the methodology that was followed in the implementation of the local meetings (1) and links the multi-actors’ regional meeting (3) through matching and selection of BMPs (2). Figure 1 also shows how steps 1 to 3 feed into step 4 on other WATDEV planned activities (awareness, training, feasibility, modelling, etc.).

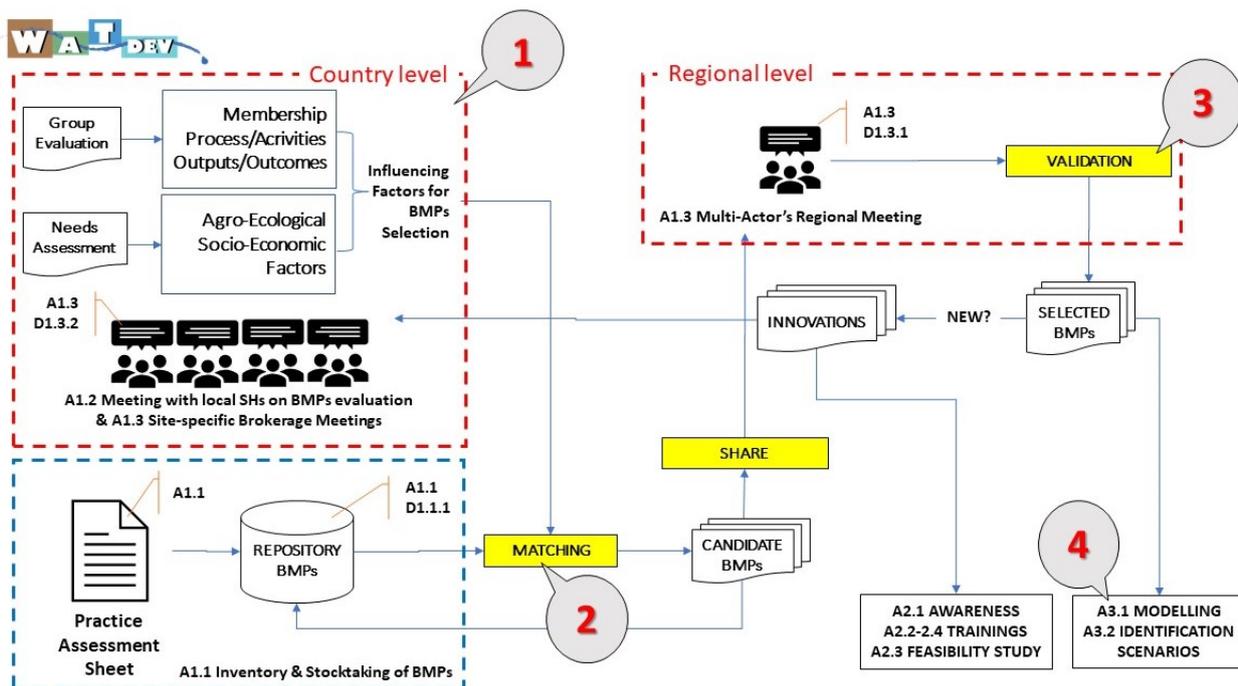


Figure 1 - Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors’ Regional meeting (3) and beyond (4).

As in the figure 1, the process is articulated into 4 steps as follows.

- I. During the local meetings, an assessment and evaluation with the local’s actors was performed. Such evaluation entailed: a) evaluation of local community needs to assess the group’s flexibility or needs in terms of area of application of BMPs; and (b) group evaluation to qualitatively assess the working group, describing: (i) the groups’ ability to collaborate and work together and the inclusiveness, (ii) the groups’ consistency and cohesion in terms of performing new processes and activities, and (iii) the groups’ ability to share individual benefit with the whole community.
- II. The outcomes of the local meetings, after a scoring procedure, was plotted using spider-graphs (see figure 2) showing the overall attitude of the local communities to put in place management practices. In line with their preferences, a matching exercise was performed to extract the “candidate” ones, from among the practices collected and available in the BMPs repository.

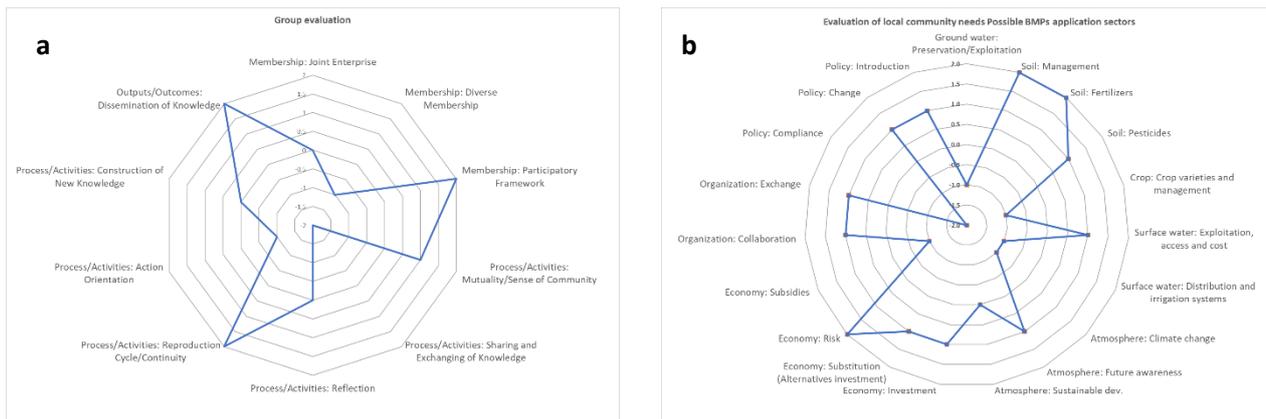


Figure 2 - Spider graphs displaying examples of Group evaluation (a) and Needs evaluation (b).

- III. The candidate BMPs pre-selected will be further discussed and validated during the multi-actor’s regional meeting (A1.3) that will be held in March 2023. This meeting will bring together a number of stakeholders (identified through stakeholder analysis at regional level. This meeting will aim to validate the BMPs that are titled to be modelled afterword (Activity 3.1). The selected BMPs could be suitable to be applied in a certain study area, and yet may not be known from the local farmers’ perspective. The regional multi-actor meeting will also further explore the feasibility of public-private partnerships to support implementation of BMPs in the target countries.
- IV. The BMPs selected after the A1.3 Multi-Actors’ Regional Meeting will be subjected to the integrated modelling processes and the simulation of possible impact scenarios due to their upscaling/out scaling, from the areas of implementation to large-scale catchments within - and possibly beyond - the study areas.

3.2 Workshop Methodology

The WATDEV Local Meetings were held over a period of two days in each country (Egypt, Sudan, Ethiopia and Kenya). The meetings were attended by both physical and online participants via zoom platform. Day 1 of the local meeting was dedicated to the dissemination event and evaluation of BMPs while Day 2 focused on the site visit and site-specific brokerage meeting. On the first day, a typical local event in each country comprised of the following sessions: (i) opening session (official opening presided by high level stakeholders); (ii) presentations on the project and plenary discussions; (iii) discussions/meetings to evaluate the needs of the communities with regards to the best management practices; and (iv) wrap. On day 2, the stakeholders engaged in field visit and participatory evaluation of the local stakeholders’ ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences. The local meetings were facilitated by ASARECA, HU, WRC/KU, WLRC and KALRO in collaboration with CIHEAM-BARI Team.

3.3 Stakeholders

The local stakeholders that attended the meeting were drawn from the following stakeholder categories: (i) Policy (Community representatives, Elected representatives, Local decision makers, Universities, National Water Research Centres, Ministry of Agriculture, and local authorities); (ii) Organization (Water users’ representatives, Opinion leaders, Members of the Stakeholders’ Forum, NGOs representatives, Staff working in the project area and Farmer representatives); and

(iii) Financial/Economy (Agricultural Finance Banks, Private Sector Actors, Input Suppliers; Micro-Finance Institutions).

Table 1 - Target stakeholders consulted during the local meetings.

| Stakeholder Category | Project Country | | | |
|----------------------|---|---|---|---|
| | Egypt | Sudan | Ethiopia | Kenya |
| Policy | <ul style="list-style-type: none"> - Heliopolis University - Zagazig University - Ministry of Agriculture - NRC - Local Authorities (Belbies District) | <ul style="list-style-type: none"> - Khartoum University - WRC - Gezira Board - Ministry of Irrigation/HRC - ARC (Wadi Madni) | <ul style="list-style-type: none"> - Federal Parliament (Agricultural standing Committee) - Amhara Bureau of Agriculture (ABOA) - MOA - EIAR - Regional Agriculture Research - Bahir Dar University - Koga Irrigation Scheme | <ul style="list-style-type: none"> - Pwani University - National Irrigation Authority, - Tana Irrigation Scheme - Directorate of Agriculture - KALRO - Local Administrative Leaders |
| Organization | <ul style="list-style-type: none"> - IWUA - Land Owners - Village Elders - Local Farmer Leaders - Local Producer Association - Farmer Cooperatives - Staff working in the project area | <ul style="list-style-type: none"> - Water Users Association - Tayba Farmers Union - Gezira Irrigation Staff - Youth Parliament for Water | <ul style="list-style-type: none"> - Koga Irrigation Farmers' Union - Lead Farmers - Contract Farmers - Village Elders | <ul style="list-style-type: none"> - IWUA - Village Elders (men and women) - Lead Farmers - Local Producer Association (Umoja United F/G) - Concern World Wide - Irrigation Staff |
| Financial/Economy | <ul style="list-style-type: none"> - Sekem for Land Reclamation | <ul style="list-style-type: none"> - Private Sector (Mahjoub & Sons) - Sudan Agricultural Bank - Dal Food (Dairy & Beverages) | <ul style="list-style-type: none"> - Private Entrepreneurs - SACCO | <ul style="list-style-type: none"> - Agrovet / Input Supplier (Syngenta) - Agricultural Finance Coop- Bura - Private Investor (Digi Farm) |

The total number of participants that participated in the local meetings as well as the meeting dates for the local events is shown in Table 2.

Table 2 - Calendar for local meetings held in 2022.

| # | Country | Meeting dates | Participants | | |
|---|--------------|-----------------|--------------|--------|------------|
| | | | Physical | Online | Total |
| 1 | Egypt | September 14-15 | 37 | 3 | 40 |
| 2 | Kenya | October 18-19 | 34 | 2 | 36 |
| 3 | Sudan | October 22-23 | 49 | 1 | 50 |
| 4 | Ethiopia | October 27-28 | 35 | 4 | 39 |
| | Total | | | | 165 |

4. Key Outcomes from Local Stakeholder Meetings

The WATDEV local stakeholder meetings were held in four countries (Kenya, Ethiopia, Sudan and Egypt). The local meetings: (i) raised awareness about the WATDEV project, (ii) investigated soil and water management practices in the agriculture sector, (iii) assessed the needs of stakeholders with regards to utilization of potential BMPs and how cooperation can be improved among various stakeholders; (iv) assessed the agricultural water and soil practices applied in the study area; (v) examined the community's gaps, and needs as well as their ability to adopt changes; and (vi) determined the community's priorities based on the intended changes.

The highlights of the key issues that emerged from these meetings are discussed below.

4.1 Exploitation of Water Resources

(a) Exploitation of surface water

The results from the local meetings indicate that all the target countries are exploiting surface water mainly through surface irrigation. Ground water is majorly used for agricultural production. In Egypt and Sudan, the irrigation infrastructure is old and dilapidated leading to loss of water through leakage. There is a motivation to preserve surface water sources mainly through use of modern and efficient irrigation technologies such as drip irrigation systems. However, the capital investment for such modern irrigation infrastructure is too high and a majority of smallholder farmers cannot afford it. This calls for strategic government intervention governments in terms of: (i) providing targeted support for rehabilitation and maintenance of the water distribution systems; and (ii) providing infrastructure subsidies to enable farmers acquire the modern irrigation equipment. Efficient irrigation water uses and management needs to be enhanced as water is becoming scarce due to climatic changes and competing uses.

(b) Exploitation of ground water

Exploitation of groundwater sources to supplement surface water sources for agricultural production was higher in Egypt compared to Sudan, Ethiopia, and Kenya. In Sudan, Ethiopia and Kenya, groundwater sources are mainly exploited for domestic use. Some have developed National Irrigation Strategic Plans which articulate strategic interventions for exploitation of groundwater sources for agricultural production in the near future. Ground water exploitation is limited due to poor water quality and the depth of the water, making it costly.

4.2 Soil Management

Across the 4 countries (Egypt, Sudan, Ethiopia, and Kenya), farmers are largely practicing soil management practices characterized by heavy use of inorganic fertilizers and pesticides which is environmentally un-sustainable as it negatively affects the soil biodiversity. There is very limited use of bio-fertilizers with very few farmers using organic fertilizers compared to those using inorganic fertilizers. Yet for environmentally sustainable soil management, use of both organic and inorganic fertilizer to ensure adequate supply of plant nutrients and sustain maximum crop yields and profitability is recommended (Kugbe *et al*, 2019). There is a strong motivation to use bio-fertilizers and organic pesticides at least in Egypt and to some extent in Ethiopia due to emergence of niche markets in Europe that do not allow use of chemical inputs (pesticides and fertilizers) in production of food crops. Many smallholder farmers are either unaware about the availability of soil and water conservation practises or do not have the prerequisite skills for application of available innovative solutions which calls for coordinated and targeted efforts in building their capacities.

4.3 Crop Management

(a) Crop Rotations

There is limited practice of crop rotations and multi-cropping across the four intervention countries. Absence of crop rotations in Ethiopia was attributed to high use of inorganic fertilizer which does not justify crop rotations previously used to improve nutrient recycling and soil fertility. In Egypt, there was lack of awareness on the beneficial effects of crop rotations and were looked like a traditional practice rather than a beneficial practice for maintenance of soil fertility.

(b) Market Opportunities

Lack of market access is a challenge in all the four (4) countries. Choice of crop commodity is largely determined by availability of the market and water resources. Countries such as Egypt, Sudan, Kenya, and Ethiopia reported that linkage to the market through contract farming was more profitable and beneficial for farmers to ensure sustainable engagement in crop production. Available evidence indicates that market access can catalyze adoption of productivity enhancing inputs (Shilpa et al, 2022) as well as soil and water management practices (Gidoi et al, 2013). Efforts towards supporting sustainable marketing approaches such as: collective marketing, through farmer associations and cooperatives; warehouse receipt system; and contracting farming should be recommended and promoted by the project.

4.3 Climate Change

Climate change has affected smallholder farmers in all the target countries, mainly manifesting increased incidences of drought, rainfall variability, hailstorms, frost, increased heat stress and shifting of cropping calendars. There is need to raise awareness about climate change and promote adoption of climate resilient technologies (CSA technologies and innovations) in order to mitigate climate change impacts. There is need also to build the capacities of the small holder farmers in using tools such as early warning systems and weather forecasts as decision support tools to mitigate against effects of climate change (Maarten van Ginkel and Chandrashekhar 2021). To counter climate change impacts, farmers also need to diversify their farm enterprises as a coping strategy and invest in proven CSA technologies and innovations including agroforestry.



Figure 3 - Crop destroyed by Hail storm.

4.4 Policy

There are plausible policy issues that need to address through introduction of specific policy measures as a means of promoting sustainable management of soil and water resources in the project countries. There is need for introduction of a policy to regulate distances between boreholes/ground wells in Ethiopia. It's anticipated that such a policy would regulate unsustainable exploitation of water sources. There is also the need to introduce a policy to regulate free range grazing of livestock to control destruction of soil and water conservation structures thereby contributing to sustainable land and water management. In both Kenya and Ethiopia land in the study areas belongs to the government and it's leased out to farmers. Policy on land tenure and administration affects adoption of soil and water conservation measures or farmer investments for land improvement (Place et al., 2000; Pender et al., 2001a; John Pender 2001b; and Muluken et al., 2020). Policies especially on land tenure need to be reviewed to allow for land ownership within the irrigation schemes. It's anticipated that such a policy review would also allow for the expansion of the irrigation schemes. Compliance to policy regulations was a major challenge in Egypt.

Sudan has mainly obsolete laws and regulations (as contained in the Gezira scheme law, irrigation law, farmers' union law) which need to be reviewed and updated.

4.5 Multi-stakeholder Partnerships

Use of multi-stakeholder approaches is critical for addressing soil and water management challenges in a holistic manner and enhances collaboration between farmers and other actors such as policy makers, researchers, extension agents and policy makers. This promotes interaction between the actors, exchange of information and provides a platform for addressing some of the challenges. Evidence from other studies shows that best management practices can be best scaled up through multi-actor collaborative efforts (Muluken et al., 2020).

4.6 Knowledge Sharing

Smallholder farmers are willing to adopt new best management practices as long as they have knowledge and information about the innovative solutions. Knowledge sharing is therefore critical to support the adoption and scaling up of innovative solutions.

5. Conclusions

- 1) The local stakeholder meetings were held in the countries to carry out community needs assessment and conduct a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices. Based on the outcomes of the local meetings and site brokerage meetings the following conclusions are made:
- 2) Smallholder farmers across all the target countries are currently organized in formal groupings. This provides a conducive environment for interaction and trust and relationship building leading that is critical for collaboration.
- 3) Smallholder farmers are willing to adopt new best management practices as long as they have knowledge and information about the innovative solutions.
- 4) For smallholder farmer organizations (farmer groups, farmer associations, farmer cooperatives, farmers' unions etc.) and other actors, to share BMPs there is need to: (i) sensitize them on the importance of the BMPs and need to share with other farmers so as to benefit the whole community; and (ii) train them on how to use the best management practices.
- 5) There is high likelihood that smallholder farmers in the target communities could potentially share the BMPs or any other benefit with other community members because of the strong motivation among community members to participate in group activities (because of the perceived benefits) and build strong relationships. This is critical for exchange of ideas, innovations, and information.
- 6) Investments in building the knowledge base of communities in water and soil management through targeted trainings and knowledge sharing platforms is critical in supporting wider adoption and scaling up of innovative solutions.
- 7) It's important to pay attention to policy processes that directly affect agriculture, soil and water management because they are critical in catalysing adoption of innovative technical solutions. Unfavourable land tenure policies have been shown to discourage adoption of soil and water management practices.
- 8) Access to markets was a challenge in all the project countries. Linkage of smallholder farmers to markets has been shown to be positively correlated with adoption of technologies. In promoting the adoption of the best practices, it's important to address market constraints along specific value chains within specific communities, watersheds or basins targeted by the project as this will catalyse the adoption of the BMPs.

References

- Agyekum TP; Antwi-Agyei P; Dougill AJ. 2022. The contribution of weather forecast information to agriculture, water, and energy sectors in East and West Africa: A systematic review. *Front. Environ. Sci.*, 29 August 2022. Volume 10 – 2022. <https://doi.org/10.3389/fenvs.2022.935696>
- Gidoi, R., Mugagga, F; Buyinza, M and Wagoire W. (2013). Implications of market access on soil and water conservation investment in the highlands of eastern Uganda. *African Crop Science Journal*, Vol. 21, Issue Supplement S3, pp. 771 -779.
- Maarten van Ginkel and Chandrashekhar B. (2021). Drought Early Warning in Agri-Food Systems. *Climate* 2021, 9(9), 134. <https://doi.org/10.3390/cli9090134>
- Muluken G. W, Okoyo E.N; and Erkaló E. (2020). Factors influencing adoption of improved structural soil and water conservation measures in Eastern Ethiopia. *Journal of Environ Systems Research* (2020) 9:13 <https://doi.org/10.1186/s40068-020-00175-4>
- Kugbe, J.X; Mawiya W; Alhassan M.H and Maganoba C. (Kugbe, J.X; Mawiya W; Alhassan M.H and Maganoba C. (2019): Increase in The Use of Organic Fertilizers as Complements to Inorganic Fertilizers in Maintenance of Soil Fertility and Environmental Sustainability.
- Pender, J., Jagger, P; Nkonya, E; Sserunkuuma, D (2001). Development of Pathways and Land Management in Uganda: Causes and Implications. Paper presented at a workshop on policies for improved land management in Uganda (unpublished).
- Pender, J. B. Gebremedlin, Benin, S. and Etui, S (2001). Strategies for Sustainable Agricultural Development in the Ethiopian Highlands EPTD Discussion Paper No. 76. International Food Policy Research Institute (IFPRI) Washington D.C 11-19.
- Place, F and K.Otsuka, (2000). "Population Pressure, Land Tenure and Tree Resource Management in Uganda." *Land economics* 76(2):233-251
- Shilpa A., Giera, B; Jeong, D; Robinson J. and Spearot, A. (2022). Market Access, Trade Costs, and Technology Adoption: Evidence from Northern Tanzania. https://people.ucsc.edu/~jmrtwo/market_access.pdf

6. ANNEXES

6.1. Annex 1 – Egypt Local Stakeholder Meeting Report



Meeting with Local Stakeholders on Evaluation and Site-specific Brokerage of Best Management Practices, Cairo- Egypt

Date: September 14-15, 2022
Hybrid (Physical and Virtual)

Meeting Report

By

ASARECA, HELIOPOLIS UNIVERSITY, CIHEAM Bari, CNR

©September, 2022



Table of Contents

| | |
|---|-----------|
| Acronyms..... | 3 |
| 1. Introduction..... | 4 |
| 1.1 Background and Rationale..... | 4 |
| 1.2 Project Area..... | 4 |
| 1.3 Purpose of the Local Event | 6 |
| 2. Methodology | 7 |
| 2.1 Workshop Methodology | 7 |
| 2.2 Stakeholders | 7 |
| 3. Workshop Sessions and discussions | 8 |
| 3.1 Dissemination and Evaluation of BMPs..... | 8 |
| 3.1.1 Dissemination Event | 8 |
| 3.1.2 Evaluation of Best Management Practices | 12 |
| 3.1.3 Wrap-up (Day 1) and Conclusion..... | 16 |
| 3.2 Site Visit and Site-specific Brokerage Meeting at SEKEM Farm- Belbies..... | 16 |
| 3.2.1 Site Visit | 16 |
| 3.2.2 Brokerage of the Best Management Practices..... | 17 |
| 3.2.3 Wrap-up (Day 2) and Conclusions | 17 |
| 4. Annexes | 18 |
| 4.1 Meeting Agenda | 18 |
| 4.2 Attendance Sheet (Physical Participants Only)..... | 19 |
| 4.3 Concept Note | 23 |
| 4.4 Event Pictures..... | 28 |

Acronyms

| | |
|-------------|---|
| AICS | Italian Agency for Development Cooperation |
| ASARECA | Association for Strengthening Agricultural Research in Eastern and Central Africa |
| BMPs | Best Management Practices |
| CNR | Italian National Research Council |
| CIHEAM Bari | International Centre for Advanced Mediterranean Agronomic Studies – Institute of Bari |
| EU | European Union |
| EUR | Euro |
| HU | Heliopolis University for Sustainable Development |
| MOA | Ministry of Agriculture |
| MOE | Ministry of Education |

1. Introduction

1.1 Background and Rationale

The Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project seeks to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. Water scarcity and climate change represent a serious threat to agricultural production and food security in Eastern and Northern African countries. To address this challenge, the project aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Eastern Africa and Egypt. It has two main specific objectives: (i) Research Institutions to improve their knowledge and management on water in agriculture; (ii) Farmers and local actors implement innovative/sustainable solutions and skills on water management.

CIHEAM-Bari is leading the implementation of the project in collaboration with other European (Finnish Environment Institute, National Research Council- Italy, and International Soil Reference and Information Centre) and African partners (Association for Strengthening Agricultural Research in Eastern and Central Africa, Kenya Agricultural and Livestock Research Organization, Water Resources and Land Council, Water Research Council and Heliopolis University). ASARECA is coordinating the implementation of the project activities in the four target countries.

1.2 Project Area

Heliopolis University as the Egyptian partner in this project has identified Belbies District, Sharqia as the project study area. Belbies is a district in Sharqia governorate in eastern Nile Delta, that constitutes a portion of an arid belt of northern Egypt. It is characterized by a long dry summer and short temperate winter with a rainfall period from October to March. The climate is hot in summer with average temperature ranging from 19.7°C to 34.7°C, while during winter it ranges from 7.4°C to 18.4°C. Farmers whose lands located at the end of canals within Belbies district, use groundwater for domestic and irrigation purposes since surface water resources are limited.

The WATDEV project will build on the results from other similar projects in the fields of water, food, and energy that were implemented in the project area. Some of the projects that attempted to deal with soil and water management challenges and find proper and sustainable solutions in the study area include: (i) De-Salt; (ii) SustInAfrica; (iii) MEASURE; (iv) Organic Egypt, and (v) Farm4Climate.

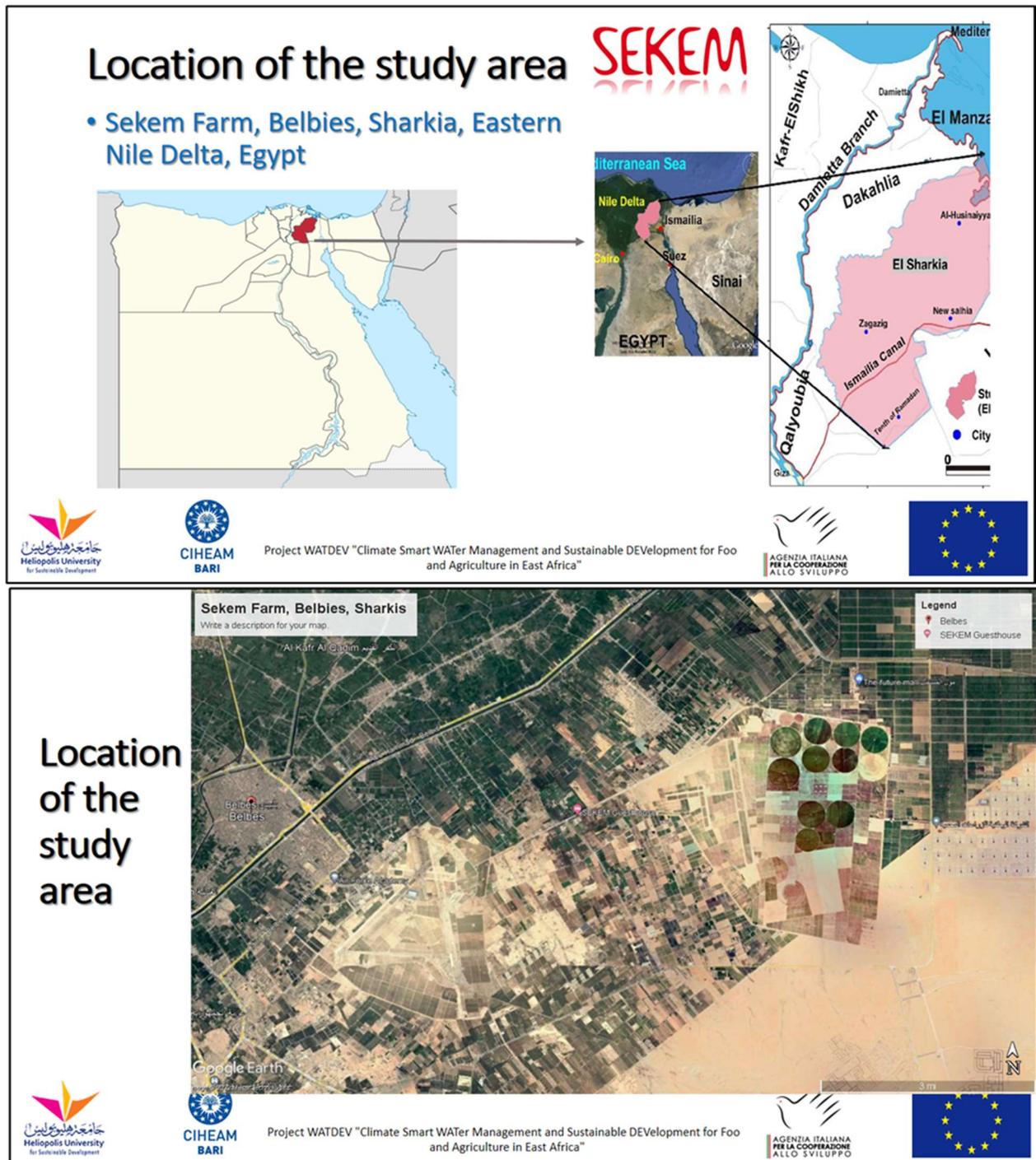


Figure 1: Study Area

The pumping of groundwater from the Quaternary aquifer and its subsequent use as irrigation water causes changes in the groundwater quality both in space and time. The deep Nile Delta aquifer is properly renewable. The main recharge source for the quaternary aquifer in Belbies district is the subsurface flow from the huge Nile Delta canal, as well as infiltration and deep percolation from the excess water application for agricultural lands, seepage from Ismailia Canal, the irrigation and drainage systems, seepage from the drinking water supply network and sewage from the trenches. Due to intensive agricultural production practices, which involve application of chemical fertilizers and pesticides, many soils and shallow aquifers are contaminated. Consequently, pollution of groundwater has become a major concern in recent years. Waste water disposed in canals can diffuse into groundwater. The main pollutants include nitrates and phosphates.

1.3 Purpose of the Local Event

The official launch of the project in May 2022 paved way for implementation of the initial activities such as: (i) inventory and stock taking of the BMPs/I (A1.1) and (ii) evaluation of BMPs/I (A1.2 & A1.3). The local event was held to kick start implementation of the project activities in Egypt and comprised of: (i) dissemination event and meeting for BMPs evaluation; and (ii) site visit and site-specific brokerage meeting. The main objective of the WATDEV local event was to sensitize stakeholders about the project and kick start a dialogue and cooperation with local actors to stimulate the debate on how to improve water management in Agriculture.

2. Methodology

2.1 Workshop Methodology

The WATDEV Local Meeting was held over a period of two days from 14th to 15th Sept 2022 and was attended by both physical and online participants via zoom platform. It comprised of sessions on plenary discussions delivered through power point presentations, meetings to evaluate in a participatory manner, the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences. The Local Meeting was facilitated by ASARECA and HU, and was attended by various stakeholders: (i) Minister of Agriculture, (ii) AICS Delegation, (iii) ASARECA, (iv) Heliopolis University, (v) Zagazig University; Members of Stakeholders Forum (Egypt), (vi) WATDEV Project Team- Sudan, (vi) Members of the Stakeholder Forum-Sudan, (vii) Local Stakeholders from the Project Area; (viii) Sekem Farm and (ix) CIHEAM-Bari Team.

2.2 Stakeholders

The local stakeholders that attended the meeting were drawn from the following stakeholder categories: (i) Policy (Community representatives, Elected representatives, Local decision makers, Zagazig University, Heliopolis University, National Water Research Centre, Ministry of Agriculture, and local authorities); (ii) Organization (Water users' representatives, Opinion leaders, NGOs representatives, Staff working in the project area and Farmer representatives); and (iii) Financial/Economy (Representatives from Sekem for Land Reclamation). A total of 37 stakeholder representatives attended the local meeting. Day 1 of the local meeting was dedicated to the dissemination event and evaluation of BMPs while Day 2 focused on the site visit and site-specific brokerage meeting at SEKEM farm – Bilbies. The plenary meetings on Day 1 and Day 2 mainly involved discussions and brainstorming as well as filling of the community needs assessment. The reflection on the brokerage of BMPs was done by the team of experts who discussed and jointly filled the group evaluation form.

3. Workshop Sessions and discussions

3.1 Dissemination and Evaluation of BMPs

Dissemination event and evaluation of BMPs was held on Day 1 of the local meeting and entailed remarks from selected delegations and presentations on the project objectives and agenda for the meeting. Day 1 focussed on discussion with the stakeholders, understanding their challenges and knowledge sharing and evaluation of the BMPs.

3.1.1 Dissemination Event

(a) Welcome and Opening Remarks

Remarks by Representative from Heliopolis University: Prof. Goda Helal, HU Vice President

The Assoc. Prof. Wael Khairy, delivered welcome remarks on behalf of Prof. Goda Helal. He welcomed participants to the meeting and expressed that HU was happy to host and share ideas with participants in the WATDEV project which is in-line with its vision to be “a pioneer scientific institution that strives for the sustainable development of individual consciousness, economic solidarity, social justice, and environmental balance in Egypt and the world.” He informed participants that HU through its partners and stakeholders provide a fertile ground for new ideas and applied research that leads to further implementation of actions to face climate change and food insecurity challenges that affect majority of the world population.

Furthermore, he noted that HU is implementing several projects in Bilbies and other districts with the aim of: (i) improving the farmers’ and local actors’ knowledge and management of efficient water use in agriculture and (ii) implementing innovative and sustainable solutions with skills toward reaching the best water management practices which fits well with the objectives of the WatDev project that local stakeholders consider as timely. He hoped that the interactive and rich discussions held during the 2 days of the meeting would lead to identification and evaluation of the actual needs that can be addressed by the good management and sustainable development practices for food and agriculture in our countries. The BMPs would be demonstrated as tool box that can be show cased to the whole world. Prof. Helal then thanked WATDEV partners and funding agencies (especially CIHEAM, the Italian cooperation, and EU) and the participating Nile sister countries: Sudan, Kenya, Ethiopia, for their continued support and cooperation for the good of our people. Prof. Helal concluded by stating that he was convinced that “*we (as partners, farmers, land-users and stakeholders) together; shall achieve our project when we work together in a participatory approach, feeling the ownership and saving no effort but to make it successful*” and wished participants a fruitful meeting.

Remarks by Representative from AICS Cairo-Egypt: Dr. Martino Melli, AICS Cairo Director

Dr. Martino Melli thanked HU for organizing the first meeting in Egypt with WATDEV stakeholders on BMP evaluation and site-specific brokerage and also thanked colleagues from the CIHEAM Bari, ASARECA, CNR for their restless commitment, and all the stakeholders for their active participation. He informed participants that WATDEV is funded by the DeSIRA Initiative of the European Union for a total amount of 7.5 million EUR and it is a regional project implemented in Kenya, Ethiopia, Sudan and Egypt. The Italian Agency for Development Cooperation (AICS) is the Executive Body, in partnership with the International Centre for Advanced Mediterranean Agronomic Studies–Agronomic Institute of Bari (CIHEAM Bari) which is the technical and scientific project lead partner.

He added that WATDEV project represents the continuation and regional expansion to the Nile River basin of previous activities carried out by AICS in the sector of sustainable use of natural resources in Egypt and builds upon the experience gained with two initiatives implemented in the past, MARSA DEV and JRDP, that aimed at the rehabilitation of irrigation canals through the use of innovative technologies, leading to increased irrigation efficiency, reduced water losses, and boost crops

production. The main goal of the MARSA DEV project – funded by the government of Italy and implemented by CIHEAM Bari – is to develop and maximize the sustainable use of water resources in Matrouh region through the restoration of rainwater harvesting infrastructures in coastal desert valleys (wadis), the increase in water storage capacity, and the watershed management and outcomes achieved in the context of the MARSA DEV project include 55 km of rehabilitated wadis that contribute to reduced erosion risk and increased lands for agricultural production, the construction and rehabilitation of cisterns and wells to increase water storage capacity, the development of circular water capture systems and of plot irrigation systems.

Following the successful implementation of the MARSA DEV project, the European Union funded the 21.9 Million EUR Joint Rural Development Programme (EU-JRDP) initiative, aiming at increasing agricultural production through more effective and sustainable management of water resources and through the adoption of improved irrigation systems in the Governorates of Minya and Fayoum and Matrouh. The JRDP activities allowed for achieving increased land and water productivity through the rehabilitation of the irrigation network in old lands. Such intervention led to a more equitable distribution of water resources among farmers, who now have access to increased water flow at reduced pumping costs. The JRDP participatory approach through the involvement of all the relevant stakeholders have improved the sustainability and ownership of the project implementation, empowering local relevant authorities with specific legal competences, and facilitating the acceptance of the newly built infrastructures by the final beneficiaries. Dr. Melli believed that the consolidation of a strong participatory approach, which concretely promoted the involvement of grassroots entities in decision-making processes, was indeed the outstanding hallmark of this initiative. A shared and participatory approach also represents one of the key characteristics of the WATDEV project, which will upscale good practices implemented in Matrouh, Minya, and Fayoum Governorates while building upon the extensive and internationally recognized Italian knowledge and skill-transfer ability in the sector of natural resources and water management. He added that the ongoing Water Knowledge training programme relies on skill sharing and capacity building and aims at fostering common regional shared vision on water resources management through the creation of advanced training centers and the development of innovative training curricula.

Both WATDEV and Water Knowledge actions will accelerate knowledge sharing on water and soil management, both at national and regional scale. Sustainable water management and agricultural practices indisputably contributes to achieving not only national and regional commitments towards environmental protection, but also, and foremost, to the creation of shared prosperity and to the achievement of the Sustainable Development Goals. With its extensive network and broad context understanding, Dr. Melli mentioned that CIHEAM Bari is in his opinion the best partner to scale up the experience of the Italian Cooperation in the water and agricultural sector, and to effectively support the project partners in promoting and enabling sustainable practices. He added that the consultations organized by HU represent an excellent opportunity for stakeholders to exchange knowledge on agricultural water management sustainability and agro-ecosystems resilience to climate change, to approach the proposed topics in a participatory and shared way, and ultimately to lead by example on the adoption and communication of best practices within their respective networks.

Dr. Melli concluded his remarks by wishing participants constructive consultations in the two days of the meeting and committed AICS' support, participation, and availability not only during this meeting, but throughout the whole WATDEV project execution.

(b) Objectives and Agenda of the Meeting

Ms Silvia Lecci from CIHEAM-Bari made a presentation that sought to stimulate the debate on how to improve water management in agriculture and share WATDEV project objectives and opportunities to understand how the project can meet local needs.

The aim was to investigate more in depth the soil and water management practices in the agriculture sector, the needs and how cooperation can be improved among various stakeholders after understanding the needs, priorities and gaps, the stakeholders, and steps for working together. Specifically, the meeting aimed at: (i) investigating the current state of agricultural water and soil practices applied in the study area; (ii) examining the community's gaps and needs; (iii) understanding the change targets; (iv) recognising the group's ability to adopt changes; and (v) determining the community's priorities based on the intended changes. (*Refer to the agenda in the annex*)

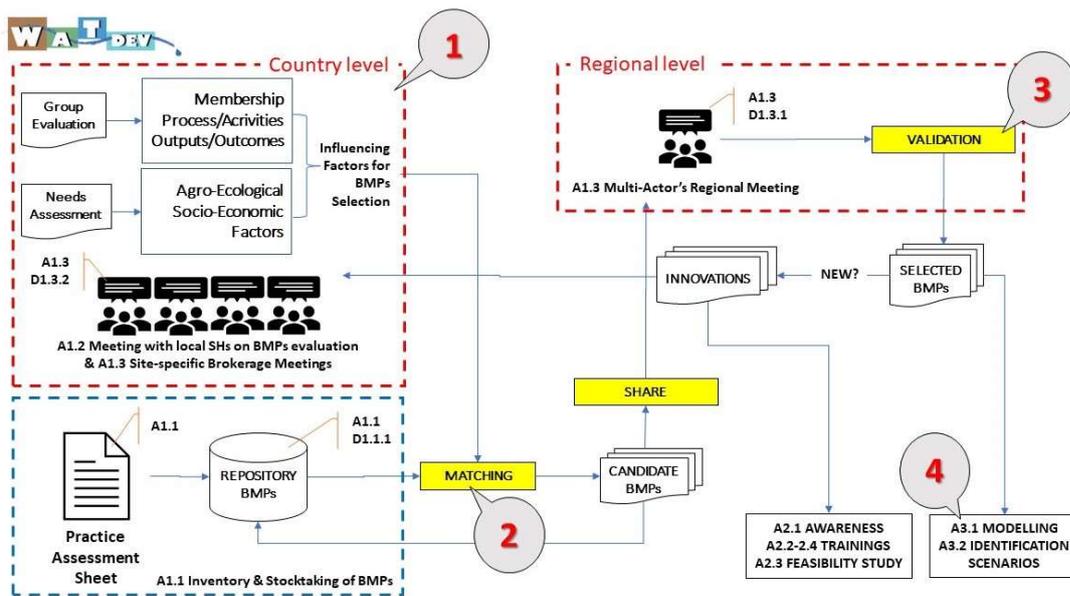
(c) WATDEV Project

In order to prepare the stakeholders for a discussion, a presentation on the WATDEV project was made by Aymen Sawassi from CIHEAM-Bari, focusing on the **objectives, methods and expected results**. It was emphasized that the WATDEV project aims to develop an in-depth understanding of small and large-scale water and agricultural resource dynamics and management while boosting people's resilience to climate, through innovative research, modelling, and capacity building approaches. The rationale for the WATDEV project is the water scarcity and climate change that represent a serious threat on agricultural production and food security in many Eastern and Northern Africa countries for example Egypt, Kenya, Ethiopia and Sudan.

The general objective of the WATDEV project is to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. Specific objectives of the project are: (i) National Ministries and Research Institutions improve their knowledge and management in the agricultural sector; and (ii) Farmers, local actors, cooperatives and Water Users' Associations, implement innovative/sustainable solutions and improve their skills in resources management.

Furthermore, stakeholders were informed that WATDEV will carry out research, analysis and modelling the implementation of agricultural management practices, and conduct capacity building activities at different communities and actors levels (from users to researchers and decision-makers), and address different problems and concerns in the selected study areas of : (i) Belbies district in Egypt, (ii) Gezira irrigation scheme in Sudan, (iii) Koga irrigation system in the Abbay basin in Ethiopia, and (iv) the Lower Tana (Tana River and Kilifi counties) in Kenya.

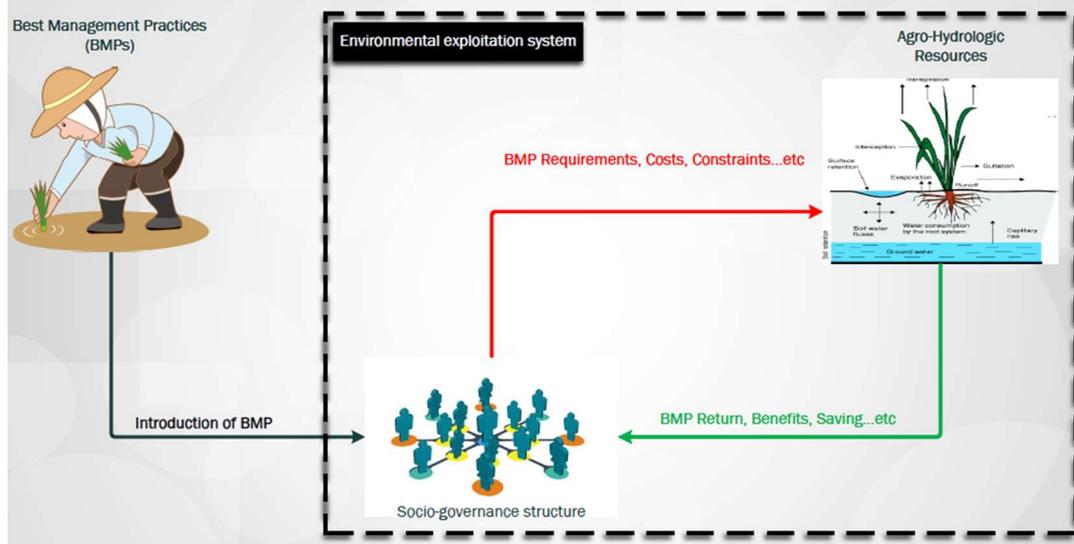
The local actors were also informed that the project will be implemented in five phases: (i) inventory and stocktaking of BMPs/Innovations; (ii) BMPs/Innovations evaluation process and brokerage; (iii) BMPs/innovations enhancement; (iv) Modelling; and (v) Legacy-toolbox (and parallel action Water Knowledge). The stakeholders were provided with information on the project activities to be implemented at national level. These activities will be implemented in a step-by-step process and include: (i) local meetings; (ii) matching the BMPs; (iii) the Multi-Actors' regional meeting; (iv) Selection/validation of BMPs; (v) Awareness of BMPs; and (vi) Modelling the scenarios. The flow chart below shows the process flow:



With regards to the project results, it was noted that the WATDEV project is anticipated to deliver five key results namely: (i) Best fitting BMPs and Innovations selected by 4 countries (**R1**); (ii) Enhanced implementation of BMPs/innovations in study areas (**R2**); (iii) BMPs /Innovations upscale and outscale scenarios performed (**R3**); (iv) A water planning/management toolbox available for Researchers and Institutions (**R4**); and (v) Strengthened knowledge and capacity building and established regional “Water Knowledge” Hub (**R5**).

(d) WATDEV Project

The presentation on the Best Management Practices (BMPs) collected and profiled, as part of activity 1.1 of WATDEV project, was provided by Ms. Alice Calvo of the Italian National Research Council (CNR). It was noted that within the context of environmental exploitation systems for agricultural value creation, a BMP sits as an external component to the system as shown in the figure below:



The BMP aims are to enhance and improve, and in some cases correct, the positive balance between the Human and Environmental subsystems. BMP collections was following two major steps: (1) collection of projects through the **Project Description Sheet**, focussing on: (i) project location, (ii) methodological data of the project, (iii) scope of the project, and (iv) applied BMP; and (2) insight on each project through the **Practice Evaluation Sheet**, focusing on: (i) project description sheet

information, (ii) socio-economic aspects of the project, (iii) agro ecological aspects of the project, and (iv) BMP description.

The BMPs collected in the study areas in Egypt, Ethiopia, Kenya and Sudan done between 18th April, 2022 and 31st August, 2022. The BMPs collected were distributed as follows: Crops (36.63%), Water (24%), Soil (23.53%), and Atmosphere (15.84%). The BMPs on soil were mainly on soil conservation (33%), water-holding improvement (28%), soil organic matter improvement (23%) and structure preservation (16%). BMPs related to water were mainly on water use efficiency (42%), surface water improvement (21%), groundwater improvement (17%), logging/salinization reduction (14%) and resistance to salinity (6%). On the other hand, the BMPs on crops were mainly on crop productivity improvement (40%), food security/livelihoods (28%), farmers' engagement (14%), specific genotype use (11%) and enhancing resistance to pests (7%). BMPs related to the atmosphere focused on climate variabilities resilience improvement (43%), evaporation/evapotranspiration reduction (28%), greenhouse gas emission reduction/soil carbon sequestration improvement (22%), and methane/nitrous oxide losses reduction (7%).

3.1.2 Evaluation of Best Management Practices

(a) Scope of Evaluation Exercise

Evaluation of BMPs was one of the key activities undertaken during Day 1 of the WATDEV Local Meeting.

To set the stage for discussion, ASARECA made a presentation on the scope of the evaluation exercise with respect to the possible Best Management Practices (BMPs) application sectors such as: (i) Groundwater (ii) Soil, (iii) Crop, (iv) Surface water, and (v) Air/Atmosphere; and focussing on the discussion on preservations, exploitation, management of various BMPs under these sectors.

(b) Scope of Evaluation Exercise

The discussion on local needs assessment exercise was facilitated by ASARECA and HU. The discussion entailed an assessment of the community needs - with respect to the potential BMPs in the various application sectors; and filling in the community needs assessment form (Annex 5: Part 2). The discussion focussed on the possible best BMPs application sectors especially with respect to issues related to preservation, exploitation, management and alternative solutions. Specifically, preservation and exploitation were discussed in dealing with ground water; while discussions on soil focussed on soil management, fertilizer use and pesticides. The stakeholders also held discussions on crop varieties and management practices under crops as well as exploitation, access, re-use, and distribution and irrigation systems under surface water. Discussions on climate change, future awareness, and sustainable development were also discussed under BMPs related to atmosphere. The other issues discussed included: economy focusing on investment, substitution (alternatives), risk, and subsidies; organization focusing on collaboration and exchange (willingness to learn and share ideas); and policy focusing on compliance, change, and introduction (willingness to see new regulations introduced).

The key findings from the evaluation of BMPs are highlighted below:

(i) Groundwater

Importance of groundwater: Participants indicated that there is ground water in the Nile Delta of Egypt and it is of two types: (i) deep groundwater and (ii) shallow groundwater. They mentioned that groundwater is the 2nd most important source of water for Egypt after surface water and it's of great importance to Egypt because they depend on it for agriculture and domestic use in most desert areas in Egypt. The mid-aquifers feed agricultural projects with fresh water. However, there were quality concerns raised about the ground water especially contamination and increasing salinity.

Recharge was also highlighted as a complex issue whether it is from rainfall or from rivers. Participants emphasized the need for policies to regulate this partly because there is also exchange from the rivers

to the aquifers and vice versa. Participants noted that when one digs wells of up to 47m, they get saline water and in order to get fresh water, one has to dig up to 78m deep. As such there is need to adopt efficient irrigation systems that ensure sustainable use of groundwater.

Sufficiency of groundwater: Groundwater is not sufficient for agricultural and domestic use especially because of the quality concerns such as salinity and contamination. A participant who suffered salinity of ground water shared that he deepened the well for a further 20m down to get better water for agriculture and noticed that the water was better in quality with a deeper well. Participants emphasised that both water quality and water quantity were key issues for them and there is a need for water to be analysed to assess its suitability for production of various crop types. There is contamination of ground water from the sewage. Participants shared findings from a recent study conducted in Egypt which revealed human waste in the water and as such they recommended a need to undertake a microbial analysis of the ground water if it is to be used for domestic consumption.

Preservation: Participants emphasized the importance of preserving groundwater through efficient water use and recommended that the Ministry of Education (MoE) should raise awareness of the students about efficient use of water. They also emphasized the need to adopt and promote organic agriculture practices as alternatives to the use of inorganic fertilizers and pesticides which greatly contribute to soil salinization.

Farmers mentioned that they would like to embrace modern irrigation but cannot afford modern irrigation technologies and related energy costs. The Advisor to the Minister of Agriculture informed participants that there are funds available at the Ministry of Agriculture to support farmers in this regard. He advised farmers that it is better to cultivate vegetables with irrigation if they are to become profitable and not wheat because the costs will be higher. He added that there are alternatives to flood irrigation e.g. sprinkler which is cheaper than drip irrigation and sprinkler irrigation can be used in the production of sweet corn. He encouraged farmers to refer to the Ministry of Agriculture for advice on irrigation. He pledged that the Ministry of Agriculture would work together with the Ministry of Natural Resources to increase awareness on water and irrigation interventions.

Participants from Sudan shared that in Sudan, there is plenty of water although they were facing similar challenges especially salinization and that they were moving away from flood irrigation to more water efficient irrigation methods such as drip irrigation.

(ii) Soil

Soil management: Participants defined soil management as agricultural practices applied to the soil to protect the soil and improve specific soil functions. They acknowledged that investment in soil is very important although using a lot of pesticides and inorganic fertilizers affects the soil negatively. Participants agreed that many years ago, the soil was so fertile but that is not the case now as the soil fertility had dropped constraining production of some crops such as cotton. They emphasized the need to increase awareness for the farmers about soil management. The Advisor to the Minister of Agriculture in Egypt advised farmers to use organic fertilizers for sustainable soil management and never leave the land without fertilizers but rather use green fertilizers. Participants reported using the following soil management practices: cover crops, inorganic fertilizers, bio-fertilizers, organic manure, green manure (using alfalfa and beans), minimum tillage and soil erosion control measures.

Fertilizers: Participants reported using both inorganic fertilizers and organic manures to improve their soil fertility. The use of organic fertilizers and bio-fertilizers was emphasized because after using these for a long time, the soil becomes immune to diseases and pests, beyond the improvements in soil fertility. Farmers were encouraged to use organic and bio-fertilizers in order to tap into and benefit from the export market of vegetables to Europe where use of chemical fertilizers is not allowed in food production.

Pesticides: Participants reported using chemical pesticides mainly because they are effective despite being aware of their negative impacts on the environment. A farmer shared a case where a pest (worm)

affected his entire corn farm and he was forced to use an inorganic pesticide fertilizer because the organic pesticide was not effective on the worm. However, biofertilizers are available and farmers are willing to adopt them.

(iii) Crops

Crop varieties and management: Various food crops are grown depending on the type and salinity of the soil and availability of the market. Production of local crop varieties is mainly influenced by the market. Crops grown include: wheat (local variety), potato (Egyptian potato variety), rice (Egyptian rice variety), tomatoes (varieties tolerant to salinity), and mangoes (Zebdeya variety and Owiss variety).

Crop rotations: Farmers do not practice crop rotation currently. The decision on what crop(s) to grow is determined by the market. The Advisor to the Minister of Agriculture in Egypt advised farmers to practice crop rotation for example by not cultivating wheat all the time and planting rice after harvesting wheat (which exhausts soil nutrients) and follow guidance from the Ministry of Agriculture. Participants recommended that the Ministry of Agriculture shares the crop rotation guide with all farmers.

Multi-cropping patterns: There were no multi-cropping patterns reported.

Market opportunities and choice of crop: Participants shared experiences as follows: A participant shared that he has a contract with a company to cultivate a medical crop that increases immunity of the body and he earns 90 pounds per kilogram stating that it is more profitable than agricultural crops like peanuts and as such he advised that it was beneficial for farmers to engage in agricultural production through contracts with private investors or government because good prices and price stability were more guaranteed under such arrangements. They recommended that such contractual arrangements should be scaled to benefit more farmers. The choice of the crop to grow is determined by the availability of the market.

Farmers expressed their trust in the quality of seed distributed by government and requested government to supply them with the desired seed because some seeds that they buy from private sector companies are of poor quality and do not produce the desired yields. In the market, participants mentioned that quantity was considered more important than the quality. They sell their vegetables and other products in the markets without any standards to be followed or enforced by the agricultural associations. The Advisor of the Minister of Agriculture in Egypt advised farmers to produce more of cucumber and not oranges because many farmers produce oranges and as such the orange prices on the market will be low.

(iv) Surface water

Exploitation, access and re-use: Surface water is available to some extent in Egypt but does not exist for all the time it is needed. Whenever it is there, it is the first and best option and when it is not there, farmers use groundwater.

Distribution and irrigation systems: The major distribution system for surface water is through canals. However, distribution systems are not efficient for farmers downstream who do not receive enough water and there is need to change the systems and make them more efficient. Participants emphasized the importance of quality of water and efficiency of distribution as important aspects in surface water management.

Influence on cropping systems: Participants reported that availability of surface water determines the crop to be cultivated for example if surface water is available, most farmers will cultivate rice. Cultivation of oranges is also very sensitive to the amount of water and could be affected by decrease or increase in water.

(v) Atmosphere

Climate change: Participants shared their experiences on climate change and how it has affected their agricultural activities. A farmer shared that they used to cultivate in September every year and now they

cultivate in October because of temperature changes, this means one-month loss in agricultural productivity. He added that humidity is also a challenge, diseases are more and affect livestock, bacterial infections increase due to temperature increases and affect crops such as mango and that high temperatures cause evaporation which increases salinity of the soils and all these negative effects are a result of climate change. Farmers mentioned that they were choosing special types of seed to cultivate and grew them under shade but sometimes the heat waves made them lose all their seeds and agricultural produce.

Future awareness: Farmers are willing to implement actions to mitigate climate change as a group. Farming is more difficult now than before, but they cannot state with clarity what exactly the changes will be. Some people are taking individual actions to mitigate climate change impacts e.g. covering the crops to reduce water loss from evapotranspiration. Participants highlighted the importance of weather forecasts in guiding today's decisions and emphasized the need for more awareness to manage effects of climate change. Other recommendations were periodic assessments of the soil and water, assessing crop tolerance, and interventions to reduce soil salinity like the model used by the "de-salt project".

Sustainable development: Farmers considered their activities sustainable and would like to see the next generations in a better state. They encouraged the shift from traditional irrigation to more efficient irrigation (such as drip and sprinkler irrigation), lining canals, planting trees, carbon sequestration in the soil, breeding and promoting drought tolerant crop varieties and using renewable energy such as solar power.

(vi) Economy

Investment: Farmers are engaged in agriculture because they love it and it is part of their history, they are willing to continue engaging in agriculture because it is their source of livelihoods. Agriculture is contributing to the economy although it is not as profitable as they would wish. Many farmers are engaged in agriculture as part of their culture and tradition and because they practice agriculture as a hobby and passion beyond the economic gains and are interested in its sustainability. Participants cited a project implemented in Egypt – the "love initiative" that considers agriculture as a love and considers both social aspects and economic aspects of agriculture.

Substitution: Areas with prolonged droughts do not have much economic activity but rather residential places. Some farmers near the red sea cannot continue with farming because it is costly to produce in such areas. Due to very arid region, some farmers have moved away from cultivation to animal rearing. Participants agreed that substituting agriculture for other activities was not a priority for them because they need to reinforce and enhance their farming activities and use their land to generate income.

Risk: Participants agreed that there were more risks associated to rainfed agriculture than irrigation agriculture. Farmers have embraced irrigation agriculture mainly through their farmer associations such as Sekem which provides sprinkler irrigation for the farmers. Participants considered low revenues from agricultural production a risk. They indicated that farmers cannot control the market and quite often invest in production of certain crop without knowing the market dynamics and prices change rapidly which is a big risk.

Subsidies: Farmers indicated that they cannot afford to pay for improved technologies and need low interest loans from government to enable them adopt such technologies. Farmers indicated that they love farming as a tradition but the challenges are increasing rapidly and they need support and mechanisms for mitigating risks and sustaining their agricultural investments.

(vii) Organization

Collaboration: Participants agreed that collaboration benefits everyone and being in a group is much better than being by oneself. Farmers are already part of various organizations including Sekem and are

willing to join other organizations. They highlighted the following as benefits of being in an organization: increased agricultural productivity, increased incomes, and jointly addressing challenges.

Exchange: Exchange of information and knowledge was a priority among the community members and they regularly shared within their communities. The local stakeholder meeting also provided a platform to further such exchanges.

(viii) Policy

Compliance: Participants understood the importance of complying with policies but highlighted some challenges hindering compliance in some cases. They indicated that digging wells to get groundwater, one needs licenses and this is time consuming and costly and there is no guarantee that they will get the license so they dig the wells illegally and in some places about 30m distances apart which is not allowed and attracts fines according to the Egyptian law. Participants recommended a need to raise awareness on challenges of unplanned and illegal digging of wells.

Change: Participants indicated that they are willing to adopt things policies enable them do things better. They would like to understand better rules and laws that affect their activities and lives positively. For example, they would like to have regulations that rationalize use of water without any illegalities. They would also like to have regulations on use of solar powers for energy generation since they are not allowed to put extra power on national grid. Participants recommended changes in regulation in power generation to renewable energy through use of solar panels which mitigates climate change effects. They also expressed willingness to comply with rules and regulations.

3.1.3 Wrap-up (Day 1) and Conclusion

The main facilitators Prof. Sherif Elsayed and Mr. Moses Odeke thanked the participants for their active participation during the first day and briefed them about the next day's field work and group discussion at Sekem farm.

3.2 Site Visit and Site-specific Brokerage Meeting at SEKEM Farm- Belbies

Site visit to Heliopolis University, Sekem Farm, Farmer fields and Site-specific brokerage meeting was held on Day 2 of the meeting.

3.2.1 Site Visit

Participants held a field visit to various sites to physically see, appreciate and discuss application of various BMPs. Some of the sites visited during the field visit include: (i) Heliopolis University, (ii) Citrus farm (with drip irrigation), (iii) Aquaculture organic pond, (iv) Water factory (ISIS), (v) Lotus herbs organic factory and (vi) Sekem organic shop. Below are the highlights of the field visit:

- The second day of the workshop started with a visit to Heliopolis University to explore and discuss existing projects. (The aquaponics – PV system – CSP system – CPL office). Participants expressed their happiness about the university's application of sustainable development in projects and the adoption of the green nature approach
- The participants then visited Mr. Hussam El-Tahawy, one of the farmers in Belbies area, Sharkia Governorate who participated in the workshop and invited the participants to: (i) see the agricultural management practices he is applying to rationalize water usage, and (ii) share with them the main challenges that he faced and how he overcame them. The main crop was orange trees, and was intercropped with a few other crops such as guava, okra, onions and figs. The farmer also uses modern irrigation methods (drip irrigation) as well as organic fertilizers (pigeon droppings) non-chemical, which makes the crops organic.

- The participants then visited Aquaculture pond in Adliya farm where irrigation water rich in neutrons is used in fish farming, following the same system of aquaponics that is being piloted at Heliopolis University. The fish is harvested when it has reached a weight of 0.5Kg and there is ready market from the surrounding communities.
- Then, the participants went to the water factory (ISIS water) and the workers in the factory explained to the group all the steps of producing still water from the beginning and sterilization to packaging.
- The participants also visited the herbs factory in SEKEM farm and the factory workers explained the steps and methods of producing organic spices right from collection, sieving and sterilization with carbon dioxide, and this is in accordance with ISO standards until packing and processing for sale. Most of the produce for processing is purchased locally from the farmers.
- Lastly, the participants visited the SEKEMs Organic Shop where processed products from the factories were being exhibited. Most of the participants purchased natural organic products after seeing how it was being processed in the factories.

3.2.2 Brokerage of the Best Management Practices

The reflection on the brokerage of BMPs was done by the team of experts who discussed and jointly filled the group evaluation form according to the reflections of the participants in the workshop (Annex 5: Part 1). After the field visit, and a lunch break, the group of experts eventually met, reflected and discussed what happened over the two days before proceeding to fill the group evaluation form. The exercise was also attended by online participants from CIHEAM-Bari. There was a problem of internet connectivity that made the online participation a challenge. Throughout the reflections and discussions, participants expressed their happiness with the exercise especially as they were able to relate to some of the things that had happened in Day 1 and this added value to the discussions. Based on the discussions and reflections by the expert group, some of the key messages that emerged are highlighted below:

- The group is able to collaborate because they have similar interests and are motivated by a common goal of improving their livelihoods through farming. Furthermore, they also face similar challenges since they invest in similar farming enterprises.
- In terms of group cohesion, there was a strong feeling that there was some level of inter-connectedness among the members in terms of members interacting with each other within the group, sharing their challenges as well as experiences and willingness not only to discuss these issues jointly but also to find solutions jointly. This was a strong sign that the members could work together.
- There was also some level of participatory engagement of the group members in terms of goals or priorities of the group. It was noted that there was an element of inclusivity as the members get to share their perspectives on what priorities the group should focus. This contributes to agenda setting of the group as a whole.
- The group could also potentially share the BMPs or any other benefit with other community members because there was a strong feeling that members of the community build strong relationships with each other which was viewed by members of the group as critical for exchange of ideas, innovations and information.
- There was a strong feeling that members are very much involved and interested in generation of new knowledge. Members through their own experimentation with innovations have been able to come up with new knowledge.

3.2.3 Wrap-up (Day 2) and Conclusions

Prof. Sherif Elsayed and Mr. Moses Odeke thanked participants for the successful meeting and meaningful discussions during the second day of the meeting.

4. Annexes

4.1 ANNEX 1 - Meeting Agenda



Meeting with local stakeholders on Best management Practices (BMPs) evaluation and site-specific brokerage meeting

September 14-15, 2022, Cairo, Egypt

Meeting Agenda

Day 1 - Dissemination Event & Meeting for BMPs Evaluation

Novotel Cairo Airport

| | |
|----------------------|---|
| Session 1 | Welcome and introduction |
| 09:00- 09.15 | Welcome <ul style="list-style-type: none">• Heliopolis University (Prof. Dr. Gouda Kamel, Vice President)• AICS Cairo (Dr. Martino Melli, Director) |
| 09:15– 09:30 | Objectives and agenda <ul style="list-style-type: none">• CIHEAM Bari• ASARECA |
| Session 2 | Preparing the ground for discussion |
| 09:30 - 10:30 | <ul style="list-style-type: none">• The WATDEV Project: Objectives, methods and expected results (CIHEAM Bari, CNR-IPSP)• Overview of activities in the country (ASARECA, HU)• Presentation of Local Stakeholders |
| 10:30 – 11:00 | Coffee break & Group photo |
| Session 3 | The evaluation's exercise |
| 11:00 – 13:30 | <ul style="list-style-type: none">• Presentation of exercise's scopes (support to fill the Needs Evaluation Sheet)• Facilitated discussion (Facilitator: Heliopolis University/ASARECA/CIHEAM Bari) |
| 14:00 – 14:30 | Lunch |
| Session 4 | Wrap-up and conclusion |
| 14:30 – 15:30 | <ul style="list-style-type: none">• Wrap-up and closure (Heliopolis University)• Next event: Site-specific brokerage event |

Day 2 – Site Visit and Site-specific Brokerage Meeting

SEKEM Farm – Bilbeis

| | |
|--|---|
| 09:00 | Departure from the hotel to the study area |
| 10:00 – 12:30 | Site visit |
| 12:30 – 13:30 | Lunch at SEKEM Farm |
| Facilitator meeting (at SEKEM farm) | |
| 13:30 – 15:00 | <ul style="list-style-type: none">• Compilation of Group Evaluation Sheet• Reflection on potentials future brokerage on BMP/I (Heliopolis University, ASARECA, AICS, CIHEAM Bari, CNR-IPSP, other partners online will meet to orient matching between group expectations/needs and WATDEV collected BMP/I) |
| 15:00 | Travel back to the hotel |



ANNEX 2 - Attendance Sheet

| # | Name | Institution | Phone numbers | Email | Country |
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Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa

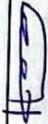
Local brokerage meeting in Cairo, Egypt
14-15 September 2022

Attendance sheet - 14 September 2022

| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | SIGNATURE (IN CAPITAL LETTERS) |
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4.3 ANNEX 3 - Concept Note



EVENT CONCEPT NOTE

Meeting with local Stakeholders on BMPs evaluation & Site-specific brokerage meeting

1. Background

Heliopolis University (HU) is participating in the implementation of the WATDEV project which aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. It has two main specific objectives: (1) Research Institutions to improve their knowledge and management on water in agriculture; (2) Farmers and local actors implement innovative/sustainable solutions and skills on water management. HU as the Egyptian partner in this project has identified Belbies District, Sharqia as the project study area. Belbies district is a part of the east Nile Delta, that constitutes a portion of an arid belt of northern Egypt. It is characterized by a long dry summer and short temperate winter with a rainfall period from October to March. The climate is hot in summer with average temperature ranging from 19.7°C and 34.7°C, while during winter it ranges from 7.4°C and 18.4°C. Most of the people use in Belbies district, use quaternary groundwater for domestic and irrigation purposes since surface water resources are so little.

The pumping of groundwater from the quaternary aquifer and its subsequent use as irrigation water causes changes in the groundwater quality both in space and time. The Nile Delta aquifer is properly renewable. The main recharge source for the quaternary aquifer in Belbies district is the subsurface flow from the huge Nile Delta aquifer, as well as infiltration and deep percolation from the excess water application for agricultural lands, seepage from Ismailia Canal, the irrigation and drainage systems, seepage from the drinking water supply network and sewage from the trenches.

Due to intensive agricultural production practices, which involve application of chemical fertilizers and pesticides, many soils and shallow aquifers are contaminated. Consequently, pollution of groundwater has become a major concern in recent years. Wastewater disposed in canals can diffuse into groundwater. The main pollutants include nitrates and phosphates.

WATDEV will build on the results from other similar projects (in the fields of water, food, and energy. that were implemented in the project area). Some of the projects that attempted to deal with soil and water management challenges and find proper and sustainable solutions in the study area include: (i) De-Salt; (ii) SustInAfrica; (iii) MEASURE; and (iv) Organic Egypt.

- **De-Salt:** The aim was to evaluate a viable saline agriculture business case for community farmers using the trickling filter technology which depends on dripping water from nozzles on a biofilm carrier (plastic stripes). The microbiological material in the biofilm decomposes biological contaminants soluble in water.
- **SustInAfrica:** The aim was to promote sustainable intensification of food production through resilient farming systems in West & North Africa (); 2020 – 2025; EU Horizon 2020
- **MA4SURE :** Mediterranean Agroecosystems for Sustainability and Resilience under Climate Change. The project aimed at enhancing sustainability and resilience under the Mediterranean agro-ecosystems.
- **Organic Egypt:** The aim was to develop and enrich the organic agriculture sector in Egypt. The project worked closely together with Egyptian farmers' associations and local training centers

2. Event Objectives

The main aim of the event is to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated. This will define the base approach for BMPs' implementation (i.e.: farmers or community level) along with

WATDEV

Local Events Concept note

01/07/2022

BMPs' suitability (need based BMPs selection). The activities will define the main factors influencing the BMPs selection at a regional/country level. The process will allow to build an assessment conceptual framework to evaluate BMPs considering factors and variables at the base of their success/failure.

Other important activities include communicating to local actors, the WATDEV project objectives, main actions as well as introducing the project teams and partners. Specifically, the local meetings will be held to undertake:

- (i) Community evaluation of local community needs in terms of application of the BMPs
- (ii) Group evaluation to qualitatively assess the working group in terms of:
 - the group's ability to collaborate and work together and the inclusiveness,
 - the group's consistency and cohesion in performing new processes and activities, and
 - the group's ability to share individual benefits with the whole community.

The outcomes of this evaluation will be subjected to analysis using spider-graphs to show the overall attitude of the local community with respect to the management practices. Based on the community preferences, a matching exercise will be performed to identify, candidate practices in the BMPs repository.

3. Target audience

The target audience will be drawn from the three main groups/interests namely: Policy, Organization, and Financial/Economy. Based on this, the stakeholders expected to attend the local meetings should comprise the following (by sector)

Based on the WATDEV approach, the target audiences for local brokerage meetings will be drawn from three (3) key stakeholder categories. These include: (i) Policy, (ii) Organization, and (iii) Financial/Economy. Based on this, various stakeholder categories have been invited to attend the local meeting. Under policy, the following stakeholders will be represented: (i) Heliopolis and Zagazig Universities; (ii) Ministry of Agriculture; (iii) National Water Research Council; and (iv) Local administrative representatives. Local community organizations invited include: (i) Irrigation Water Users Association (IWUA); (ii) Landowners; (iii) Village Elders (men & women); (iii) local farmer leaders; (iv) local producer' association; (iv) farmer cooperatives; (v) NGOs working in the area; and (vi) staff working in area.

Based on this, the participants that will attend the local meetings will be drawn from the following stakeholder categories.

Policy

- Community representatives
- Elected representatives
- Local community decision makers
- Zagazig University
- Heliopolis University (HU)-Rural Development Centre
- National Water Research Centre (WRC)-Egypt
- Ministry of Agriculture, Egypt
- Local Authorities (Representatives from Bilbies District)

Organization

- Users' representatives (e.g., water users' organization)
- Landowners
- Influential individuals (opinion leaders, big landowners)
- Local associations (e.g., farmers' association, producers' association, ...)
- Relevant local NGOs
- Staff working in area or project management

Financial/economy

- Agency (with legal jurisdiction or function in the area)
- Business and commercial enterprises
- Funding organization (Banks, Foundations, Insurance Companies, ...)
- SEKEM for Land Reclamation

To ease the discussion, about 10-15 persons will attend the local meetings.

4. Expected Outputs

The events are aimed to provide the following outputs, in charge of organizing Partners:

- Preliminary list of Stakeholders involved in the study area;
- Completed "Group Evaluation Sheet";
- Completed "Needs Evaluation Sheet";
- Report on site-level brokerage meeting in Egypt

5. Method

The present events are linked to the Activities falling under Result R1 "Best fitting MBPs and innovations in project countries". In particular, the local events are aimed at applying an evaluation framework that will lead to the selection of the BMPs – among the ones collected, described, and evaluated in the Repository – suitable for implementation in the study areas.

In the picture below (Figure 1) the whole process, from the local meetings (1) to the multi-Actors' regional meeting (3) through matching and selection of BMPs (2) is shown. Figure 1 shows how steps from 1 to 3 will feed step 4 other activities planned in WATDEV (awareness, training, feasibility, modelling, etc.).

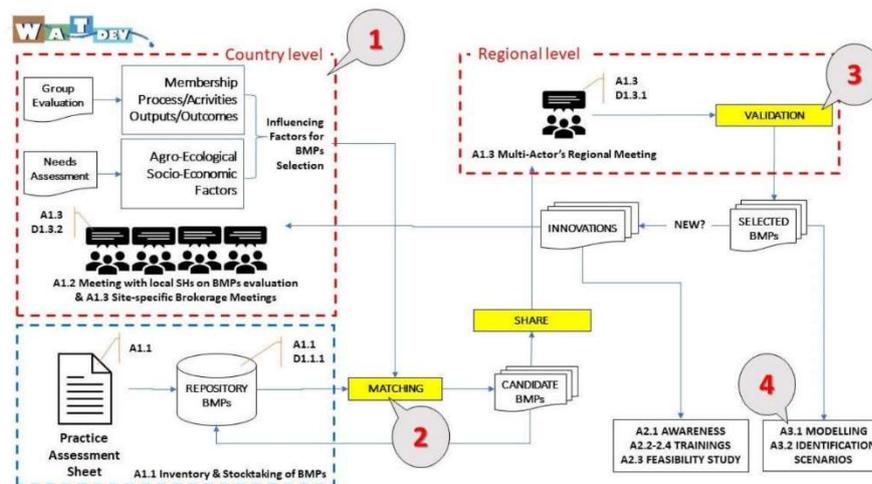


Figure 1 – Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors' Regional meeting (3) and beyond (4)

As in the figure 1, the process is articulated into 4 steps as follows.

- I. During the local meetings, an assessment and evaluation with the local's actors will be performed. Such evaluation is composed of: i) **Group evaluation:** with a set of question, it aims at qualitatively assess the working group, describing the group ability to collaborate and work together and the inclusiveness, the group consistency and cohesion in performing new processes and activities, the Group ability to share individual benefit with the whole community. ii) **Evaluation of local community needs:** this aims at evaluating the group flexibility (needs), by area of application of BMPs, to undergo changes.
- II. The outcomes of the local meetings, after a scoring procedure, will be plotted through spider-graphs (see figure 2) showing the overall attitude of the local community to put in place management practices. In line with their preferences, a matching exercise will be performed to extract, among the practices collected (after a preliminary assessment) in the BMPs repository, the "candidate" ones.

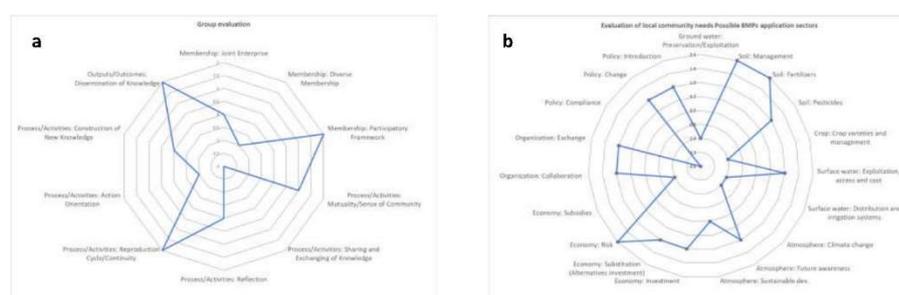


Figure 2 – Spider graphs displaying examples of Group evaluation (a) and Needs evaluation (b).

- III. The candidate BMPs will be discussed in the A1.3 Multi-Actor's Regional meeting, bringing together a number of stakeholders (identified by means of a specific Stakeholder Analysis) at regional level. This meeting will aim to validate the BMPs that are titled to be modelled afterward (Activity 3.1). The selected BMPs could be suitable to be applied in a certain study area, but not already known from the local farmers. For the application of this innovation, it could be useful to explore the feasibility of a public-private partnership able to support its implementation, by means of the second round of brokerage meetings (Activity 1.3). In any case, it would also be necessary to carry out a feasibility study (Activity 2.3) as well as an awareness (Activity 2.1) and training campaign (Activity 2.2-2.4) for local communities.
- IV. The BMPs selected after the A1.3 Multi-Actors' Regional Meeting will be subjected to the integrated modelling process and the simulation of possible impact scenarios due to their upscaling/outscaling, from the areas of implementation to large-scale catchments within - and possibly beyond - the study areas.

6. Venue and date

The local meetings will be held on 14th – 15th September 2022 in Novotel Cairo airport Cairo Hotel and SEKEM Farm- Belbies, Egypt

7. Communication

Information about the meeting and its scope will be provided by means of:

- WATDEV Project and HU websites



- Local partners' websites
- WATDEV Social media channels (Facebook, Twitter, LinkedIn, Instagram)
- Direct mailing
- Local media and newspapers

An information leaflet illustrating the Project's objectives and expected results will be provided in English and in Local language.

Organizers/Collaborators

| Name | Acronyms | Logo |
|---|----------|------|
| The Association for Strengthening Agricultural Research in Eastern and Central Africa | ASARECA | |
| Heliopolis university for sustainable development | HU | |
| SEKEM for Land Reclamation | SLR | |

8. Contact person(s) (name, affiliation, phone, email)

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4.4 ANNEX 4 - Event Pictures

Day 1 (Novotel Hotel)



Day 2: Visit to Heliopolis University



Day 2: Visit to Study Area (Citrus Farm)



Day2: Visit to Study Area (SEKEM Farm)



Day 2 : Facilitators' Meeting



4.5 ANNEX 5 - LMES: Local Meeting Evaluation Sheets

Part 1. Group Evaluation:

-2: No; -1: Relatively No; 0: Equally mixed; 1: Relatively yes; 2: Yes

| Type | Criterion | Question | Score |
|-----------------------------|-------------------------------------|---|-------|
| Membership | <i>Joint Enterprise</i> | Do members share a competence that distinguishes them from others? Yes. Members possess unique competencies that are representative of the various sectors that they represent | 2 |
| | | Do the members share a common sense of purpose? Yes. Members are motivated by a common goal of improving their livelihoods through farming. | 2 |
| | | Do members appear to have similar interests? Relatively Yes. They have the same passion/interest of investing in agricultural production to improve their livelihoods. They exchange ideas and information with each other about farming. | 1 |
| | | Do members report similar problems or experiences? Yes. They invest in similar farming enterprises and face similar problems and experiences. That is why they engage actively in sharing information in an interactive manner to solve their problems. | 2 |
| | <i>Diverse Membership</i> | Do the members of the community represent a variety of stakeholders? Yes. The members are drawn from the different sectors represented in the community | 2 |
| | | Does the community transcend organizational and geographical boundaries? Relatively Yes. Largely members interact with other members within the group. However, members also interact with other members outside the group. However, this engagement with actors outside the group seems to be limited rather than extensive. (Refer to a story of a member who tried to influence his father to join the organic movement). | 1 |
| | <i>Participatory Framework</i> | Are members actively involved in setting goals? Relatively Yes. Members get the opportunity to share their perspectives on what the priorities that the group should focus. This contributes to the agenda/goal setting. | 1 |
| | | Are members responsible for devising a strategy or plan of action? Equally mixed. There was no concrete evidence that members are responsible for devising strategy or action plan despite sharing their opinions on priorities for the group | 0 |
| | | Do members assist in running the community? | -1 |
| | | Are members of the community internally motivated? | 1 |
| Process / Activities | <i>Mutuality/Sense of Community</i> | Do the members of the community build relationships with each other? Yes. This is viewed as critical for exchange ideas, sharing communication and other information. | 2 |
| | | Do the members engage in joint activities and discussions? Yes. When they have challenges with their problems they discuss and look for solutions jointly | 2 |
| | | Do the members offer each other help when needed? Yes. When they have challenges with their problems they discuss and look for solutions jointly. | 2 |
| | | Do members report encounters across geographical or organizational boundaries? Relatively Yes. | 1 |
| | | Do the members report feeling a sense of “belonging” within the community? Yes. Members have a strong feeling of belonging to the community. Members have a strong attachment to their land and | 2 |

| | | | |
|--|--|---|---|
| | | investments in the community. In case of challenges related to farming, the first option of where to get help/solution is the community. | |
| | <i>Sharing and Exchanging of Knowledge</i> | Do members engage in narration, or sharing their experiences through stories? Yes. For example, a story of one member about his father who refused to be part of the organic movement. | 2 |
| | | Do members spend a significant amount of time sharing and exchanging knowledge? Relatively Yes. Members engage in sharing and exchanging knowledge. Members also have the interest in being involved more and more in group interactions. | 1 |
| | | Do members view the community as a forum for the free-flow of ideas and information? Yes. Community is like a forum that they can share their experience. Members tell their experiences to one another. | 2 |
| | | Do members view their interactions in the community as a conversation, as opposed to a series of 1-sided reports? Relatively Yes. Interaction is mostly participatory where all partners contribute as opposed to presentation of 1 –sided reports | 1 |
| | | Do the members believe that they learn useful information from their interactions with others in the community? Yes | 2 |
| | | Do members report any coaching or mentoring from others in the “Community of practice” group? Relatively Yes. Implicitly coaching and mentoring is done to enhance adoption of practices although this might be at a very low level | 1 |
| | <i>Reflection</i> | Do the members of the community engage in collaborative reflection on their individual and each other’s experiences and concerns? Yes. They engage in interactive sharing of lessons and experiences which strengthens the relationship between them as individuals and as a group as a whole. | 2 |
| | | Do members feel like their own level of self-reflection has been increased by participating in the community? Yes. They share their own experiences | 1 |
| | <i>Reproduction Cycle/Continuity</i> | Do members believe that the Community of practice will extend beyond the current time/place/members? | |
| | | Do new members join? | |
| | | Do members believe it will be useful to join a community of practice? | |
| | | ...6 months from now? | |
| | | ...1 year from now? Yes. May be 1 year from now. There is need to raise awareness about the CoP, what it will do, who are the stakeholders, and build trust among the actors and then be able to use it as resource platform for sharing knowledge, information and BMPs | |
| | | ...3 years from now? | |
| | | Does the level of activity of the Community of practice evolve over time?- Yes, the CoP is likely to evolve over time as members appreciate its roles and functions | |
| | | Do members spend the majority of their time analyzing real-life situations/ problems? Yes. Members spend time interacting especially on issues pertaining to farming and how that is affecting their livelihoods and tend to look for solutions jointly. | 2 |
| | <i>Action Orientation</i> | Do members of the community express a desire to initiate change? Yes. Members share new organic crop and soil management practices with others with a hope of influencing them. | 2 |
| | | Do members of the community express a desire solve common problems? Yes. Members collectively discuss common challenges in an interactive manner, share information on how to address the challenges. | 2 |
| | | Is the community successful in turning principles/values of the field into realized policies and practices? Members report being able to turning | 0 |

| | | | |
|---------------------------|--------------------------------------|--|----|
| | | from traditional to modern irrigation systems but there were mixed feelings as to whether they have been able to turn this into recognized practices or policies. | |
| | <i>Construction of New Knowledge</i> | Do members report that their previous understanding/knowledge has been transformed through participation in the community? Yes. Because of the knowledge gained from the community, members report saving significant amount of water as well as increased production on their farms. | 2 |
| | | Do the members report generating new knowledge as a group through their interactions in the community? Yes. Through their local experimentation, farmers have been able to generate new knowledge regarding the quality of water. They now know that wells that are between 0-50m have saline water, while those that are 70m and above have less saline water. | 2 |
| | | Are members confident that they have developed a common knowledge base that they can refer to in the future? Some knowledge base has been developed. Based on the available knowledge, farmers are able to forecast yields they are likely to get after certain period of time (in years). | 1 |
| Outputs / Outcomes | <i>Dissemination of Knowledge</i> | Do members feel connected with others in their field, outside of the community of practice itself? No. Members currently do not feel connected to other farmers/actors in their field outside their group. Members are interested in connecting with others to be aware about market issues. | -2 |

Part 2. Evaluation of local community needs: Possible BMPs application sectors

| Score | Interpretation |
|-------|---|
| -2: | No need (or change) is required (accepted) |
| -1: | Limited need (or change) is felt (possible) |
| 0: | Equally accepted, but not considered as priority |
| 1: | Relatively important where changes are welcome |
| 2: | Priority where the need for change is felt and critical |

| Target of Changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|---|-------|
| Ground water | <i>Preservation</i> | <p>If already in exploited:</p> <p>Discuss its extent, importance and sufficiency and willingness to preserve it by managing its use (reduction) or invest in alternatives.</p> <p><u>Importance:</u> Ground water sources exist mainly in form of wells dug in the ground to access water from the aquifers. Ground water is mainly used for domestic use and agricultural production. Based on the views shared by the participants, ground wells are extremely important for the survival of communities in the target area.</p> <p><u>Sufficiency:</u> Water availability is limited. There are frequent water shortages especially for surface water and ground is used to meeting the water shortages. Comparing quantity and quality of ground water, quality seems to be a much bigger challenge. Ground water significantly suffers much more from quality related issues rather than quantity. Most of the ground water is saline. In fact, water from ground wells that are in the range of 0-70m depth is saline. Only ground water from the depth of 78m and above is less saline. Deeper wells have better quality water.</p> <p><u>Preservation:</u> The willingness to preserve is evident among the community members. This has been demonstrated by their willingness to adopt modern and efficient irrigation technologies/systems compared to wasteful traditional systems like flooding. Participants agreed that they urgently need to switch to efficient irrigations systems in order to preserve water. Priority for change is critical.</p> | +2 |
| | <i>Exploitation</i> | <p>If not exploited:</p> <ul style="list-style-type: none"> Discuss its availability, easiness of access and exploitation and willingness to invest in it. | |
| Soil | <i>Management</i> | <p>Definition and role of soil management</p> <p>Based on the discussion by the participants, it was agreed that the appropriate and simple definition for soil management is use of relevant/appropriate practices that protect the soil health (organic matter and biodiversity in it) and enhances the performance of the soil.</p> <p>Examples of soil management practices</p> <p>Examples shared include: (i) use of cover crops, (ii) use of manure, (iii) use of compost, (iv) use of fertilizers, (v) minimum tillage, (vi) green manure (alfalfa and beans) and (vii) shallow tillage to break the hard pans and aerate the soils.</p> <p>Discuss the importance given to soil management</p> <p>Participants recognize that application of fertilizer (both inorganic and organic) is critical for increasing the productivity of their crops. They also acknowledge that long terms use of fertilizer may be detrimental to the environment.</p> <p>Discuss the need to learn new practices</p> | +1 |

| | | | |
|-------------|--------------------------------------|---|----|
| | | Stakeholders noted that farmers are willing to learn new practices. They gave an example of where farmers have adopted use of magnesia (herbs) to improve soil fertility. | |
| | <i>Fertilizers</i> | <p>If already in use: Discuss how important is the use of fertilizers in the profitability of their farms Use of fertilizer increases productivity of their farm since they are able to produce high number of tons/unit area. This translates into more income earned by the farmers.</p> <p>Discuss the willingness to reduce chemical fertilizer or use alternatives to preserve productivity at longer term Participants are aware that using chemical fertilizers has long terms negative impacts and so are willing to adopt organic fertilizer as the alternative. However, the rate of adoption of the organic alternatives is still low. Considering the impact of chemical fertilizers on the environment, changing to organic fertilizers is a priority.</p> | +2 |
| | | <p>If not already in use:</p> <ul style="list-style-type: none"> • Discuss the cost and easiness of access • Discuss the willingness to invest/introduce fertilizers in their farming <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | |
| | <i>Pesticides</i> | <p>If already in use: Discuss their importance for the crop productivity and the presence of local diseases risks Participants perceive use of pesticides as very important for crop production. However, they also know that chemical pesticides have long term impact in terms of the quality of the crop. Chemical pesticides increase productivity but are not good to use because they affect quality of the crop.</p> <p>Discuss willingness of adoption of alternatives such as bio-pesticides and/or soil management practices Bio-pesticides are available and they are willing to adopt them. They want to adopt organic pesticides because of the negative impacts of chemical pesticides. They know that market will not allow crops produced using inorganic pesticides in the near future.</p> | +2 |
| | | <p>If not already in use:</p> <ul style="list-style-type: none"> • Discuss their availability, access easiness and presence of local diseases • Willingness to invest in biopesticides to improve productivity | |
| Crop | <i>Crop varieties and management</i> | <p>Initiate talk on food culture and local varieties cultivated <u>Food culture and local varieties cultivated</u>: Various crops are grown in the study area. Food crops mainly include: Wheat (local), Potato (Egyptian variety), Rice (local), Simsim, Corn/Maize, Tomato (variety tolerant to salinity), Mango (zebdeya, owiss) and Citrus.</p> <p>Discuss crop rotation and its benefits</p> | +2 |

| | | | |
|---------------|--|--|----|
| | | <p><u>Crop rotations</u>: In the past, the government actively promoted crop rotations among farming communities. Currently the farmers do not follow any rotation (no crop rotation). Production of crops is dictated by the availability of market.</p> <p>Discuss multi-cropping pattern and its benefits <u>Multi-cropping patterns</u>: No multi-cropping patterns. Mono-cropping pattern is common among the farmers.</p> <p>Discuss market opportunities and choice of crop <u>Market opportunities and choice of crop</u>: The local communities grow crops that have market since they have a lot of problems with market. Market is not stable. It's the most important reason for choice of the crop. Crop production done under contract with government or company- seems to be more profitable because market is guaranteed. Farmers produce according to what the market wants. Production under contract is also efficient and could be adopted.</p> <p>+2: Priority change, to produce under contract (-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | |
| Surface water | <i>Exploitation, access and reuse</i> | <p>If already in exploited: Discuss its extent, importance and sufficiency and willingness to find/invest in other surface resource alternatives. <u>Extent and Importance</u>: Surface water is widely exploited for both domestic and agricultural use. It's considered as very important. It's usually considered as the first and best option to use. <u>Sufficiency</u>: Because of the huge demands, the available surface water is not sufficient especially for the upstream farmers at the end of the canals. Surface water is complemented/augmented by the ground water.</p> <p>Communities are willing to invest in other resources like ground water to complement water from the surface water sources to address the shortages. Participants agree that preservation through investment in other water sources is critical and should be accorded a priority. (-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +2 |
| | | <p>If not already exploited:</p> <ul style="list-style-type: none"> Discuss its potential relevance for crop productivity enhancement, easiness of access, the trade off such investment | |
| | <i>Distribution and irrigation systems</i> | <p>If already existing: Discuss the existing distribution systems, efficiency and influence on cropping patterns (choice of crop) <u>Existing distribution systems</u>: The major distribution system for surface water is through canals. <u>Efficiency</u>: The distribution system comprising of canals is not efficient. Water is not enough especially for farmers at the end of the canals</p> | +2 |

| | | | |
|-------------------|-------------------------|---|----|
| | | <p><u>Influence on cropping systems</u>: The distribution of water influences the cropping pattern. Rice is only cultivated if sufficient water is available. This means farmers cannot grow any type of crop without considering its water needs. The crop water requirements are carefully considered before decision to plant/grow the crop are taken. Crops that require less water are commonly grown as an adaptation to the scarce water resources. There is a need for a change to efficient distribution systems so that all farmers have access to fairly sufficient quantities of water for irrigation and reduce on wastage.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | |
| | | <p>If not already existing:</p> <ul style="list-style-type: none"> Discuss the feasibility, fundings (typology and actors), water management and influence on cropping patterns (choice of crop) | |
| Atmosphere | <i>Climate change</i> | <p>Introduce and define “climate change” as a fact.</p> <p>Climate change was defined as the long term changes in temperature and weather. Participants noted that climate change was causing rise in temperature and erratic weather patterns affecting agricultural production.</p> <p>Discuss the concerns and issues encountered due to climate changes and willingness to undertake actions</p> <p><u>Concerns</u>: There were concerns about climate change. Specifically, climate change causes: (i) saline soils leading to saline crops, (ii) shift in production patters, (iii) reduced production due to heat waves (e.g. mango production is affected by heat waves), and (iv) reduced water affects production.</p> <p><u>Willing to take actions</u>: Farmers are willing or motivated to take action to mitigate effects of climate change since climate change directly affects agricultural production and hence livelihoods that depend on it. Some of the potential actions include: (i) replace fossil fuels with renewable energy; (ii) use of heat resistant crops; and (iii) adjusting the irrigation schedule according weather forecasting schedule. Participants feel that they should undertake these changes.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +1 |
| | <i>Future awareness</i> | <p>Discuss probable future scenarios (suggested by locals) in term of farming viability, resources availability and access and political/social/economic changes</p> <p>Participants imagined and discussed how climate change is likely to impact their livelihoods in the future and came to a consensus that the future will be worse in terms of climate change effects. In that regard, they will need more knowledge to manage effects of climate change.</p> <p>Share knowledge for people to know about relationship between agriculture and climate change</p> <p>Participants clearly understand the link between climate change and agriculture because they have seen how impacts of climate change</p> | +1 |

| | | | |
|----------------|-------------------------|--|----|
| | | <p>(heat waves, water shortages etc.) have significantly affected their productivity and profitability of their farms. They need to take action (planting trees, carbon sequestration, following weather forecasts daily, etc.) to mitigate these effects. They are willing to implement actions as a group. Being part of the group will enable them to be stronger in dealing with the challenges posed by climate change.</p> <p>Discuss willingness to undertake actions collectively/individually from now to prevent or mitigate those future risks The participants are willing to take action collectively to mitigate against future risks. They greatly feel the need to act as a group to undertake actions to mitigate impacts of climate change (-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | |
| | <i>Sustainable dev.</i> | <p>Introduce and define sustainability in terms of agro-ecological understanding and its benefit for the future generation. Sustainability was defined as way of managing natural resources (water and land) in such a way that the future generations are also able to benefit from it.</p> <p>Discuss the willingness and motivation to resources economic (saving) and management to preserve the resources for future generations The participants are willing and motivated to economically utilize and preserve the available resources. The local stakeholders are willing to: (i) undertake/practice sustainable management to preserve/conservate natural resources for future generations; (ii) improve irrigation systems to manage available water, lining and closing the canals to reduce evaporation, (iii) use renewable energy, and (iv) use greenhouse production. Change was assessed a priority because they want their next generation also to benefit (-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +1 |
| Economy | <i>Investment</i> | <p>Discuss the vocation of the land owned by locals and contribution of agriculture to the locals and local economy and wellbeing, along with willingness to enhance it <u>Vocation of land and contribution to agriculture:</u> The local stakeholders believe that land is part of their wellbeing- its contributing to their livelihoods (through agricultural production), local economy and history. They love their land. The most appropriate land use is agricultural production and this tied to their culture and history. Agriculture contributes significantly to the local economy. Most of the family incomes comes from agricultural production. To obtain better/higher production from their farm enterprises, farmers have to invest heavily on efficient irrigation facilities, and yield enhancing inputs (fertilizer and seed) as well as proper crop management. <u>Willingness to enhance contribution of agriculture:</u> The participants are willing to enhance the contribution of agriculture to their well- being and economy. However, priority for change is not significant.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +1 |

| | | | |
|---------------------|------------------------------------|---|----|
| | <i>Substitution (Alternatives)</i> | <p>Discuss willingness to complement/replace land use economical outcome with other practice</p> <p>Land use for agricultural purposes is tied to their culture and history. They do not see adoption of industrial activities or other income generating activities as a priority to them. For them their priority is to see how they can enhance their farm enterprises as a source of income. Agricultural sector is still considered much more important than the industrial sector. Most of the available industries depend on raw materials generated from the agricultural sector.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | 0 |
| | <i>Risk</i> | <p>Assess the relevance of farming for singular families and its contribution to year-to-year budgeting.</p> <p>The major source of income for the rural families is farming. The income earned from farming operations supports the household expenditures throughout the year.</p> <p>Discuss the willingness, and interest, to invest in potential solutions that have the promises to increase revenue (financial) at short or long term There is willingness and interest to invest in production even though they are not sure about the market. This is the major risk since the market is not stable. The other risk is crop failure or reduced harvests attributed to several factors. Local stakeholders indicate that there is a need for government support in terms of provision of subsidies, credit/loans to help them: (i) acquire or invest in new irrigation technologies, and (ii) support/pay for on farm agricultural production practices. Such investments will help to mitigate against crop failure/poor harvests.</p> <p>2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +1 |
| | <i>Subsidies</i> | <p>Discuss the willingness to follow rules and management practices, be part of a cooperation in exchange of subsidies</p> <p>The need for subsidies is a priority, mainly driven by a motivation to sustain investment and mitigate risks. There is willingness to follow regulations that manage the subsidies. Farmers undertake risks especially those related to investments in their farming operations. They are farmers and do not want to leave farming which is their major source of livelihood. Local stakeholders indicated that they welcome any mechanisms to better mitigate the risks they are facing.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +2 |
| Organization | <i>Collaboration</i> | <p>If already part of a cooperation/group/organization: Discuss their feeling of belonging, security and benefit and their willingness to continue to be part of the aggregation</p> <p><u>Belonging, security and benefit:</u> Farmer organizations (groups) exist. Some of the local participants were already part of a group and were positive about being part of the groups/organizations. They feel secure because they can discuss all their concerns within the context of the group. They have also seen the benefits in terms of increased</p> | -2 |

| | | | |
|---------------|---------------------|--|----|
| | | <p>productivity and income, hence willing to continue being part of the group.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical).</p> | |
| | | <p>If already not part of a cooperation/group/organization:</p> <ul style="list-style-type: none"> • Discuss their willing to be part of one and their interest to do so | |
| | <i>Exchange</i> | <p>Discuss the benefit perceived from repeating actions/initiative from neighboring farms and their willingness to learn and share experiences.</p> <p>Repeating actions/beneficial initiatives was perceived as as good and beneficial. It was also felt that whenever, there is an opportunity, this should be treated as a priority. They are also willing to learn and share experiences. However, the process of sharing initiatives or promising best practices needs to be managed/supported by the government or other development actors</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | +2 |
| Policy | <i>Compliance</i> | <p>Discuss the importance given to local regulation and their impact on their farming systems</p> <p>Local stakeholders indicated that they have to comply with existing regulations. Level of compliance to local regulations is high. Participants perceive the local regulations/bye laws as important in ensuring order as well as adoption of certain practices.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | -2 |
| | <i>Change</i> | <p>Discuss their willing to change a fraction/part or totally the regulation system of their that manage their activities</p> <p>Local stakeholders know that they should follow and comply with existing regulations. However, there are some regulations that need to be changed. For example, the regulation on digging wells (- they have to have license) to add available surface water. If they follow the regulation they will not be able to establish/dig wells for ground water. The process to be follow is very length and they cannot guarantee that they will have the license. In this particular case the regulation is bad. Another example, is the regulation related to solar power generation. They are generating solar power using solar and yet it cannot be added to the national grid. Overall, local stakeholders are very much willing to change regulations that are impacting them negatively. However, they do not see this as a priority.</p> <p>(-2. No need (or change) is required (accepted); -1. Limited need (or change) is felt (possible); 0. Equally accepted, but not considered as priority; 1. Relatively important where changes are welcome; 2. Priority where the need for change is felt and critical)</p> | 0 |
| | <i>Introduction</i> | <p>Discuss their willingness to see new regulations to be introduced/facilitated</p> <p>Generally, farmers are afraid of introducing new regulations. Instead more awareness and sensitization should be carried out on existing regulations as well as new ones planned to be introduced. For example,</p> | 0 |

6.2. Annex 2 - Kenya Local Stakeholder Meeting Report



Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in North-East Africa

R1: Best fitting BMPs and innovations in Project Countries



January/2023

Funding source: EU Initiative on Climate-relevant Development Smart Innovation Through Research in Agriculture in developing countries – DeSIRA

Project Acronym: WATDEV

Project Full Title: Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in North-East Africa

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WATDEV CONSORTIUM

The project consortium is comprised of:

| | |
|------------------------|---|
| EGYPT | Heliopolis University (HU) |
| ETHIOPIA | Water and Land Resources Institute (WLRI) |
| FINLAND | Finnish Environment Institute (SIKE) |
| ITALY | Centro Internazionale di Alti Studi Agronomici Mediterranei di Bari (CIHEAM-Bari) |
| ITALY | Italian Research Council (CNR) |
| KENYA | Kenya Agricultural & Livestock Research Organization (KALRO) |
| SUDAN | Water Research Centre (WRC) |
| THE NETHERLANDS | International Soil Reference Center (ISRIC) |
| UGANDA | Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) |

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CIHEAM
BARI

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| Abstract (for dissemination) | <p>The Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project seeks to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. Water scarcity and climate change represent a serious threat to agricultural production and food security in Eastern and Northern African countries. To address this challenge, the project aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Eastern Africa and Egypt. It has two main specific objectives: (i) Research Institutions to improve their knowledge and management on water in agriculture; (ii) Farmers and local actors implement innovative/sustainable solutions and skills on water</p> |
|-------------------------------------|---|

| | |
|-----------------|--|
| | <p>management.</p> <p>CIHEAM-Bari is leading the implementation of the project in collaboration with other European partners (Finnish Environment Institute, National Research Council- Italy, and International Soil Reference and Information Centre) and African partners (Association for Strengthening Agricultural Research in Eastern and Central Africa, Kenya Agricultural and Livestock Research Organization, Water Resources and Land Council, Water Research Council and Heliopolis University). ASARECA is coordinating the implementation of the project activities in the four target countries. In Kenya, the project is being implemented in Hola and Bura irrigation scheme, both situated in Lower Tana River County with mean holding land of 4 hectares. The sites have high potential for crop farming, pastoralism, and grazing. The major challenges facing farming households include high soil salinity; low soil organic carbon; poor leached soils; flooding; water scarcity during the dry season; encroachment of land by invasive species; groundwater salinity; limited groundwater storage; deterioration of water quality because of intrusion of saline water (in coastal areas), and recurring drought leading to conflicts. Some of the challenges are attributed to continuous use of land, fertilizer use, poor land management practices and water quality. Most farmers often abandon their land when becomes saline because production declines and income is lost.</p> <p>Several activities were undertaken during the year of reporting. The project undertook a reconnaissance to the project to map out the project sites, discuss on the potential members of the Stakeholder Forum and document the available Best Management Practices (BMPs). The team discussed with various stakeholders on the potential persons from various organization that are needed to be part of the project governance. The membership selected includes Research – KALRO; National Irrigation Authority; Irrigation Water Users Association (IWUA); Local Cooperative/CBO; Agricultural Finance Cooperation; and Agricultural Extension.</p> <p>The project undertook the activity on Inventory and stocktaking of BMPs and Innovations. The key Best Management Practices (BMPs) inventoried in the study areas were classified under water management i.e. (i) basin irrigation; (ii) furrow irrigation; (iii) water control canals; (iv) sub-surface dams; (v) improved water resource administration through the Irrigation Water Users Association; and (vi) rehabilitation of degraded water points. Soil fertility BMPs being promoted include: (i) manuring – use of farmyard manure; (ii) application of chemical fertilizers; (iii) use of gypsum, Muriate of Potash (MoP), black earth and humix power to correct soil salinity; (iv) crop rotation; and (v) bio-char from rice husks. Climate resilience BMPs include: (i) drought tolerant crops; (ii) cover crops; and (iii) early maturing varieties. The local stakeholder’s brokerage meeting was held in October 2022 in Malindi Kenya. The meeting was attended by 37 participants. The stakeholders were drawn from Policy i.e. Pwani University, National Irrigation Authority, Local area chief, and Directorate of County Agriculture; Local community organizations i.e. Irrigation Water Users Association (IWUA), Landowners, Village Elders (men & women), Local lead farmer leaders, Local producer’ association; development partners (NGOs) working in the area; Financial/Economy i.e. Agrovets/Input suppliers, Agricultural Finance Cooperation, private investor- DigiFarm. The meeting evaluated community needs and had site visits to Bura and Hola irrigation schemes. The main aim of the event was to carry out a participatory evaluation of the local stakeholders’ ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated.</p> |
| Keywords | Best Management Practices, Tana River, Climate resilience |

Index

| | |
|--|------|
| <u>WATDEV CONSORTIUM</u> | ii |
| <u>DOCUMENT INFORMATION</u> | iii |
| <u>Index</u> | v |
| <u>Index of Figures</u> | vi |
| <u>Index of Tables</u> | vi |
| <u>Acronyms and Abbreviations</u> | vii |
| <u>Executive Summary</u> | viii |
| <u>1.0. Introduction</u> | 10 |
| <u>1.1. Purpose, context and scope of this deliverable</u> | 11 |
| <u>1.2. Structure and content of this deliverable</u> | 12 |
| <u>2.0. Context</u> | 13 |
| <u>2.1. Project objectives and impacts</u> | 13 |
| <u>1.3. Communication and dissemination</u> | 19 |
| <u>3.0. Conclusions</u> | 19 |
| <u>References</u> | 20 |
| <u>ANNEXES</u> | 21 |
| <u>Annex 1: Concept Note</u> | 21 |
| <u>Annex 2: Local brokerage meeting at Malindi, Kenya</u> | 28 |
| <u>Annex 3: Program for the local brokerage meetings</u> | 42 |
| <u>Annex 4: Participants list for the local brokerage meetings</u> | 44 |
| <u>Annex 5: Local brokerage meeting event pictures</u> | 46 |
| <u>Annex 6: Local brokerage project site visit pictures</u> | 47 |
| <u>Annex 7: local brokerage meeting group evaluation</u> | 48 |

Index of Figures

| | |
|--|--|
| Figure 1 : Project sites | Errore. Il segnalibro non è definito. |
| Figure 2 : Pictorial presentation of examples of Best Management Practices for Kenya | 16 |

Index of Tables

| | |
|---|--|
| Table 1 : GPS Coordinates for the project sites | Errore. Il segnalibro non è definito. |
| Table 2 : Stakeholder Forum members | 15 |

Acronyms and Abbreviations

| | |
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| AICS | Italian Agency for Development Cooperation |
| ASARECA | Association for Strengthening Agricultural Research in Eastern and Central Africa, Uganda |
| AU-EU | Africa Union-Europe Union |
| CIHEAM | Centre International de Hautes Etudes Agronomiques Méditerranéennes, Italy |
| CNR- | Consiglio Nazionale delle Ricerche, Italy |
| DG DEVCO | The Commission's Directorate-General for International Cooperation and Development |
| EU | European Union |
| FAO | Food and Agricultural Organization of the United Nations |
| HU | Heliopolis University, Egypt |
| ISRIC | International Soil Reference Center, The Netherlands |
| KALRO | Kenya Agricultural & Livestock Research Organization, Kenya |
| R&I | Research and Innovation |
| WRC | Water Research Centre, Sudan |
| STI | Science, Technology and Innovation |
| SYKE | Finnish Environment Institute, Finland |
| WATDEV | Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in North and East Africa |
| WLRI | Water and Land Resources Institute, Ethiopia |

Executive Summary

The Climate Smart WATER Management and Sustainable DEvelopment for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project seeks to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. Water scarcity and climate change represent a serious threat to agricultural production and food security in Eastern and Northern African countries. To address this challenge, the project aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Eastern Africa and Egypt. It has two main specific objectives: (i) Research Institutions to improve their knowledge and management on water in agriculture; (ii) Farmers and local actors implement innovative/sustainable solutions and skills on water management.

CIHEAM-Bari is leading the implementation of the project in collaboration with other European partners (Finnish Environment Institute, National Research Council- Italy, and International Soil Reference and Information Centre) and African partners (Association for Strengthening Agricultural Research in Eastern and Central Africa, Kenya Agricultural and Livestock Research Organization, Water Resources and Land Council, Water Research Council and Heliopolis University). ASARECA is coordinating the implementation of the project activities in the four target countries.

In Kenya, the project is being implemented in Tana River County. The county is divided into four agro-ecological zones; the soils range from sandy, dark clay and sandy loam to alluvial deposits. The vegetation ranges from scrubland to thorny thickets within the riverine area. Average annual temperatures are about 30°C; rainfall is low, bimodal, and conventional in nature. The project sites include Hola and Bura irrigation scheme, both situated in Lower Tana River County with mean holding land size in the county is 4 hectares. The sites have high potential for crop farming, pastoralism and grazing. The inhabitants practice mixed farming while others are purely livestock keepers (pastoralists). The farming households face soil and water management challenges especially in terms of high soil salinity and low soil organic carbon. This has been largely attributed to continuous use of land, fertilizer use, poor land management practices and water quality. Most farmers often abandon their land when becomes saline, because production declines and income is lost. Other challenges include poor leached soils, fluctuation of water levels in Tana River, causing damage to cultivated fields close to the river bank; water scarcity during the dry season, encroachment of land by invasive species; groundwater salinity; limited groundwater storage, deterioration of water quality as a result of intrusion of saline water (in coastal areas), and recurring drought leading to conflicts.

In order to achieve its objectives, the program approach consists of two main lines of work at two different scales:

1. Carrying out inventory, sustainability and feasibility analysis and implementation of agricultural water-related Best Management Practices (BMP) and Innovations (innovative technical and non-technical solutions) in the selected study areas through pilot initiatives;
2. Integrated modeling at catchment to basin-scale in selected study areas to assess BMP and Innovations upscale and out-scale scenarios and their large-scale impact on water resources, soil, ecosystems services, economics and agricultural production.

Several activities were undertaken during the year of reporting. The project undertook a reconnaissance to the project to map out the project sites, discuss on the potential members of the

Stakeholder Forum and document the available Best Management Practices (BMPs). During the reconnaissance, the project team visited various farms within the irrigation scheme and geo-referenced the exact project sites. The SFs will interact with the Executive Agency and the lead partner with the aim of ensuring project adherence to local communities' needs and the ever-evolving challenges in the study areas. The team discussed with various stakeholders on the potential persons from various organization that are needed to be part of the project governance. The membership selected includes Research – KALRO; National Irrigation Authority; Irrigation Water Users Association (IWUA); Local Cooperative/CBO; Agricultural Finance Cooperation; and Agricultural Extension.

The project undertook the activity on Inventory and stocktaking of BMPs and Innovations. The key Best Management Practices (BMPs) inventoried in the study areas were classified under water management i.e. (i) basin irrigation; (ii) furrow irrigation; (iii) water control canals; (iv) sub-surface dams; (v) improved water resource administration through the Irrigation Water Users Association; and (vi) rehabilitation of degraded water points. Soil fertility BMPs being promoted include: (i) manuring – use of farmyard manure; (ii) application of chemical fertilizers; (iii) use of gypsum, Muriate of Potash (MoP), black earth and humix power to correct soil salinity; (iv) crop rotation; and (v) bio-char from rice husks. Climate resilience BMPs include: (i) drought tolerant crops; (ii) cover crops; and (iii) early maturing varieties.

The local stakeholder's brokerage meeting was held in October 2022 in Malindi Kenya. The meeting was attended by 24 participants. The stakeholders in the meeting were drawn Policy i.e. Pwani University, National Irrigation Authority, Local area chief, and Directorate of County Agriculture; Local community organizations i.e. Irrigation Water Users Association (IWUA), Landowners, Village Elders (men & women), Local lead farmer leaders, Local producer' association; development partners (NGOs) working in the area; Financial/Economy i.e. Agrovets/Input suppliers, Agricultural Finance Cooperation, private investor- DigiFarm. A total of 37 stakeholder representatives attended the local meeting. Day 1 of the local meeting was dedicated to the dissemination event and evaluation of BMPs while Day 2 focused on the site visit and site-specific brokerage meeting at Bura and Hola irrigation scheme. At the end of Day 1, there was a reflection on the brokerage of BMPs by the team of experts drawn from CIHEAM Bari, KALRO and ASARECA. The team reviewed the questions and jointly filled the group evaluation form. The meeting was facilitated by KALRO, CIHEAM and ASARECA. The main aim of the event was to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated.

1.0. Introduction

The East African region undoubtedly has great potential not only to feed itself but to play a strategic role in global food systems. The potential lies in the region's natural resources, people and burgeoning markets. Large and diverse natural ecosystems, such as wetlands, rainforests, and savannahs, provide numerous services to local communities. If leveraged, the agricultural sector can boost investment and fierce competitiveness, provide opportunities for employment, contribute to poverty eradication and foster food security and human well-being. Nevertheless, food security and agricultural development in East Africa are constrained by increasingly more extreme and erratic climatic conditions - with strong seasonality of precipitation, large inter-annual variability, and frequent droughts due to climate change. Degradation of soil, land, water, and ecosystems further limits the sector's productivity. Economic barriers, including lack of access to inputs, markets, capital, credit, and finance, are significant. Poor infrastructure, rising land prices, and fragmented tenure arrangements put a stranglehold on productivity and profitability. What is at stake is nothing short of a transformation of the agricultural sector to meet food and nutritional needs, raise incomes and increase employment opportunities, while protecting the environment and reducing inequalities. Agriculture accounts for 70% of total global freshwater withdrawals, making it the largest user of water. Simultaneously, food production and supply chains consume about 30% of total energy consumed globally. This situation is expected to exacerbate in the near future as 60% more food will need to be produced in order to feed the world population in 2050. Against this backdrop, accelerating and scaling up innovation for sustainable water and energy use in agriculture can trigger this much-needed transformation.

Historically, the management of water resources in East African river basins has been a sensitive and ever-important issue, linked both to food security and water management in agriculture, being the main sector/user of freshwater in the basin, up to 75% of the total withdrawal. Water management is strictly interlinked with the sustainability of other natural resources, such as biodiversity and ecosystem functioning, soil, energy and with the way of living and livelihoods of the people. Managing water in East African basins implies the sustainable use of agricultural water while looking at its nexus with food and energy. In many East-African areas, including the Tana River ecosystem in Kenya, the benefits of agricultural resources are endangered by demographic pressure, unplanned rural development and lack of alternative livelihood opportunities causing deforestation, overgrazing, soil, and water degradation and – on the socio-economic side - reduction of agricultural productivity and agricultural systems efficiency.

The scarcity or limited availability of water resources and climate conditions are severely compromising agricultural production and food security. The extreme climatic conditions, with strong seasonality of rainfall, large inter-annual variations, and frequent droughts pose challenges to water management and food security, triggering serious conflicts in the future. Resilience, limited innovation and management gaps in water resources are a major concern to be addressed and call for increased multi-country common efforts in agricultural water research, innovation and capacity building at different levels and scales. There is more need for integration and inter-sectoral approach and consistently to address sensitive issues associated with the complex functioning of ecosystems and their interaction from small to large scale under different environmental, socio-economic, historical and political contexts for supporting local livelihoods. The situation is exacerbated by the increasing human population along the Tana River ecosystem.

Ensuring long-term and long-lasting individual and institutional capacity for the management of water and natural resources requires multi-actors' involvement and engagement, as natural resources provide ecosystem services to different communities, particularly in the agriculture

sector. Also, the transnational policies and dialogues among countries have been difficult in the last years and need support through an improved common and shared water management knowledge.

The wealth of available data offers a repository of many research and cooperation projects delivering good agricultural water management practices and innovative solutions with impacts on small farm scale, but producing limited knowledge of impacts on large scale catchment and giving limited support to the country and regional policymaking. Hence, there is the need for out-scaling technical solutions and best practices to as many as possible areas and, at the same time, improving modelling capacity for mid to long term scenarios assessment of the resilience of water yields, soil, ecosystems, agriculture, food production, and socio-economics. The project builds on ongoing initiatives and datasets.

The general objective of the project is sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. The specific objectives include: - national ministries and research institutions improve their knowledge and management of water in agriculture; and farmers and local actors, cooperatives and Water User Associations implement innovative/sustainable solutions and skills on water management. In order to achieve the above specific objectives, the program approach consists of two main lines of work at two different scales: Carrying out inventory, sustainability and feasibility analysis and implementation of agricultural water-related Best Management Practices (BMP) and Innovations (innovative technical and non-technical solutions) in the selected study areas through pilot initiatives; Integrated modeling at catchment to basin-scale in selected study areas to assess BMP and Innovations upscale and out-scale scenarios and their large-scale impact on water resources, soil, ecosystems services, economics and agricultural production. The specific deliverables of the project best fitting BMPs and Innovations in project countries; enhanced implementation of BMPs/innovations in study areas; BMPs /Innovations upscale and outscale scenarios performed; A water planning/management toolbox available for Researchers and Institutions; and Strengthened knowledge and capacity building and established regional “Water Knowledge” Hub.

This report highlights the activities done within the reporting year under the contributed to deliverable 1.

1.1. Purpose, context and scope of this deliverable

Deliverable D1.1.1 Report on the current water/soil/crop management practices in Kenya countries

Under this deliverable two (2) activities are supposed to be undertaken including i) Inventory and stocktaking of BMPs and Innovations; and ii) Setting the evaluation process of BMPs and Innovation.

The inventory and stocktaking of BMPs and innovations is aimed at assessing and identifying successful stories, their impact, and embedded innovations. The inventory and analysis will mainly focus on initiatives of water management having an impact on water-energy nexus, surface, and groundwater resources, soil quality and erosion, ecosystems, farmers' income, climate impact mitigation. Activities devoted to the collection of water/soil/crop management practices already in use, with the aim to identify the good/best practices to increase resilience to climate.

The development of guidelines for evaluation of best/good practices, associated with different environments/crop genotypes, as a tool to be used in the feasibility task. The evaluation protocol will be developed, allowing the assessment of BMPs feasibility in different settings and conditions, considering study areas in all participating countries. The protocol will identify needed

preconditions for BMPs implementation and evaluation of their performance based on collected data. This activity was undertaken by CIHEAM BARI with no input from KALRO.

Deliverable D 1.2.3 Reports of site-level brokerage meetings

The site-level brokerage meetings main objective was to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated. This will define the base approach for BMPs' implementation (i.e.: farmers or community level) along with BMPs' suitability (need based BMPs selection). The activities will define the main factors influencing the BMPs selection at national level. The process will allow us to build an assessment conceptual framework to evaluate BMPs considering factors and variables at the base of their success/failure. Other important activities include communicating to local actors, the WATDEV project objectives, main actions as well as introducing the project teams and partners.

1.2. Structure and content of this deliverable

Deliverable D1.1.1 Report on the current water/soil/crop management practices in Kenya countries

Under this deliverable 3 activities were undertaken including

- a) Reconnaissance surveys for selection of the actual field sites with full description and digital location;
- b) Identification and submission of stakeholder forum (SF) members and their roles
- c) Inventory and stocktaking of BMPs and Innovations - detailed desktop study and stakeholder engagement to document the information on BMPs along the Tana River ecosystem;

Deliverable 1.1.2: Guidelines of the best/good practices, associated with different environments/crop genotypes, as a tool to be used in the feasibility task.

This activity was undertaken by CIHEAM BARI with no input from KALRO. However, KALRO filled the digital practice assessment sheet capturing all the potential BMPs within the Tana River project site.

Deliverable D 1.2.3 Reports of site-level brokerage meetings

Under this deliverable 4 activities were undertaken including:

- a. Stakeholder Analysis to identify relevant stakeholder/actors and their interrelations;
- b. Preparation of meeting concept notes and invitation letters for country-level brokerage meetings;
- c. Actual convening of site-specific brokerage meetings for buy-in and potential commitment for increased investments;
- d. Preparation of meeting reports.

The reports on the list of stakeholder forum, concept note and local stakeholders' brokerage report are available in the annexes.

2.0. Context

2.1. Project objectives and impacts

Deliverable D1.1.1 Report on the current water/soil/crop management practices in Kenya countries

2.1.1. Reconnaissance surveys for selection of the actual field sites with full description and digital location

During the reconnaissance surveys, the technical team visited several sites and ascertained with consensus that they will be the project sites. The team started by visiting the National Irrigation Authority (NIA) Offices at Hola. The team briefed the manager on the WATDEV project goal, KALROs interest in the Lower Tana River ecosystem and the need for NIAs involvement. The Manager noted that KALRO was active in the scheme with research on rice and cotton, which was impacting positively on people's livelihoods. A discussion was held on the BMPs in practice; the current status of the irrigation and settlement scheme and challenges; the number of people being served by the scheme; the area under irrigation and potential area for expansion; economic returns; farmer organizations and cooperatives within the scheme; and main crops under irrigation. After discussions and interactions, the following 3 sites were taken as project sites

- a) **NIA managed irrigated farms.** The NIA managed farms were mainly under irrigated rice under basin irrigation. However, the farms were leased to farmers during the cropping season for crop cultivation. Discussions were held with the NIA officials and farmers on the management practices and also the challenges.
- b) **Farmer managed irrigated farms.** These farms were supplied water by the NIA on a scheduled basis but all the management of the farm operations including crops to be grown and management of the soils is done by the individual farmers. A discussion was held with some of the farmers on soil and water management practices.
- c) **KALRO managed irrigation farm.** KALRO worked directly with farmers, whether within farmer managed or NIA managed farms. KALROs is undertaking research work on Cotton and Rice. Cotton is being reintroduced after it was abandoned many years ago. Discussions were held with the scientists involved and the farmers within the project.

After technical discussions several GPS points were taken to delineate the project sites (Table 1). This were used to produce the map of the project site (Figure 1). All the project sites fall within the irrigation and settlement scheme but differ in terms of management and the dominant crop in production. In terms of management, there are farms under the NIA management and some farms under the community management. The most important crops grown include cotton, maize, bulb onions, rice and watermelons.

Table 1 - GPS Coordinates for the project sites

| ID_Site | Latitude | Longitude | Elevation (msl) | GPS Accuracy (m) |
|------------------------------------|----------|-----------|-----------------|------------------|
| Hola irrigation rice field_site1 | -1.48158 | 39.99461 | 100.4 | 4.21 |
| Hola irrigation rice field_site2 | -1.48309 | 39.99254 | 93.6 | 4.14 |
| Hola irrigation rice field_site3 | -1.42088 | 40.0065 | 97.91 | 4.74 |
| Bura irrigation rice field_site4 | -1.10803 | 39.87428 | 162.18 | 3.90 |
| Bura irrigation rice field_site2 | -1.10825 | 39.87444 | 155.58 | 3.90 |
| Bura irrigation cotton field_site4 | -1.14036 | 39.85864 | 129.48 | 3.90 |

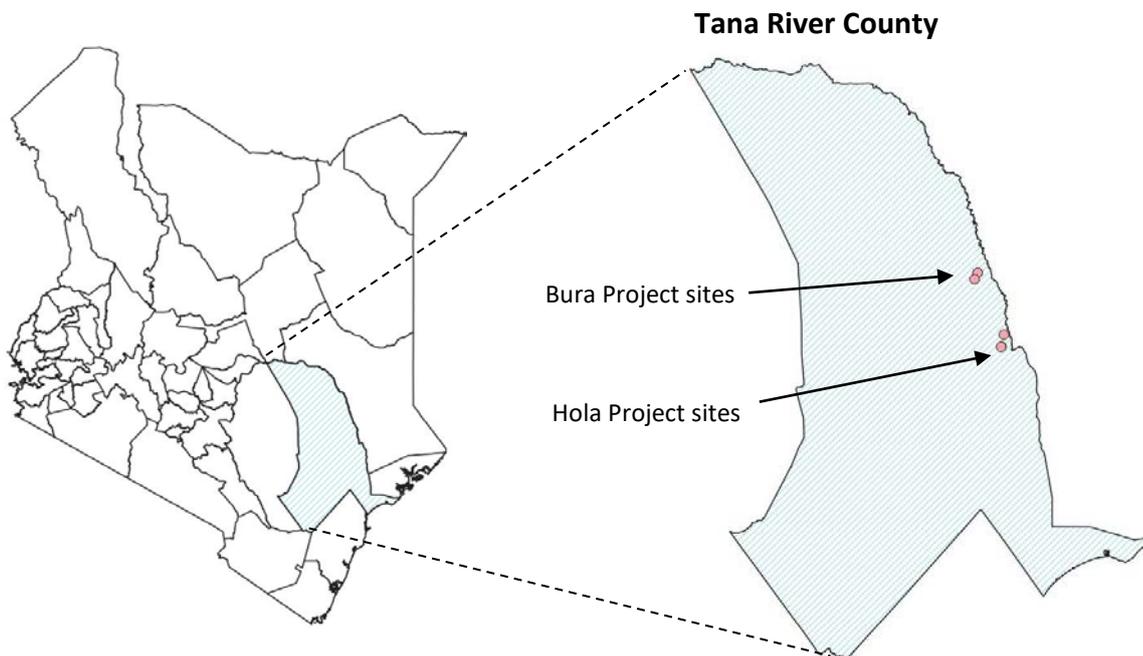


Figure 1 - Project sites

a) Identification and submission of stakeholder forum (SF) members and their roles

The project governance structure includes a Stakeholder Forum (SF) in each country. The SFs will interact with the Executive Agency and the lead partner with the aim of ensuring project adherence to local communities’ needs and the ever-evolving challenges in the study areas.

The team discussed with various stakeholders on the potential persons from various organization that are needed to be part of the project governance. The names agreed are outlined in table 2 below.

Table 2 - Stakeholder Forum members

| Name | Organization | Role | Contacts |
|--------------------|---|--|---|
| Dr. Ruth Musila | Research | Research and dissemination on high value crops under irrigation | ruthmusila@gmail.com ruth.musila@kalro.org Tel: +254 723 917819 |
| Dr Raphael Wanjogu | National Irrigation Authority | Policy and research on water and soil management practices | wanjogurk@gmail.com rwanjogu@irrigation.go.ke Tel: +254 722865449 |
| Jonas Asumbi | Irrigation Water Users Association (IWUA) | Irrigation water use and management | Email: johnasumbi@gmail.com Tel: +254 724816968 |
| Akumu Ernest | Cooperative/CBO | Produce aggregation and marketing; provision of credit and farm inputs | Email: hola@irrigation.go.ke Tel: +254 726637072 |
| Eric Masese | Agricultural Finance Cooperation Bura | Provision of credit and farm inputs | Email: maseseeric1@gmail.com Tel: +254 700213499; 729261178 |
| Alex Kubende | Agricultural Extension | Extension services on crop, soil and water management | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com , Tel: +254 721143388 |

b) Inventory and stocktaking of BMPs and Innovations

This involved a detailed desktop study and stakeholder engagement to document the information on BMPs along the Tana River ecosystem. The discussions on the various BMPs were done with various stakeholders in Tana River Ecosystem. These included farmers, the NIA, the County Agriculture Office, and other stakeholders in the agriculture sector.

Deliverable 1.1.2: Guidelines of the best/good practices, associated with different environments/crop genotypes, as a tool to be used in the feasibility task

This activity was undertaken by CIHEAM BARI with no input from KALRO. However, KALRO filled the digital practice assessment sheet capturing all the potential BMPs within the Tana River project site.

The BMP aims are to enhance and improve, and in some cases correct, the positive balance between the Human and Environmental subsystems. BMP collections was following two major steps: (1) collection of projects through the Project Description Sheet, focusing on: (i) project location, (ii) methodological data of the project, (iii) scope of the project, and (iv) applied BMP; and (2) insight on each project through the Practice Evaluation Sheet, focusing on: (i) project description sheet information, (ii) socio-economic aspects of the project, (iii) agro ecological aspects of the project, and (iv) BMP description.

The BMPs collected in Kenya were distributed in Crops, Water, Soil and Atmosphere. The BMPs on soil were mainly on soil conservation, water-holding improvement, soil organic matter improvement and structure preservation. BMPs related to water were mainly on water use efficiency, surface water improvement, groundwater improvement, logging/salinization reduction and resistance to salinity. On the other hand, the BMPs on crops were mainly on crop productivity improvement, food security/livelihoods, farmers' engagement, and specific genotype. BMPs related to the atmosphere focused on climate smart energy sources like solar power.



Figure 2 - Pictorial presentation of examples of Best Management Practices for Kenya

Deliverable D 1.2.3 Reports of site-level brokerage meetings

Under this deliverable, 4 activities were undertaken including: - stakeholder Analysis to identify relevant stakeholder/actors and their interrelations; preparation of meeting concept notes and invitation letters for country-level brokerage meetings; actual convening of site-specific brokerage meetings for buy-in and potential commitment for increased investments; and preparation of meeting reports.

A1.3. Organization of multi-actors regional meetings and brokerage on BMPs and Innovations.

This activity was organized by KALRO in collaboration with ASARECA. The local brokerage meeting was held in Hola and Bura project sites in the Tana River county. A concept note was developed (Annex 1) to guide the preparations for the meeting. The main objective of the event was to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated. This will define the base approach for BMPs' implementation (i.e.: farmers or community level) along with BMPs' suitability (need based BMPs selection). The activities will define the main factors influencing the BMPs selection at national level. The process will allow us to build an assessment conceptual framework to evaluate BMPs considering factors and variables at the base of their success/failure. Other important activities include communicating to local actors, the WATDEV project objectives, main actions as well as introducing the project teams and partners. Specifically, this meeting was held to undertake:

1. Community evaluation of local community needs in terms of application of the BMPs
2. Group evaluation to qualitatively assess the working group in terms of:
 - a) the group's ability to collaborate and work together and the inclusiveness,
 - b) the group's consistency and cohesion in performing new processes and activities, and
 - c) the group's ability to share individual benefits with the whole community.

The stakeholders in the meeting were drawn from research i.e. KALRO and Pwani University; Policy i.e. National Irrigation Authority, Local area chief, and Directorate of County Agriculture; Local community organizations i.e. Irrigation Water Users Association (IWUA), Landowners, Village Elders (men & women), Local lead farmer leaders, Local producer' association; development partners (NGOs) working in the area; Financial/Economy i.e. Agrovets/Input suppliers, Agricultural Finance Cooperation, private investor- DigiFarm. A total of 37 stakeholder representatives attended the local meeting. Day 1 of the local meeting was dedicated to the dissemination event and evaluation of BMPs while Day 2 focused on the site visit and site-specific brokerage meeting at Bura and Hola irrigation scheme. At the end of Day 1, there was a reflection on the brokerage of BMPs by the team of experts drawn from CIHEAM Bari, KALRO and ASARECA. The team reviewed the questions and jointly filled the group evaluation form.

Opening speeches were provided by Dr. Eliud Kireger - Director General KALRO; M/s Margherita Tenedini – AICS Cairo; and Dr. Gaetano Ladisa - CIHEAM Bari. The opening speeches centred on the background of the project, goal of the project, funding and institutional collaboration arrangements, key deliverables and timelines. After opening speeches, there were plenary sessions moderated jointly by KALRO and ASARECA. During the plenary sessions, the participants were involved in the evaluation of possible BMPs and also the assessment of the local needs. The discussions enabled the filling in of the community needs assessment form (detailed in the Annex 2 report). The discussion focused on the possible best BMPs application sectors especially with respect to issues related to preservation, exploitation, management and alternative solutions. The issues discussed included: -

1. Ground water - preservation and exploitation
2. Soil focused - soil management, fertilizer use and pesticides
3. Crop - varieties and management practices
4. Surface water - Exploitation, access and reuse; distribution and irrigation systems
5. Atmosphere - Climate change, future awareness and sustainable development.
6. Economy - investment, substitution (alternatives), risk, and subsidies
7. Organization - collaboration and exchange (willingness to learn and share ideas)
8. Policy - compliance, change, and introduction (willingness to see new regulations introduced).

The site visits to Hola and Bura irrigation schemes was carried out on the second day. Participants were able to physically see, appreciate and discuss application of various BMPs. The sites visited include the Kenya Climate Smart Agriculture solar powered irrigation scheme; the National Irrigation Authority offices; KALRO rice demonstration farms and National Irrigation Authority water intake point or pumping station. A comprehensive analysis of the plenary discussions and site visits can be found in the Local brokerage report (Annex 2).

From the local brokerage meetings and site visits, the following summary can be made:

- Efficient irrigation water use and management need to be enhanced as water is becoming scarcer due to climatic changes and competing uses. Ground water exploitation is limited due to poor water quality and the depth of the water, making it costly.
- The exploitation of surface water from Tana River, whose source is in the highlands, somehow made some of the participants think that climate change is not an issue on concern. But after plenary discussions, it was clear that climate change should be an issue concern in the irrigation scheme.
- There is a policy conflict between the County government and the National government on irrigation land administration. All the land belongs to the National Irrigation Authority, and it's leased out to farmers. This land tenancy system seems to be inhibiting farmer investments in land improvement. Policies especially on land tenure need to be reviewed to allow land ownership within the irrigation scheme. The policy review will also allow the expansion of the irrigation scheme.
- The projects initiatives are welcome as this will help farmers in their efforts to make irrigation efficient.
- The multi-stakeholder approach i.e., bringing stakeholders from different back ground to discuss and common agenda, is innovative and enhances collaboration between farmers and professionals. This resonates well with the bottom-up community approach or the already existing community structures.
- Moisture management within the irrigation schemes in a big research gap that the project can address.
- Most farmers don't invest in soil management practices due to cost of fertilizers, and also some cultural factors.
- Though the irrigation scheme has been operational for many years, there are still infrastructural challenges affecting optimal productivity of the land.

- To counter climate change impacts, farmers need to invest in robust adaptation measures including agroforestry. Farmers were also encouraged to diversity as a coping mechanisms to climate change.
- Farmer exchange visits in one way for farmer-to-farmer learning and has been instrumental in agricultural information and technology dissemination. Most participants were willing to embrace or try out new BMPs.
- The participants noted that horticulture involved high use of inputs, and which are also costly e.g., fertilizer.
- Contract farming is being embraced by farmers for ease of produce aggregation and marketing. This also allows them to access credit.
- Development actors and partners are active in the project sites supporting farmers in adoption of various BMPs. The private sector e.g., agro-dealers and NGOs play a major role in extension support to farmers. This augments the extension services offered by the County Government.

2.2. Communication and dissemination

A video on the WATDEV project initiatives was made and aired in the local TV stations and newspaper, and posted in youtube for wider dissemination. The short video clips elaborated on the project, its objectives and intended outcomes. The links to the videos are given below:-

1. Water management project to mitigate climate change effects.
<https://www.standardmedia.co.ke/farmkenya/video/2000226705/water-management-project-to-mitigate-climate-change-effects>
2. Business Cafe: Water Management Project 'Watdev' To Focus On Key Dam Projects.
<https://www.kenyamoja.com/video/business-cafe-water-management-project-watdev-focus-key-dam-projects-ktn-news-210129>

3.0. Conclusions

The WATDEV Project was developed with an objective of getting a deeper understanding smallholder resilient to climate change. The project being led by CIHEAM Bari is being implemented in 4 countries (Kenya, Sudan, Ethiopia, and Egypt). In Kenya, the sites are in Bura and Hola in the Tana River County. Within the last six months since the project inception, a number of activities have been accomplished. The activities include the reconnaissance survey, identification of best management practices (BMPs), site brokerage and ranking of BMPs.

The proposed activities include analysis of soil, water and crop management practices in the study sites have been analysed. During the site brokerage meeting, the stakeholders discussed and ranked in BMPs which will further be used for modelling site specific innovations.

These fall in three project sites (NIA managed farms, Farmer managed farms and KALRO managed farms). The selection of these three categories will give an opportunity to compare the impact of the BMPs in different scenarios. The activities and the findings so far have been documented and reported in the annexed reports. Efforts have also been made to disseminate the findings widely through the existing project and KALRO platforms such as YouTube, Facebook, and twitter. The findings will guide in further implementation of activities and also soliciting feedback from the stakeholders.

References

- Adams, J., 1995. Risk. UCL Press, London.
- Breukers, A., van Asseldonk, M., Bremmer, J., and Beekman, V., 2012. Understanding Growers' Decisions to Manage Invasive Pathogens at the Farm Level, *Phytopathology* 102:6, 2012, Pages 609-619, <http://dx.doi.org/10.1094/PHYTO-06-11-0178>, (<https://apsjournals.apsnet.org/doi/10.1094/PHYTO-06-11-0178>)
- Déus, I., Wybo, J.L., Paré-Chamontin, A., 2011. Assessing Tomato Producers' Vulnerability to Pest Risk (*Bemisia tabaci*/TYLCV) for a Better Risk Governance, *Acta Hort.* 914, Pages 307-310, DOI: 10.17660/ActaHortic.2011.914.55, <https://doi.org/10.17660/ActaHortic.2011.914.55>
- ECOM – Effective Communication in Outbreak Management for Europe, 2015. Standard questionnaire on risk perception of an infectious disease outbreak (<http://ecom.eu.info/>)
- Fischer, F., 2005. Are scientists irrational? Risk assessment in practical reason. In: Leach, M., Scoones, I., Wynne, B. (Eds.), *Science and Citizens*. Zed Books, London, pp. 54–65.
- Fish, R., Austin, Z., Christley, R., Haygarth, P.M., Heathwaite, A.L., Latham, S., Medd, W., Mort, M., Oliver, D.M., Pickup, R., Wastling, J.M., and Wynne, B., 2011. Uncertainties in the governance of animal disease: an interdisciplinary framework for analysis. *Phil. Trans. R. Soc. B* 366, 2023–2034 (12 July 2011) (doi:10.1098/rstb.2010.0400)
- Gaillard, J-C. & Dibben, J.L., 2008. Editorial: Volcanic risk perception and beyond. *Journal of Volcanology and Geothermal Research*. 172. 163-169. 10.1016/j.jvolgeores.2007.12.015.
- Goodman, L.A., 1961. "Snowball sampling". *Annals of Mathematical Statistics*. 32(1): 148–170. doi:10.1214/aoms/1177705148.
- Grasmück, D., and R. W. Scholz. 2005. "Risk Perception of Heavy Metal Soil Contamination by High-Exposed and Low-Exposed Inhabitants: The Role of Knowledge and Emotional Concerns." *Risk Analysis* 25: 611–622.
- Greimas A.J., 1966. *Sémantique structurale*. Paris: Larousse
- Ilbery B., Maye D., Little R., 2012. Plant disease risk and grower–agronomist perceptions and relationships: An analysis of the UK potato and wheat sectors, *Applied Geography*, Volume 34, 2012, Pages 306-315, ISSN 0143-6228, <https://doi.org/10.1016/j.apgeog.2011.12.003>. (<http://www.sciencedirect.com/science/article/pii/S0143622811002396>)
- Ilbery B., Maye D., Ingram J., Little R., 2013. Risk perception, crop protection and plant disease in the UK wheat sector, *Geoforum*, Volume 50, 2013, Pages 129-137, ISSN 0016-7185, <https://doi.org/10.1016/j.geoforum.2013.09.004>. (<http://www.sciencedirect.com/science/article/pii/S0016718513001863>)
- Jaccard, J., T. Dodge, and V. Guilamo-Ramos. 2005. Metacognition, Risk Behavior, and Risk Outcomes: The Role of Perceived Intelligence and Perceived Knowledge. *Health Psychology* 24: 161–170.
- Lave, J., Wenger, E., 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press. ISBN 0-521-42374-0.; first published in 1990 as Institute for Research on Learning report 90-0013.
- McCarthy, J.J., Canziani, O.F., Leary, N.A., Dokken, D.J. and White, K.S. (eds.) 2001. *Climate change 2001: impacts, adaptation and vulnerability*. Cambridge University Press, Cambridge, UK.

ANNEXES

Annex 1: Concept Note

EVENT CONCEPT NOTE: Activity number: A1.2 / A1.3

Name/Title of the event: Meeting with local Stakeholders on BMPs evaluation and Site-specific brokerage meeting

Background

Tana River county is divided into four agro- ecological zones; the soils range from sandy, dark clay and sandy loam to alluvial deposits. The vegetation ranges from scrubland to thorny thickets within the riverine area. Average annual temperatures are about 30°C; rainfall is low, bimodal, and conventional in nature. The project sites include Hola and Bura irrigation scheme, both situated in Lower Tana River County with mean holding land size in the county is 4 hectares. The sites have high potential for crop farming, pastoralism and grazing. The inhabitants practice mixed farming while others are purely livestock keepers (pastoralists).

The farming households face soil and water management challenges especially in terms of high soil salinity and low soil organic carbon. This has been largely attributed to continuous use of land, fertilizer use, poor land management practices and water quality. Most farmers often abandon their land when becomes saline, because production declines and income is lost. Other challenges include poor leached soils, fluctuation of water levels in Tana River, causing damage to cultivated fields close to the river bank; water scarcity during the dry season, encroachment of land by invasive species; groundwater salinity; limited groundwater storage, deterioration of water quality as a result of intrusion of saline water (in coastal areas), and recurring drought leading to conflicts.

The key Best Management Practices (BMPs) currently used in the study areas can be classified under water management i.e. (i) basin irrigation; (ii) furrow irrigation; (iii) water control canals; (iv) sub-surface dams; (v) improved water resource administration through the Irrigation Water Users Association; and (vi) rehabilitation of degraded water points. Soil fertility BMPs currently being promoted include: (i) manuring – use of farm yard manure; (ii) application of chemical fertilizers; (iii) use of gypsum, Muriate of Potash (MoP), black earth and humix power to correct soil salinity; (iv) crop rotation; and (v) bio-char from rice husks. Climate resilience BMPs include: (i) drought tolerant crops; (ii) cover crops; and (iii) early maturing varieties.

Event Objectives

The main aim of the event is to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated. This will define the base approach for BMPs' implementation (i.e.: farmers or community level) along with BMPs' suitability (need based BMPs selection).

The activities will define the main factors influencing the BMPs selection at national level. The process will allow us to build an assessment conceptual framework to evaluate BMPs considering factors and variables at the base of their success/failure. Other important activities include communicating to local actors, the WATDEV project objectives, main actions as well as introducing the project teams and partners. Specifically, the local meetings will be held to undertake:

Community evaluation of local community needs in terms of application of the BMPs Group evaluation to qualitatively assess the working group in terms of the group's ability to collaborate and work together and the inclusiveness, the group's consistency and cohesion in performing new

processes and activities, and the group's ability to share individual benefits with the whole community.

The outcomes of this evaluation will be subjected to analysis using spider-graphs to show the overall attitude of the local community with respect to the management practices. Based on the community preferences, a matching exercise will be performed to identify, candidate practices in the BMPs repository.

Target Audience

Based on the WATDEV approach, the target audiences for local brokerage meetings will be drawn from three (3) key stakeholder categories. These include: (i) Policy, (ii) Organization, and (iii) Financial/Economy. Based on this, various stakeholder categories have been invited to attend the local meeting. Under policy, the following stakeholders will be represented: (i) Pwani University, (ii) National Irrigation Authority, and (iii) Directorate of County Agriculture. Local community organizations invited include: (i) Irrigation Water Users Association (IWUA); (ii) Landowners; (iii) Village Elders (men & women); (iii) Local farmer leaders; (iv) Local producer' association; (iv) Farmer cooperatives; (v) NGOs working in the area; and (vi) Irrigation staff working in area.

Based on this, the participants that will attend the local meetings will be drawn from the following stakeholder categories.

Policy: - Local administrative leaders (local area chief and sub chief); Pwani University; National Irrigation Authority; Tana Irrigation Scheme National Irrigation Authority; County Directorate of Agriculture; and Kenya Agricultural Research and Livestock Organization

Organizations: - Irrigation Water Users Association (IWUA); Village Elders (men & women); Lead Farmers; Local Producer' association – Umoja United Farmers Group; Cooperative/Community Based Organization; Concern worldwide (NGO); and Irrigation staff working in area

Financial/Economy: - Agrovets/Input supplier/company in the area – Syngenta; Agricultural Finance Cooperation Bura; and Private investor- Digi Farm

Expected Outputs

The expected outputs of this local Stakeholders on BMPs evaluation & Site-specific brokerage meeting includes: Preliminary list of stakeholders involved in each study area identified; Completed group evaluation sheet; Completed needs evaluation sheet; Report on site-level brokerage meeting in Kenya

Method

The present events are linked to the Activities falling under Result R1 “Best fitting MBPs and innovations in project countries”. In particular, the local events are aimed at applying an evaluation framework that will lead to the selection of the BMPs – among the ones collected, described, and evaluated in the Repository – suitable for implementation in the study areas. In the picture below (Figure 1) the whole process, from the local meetings (1) to the Multi-Actors' regional meeting (3) through matching and selection of BMPs (2) is shown. Figure 4 shows how steps from 1 to 3 will feed step 4 other activities planned in WATDEV (awareness, training, feasibility, modelling, etc.).

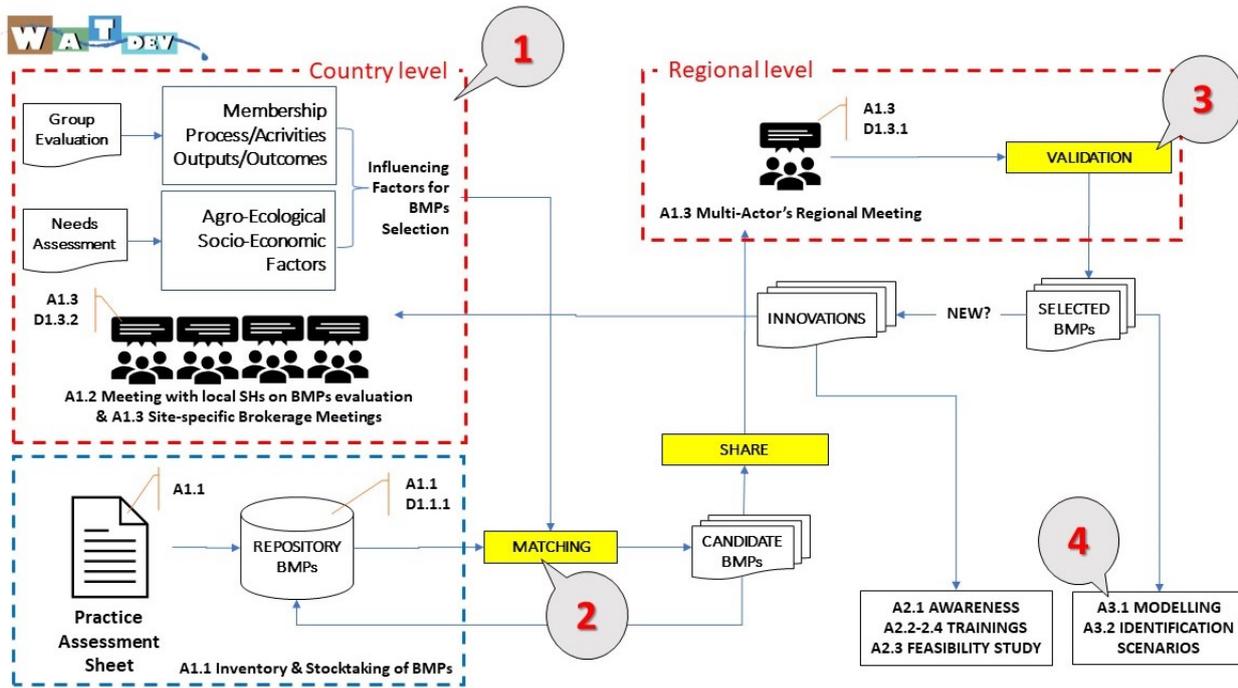


Figure 1. Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors' Regional meeting (3) and beyond (4)

As in the figure 1, the process is articulated into 4 steps as follows. During the local meetings, an assessment and evaluation with the local's actors will be performed. Such evaluation is composed of: i) **Group evaluation:** with a set of question, it aims at qualitatively assess the working group, describing the group ability to collaborate and work together and the inclusiveness, the group consistency and cohesion in performing new processes and activities, the Group ability to share individual benefit with the whole community. ii) **Evaluation of local community needs:** this aims at evaluating the group flexibility (needs), by area of application of BMPs, to undergo changes.

The outcomes of the local meetings, after a scoring procedure, will be plotted through spider-graphs (see figure 2) showing the overall attitude of the local community to put in place management practices. In line with their preferences, a matching exercise will be performed to extract, among the practices collected (after a preliminary assessment) in the BMPs repository, the "candidate" ones.

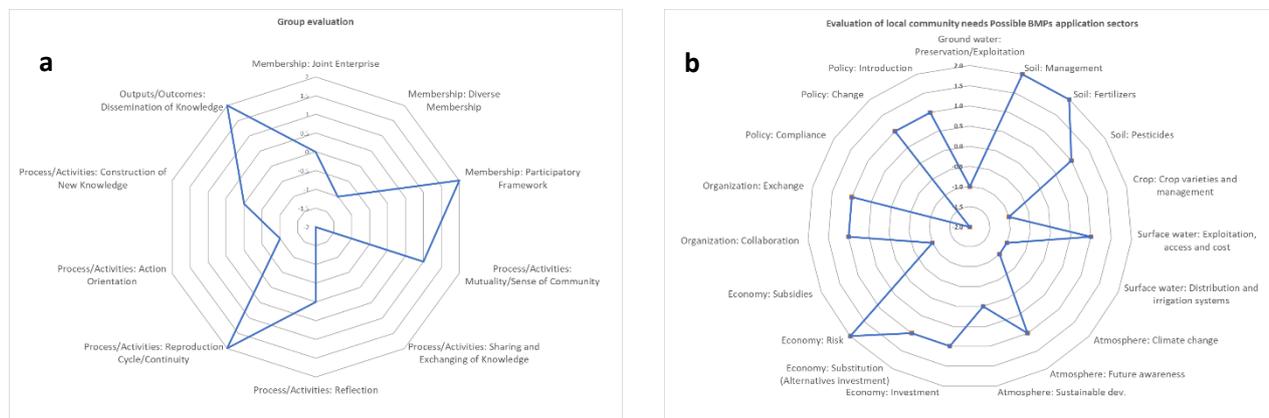


Figure 2 - Spider graphs displaying examples of Group evaluation (a) and Needs evaluation (b).

The candidate BMPs will be discussed in the A1.3 Multi-Actor's Regional meeting, bringing together a number of stakeholders (identified by means of a specific Stakeholder Analysis) at regional level. This meeting will aim to validate the BMPs that are titled to be modelled afterward

(Activity 3.1). The selected BMPs could be suitable to be applied in a certain study area, but not already known from the local farmers. For the application of this innovation, it could be useful to explore the feasibility of a public-private partnership able to support its implementation, by means of the second round of brokerage meetings (Activity 1.3). In any case, it would also be necessary to carry out a feasibility study (Activity 2.3) as well as an awareness (Activity 2.1) and training campaign (Activity 2.2-2.4) for local communities.

The BMPs selected after the A1.3 Multi-Actors' Regional Meeting will be subjected to the integrated modeling process and the simulation of possible impact scenarios due to their upscaling/outscaling, from the areas of implementation to large-scale catchments within - and possibly beyond - the study areas.

Venue and Date

The local meeting will be held from 18-19 October 2022 in Malindi- Kenya. The meetings will be held in the study areas to allow the local actors to easily participate in the meetings.

Table 1 - Identification of stakeholder forum (SF) members and their roles(Kenya)

| Name | Gender | Organization | Role | Contacts |
|------------------|--------|---|--|---|
| Dr. Ruth Musila | Female | Research | Research and dissemination on high value crops under irrigation | ruthmusila@gmail.com ruth.musila@kalro.org Tel: +254 723 917819 |
| Ms Florence Ndai | Female | National Irrigation Authority | Policy | Participant (Policy and research on water and soil management practices) |
| Jonas Asumbi | Male | Irrigation Water Users Association (IWUA) | Irrigation water use and management | Email: johnasumbi@gmail.com Tel: +254 724816968 |
| Akumu Ernest | Male | Cooperative/CBO | Produce aggregation and marketing; provision of credit and farm inputs | Email: hola@irrigation.go.ke Tel: +254 726637072 |
| Alex Kubende | Male | Agricultural Extension | Extension services on crop, soil and water management | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com , Tel: +254 721143388 |

Table 2 - Stakeholders identified for the local brokerage meetings (Kenya)

| # | Name | Gender | Organization | Category | Role | Contacts |
|----|---------------------|--------|--|-----------------|--|---|
| 1 | Dr. Ruth Musila | Female | Research | Policy | Participant (Research & dissemination on high value crops under irrigation) | Email: ruthmusila@gmail.com ; ruth.musila@kalro.org Tel: +254 723 917819 |
| 2 | Ms Florence Ndai | Female | National Irrigation Authority | Policy | Participant (Policy and research on water and soil management practices) | Email: flondai@yahoo.com Tel: +254 720906226 |
| 3 | Johnson Mko | Male | Tana Irrigation Scheme National Irrigation Authority | Policy | Participant (Irrigation Agronomist) | Email: jmko@irrigation.go.ke Tel: +254 712471191; |
| 4 | Jonas Asumbi | Male | Irrigation Water Users Association | Organization | Participant (Irrigation water use and management) | Email: johnasumbi@gmail.com ; Tel: +254 724816968 |
| 5 | Akumu Ernest | Male | Cooperative/CBO | Organization | Participant (Product aggregation & marketing; provision of credit and farm inputs) | Email: hola@irrigation.go.ke ; Tel: +254 726637072 |
| 6 | Eric Masese | Male | Agricultural Finance Cooperation Bura | Finance | Participant (Provision of credit and farm inputs) | Email: eonyango@agrifinance.org ; maseseeric1@gmail.com Tel: +254 700213499; 729261178 |
| 7 | Alex Kubende | Male | County Directorate of Agriculture | Policy | Participant (Extension services on crop, soil and water management) | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com , Tel: +254 721143388 |
| 8 | Dr. Esther Muindi | Female | Pwani University | Policy | Participant (Water and Agricultural research) | Email: e.muindi@pu.ac.ke ; Tel: 07234564427 |
| 9 | Hamisi Kofa | Male | Local Producer' association – Umoja United Farmers Group | Organization | Participant (Group production and marketing) | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254724144608 |
| 10 | Pius Kinuthia | Male | Agrovets/Input supplier/company in the area - Syngenta | Finance/Economy | Participant (Agro-input supply) | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254716031159 |
| 11 | Mohamed Bodole Abdi | Male | Chief | Policy | Participant | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254722861524 |
| 12 | Esther Wanjera | Female | Village elder – women | Organization | Participant | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254703111354 |
| 13 | George Kahango | Male | Village elder – men | Organization | Participant | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com |

| # | Name | Gender | Organization | Category | Role | Contacts |
|----|----------------|--------|------------------------------------|-----------------|-------------|---|
| | | | | | | Tel: +254711541131 |
| 14 | Caroline Mugo | Female | NGO – Concern worldwide | Organization | Participant | Email: Caroline.mugo@concern.net Tel: +254720376469 |
| 15 | Naphtal Semi | Male | Lead farmer | Organization | Participant | Email: C/okubendea@yahoo.com; cdatahariver@yahoo.com Tel: +254716528560 |
| 16 | Hesbon Ondieki | Male | Private sector investor- Digi Farm | Finance/Economy | Participant | Email: hesbornondiek@gmail.com Tel:+254729270664 |

Facilitators/Speakers:

1. Dr. Eliud Kireger - Director General – Kenya Agricultural and Livestock Research Organization – Director@kalro.org
2. Dr. Michael Okoti – Senior Scientist – Natural Resource Management - Kenya Agricultural and Livestock Research Organization – michael.okoti@kalro.org
3. Moses Odeke and Ben Moses Ilakut – ASARECA, m.odeke@asareca.org
4. Gaetano Ladisa and Guissep- CIHEAM-BARRI

Annex 2: Local brokerage meeting at Malindi, Kenya

Meeting with Local Stakeholders on Evaluation and Site-specific Brokerage of Best Management Practices, Malindi-Kenya.

This was a Hybrid (Physical and Virtual) held on September 14-15, 2022.

1.1 Background and Rationale

The Climate Smart WATER Management and Sustainable DEVelopment for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project seeks to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. Water scarcity and climate change represent a serious threat to agricultural production and food security in Eastern and Northern African countries. To address this challenge, the project aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Eastern Africa and Egypt. It has two main specific objectives: (i) Research Institutions to improve their knowledge and management on water in agriculture; (ii) Farmers and local actors implement innovative/sustainable solutions and skills on water management.

CIHEAM-Bari is leading the implementation of the project in collaboration with other European. (Finnish Environment Institute, National Research Council- Italy, and International Soil Reference and Information Centre) and African partners (Association for Strengthening Agricultural Research in Eastern and Central Africa, Kenya Agricultural and Livestock Research Organization, Water Resources and Land Council, Water Research Council and Heliopolis University). ASARECA is coordinating the implementation of the project activities in the four target countries.

1.2 Project Area

Tana River County is divided into four agro-ecological zones; the soils range from sandy, dark clay and sandy loam to alluvial deposits. The vegetation ranges from scrubland to thorny thickets within the riverine area. Average annual temperatures are about 30°C; rainfall is low, bimodal, and conventional in nature. The project sites include Hola and Bura irrigation scheme, both situated in Lower Tana River County with mean holding land size in the county is 4 hectares. The sites have high potential for crop farming, pastoralism, and grazing. The inhabitants practice mixed farming while others are purely livestock keepers (pastoralists).

The farming households face soil and water management challenges especially in terms of high soil salinity and low soil organic carbon. This has been largely attributed to continuous use of land, fertilizer use, poor land management practices and water quality. Most farmers often abandon their land when becomes saline because production declines and income is lost. Other challenges include poor leached soils, fluctuation of water levels in Tana River, causing damage to cultivated fields close to the riverbank; water scarcity during the dry season, encroachment of land by invasive species; groundwater salinity; limited groundwater storage, deterioration of water quality as a result of intrusion of saline water (in coastal areas), and recurring drought leading to conflicts.

The key Best Management Practices (BMPs) currently used in the study areas can be classified under water management i.e. (i) basin irrigation; (ii) furrow irrigation; (iii) water control canals; (iv) sub-surface dams; (v) improved water resource administration through the Irrigation Water Users Association; and (vi) rehabilitation of degraded water points. Soil fertility BMPs currently being promoted include: (i) manuring – use of farmyard manure; (ii) application of chemical fertilizers; (iii) use of gypsum, Muriate of Potash (MoP), black earth and humix power to correct soil salinity; (iv) crop rotation; and (v) bio-char from rice husks. Climate resilience BMPs include: (i) drought tolerant crops; (ii) cover crops; and (iii) early maturing varieties.

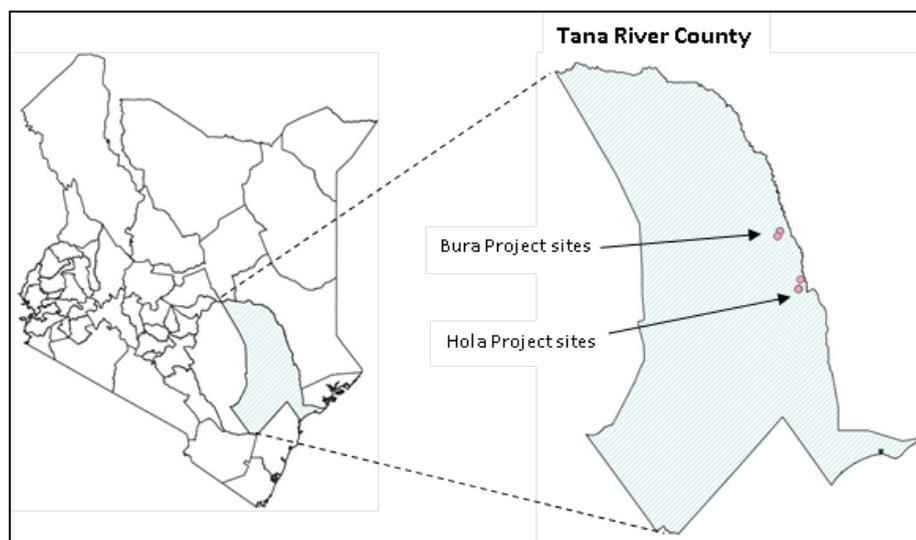


Figure 1 - Project sites

1.3 Purpose of the Local Event

The official launch of the project in May 2022 paved way for implementation of the initial activities such as: (i) inventory and stock taking of the BMPs/I (A1.1) and (ii) evaluation of BMPs/I (A1.2 & A1.3). The local event was held to kick start implementation of the project activities in Kenya and comprised of: (i) dissemination event and meeting for BMPs evaluation; and (ii) site visit and site specific brokerage meeting. The main objective of the WATDEV local event was to sensitize

stakeholders about the project and kick start a dialogue and cooperation with local actors to stimulate the debate on how to improve water management in Agriculture.

2. Methodology

2.1 Workshop Methodology

The WATDEV Local Meeting was held over a period of two days from 18th to 19th October 2022 and was attended by both physical and online participants via zoom platform. The background to the project, including objectives and goal; and the initial work on BMPs documentation was done through PowerPoint presentations. A short video was also shown on KALRO. The needs assessment sessions were done through engagements and discussion in plenary. The aim was to evaluate in a participatory manner, the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences.

The Local Meeting was facilitated by KALRO and ASARECA and was attended by various stakeholders: (i) County Department of Agriculture, (ii) AICS Delegation, (iii) ASARECA, (iv) CIHEAM Bari, (v) KALRO (vi) WATDEV Project Team – Ethiopia, (vii) Local Stakeholders from the Project Area.

2.2 Stakeholders

The stakeholders in the meeting were drawn Policy i.e. Pwani University, National Irrigation Authority, Local area chief, and Directorate of County Agriculture; Local community organizations i.e. Irrigation Water Users Association (IWUA), Landowners, Village Elders (men & women), Local lead farmer leaders, Local producer' association; development partners (NGOs) working in the area; Financial/Economy i.e. Agrovets/Input suppliers, Agricultural Finance Cooperation, private investor- DigiFarm. A total of 37 stakeholder representatives attended the local meeting.

Day 1 of the local meeting was dedicated to the dissemination event and evaluation of BMPs while Day 2 focused on the site visit and site-specific brokerage meeting at Bura and Hola irrigation scheme. At the end of Day 1, there was a reflection on the brokerage of BMPs by the team of experts drawn from CIHEAM Bari, KALRO and ASARECA. The team reviewed the questions and jointly filled the group evaluation form.

3. Workshop Sessions and discussions

3.1 Dissemination and Evaluation of BMPs

Dissemination event and evaluation of BMPs was held on Day 1 of the local meeting and entailed remarks from selected delegations and presentations on the project objectives and agenda for the meeting.

Day 1 focused on discussion with the stakeholders, understanding their challenges and knowledge sharing and evaluation of the BMPs.

3.1.1 Dissemination Event

(a) Welcome and Opening Remarks

Remarks given by Dr. Eliud Kireger (Director General - KALRO).

Dr. Kireger thanked the European Union on behalf of the partners, for funding the project on Climate Smart Water Management and Sustainable Development for Food and Agriculture (WATDEV) in East Africa for 5 years. He noted that the meeting was key as part of the dissemination event & meeting for Climate Smart Water Management and Sustainable

Development for Food and Agriculture in East Africa (WATDEV) Project. The project goal is to develop an in-depth understanding of small and large-scale water resource use and management while boosting people's resilience to climate change, through innovative research, modelling, and capacity building. To achieve this goal, the project will address challenges of limited availability of water resources and climate conditions which severely compromise agricultural production and food security. The project also seeks to address limited institutional and individual capacity in the management of water and natural resources.

In Kenya, the project targets Bura and Hola irrigation schemes in lower eastern Kenya along lower Tana river. Lower Tana was chosen because of various challenges including fluctuation of water levels and meandering of the river which causes untold damages to cultivated fields close to the bank. Further, there is water scarcity during dry spells and in wet season, flooding water is usually not utilized optimally for beneficial purposes. The land is also seriously encroached by invasive species particularly *prosopis juliflora* (locally known as mathenge) while water quality has deteriorated as a result of salinity.

The projects approach using multi-actors' as the engagement, will help to achieve targeted objectives. The various local, regional and international actors were noted and appreciated. He lauded the idea of achieving project objectives through improvement of knowledge and capacity of national government ministries and research institutions in management of water in agriculture, and also improvement of knowledge and skills of farmers and local actors to implement innovative and sustainable solutions in water management. KALRO and other stakeholders, under the project, will collect, analyze and implement available best management practices (BMPs) and innovations in the study areas and simulate their impact with the use of models and knowledge accumulated in regional water studies. The project will also extract best lessons of water resources and replicate them in local project sites. There will also be an exchange of information and knowledge from the other project countries.

At the local level, WATDEV project will work with other relevant stakeholders including National and County Government, farmers' associations, extension services, integrated water resources users' association, and non-Governmental organizations. The local brokerage meetings will help to evaluate local stakeholders' ability to work together to adopt BMPs and evaluate their capacity to share the outcomes and experiences; define the approach for BMPs' implementation and suitability, success or failure in the Lower Tana project site. They will also help in finalizing the choice of BMPs for the projects site, communicate WATDEV project objectives and main actions to local actors. He noted that all the invited stakeholders are key in the project success.

A seven-minute video about KALRO was played to appreciate the activities that the organization implements.

Remarks given by Ms. Margherita Tenedini – AICS representative

Ms. Margherita Tenedini – AICS Cairo highlighted the importance of this collaboration in implementing the project activities. She assured the team of support from AICS during the implementation period.

(b) Objectives and Agenda of the Meeting

Mr. Joshua Okonya – ASARECA presented on the Presentation of the objectives and outcomes of the meeting, and a brief description of Best Management Practice. The overall objective as presented was to carry out community needs assessment as well as conducting a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices. The specific objectives as presented were:

Introduce and create awareness about the “Climate Smart WATer Management and Sustainable DEvelopment for Food and Agriculture in East Africa (WATDEV)” project at community level. Identify key stakeholders in the study area & their ability to work together to adopt farming practices as well as to disseminate/share the outcomes/experiences. Identify and evaluate the local community needs in terms of application of the Best Management Practices (BMPs). To jointly identify, describe and evaluated suitable BMPs for implementation in the study areas

The outcomes of the meeting were: -

- An informed selection of BMPs based on needs of local actors
- An understanding on the attitude of the local community towards putting in place management practices
- Identification of the main factors influencing the BMPs selection
- Support the development of an assessment conceptual framework for evaluating BMPs considering factors and variables at the base of their success/failure

(c) WATDEV Project

In order to prepare the stakeholders for a discussion, a presentation on the WATDEV project was made by Dr. Gaetano Ladisa from CIHEAM-Bari, focusing on the objectives, methods and expected results. He emphasized that the WATDEV project aims to develop an in-depth understanding of small and large-scale water and agricultural resource dynamics and management while boosting people’s resilience to climate, through innovative research, modelling, and capacity building approaches. The rationale for the WATDEV project is the water scarcity and climate change that represent a serious threat on agricultural production and food security in many Eastern and Northern Africa countries for example Egypt, Kenya, Ethiopia and Sudan.

The general objective of the WATDEV project is to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. Specific objectives of the project are: (i) National Ministries and Research Institutions improve their knowledge and management in the agricultural sector; and (ii) Farmers, local actors, cooperatives and Water Users’ Associations, implement innovative/sustainable solutions and improve their skills in resources management.

Furthermore, stakeholders were informed that WATDEV will carry out research, analysis and modelling the implementation of agricultural management practices, and conduct capacity building activities at different communities and actors’ levels (from users to researchers and decision-makers), and address different problems and concerns in the selected study areas of: (i) Belbies district in Egypt, (ii) Gezira irrigation scheme in Sudan, (iii) Koga irrigation system in the Abbay basin in Ethiopia, and (iv) the Lower Tana (Tana River and Kilifi counties) in Kenya.

The local actors were also informed that the project will be implemented in five phases: (i) inventory and stocktaking of BMPs/Innovations; (ii) BMPs/Innovations evaluation process and brokerage; (iii) BMPs/innovations enhancement; (iv) Modelling; and (v) Legacy–toolbox (and parallel action Water Knowledge). The stakeholders were provided with information on the project activities to be implemented at national level. These activities will be implemented in a step-by-step process and include: (i) local meetings; (ii) matching the BMPs; (iii) the Multi-Actors’ regional meeting; (iv) Selection/validation of BMPs; (v) Awareness of BMPs; and (vi) Modelling the scenarios. The flow chart below shows the process flow:

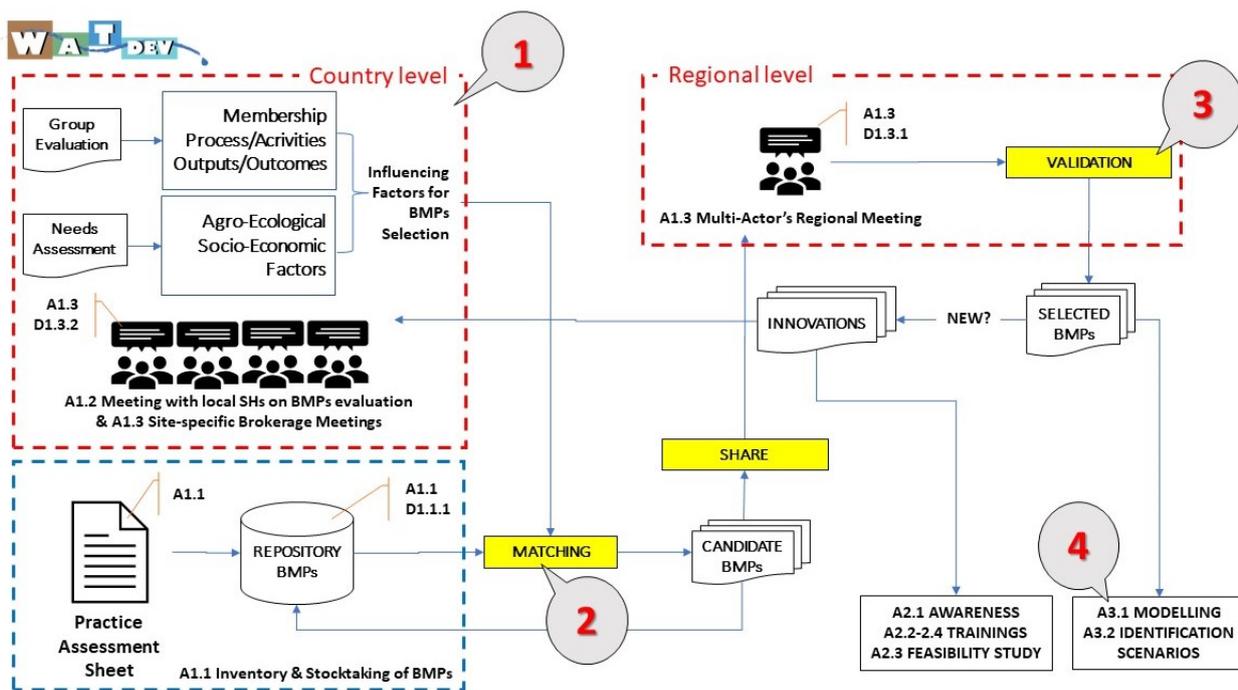


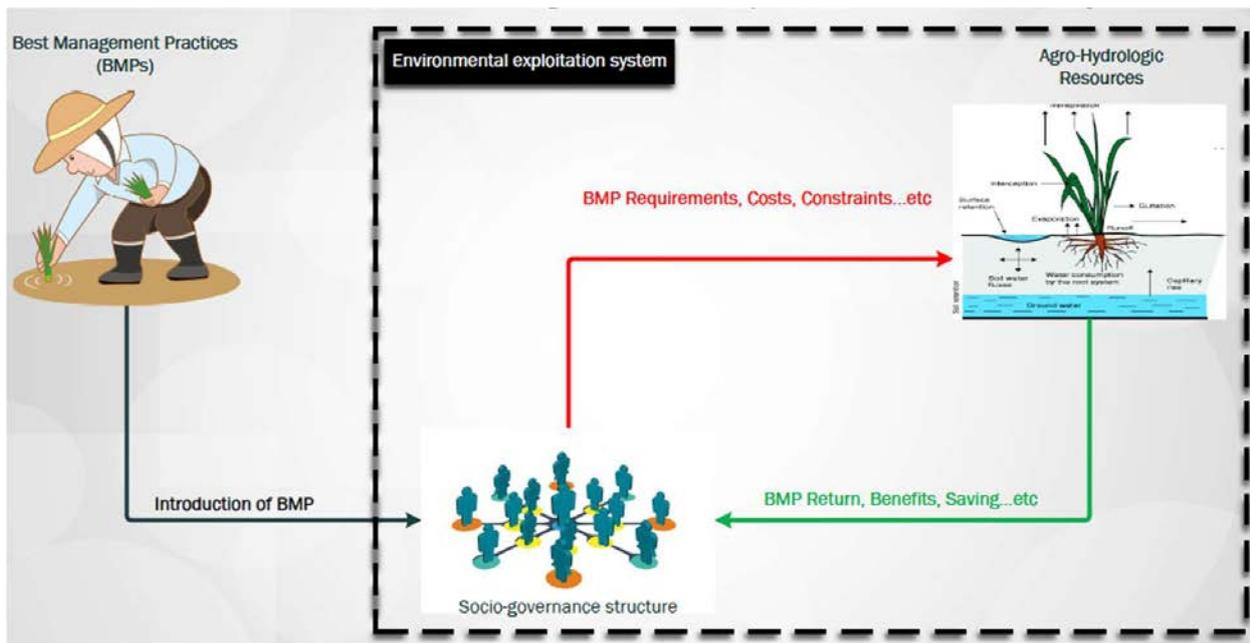
Figure 2 – Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors’ Regional meeting (3) and beyond (4)

With regards to the project results, it was noted that the WATDEV project is anticipated to deliver five key results namely: (i) Best fitting BMPs and Innovations selected by 4 countries (R1); (ii) Enhanced implementation of BMPs/innovations in study areas (R2); (iii) BMPs /Innovations upscale and outscale scenarios performed (R3); (iv) A water planning/management toolbox available for Researchers and Institutions (R4); and (v) Strengthened knowledge and capacity building and established regional “Water Knowledge” Hub (R5).

(d) Best Management Practices

The presentation on the Best Management Practices (BMPs) collected and profiled, as part of activity 1.1 of WATDEV project, was provided by Ms. Alice Calvo of the Italian National Research Council (CNR).

It was noted that within the context of environmental exploitation systems for agricultural value creation, a BMP sits as an external component to the system as shown in the figure below:



The BMP aims are to enhance and improve, and in some cases correct, the positive balance between the Human and Environmental subsystems. BMP collections was following two major steps: (1) collection of projects through the Project Description Sheet, focussing on: (i) project location, (ii) methodological data of the project, (iii) scope of the project, and (iv) applied BMP; and (2) insight on each project through the Practice Evaluation Sheet, focusing on: (i) project description sheet information, (ii) socio-economic aspects of the project, (iii) agro ecological aspects of the project, and (iv) BMP description.

The BMPs collected in the study areas in Egypt, Ethiopia, Kenya and Sudan done between 18th April, 2022 and 31st August, 2022. The BMPs collected were distributed as follows: Crops (36.63%), Water (24%), Soil (23.53%), and Atmosphere (15.84%). The BMPs on soil were mainly on soil conservation (33%), water-holding improvement (28%), soil organic matter improvement (23%) and structure preservation (16%). BMPs related to water were mainly on water use efficiency (42%), surface water improvement (21%), groundwater improvement (17%), logging/salinization reduction (14%) and resistance to salinity (6%). On the other hand, the BMPs on crops were mainly on crop productivity improvement (40%), food security/livelihoods (28%), farmers' engagement (14%), specific genotype use (11%) and enhancing resistance to pests (7%). BMPs related to the atmosphere focused on climate variabilities resilience improvement (43%), evaporation/evapotranspiration reduction (28%), greenhouse gas emission reduction/soil carbon sequestration improvement (22%), and methane/nitrous oxide losses reduction (7%).

3.1.2 Evaluation of Best Management Practices

(a) Scope of Evaluation Exercise

Evaluation of BMPs was one of the key activities undertaken during Day 1 of the WATDEV Local

Meeting. Dr. Michael Okoti (KALRO) led the plenary questions and discussions with respect to the scope of the evaluation exercise on the possible Best Management Practices (BMPs). The sectors discussed (i) Groundwater (ii) Soil, (iii) Crop, (iv) Surface water, and (v) Air/Atmosphere; and focusing on the discussion on preservations, exploitation, and management of various BMPs under these sectors.

KALRO facilitated the local needs assessment exercise. The discussion entailed an assessment of the community needs - with respect to the potential BMPs in the various application sectors; and

filling in the community needs assessment form. The discussion focused on the possible best BMPs application sectors especially with respect to issues related to preservation, exploitation, management and alternative solutions. The issues discussed included: -

- Ground water - preservation and exploitation
- Soil focused - soil management, fertilizer use and pesticides
- Crop - varieties and management practices
- Surface water - Exploitation, access and reuse; distribution and irrigation systems
- Atmosphere - Climate change, future awareness and sustainable development.
- Economy - investment, substitution (alternatives), risk, and subsidies
- Organization - collaboration and exchange (willingness to learn and share ideas)
- Policy - compliance, change, and introduction (willingness to see new regulations introduced).

The key findings from the evaluation of BMPs are highlighted below:

(i) Groundwater

The participants noted that there were some efforts made to exploit ground water using shallow wells within and around the Tana irrigation scheme. Along the river line, ground water extraction is at up to 17 m deep, while in the hinterland, ground water extraction can go up to 75 meters. Some regions in the hinterland were also said to be too rocky to allow for ground water exploitation. Because of this high cost of water extraction in the hinterland, many households or farmers are not willing to invest. In the areas where ground water has been exploited, the quality is no good since its salty and not suitable for use in agricultural production.

Importance of groundwater: Though there was groundwater, participants indicated that because of its saltiness and cost of exploitation, this resource is not very important in agricultural production activities. The engineers from NIA and TARDA indicated that the saltiness of water has to do with the geology of the area. The importance of ground water will be realized if there are efforts to reduce its salinity once abstracted.

Sufficiency of groundwater: Since it's not very much used, its sufficiency is not well known.

(ii) Soil

Soil Management. It was noted that soil management is an integral part of land management and may focus on differences in soil types and soil characteristics to define specific interventions that are aimed to enhance the soil quality for the land use selected. Specific soil management practices are needed to protect and conserve the soil resources. Good management of soils ensures that mineral elements do not become deficient or toxic to plants, and that appropriate mineral elements enter the food chain. Soil management is important, both directly and indirectly, to crop productivity, environmental sustainability, and human health. The goal of good soil management is to meet essential plant needs. Healthy plants need water, nutrients, oxygen, and a physical medium that allows seeds to germinate, shoots to emerge and grow up toward the sunlight, and roots to anchor the plant by growing strong and deep

Within the irrigation scheme there were various soil management practices. These included using cover crops such as green grams, applying manure and compost, crop rotation, minimum tillage, use of fertilizers and controlling erosion for soil conservation. They also practice mechanized land preparation through the NIA at a fee.

Fertilizer use: the participants indicated that they used fertilizers (organic and inorganic) for their farming activities, without which the yield will be too low. these included UREA, CAN, NPK, black earth (Humic), and animal manure (farmyard manure). This is because it was indicated that the soils are low in most of the required minerals. Though the Ministry of Agriculture advises farmers to plough back agricultural wastes, as a way of nutrient recycling, most of them don't. Farmers

indicated that they want to use the agricultural waste for livestock feeds because of the persistent droughts outside the irrigation scheme. This brings in resource use competition.

In the public irrigation schemes, the NIA conducts periodic soil data collection and analysis to ascertain the soil nutrient status and advice accordingly. Soil salinity is controlled by using black earth (Humic) and also some farmers practice continuous flooding.

The limitations on the use of fertilizers include the high costs involved vis a vis low returns on the enterprise of choice; low productivity of most crops maybe because of poor choice of varieties; and low organic matter in the soil. Farmers along the river believe that their soils have alluvial deposits from flooding, hence they don't use fertilizer. Some farmers believe that fertilizer destroy the soil if used overtime, hence they do not use it. Because of the presence of the *Prosopis* seeds in most of the livestock manure, since they feed on the *Prosopis* pods, farmers avoid using manure from their animals. This is because this will continually spread the invasive *Prosopis* tree, which increases the farm maintenance costs.

Pesticides use: There was a high use of pesticides in the Irrigation scheme for th control of various peats and diseases. The participants indicated that this is because the Tana river ecosystem has conducive environment pests. There is also a high load on insects in most farms especially in dryland farming. Because on this there are many company agents are on the ground to market their products. Most of the pesticide use in mainly geared towards the control of Fall armyworm, which is a major pest in cereal, and the control of pests on horticultural crops like tomatoes and onions.

There is attempt to use biological control by controlling the males e.g. the use of Pheromone traps for trapping fruit flies but has not been very effective. The participants also noted that they practice traditional pesticides and pest control strategies.

(iii) Crops

Crop varieties and management: The participants noted that there were a variety of crops grown within the irrigation scheme. This was driven by local consumption needs and markets. It was indicated that all that the County produces has market. Crops grown include Maize, rice, beans, Bananas, green gram, rice, cowpea and tomatoes. Maize was grown for household consumption but also on contract by the Kenya Seed Company for production of Seed Maize. The farmers plant both local and improved varieties.

Crop rotations: Farmers practiced crop rotation. The reasons for crop rotation were to improve soil fertility; break pest cycle which affects different crops e.g. Fall armyworm; improve water use efficiency; conserve soil and improve soil structure. An example of seasonal crop rotation included planting maize and rotating with cotton and later green gram. This is mainly due to water management since different crops has different water requirement.

Multi-cropping patterns: Inter cropping is not done in the public schemes, this was only done in individual farms. It is the practice of producing two or more crops on the same plot of land at the same time, rather than simply one, throughout the same growing season. Multiple cropping aids in enhancing the land's yield and give a diversity of food at the household. For example, Maize was grown with cow peas and beans, which are legumes. Increased crop diversity, improved functioning of agricultural systems, and reduced use of inorganic fertilizers and pesticides were the advantages mentioned.

Market opportunities and choice of crop: Market opportunities dictate type of crop grown. Participants noted that for many years they have been planting maize for seed on contract by the local seed companies. But recently when KALRO introduced the Komboka rice variety, which has high returns and a bigger produce market share, most farmers shifted to rice. It was indicated that some crops are grown specifically for the market not home consumption like green grams, butter nut, watermelons, pumpkins, tomatoes and onions. There is a ready market in the satellite towns. Contract farming assures the farmers on markets and hedges them from price fluctuations. Though

beneficial most farmers who are not in the farmer groups are not part of the contract farming. The County Government extension office reiterated that it's easy to offer extension services to organized groups than individual farmers.

(iv) Surface water

Exploitation, access and re-use: Surface water is the most reliable resource for irrigation along the Tana. It's largely available, though the quantities fluctuate with within and between seasons. All the water in the irrigation scheme is provided for, distributed and managed by the NIA. Farmers access the water at a subsidized fee of USD 34/acre/cropping season, against the calculated actual cost of USD 110/acre/cropping season. The funds are used to cater for the costs of water provision. Water is pumped by generators and in the cases where it breaks down, then the water provision services stop.

Challenges in water distribution were high cost of maintenance and high cost of fuel for conveying water. The alternative would be the use of solar power to pump the water, though NIA is constructing a new canal that will channel water by gravity, hence reducing the costs of water conveyance. The use of solar, renewable energy, technology has not been popularized in Tana, though few households use it. NIA should also allow other development partners open up village irrigation schemes outside NIA schemes; invest in drilling boreholes and shallow well that are not salty after right sighting by geologists; and harvest rain and flood water using earth dams. Some participants note that drip irrigation has been done but by use of water from shallow well and bore holes.

Distribution and irrigation systems: The major distribution system for surface water is through canals. Most of the canals need regular maintenance otherwise a lot of water is wasted in seepage. The major canals draw water from the main distribution points and channel the same to different agricultural field blocks. The water has a scheduled plan for distribution, to allow all farms access the resource. With the increase in the acreage under rice, after farmers started shifting from maize production, the demand for water has greatly increased.

Influence on cropping patterns: Due to water level fluctuations, crops to be grown depends on the available water, though many farmers opt for rice because of the ready markets and good prices. The shift towards rice puts a strain on water allocation within the irrigation schemes.

(v) Atmosphere

Climate change: Participants agreed that there were observed climatic changes in Tana river ecosystem. These changes were manifested unpredictable weather (sometimes it rains so much, sometime prolonged drought); shifts in seasonal rainfall patterns, which affects planning for the season; increased temperatures; and increased flooding along the riverine ecosystems. The climatic changes were said to be caused by human actions that have caused degradation, pollution of the atmosphere and also land cover change through deforestation. During the discussions some of the participants claimed that they are not bothered about climate change because they use irrigation for their farming activities, especially farmers near the riverine. After plenary deliberations, they got clarity that climate change transcends boundaries and there is need for collective action.

To curb on pollution to mitigate against the causes of climate change, the participants proposed the use of solar power for pumping water instead of diesel. Other adaptation measures proposed and that are being practiced include agro-forestry; water conservation measures e.g. water harvesting through water pans, lining up the canal to reduce water loss; cultivation of suitable crops for the prevailing climate e.g. drought resilient crops; adapt water saving technologies; embrace technologies such as precision agriculture; embrace sustainable pastoral livelihoods e.g. proper livestock feeding programmes; balance water use, crop varieties and food security goals. The County Government extension staff and other development actors indicated that they continually invest in adaptation measures for better livelihoods. They noted that climate change impacts have affected many livelihoods and caused many families, who were once pastoralists

embrace crop production. On the other hand, there is a strong crop-livestock integration with farmers allowing livestock access to stovers as feed during the harvest season.

The crop-livestock integration will continue, according to the participants, since the future scenario on climate changes is likely to be worse. The participants have been observing worsening trends in climatic risks and they don't think that in future the climate may be better. The need to continually adapt to the changes was seen as important. Some of the participants indicated that the community need to be supported so that they can stabilize their livelihoods amidst increased climatic risks.

(vi) Economy

Investment: The community, though placing a lot of value on their land because its a source of their livelihoods and the local economy, still feel limited because of the tenure system. All the land is owned by the NIA though it was originally community land. The NIA developed then infrastructure and leased the land to the same community many years ago. Part of the community feels that this should change and the land should revert back to them so that they can steer agricultural development in their own way. The current tenancy arrangement seems to be a deterrence to their willingness to enhance the various portions of land they have.

Substitution: This can only happen when the tenancy allows them to. At the current state of affairs, members can hardly make choices on changes in land use.

Risk: Farming is a major source of livelihood and accounts for a very high percentage of household incomes and also budget for agricultural inputs. The members showed willingness to invest in short term beneficial initiatives not long-term ones. This is because of the tenure system. Since land is allocated for specific years and seasons, many members plan to get the most yield during the time period without feeling obligated to invest in future dynamics.

Subsidies: Subsidies are advanced by both the national and county governments guided by specific policies and rules. The objective of the subsidies is to mitigate the farming operations against risks. Subsidies are also used as a plat for dissemination of specific agricultural information and technologies. The members welcome the issue of subsidies as a vehicle for new or innovative ways of introducing new agricultural management practices.

(vii) Organization

Collaboration: Within the groups, the participants noted that they address issues that include water availability after expanding the land under production; farmers' low capacity for agricultural investments; high cost of inputs e.g. fertilizer - more preferred because in leads to high production; low quality of manure used; limited access to subsidized credit. These collaborative efforts have helped them solve or address the above challenges.

Exchange: Participants indicated that there are some organization with the irrigation scheme, with specified by-laws, where exchange of ideas and knowledge take place. Farmers are organized in group where they plant commercial crops such as maize, green gram, cotton and seed maize. They also practice group farming and marketing. The proceeds from the groups is reinvested to generate more income e.g. buying tractors to lease to other farmers. The participants noted that there were farmers that were not in any organized group, since this was voluntary. The benefits in being in an organized group include ability to get contract farming hence assured of market and prices; ease of procuring equipment or farm inputs; increased market accessibility; ability to access irrigation water; ease access to credit as a group from the finance service providers, can use of farming contract as a collateral for credit e.t.c.

(viii) Policy

Compliance: There were diverse policies around land and water use and management. These policies were being enforced by the national and county government administrative structures.

Some of the policies mentioned included the County Integrated Development Plans; Sustainable Food System Strategy; Climate Change Policy and National Land Use Policy. The participants noted that the NIA Land Use Policy governing the use of the irrigation scheme, though enshrined in the law, needs to be changed especially on the land tenure arrangements. It was indicated that some amendments are in the process. To enforce compliance and management on land and water use, the IWUA, agricultural extension and the administration offices are involved. These management structures fosters participatory engagement. Management of the scheme is done at Blocks level where they meet on monthly and quarterly. Every block has a representative chairperson; and all blocks elect one chairperson and a secretary. These representatives discuss water use in the block. Each block also has a conflict resolution committee

Change: The plenary discussions indicated the willingness of the participants to learn and embrace new ways of doing things including policies. Especially policies and practices that enhance their agricultural activities.

3.1.3 Wrap-up (Day 1) and Conclusion

The main facilitators Dr. Michael Okoti and Mr. Joshua Okonya appreciated the active participation from all stakeholders. They also discussed the logistic of the next day's field visit to the project sites in Bura and Hola.

3.1.4 Local community needs assessment and group valuation

Local community needs assessment and group valuation was done jointly by KALRO, CIHEAM Bari and ASARECA. There were discussions and agreements on the scores that each had given during the day. An agreement was reached after discussions on the merits of demerits of the give score. The scores are attached sheets are attached in the annex.

Summary of plenary discussions

Efficient irrigation water use and management need to be enhanced as water is becoming more scarce due to climatic changes and competing uses. Ground water exploitation is limited due to poor water quality and the depth of the water, making it costly.

The exploitation of surface water from Tana River, whose source is in the highlands, somehow made some of the participants think that climate change is not an issue on concern. But after plenary discussions, it was clear that climate change should be an issue concern in the irrigation scheme.

There is a policy conflict between the County government and the National government on irrigation land administration. All the land belongs to the National Irrigation Authority and its leased out to farmers. This land tenancy system seems to be inhibiting farmer investments in land improvement. Policies especially on land tenure need to be reviewed to allow land ownership within the irrigation scheme. The policy review will also allow the expansion of the irrigation scheme.

The projects initiatives are welcome as this will help farmers in their efforts to make irrigation efficient.

The multi-stakeholder approach i.e. bringing stakeholders from different back ground to discuss and common agenda, is innovative and enhances collaboration between farmers and professionals. This resonates well with the bottom up community approach or the already existing community structures.

Moisture management within the irrigation schemes in a big research gap that the project can address. Most farmers don't invest in soil management practices due to cost of fertilizers, and also some cultural factors.

Though the irrigation scheme has been operational for many years, there are still infrastructural challenges affecting optimal productivity of the land.

To counter climate change impacts, farmers need to invest in robust adaptation measures including agroforestry. Farmers were also encouraged to diversity as a coping mechanisms to climate change

Farmer exchange visits in one way for farmer-to-farmer learning and has been instrumental in agricultural information and technology dissemination. Most participants were willing to embrace or try out new BMPs

The participants noted that horticulture involved high use of inputs, and which are also costly e.g. fertilizer.

Contract farming is being embraced by farmers for ease of produce aggregation and marketing. This also allows them to access credit.

Development actors and partners are active in the project sites supporting farmers in adoption of various BMPs. The private sector e.g. agro-dealers and NGOs play a major role in extension support to farmers. This augments the extension services offered by the County Government.

3.2 Site Visit and Site-specific Brokerage Meeting at Hola Irrigation scheme

Site visit to various farms at the Hola irrigation scheme, the NIA offices and KALRO demonstration farm was held on Day 2 of the meeting.

3.2.1 Site Visit

Participants held a field visit to various sites to physically see, appreciate and discuss application of various BMPs. Some of the sites visited during the field visit include: the NIA water intake point or pumping station; the group irrigation project; NIA irrigated farms; and KALRO irrigated demonstration plots.

Below are the highlights of the field visit:

Visit to Kenya Climate Smart Agriculture solar powered irrigation scheme.

The 30 acres' group farm supports 60 households. They grow various crops like maize and green grams specifically for the market.

The BMP is furrow irrigation. Water is pumped from the river by a solar pump and water channeled to the farms through furrows. The pump stops when the sun goes down. The group has 90 solar panels. The main challenge on this farm is that the land is uneven, affecting water distribution.

Courtesy call to the National Irrigation Authority offices

The manager of the NIA scheme in Hola welcome all. Other NIA staff were introduced. Gave a brief of Hola irrigation scheme, indicating that there is a clear framework on irrigation development and expansion; the challenges within the scheme and what is being done to address the same. Dr. Gaetano Ladisa discussed the project focus and the planned technical capacity building that NIA staff can benefit from. Dr. Michael Okoti reiterated that KALRO will work closely with NIA since all the project sites are within their scheme.

Visit to KALRO rice demonstration farms

Ms. Anita Nunu explained that this are field demonstration plots for different rice varieties that farmers are able to evaluate and choose from. The farmers are also trained on GAPs within this demonstration farms.

The demonstration farm is leased from the NIA and its adjacent other farmers' fields, for ease of conducting farmer field days.

Visit to the NIA water intake point or pumping station

The water is pumped from the river to 14m height to allow it to flow by gravity to the rest of the irrigation scheme. The main station has 3 generators to supply power and 10 pumps that pump water 18 hours per day to meet the demand of rice cultivation.

The station should explore the possibility of using solar which may be cheaper than the current diesel fueled pumps.

During the field visit in the irrigation scheme, the participants were able to appreciate the challenges and opportunities in the Tana Irrigation scheme.

Wrap-up and way forward

The meeting was facilitated by Dr. Gaetano Ladisa and had KALRO and CIHEAM Bari in attendance. Issues discussed included: -

- Review of the meeting logistics
- Need to manage communication between partners
- Meeting venue – was good and homely
- Accommodation was good
- Good hospitality

Program management

Session timings – more time should have been given to plenary discussions during needs assessment. Internet connectivity was not very good causing lapses in the zoom participation. Need to test a day before the meeting.

- Time management was good
- Technical content
- Was good and participants were proactive and contributed well
- The blending of the local language and English helped in clarifying some technical issues.
- Presence of policy makers in the meeting stimulated debate of the national and county policy dynamics and how this can impact on agricultural activities at the local level
- Group evaluation
- This was handled well and the results reflect consensus.
- Regional brokerage meetings

CIHEAM will share a framework of the collaborative event, detailing event management and number of people planned to attend. KALRO will help in the preparations of the meeting.

The local community training and awareness activities will start after the regional meeting and definition of BMPs of focus for Kenya.

Annex 3: Program for the local brokerage meetings

| | |
|---|---|
| Tuesday 18th October 2022 - Dissemination Event & Meeting for BMPs Evaluation | |
| Welcome and introduction | |
| Chair – Dr. Alice Murage | |
| 8.30-8.45am | Participants arrival and registration |
| 8.45-9.00am | Participant introductions – Dr. Alice Murage – KALRO |
| 9.00-9.45am | Welcome remarks – Dr. Eliud Kireger (DG KALRO) |
| | Welcome remarks – AICS (Nairobi/Cairo) representative |
| | Objectives and agenda – Moses Odeke (ASARECA) |
| Preparing the ground for discussion | |
| Chair – Dr. Michael Okoti | |
| 09.45-10.30am | The WATDEV Project: Objectives, methods and expected results – Dr. Gaetano Ladisa (CIHEAM Bari) |
| | Overview of activities in the country and presentation of Local stakeholders – Dr. Michael Okoti (KALRO) |
| 10.30-11.00am | Coffee/Health break & Group photo |
| The BMP evaluation’s exercises | |
| Chair – Dr. Michael Okoti | |
| 11.00-1.00pm | Facilitated discussion – Lead Facilitator: KALRO |
| | Co-facilitators – ASARECA and CIHEAM Bari |
| | Presentation of exercise’s scopes (support to fill the Needs Evaluation Sheet) |
| 1.00-2.00pm | Lunch/Health Break |
| Chair – Dr. Eliud Kireger | |
| 2.00-3.00pm | Plenary presentations and discussions – KALRO/CHEAM Bari |
| | Reflection on potentials future brokerage on BMP/I to orient matching between group expectations/needs and WATDEV collected BMP/I |
| 3.00-3.15pm | Wrap-up and closure - ASARECA |
| 3.15-3.30pm | Next event: Regional brokerage event - KALRO |
| 3.30-4.00 pm | Workshop evaluation - KALRO |
| 4.00-5.00pm | Health Break and departure |

| | |
|--|---|
| Wednesday 19th October 2022 – Field visit | |
| 8.00am – Departure for Hola irrigation scheme (273Km) | |
| 11.30-1.30pm | <p>Courtesy call to the NIA offices</p> <p>Courtesy call to the County Agricultural Offices</p> <p>Visit some farms within the scheme to see their BMPs</p> |
| 1.30-2.30pm | Health/Lunch break |
| 2.30-3.00pm | <p>Wrap-up</p> <p>Drive back to Malindi</p> |

Annex 4: Participants list for the local brokerage meetings

| # | Name | Organization | Category | Contacts |
|----|-----------------------|--|----------------|---|
| 1 | Dr. Eliud Kireger | KALRO | Research | directorgeneral@kalro.org Tel. +254 730707303 |
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| 5 | Dr. Michael Okoti | KALRO | Research | Michael.okoti@kalro.org Tel. +254 710696251 |
| 6 | Ms. Carolyne Minayo | KALRO | Research | Carolyne.Minayo@kalro.org Tel +254 703508554 |
| 7 | Dr. Alice Murage | KALRO | Research | Alice.Murage@kalro.org Tel. +254 720891539 |
| 8 | Mr. David Muriithi | KALRO | | David.Muriithi@kalro.org Tel. +254 709104000 |
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| 17 | Amare Bantider | WLRC-Ethiopia | | amare.b@wlr-eth.org |
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| 19 | Ms. Florence Ndai | National Irrigation Authority | Policy | Email: flondai@yahoo.com Tel: +254 720906226 |
| 20 | Eric Masese | Agricultural Finance Cooperation Bura | Finance | Email: eonyango@agrifinance.org ; maseseric1@gmail.com Tel: +254 700213499; 729261178 |
| 21 | Alex Kubende | County Directorate of Agriculture | Policy | Email: kubendea@yahoo.com ; cdatahariver@yahoo.com , Tel: +254 721143388 |
| 22 | Dr. Esther Muindi | Pwani University | Policy | Email: e.muindi@pu.ac.ke ; Tel: 07234564427 |
| 23 | Hamisi Kofa | Local Producer' association - Umoja United Farmers Group | Organization | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254724144608 |
| 24 | Mohamed Bodole Abdi | Chief | Policy | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: +254722861524 |
| 25 | Esther Wanjera | Village Elder – Women | Organization | Email: C/o kubendea@yahoo.com ; cdatahariver@yahoo.com Tel: |

| # | Name | Organization | Category | Contacts |
|----|-----------------|------------------------------------|-----------------|---|
| | | | | +254703111354 |
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Annex 5: Local brokerage meeting event pictures



Annex 6: Local brokerage project site visit pictures



Annex 7: local brokerage meeting group evaluation

(Scale: -2: No; -1: Relatively No; 0: Equally mixed; 1: Relatively yes; 2: Yes)

| Type | Criterion | Question | Score |
|----------------------------|--|---|-------|
| Membership | <i>Joint Enterprise</i> | Do members share a competence that distinguishes them from others? Relatively Yes. Most members possessed competencies that distinguished them from others | 1 |
| | | Do the members share a common sense of purpose? Relatively Yes. Some members were focused on the goal of increased agricultural productivity for livelihood improvement while others, especially the private sector focused on the profit for their enterprises though still in the agricultural sector | 1 |
| | Do members appear to have similar interests? Relatively Yes. Some members interests in livelihood improvement at the household level while others were looking at the external markets. | 1 | |
| | Do members report similar problems or experiences? Equally mixed. There were divergent views on problems and experiences depending on the members' production orientation and objectives. | 0 | |
| | <i>Diverse Membership</i> | Do the members of the community represent a variety of stakeholders? Yes. The members are drawn from the different stakeholder groups within the community | 2 |
| | | Does the community transcend organizational and geographical boundaries? Equally mixed. From the discussions, group members interact mostly among themselves. There is limited cross boundary interactions too | 0 |
| | <i>Participatory Framework</i> | Are members actively involved in setting goals? Relatively Yes. Within the various blocks, the members discuss there issues and their representatives share this priorities within the larger committee. Though this is good, the groups priorities are subject to the good representation of the chairperson. | 1 |
| | | Are members responsible for devising a strategy or plan of action? Equally mixed. This is because the members' representative discusses the issues at hand and then passes down the strategies of agreed plan of actions to the members. On the other hand, some decisions or strategies are discussed and implemented at the group level. | 0 |
| | | Do members assist in running the community? Yes. The Chief and Sub-Chief, show are administration officers at the local level; the village heads; led farmers and | 2 |
| | | Are members of the community internally motivated? Equally mixed. From the discussions there were indications that some members were not motivated and would wish some policies be reviewed to enhance their farming activities. | 0 |
| Process/ Activities | <i>Mutuality/Sense of Community</i> | Do the members of the community build relationships with each other? Yes. This can be seen from the groups formed for contract farming and also elements of collective | 1 |

| Type | Criterion | Question | Score |
|------|--|--|-------|
| | | marketing. The relationships are seen as critical for information and technology dissemination | |
| | | Do the members engage in joint activities and discussions? Yes. This was articulated in most farming operations, from planning on when to plant crops, regimes of water scheduling, product marketing and discussing on issues affecting the irrigation scheme and their solutions | 2 |
| | | Do the members offer each other help when needed? Relatively Yes. This depends on individual members' ability or capacity. | 1 |
| | | Do members report encounter across geographical or organizational boundaries? Yes. The interface between the pastoralists, who live in the hinterland, and the farming community, living along the riverine ecosystem. The two communities interact for mutual benefit i.e. manures in exchange of crop residues. | 2 |
| | | Do the members report feeling a sense of "belonging" within the community? Yes. There seems to be strong community relations and social systems that the members subscribe to. | 2 |
| | <i>Sharing and Exchanging of Knowledge</i> | Do members engage in narration, or sharing their experiences through stories? Yes. There is a strong and rich cultural practice that support this. They also learn from each other. | 2 |
| | | Do members spend a significant amount of time sharing and exchanging knowledge? Relatively Yes. Members spend more time learning from each other since the farming operations are done according to specific seasons for ease of water scheduling. This implies that members are | 1 |
| | | Do members view the community as a forum for the free flow of ideas and information? Equally mixed. Some members of the community seemed to have different narratives or ideas and didn't see the importance of others. For example, a member indicated that climate change does not affect him since he will always get irrigation water. With this attitude he may not see the value of concerted efforts in adaptation and mitigation. | 0 |
| | | Do members view their interactions in the community as a conversation, as opposed to a series of 1-sided reports? Relatively Yes. Most conversations and decisions re interactive and participatory, with a few instances where the national or county government policies are implemented without redress to community feedback or participation. | 1 |
| | | Do the members believe that they learn useful information from their interactions with others in the community? Yes. This can be told from the enthusiasm about farmer field days that are always organized by various stakeholders and from the exchanges during plenary sessions. | 2 |
| | | Do members report any coaching or mentoring from others in the Community of practice community? Relatively Yes. It was indicated that the lead farmers | 1 |

| Type | Criterion | Question | Score |
|------|--------------------------------------|---|-------|
| | | are mentors and coaches within the community on agricultural issues. Agricultural initiatives, most of the time pass through these channels also because of their influence on the community. | |
| | <i>Reflection</i> | Do the members of the community engage in collaborative reflection on their individual and each other's experiences and concerns? Equally mixed. This is done to some extent and at a low scale, though it's not the norm. | 0 |
| | | Do members feel like their own level of self-reflection has been increased by participating in the community? Yes. This is so because members' personal values, needs and wants are expressed and acknowledged | 2 |
| | <i>Reproduction Cycle/Continuity</i> | Do members believe that the Community of practice will extend beyond the current time/place/members? Yes. Already the community is organized around irrigated agriculture, and all the practices and resources that goes into the same are handled with the community of practice. | 2 |
| | | Do new members join? Yes. New members join as seasons unfold | 2 |
| | | Do members of the Community of practice believe it will be useful | |
| | | ...6 months from now? Yes. Though this looks short term, it synchronizes with the planting cycles of most crops. | 2 |
| | | ...1 year from now? Relatively Yes. Dynamics change and some members may change their priority enterprises or diversify into other enterprises that will need them to change the community of practice. | 1 |
| | | ...3 years from now? Equally mixed. | 0 |
| | | Does the level of activity of the Community of practice ebb and flow over time? Relatively Yes. Dynamics change and some members may change their priority enterprises or diversify into other enterprises that will need them to change the community of practice | 1 |
| | | Do members spend most of their time analysing real-life situations or problems? Relatively yes. | 1 |
| | <i>Action Orientation</i> | Do the members of the community express a desire to initiate change? Relatively no. | -1 |
| | | Do the members of the community express a desire solve common problems? Yes. The members showed great interest in solving common problems around water resource management, soil salinity and land use conflicts. | 2 |
| | | Is the community successful in turning principles/values of the field into realized policies and practices? No. There was no indication of this, though challenges were noted, and various strategies being tried with the community ascertained. | -2 |
| | <i>Construction of New Knowledge</i> | Is the community successful in turning principles/values of the field into realized policies and practices? | \\ |

| Type | Criterion | Question | Score |
|--------------------------|-----------------------------------|--|-------|
| | | <p>Do members report that their previous understanding/knowledge has been transformed through participation in the community? Yes. This was articulated well during the plenary sessions from the lead farmers, indicating success stories in their various localities. Success in controlling soil salinity, improving yields and generating more income through group marketing approaches.</p> | 2 |
| | | <p>Do the members report generating new knowledge as a group through their interactions in the community? Relatively yes. Farmer to farmer learning have seen some of the members adopt new crop varieties that are more resilient to moisture stress, hence can grow well with the dwindling water resources. The members have also learned ways of controlling soil salinity through flood irrigation management.</p> | 1 |
| | | <p>Are members confident that they have developed a common knowledge base that they can refer to in the future? Equally mixed. This is because there are a lot of dynamics in the system affecting their livelihood base. For example, the unpredictable climatic extremes – droughts and floods; and the insecure land tenure system that they feel limits their investments on land.</p> | 0 |
| Outputs/ Outcomes | <i>Dissemination of Knowledge</i> | <p>Do members feel connected with others in their field, outside of the community of practice itself? Relatively yes. The members interact with the pastoral communities who graze their animals on the crop residues. They also connect with marketers outside their community of practice when marketing their produce.</p> | 1 |

Annex 8: Local Community Needs Assessment

Part 2. Evaluation of local community needs: Possible BMPs application sectors

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|---|-------|
| Ground water | Preservation | If already in exploited: Discuss it extend, importance and sufficiency and willingness to preserve it by managing it use (reduction) or invest in alternatives. | 0 |
| | Exploitation | If not exploited: Discuss its availability, easiness of access and exploitation and willingness to invest in it. The participants noted that there were some efforts made to exploit ground water using shallow wells within and around the Tana irrigation scheme. Along the river line, ground water extraction is at up to 17 m deep, while in the hinterland, ground water extraction can go up to 75 meters. Some regions in the hinterland were also said to be too rocky to allow for ground water exploitation. Because of this high cost of water extraction in the hinterland, many households or farmers are not willing to invest. In the areas where ground water has been exploited, the quality is no good since its salty and not suitable for use in agricultural production. Importance of groundwater: Though there was groundwater, participants indicated that because of its saltiness and cost of exploitation, this resource is not very important in agricultural production activities. The engineers from NIA and TARDA indicated that the saltiness of water has to do with the geology of the area. The importance of ground water will be realized if there are efforts to reduce its salinity once abstracted. Sufficiency of groundwater: Since it's not very much used, its sufficiency is not well known. | |
| Soil | Management | Definition and role of soil management Examples of soil management practices Discuss the importance given to soil management Discuss the need to learn new practices Soil Management. It was noted that soil management is an integral part of land management and may focus on differences in soil types and soil characteristics to define specific interventions that are aimed to enhance the soil quality for the land use selected. Specific soil management practices are needed to protect and conserve the soil resources. Good management of soils ensures that mineral elements do not become deficient or toxic to plants, and that appropriate mineral elements enter the food chain. Soil management is important, both directly and indirectly, to crop productivity, environmental sustainability, and human health. The goal of good soil management is to meet essential plant needs. Healthy plants need water, nutrients, oxygen, and a physical | 1 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|---|-------|
| | | <p>medium that allows seeds to germinate, shoots to emerge and grow up toward the sunlight, and roots to anchor the plant by growing strong and deep</p> <p>Within the irrigation scheme there were various soil management practices. These included using cover crops such as green grams, applying manure and compost, crop rotation, minimum tillage, use of fertilizers and controlling erosion for soil conservation. They also practice mechanized land preparation through the NIA at a fee.</p> | |
| | <i>Fertilizers</i> | <p>If already in use: Discuss how important is the use of fertilizers in the profitability of their farms Discuss the willingness to reduce chemical fertilizer or use alternatives to preserve productivity at longer term the participants indicated that they used fertilizers (organic and inorganic) for their farming activities, without which the yield will be too low. these included UREA, CAN, NPK, black earth (Humic), and animal manure (farmyard manure). This is because it was indicated that the soils are low in most of the required minerals. Though the Ministry of Agriculture advice farmers to plough back agricultural wastes, as a way of nutrient recycling, most of them don't. Farmers indicated that they want to use the agricultural waste for livestock feeds because of the persistent droughts outside the irrigation scheme. This brings in resource use competition.</p> <p>In the public irrigation schemes, the NIA conducts periodic soil data collection and analysis to ascertain the soil nutrient status and advice accordingly. Soil salinity is controlled by using black earth (Humic) and also some farmers practice continuous flooding.</p> <p>The limitations on the use of fertilizers include the high costs involved vis a vis low returns on the enterprise of choice; low productivity of most crops maybe because of poor choice of varieties; and low organic matter in the soil. Farmers along the river believe that their soils have alluvial deposits from flooding, hence they don't use fertilizer. Some farmers believe that fertilizer destroy the soil if used overtime, hence they do not use it. Because of the presence of the Prosopis seeds in most of the livestock manure, since they feed on the Prosopis pods, farmers avoid using manure from their animals. This is because this will continually spread the invasive Prosopis tree, which increases the farm maintenance costs.</p> | - |
| | <i>Pesticides</i> | <p>If not already in use: Discuss the cost and easiness of access Discuss the willingness to invest/introduce fertilisers in their farming</p> <p>If already in use: Discuss their importance for the crop productivity and the presence of local diseases risks</p> | 1 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|--------------------------------------|--|-------|
| | | <p>Discuss willingness of adoption of alternatives such as bio pesticides and/or soil management practices</p> <p>There was a high use of pesticides in the Irrigation scheme for th control of various peats and diseases. The participants indicated that this is because the Tana river ecosystem has conducive environment pests. There is also a high load on insects in most farms especially in dryland farming. Because on this there are many company agents are on the ground to market their products. Most of the pesticide use in mainly geared towards the control of Fall armyworm, which is a major pest in cereal, and the control of pests on horticultural crops like tomatoes and onions.</p> <p>There is attempt to use biological control by controlling the males e.g. the use of Pheromone traps for trapping fruit flies but has not been very effective. The participants also noted that they practice traditional pesticides and pest control strategies.</p> <p>If not already in use: Discuss their availability, access easiness and presence of local diseases Willingness to invest in bio pesticides to improve productivity</p> | |
| Crop | <i>Crop varieties and management</i> | <p>Initiate talk on food culture and local varieties cultivated</p> <p>Discuss crop rotation and its benefits</p> <p>Discuss multi-cropping pattern and its benefits</p> <p>Discuss market opportunities and choice of crop</p> <p>Crop varieties and management: The participants noted that there were a variety of crops grown within the irrigation scheme. This was driven by local consumption needs and markets. It was indicated that the all that the County produces has market. Crops grown include: Maize, rice, beans, Bananas, green gram, rice, cowpea and tomatoes. Maize was grown for household consumption but also on contract by the Kenya Seed Company for production of Seed Maize. The farmers plant both local and improved verities.</p> <p>Crop rotations: Farmers practiced crop rotation. The reasons for crop rotation were to improve soil fertility; break pest cycle which affects different crops e.g. Fall armyworm; improve water use efficiency; conserve soil and improve soil structure. An example of seasonal crop rotation included planting maize and rotating with cotton and later green gram. This is mainly due to water management since different crops has different water requirement.</p> <p>Multi-cropping patterns: Inter cropping is not done in the public schemes, this was only done in individual farms. It is the practice of producing two or more crops on the same plot of land at the same time, rather than simply one, throughout the same growing season. Multiple cropping</p> | 1 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-----------------------------|--|---|----------|
| | | <p>aids in enhancing the land's yield and give a diversity of food at the household. For example, Maize was grown with cow peas and beans, which are legumes. Increased crop diversity, improved functioning of agricultural systems, and reduced use of inorganic fertiliser and pesticides, were the advantages mentioned.</p> <p>Market opportunities and choice of crop: Market opportunities dictate type of crop grown. Participants noted that for many years they have been planting maize for seed on contract by the local seed companies. But recently when KALRO introduced the Komboka rice variety, which has high returns and a bigger produce market share, most farmers shifted to rice. It was indicated that some crops are grown specifically for the market not home consumption like green grams, butter nut, water melons, pumpkins, tomatoes and onions. There is a ready market in the satellite towns. Contract farming assures the farmers on markets and hedges them from price fluctuations. Though beneficial most farmers who are not in the farmer groups are not part of the contract farming. The County Government extension office reiterated that it's easy to offer extension services to organized groups than individual farmers.</p> | |
| <p>Surface water</p> | <p><i>Exploitation, access and reuse</i></p> | <p>If already in exploited: Discuss it extend, importance and sufficiency and willingness to find/invest in other surface resource alternatives.</p> <p>Exploitation, access and re-use: Surface water is the most reliable resource for irrigation along the Tana. It's largely available, though the quantities fluctuate with within and between seasons. All the water in the irrigation scheme is provided for, distributed and managed by the NIA. Farmers access the water at a subsidized fee of USD 34/acre/cropping season, against the calculated actual cost of USD 110/acre/cropping season. The funds are used to carter for the costs of water provision. Water is pumped by generators and in the cases where it breaks down, then the water provision services stop.</p> <p>Challenges in water distribution were high cost of maintenance and high cost of fuel for conveying water. The alternative would be the use of solar power to pump the water, though NIA is constructing a new canal that will channel water by gravity, hence reducing the costs of water conveyance. The use of solar, renewable energy, technology has not been popularized in Tana, though few households use it. NIA should also allow other development partners open up village irrigation schemes outside NIA schemes; invest in drilling boreholes and shallow well that are not salty after right sighting by geologists; and harvest rain and flood water using earth dams. Some participants note that drip irrigation has been done but by use of water from shallow well and bore holes.</p> <p>If not already exploited:</p> | <p>1</p> |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|--|--|-------|
| | | Discuss its potential relevance for crop productivity enhancement, easiness of access, the trade off such investment | |
| | <i>Distribution and irrigation systems</i> | <p>If already existing:</p> <p>Discuss the existing distribution systems, efficiency, and influence on cropping patterns (choice of crop)</p> <p>The major distribution system for surface water is through canals. Most of the canals need regular maintenance otherwise a lot of water is wasted in seepage. The major canals draw water from the main distribution points and channel the same to different agricultural field blocks. The water has a scheduled plan for distribution, to allow all farms access the resource. With the increase in the acreage under rice, after farmers started shifting from maize production, the demand for water has greatly increased.</p> <p>Due to water level fluctuations, crops to be grown depends on the available water, though many farmers opt for rice because of the ready markets and good prices. The shift towards rice puts a strain on water allocation within the irrigation schemes.</p> | 2 |
| | | <p>If not already existing:</p> <p>Discuss the feasibility, funding (typology and actors), water management and influence on cropping patterns (choice of crop)</p> | |
| Atmosphere | <i>Climate change</i> | <p>Introduce and define “climate change” as a fact.</p> <p>Request the opinion and observation on changes in agricultural practices and pattern from previous generations up to now.</p> <p>Discuss the concerns and issues encountered due to climate changes and willingness to undertake actions</p> <p>Participants agreed that there were observed climatic changes in Tana river ecosystem. These changes were manifested unpredictable weather (sometimes it rains so much, sometime prolonged drought); shifts in seasonal rainfall patterns, which affects planning for the season; increased temperatures; and increased flooding along the riverine ecosystems. The climatic changes were said to be caused by human actions that have caused degradation, pollution of the atmosphere and also land cover change through deforestation. During the discussions some of the participants claimed that they are not bothered about climate change because they use irrigation for their farming activities, especially farmers near the riverine. After plenary deliberations, they got clarity that climate change transcends boundaries and there is need for collective action.</p> | 0 |
| | <i>Future awareness</i> | <p>Discuss probable future scenarios (suggested by locals) in term of farming viability, resources availability and access and political/social/economic changes</p> <p>Discuss willingness to undertake actions collectively/individually from now to prevent or mitigate those future risks</p> <p>To curb on pollution to mitigate against the causes of</p> | 0 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-------------------------------------|---|-------|
| | | <p>climate change, the participants proposed the use of solar power for pumping water instead of diesel. Other adaptation measures proposed and that are being practiced include agro-forestry; water conservation measures e.g. water harvesting through water pans, lining up the canal to reduce water loss; cultivation of suitable crops for the prevailing climate e.g. drought resilient crops; adapt water saving technologies; embrace technologies such as precision agriculture; embrace sustainable pastoral livelihoods e.g. proper livestock feeding programmes; balance water use, crop varieties and food security goals. The County Government extension staff and other development actors indicated that they continually invest in adaptation measures for better livelihoods. They noted that climate change impacts have affected many livelihoods and caused many families, who were once pastoralists embrace crop production. On the other hand, there is a strong crop-livestock integration with farmers allowing livestock access to stovers as feed during the harvest season.</p> <p>The crop-livestock integration will continue, according to the participants, since the future scenario on climate changes is likely to be worse. The participants have been observing worsening trends in climatic risks and they don't think that in future the climate may be better. The need to continually adapt to the changes was seen as important. Some of the participants indicated that the community need to be supported so that they can stabilize their livelihoods amidst increased climatic risks.</p> | |
| | <i>Sustainable dev.</i> | <p>Introduce and define sustainability in terms of agro ecological understanding and its benefit for the future generation.</p> <p>Discuss the willingness and motivation to resources economic (saving) and management to preserve the resources for future generations</p> | -1 |
| Economy | <i>Investment</i> | <p>Discuss the vocation of the land owned by local and contribution of agriculture to the locals and local economy and wellbeing, along with willingness to enhance it</p> <p>The community, though placing a lot of value on their land because its a source of their livelihoods and the local economy, still feel limited because of the tenure system. All the land is owned by the NIA though it was originally community land. The NIA developed then infrastructure and leased the land to the same community many years ago. Part of the community feels that this should change and the land should revert back to them so that they can steer agricultural development in their own way. The current tenancy arrangement seems to be a deterrence to their willingness to enhance the various portions of land they have.</p> | -2 |
| | <i>Substitution (Alternatives)</i> | <p>Discuss willingness to complement/replace land use economical outcome with other practice</p> <p>This can only happen when the tenancy allows them to. At</p> | -2 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|---------------------|-----------------------|--|-------|
| | | the current state of affairs, members can hardly make choices on changes in land use. | |
| | <i>Risk</i> | <p>Assess the relevance of farming for singular families and its contribution to year-to-year budgeting.</p> <p>Farming is a major source of livelihood and accounts for a very high percentage of household incomes and also budget for agricultural inputs.</p> <p>Discuss the willingness, and interest, to invest in potential solution that have the promises to increase revenue (financial) at short or long term</p> <p>The members showed willingness to invest in short term beneficial initiatives not long-term ones. This is because of the tenure system. Since land is allocated for specific years and seasons, many members plan to get the most yield during the time period without feeling obligated to invest in future dynamics.</p> | 1 |
| | <i>Subsidies</i> | <p>Discuss the willingness to follow rules and management practices, be part of a cooperation in exchange of subsidies</p> <p>Subsidies are advanced by both the national and county governments guided by specific policies and rules. The objective of the subsidies is to mitigate the farming operations against risks. Subsidies are also used as a plat for dissemination of specific agricultural information and technologies. The members welcome the issue of subsidies as a vehicle for new or innovative ways of introducing new agricultural management practices.</p> | 2 |
| Organization | <i>Collaboration</i> | <p>If already part of a cooperation/group/organization: Discuss their feeling of belonging, security and benefit and their willingness to continue to be part of the aggregation</p> <p>Collaboration: Within the groups, the participants noted that they address issues that include water availability after expanding the land under production; farmers' low capacity for agricultural investments; high cost of inputs e.g. fertilizer - more preferred because in leads to high production; low quality of manure used; limited access to subsidized credit. These collaborative efforts have helped them solve or address the above challenges.</p> | 2 |
| | | <p>If already not part of a cooperation/group/organization: Discuss their willing to be part of one and their interest to do so</p> | |
| | <i>Exchange</i> | <p>Discuss the benefit perceived from repeating actions/initiative from neighbouring farms and their willingness to learn and share experiences</p> <p>Participants indicated that there are some organization with the irrigation scheme, with specified by-laws, where exchange of ideas and knowledge take place. Farmers are organized in group where they plant commercial crops such as maize, green gram, cotton and seed maize. They also practice group farming and marketing. The proceeds from the groups is reinvested to generate more income e.g. buying tractors to lease to other farmers. The participants noted that there were farmers that were not in any organized group, since this was voluntary. The</p> | 2 |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|--|-------|
| | | benefits in being in an organized group include ability to get contract farming hence assured of market and prices; ease of procuring equipment or farm inputs; increased market accessibility; ability to access irrigation water; ease access to credit as a group from the finance service providers, can use of farming contract as a collateral for credit e.t.c. | |
| Policy | <i>Compliance</i> | Discuss the importance given to local regulation and their impact on their farming systems There were diverse policies around land and water use and management. These policies were being enforced by the national and county government administrative structures. Some of the policies mentioned included the County Integrated Development Plans; Sustainable Food System Strategy; Climate Change Policy and National Land Use Policy. The participants noted that the NIA Land Use Policy governing the use of the irrigation scheme, though enshrined in the law, needs to be changed especially on the land tenure arrangements. It was indicated that some amendments are in the process. To enforce compliance and management on land and water use, the IWUA, agricultural extension and the administration offices are involved. These management structures fosters participatory engagement. Management of the scheme is done at Blocks level where they meet on monthly and quarterly. Every block has a representative chairperson; and all blocks elect one chairperson and a secretary. These representatives discuss water use in the block. Each block also has a conflict resolution committee | 1 |
| | <i>Change</i> | Discuss their willing to change a fraction/part or totally the regulation system of their that manage their activities The plenary discussions indicated the willingness of the participants to learn and embrace new ways of doing things including policies. Especially policies and practices that enhance their agricultural activities. | 1 |
| | <i>Introduction</i> | Discuss their willingness to see new regulations to be introduced/facilitated The community is willing to see new regulations introduced so long as they contribute to their livelihoods and don't increase their costs of agricultural production. | 1 |

6.3. Annex 3 - Sudan Local Stakeholder Report



Meeting with Local Stakeholders on Evaluation and Site-specific Brokerage of Best Management Practices, Khartoum- Sudan

Date: October 22-23, 2022
Hybrid (Physical and Virtual)

Meeting Report

By

ASARECA, KHARTOUM UNIVERSITY, CIHEAM Bari, CNR

©November, 2022



Table of Contents

| | | |
|----------|---|-----------|
| 1 | Introduction..... | 4 |
| 1.1 | Background and Rationale..... | 4 |
| 1.2 | Project Area | 4 |
| 1.3 | Purpose of the Local Event..... | 7 |
| 2 | Methodology | 7 |
| 2.1 | Workshop Methodology | 7 |
| 2.2 | Stakeholders..... | 8 |
| 3 | Workshop Sessions and Discussions | 8 |
| 3.1 | Dissemination and Evaluation of BMPs | 8 |
| 3.1.1 | Dissemination Event | 8 |
| 3.1.2 | Evaluation of Best Management Practices | 11 |
| 3.1.3 | Wrap-up (Day 1) and Conclusion: | 15 |
| 3.1.4 | Brokerage of the Best Management Practices | 15 |
| 3.2 | Site Visit and Site-specific Brokerage Meeting: | 16 |
| 3.2.1 | Site Visit:..... | 16 |
| 4 | Annex:..... | 17 |
| 4.1 | Annex 1 – Meeting Agenda | 17 |
| 4.2 | Annex 2: Attendance sheet:..... | 18 |
| 4.3 | Annex 3 – Concept Note: | 22 |
| 4.4 | Annex 4 – Event Pictures:..... | 27 |
| 4.5 | Annex 5: LMES: Local Meeting Evaluation Sheets | 33 |

Acronyms

| | |
|-------------|---|
| AICS | Italian Agency for Development Cooperation |
| ASARECA | Association for Strengthening Agricultural Research in Eastern and Central Africa |
| BMPs | Best Management Practices |
| CNR | Italian National Research Council |
| CIHEAM Bari | International Centre for Advanced Mediterranean Agronomic Studies – Institute of Bari |
| EU | European Union |
| EUR | Euro |
| MOIWR | Ministry of Irrigation and Water Resources |
| WRC | Water Research Center , University of Khartoum |

1 Introduction

1.1 Background and Rationale

The Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy, and agriculture nexus in Kenya, Ethiopia, Sudan, and Egypt to improve economic development and resilience to climate change. Through innovative research, modeling, and capacity-building approaches, the project aims to gain a comprehensive understanding of small to large-scale water and agricultural resource dynamics and management, as well as people's climate resilience.

Water scarcity and climate change pose a serious threat to agricultural production and food security in countries in Eastern and Northern Africa. To address this issue, the project aims to improve agricultural water management sustainability and agro-ecosystem resilience to climate change in Eastern Africa. It has two main specific objectives: improve research institutions' knowledge and management of water in agriculture; and (ii) farmers and local actors implement innovative/sustainable water management solutions and skills, in collaboration with other European (Finnish Environment Institute, National Research Council-Italy, and International Soil Reference and Information Center) and African partners.

CIHEAM-Bari is leading the project's implementation in collaboration with (Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Kenya Agricultural and Livestock Research Organization, Ethiopia Water and Land Resource Centre, Sudan Water Research Center (WRC) and Heliopolis University in Egypt).

The Italian Agency for the Development Cooperation (Agenzia Italiana per la Cooperazione allo Sviluppo – AICS) is the Executive Body and assures the overall project coordination and monitoring, whereas the CIHEAM Bari is the technical and scientific project lead partner. ASARECA is in charge of coordinating the project's activities in the four target countries.

1.2 Project Area

The Gezira Scheme is located between the Blue Nile and the White Nile Rivers within a semi-arid agro-climatic zone (Fig. 1). In terms of accessibility, it is easily accessible by Khartoum-Wad Medani road, and the trip between Wad Medani, the capital of the Gezira State and the neighboring headquarter of the scheme (Barakat), and Khartoum takes about three hours by car. There is no problem of security and the area is very safe.

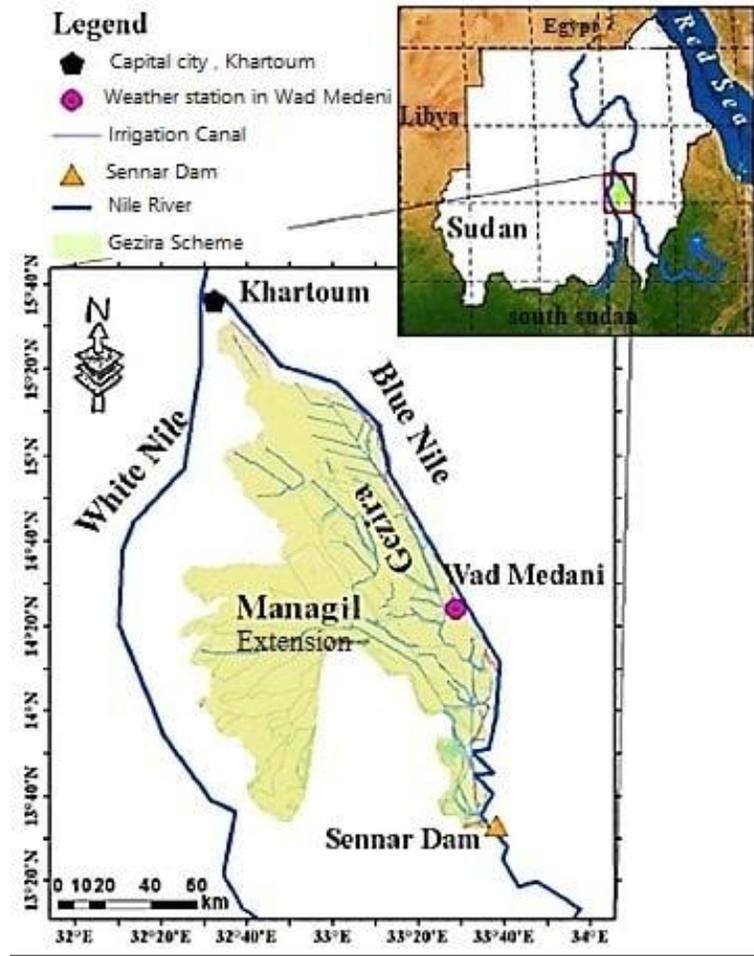


Figure 1: The location of the Gezira scheme.

Challenges Facing the Gezira Scheme

There are many challenges that face the scheme including the urgent need to investigate and find Best Management Practices (BMPs) that can overcome these challenges and enhance productivity. Listed below are some of these challenges:

- Deterioration of irrigation infrastructure.
- Inefficient water distribution within the scheme.
- Low irrigation efficiency.
- Low capacity of drainage network leading to surface water ponding in some areas.
- Agricultural drainage discharges directly in the Blue Nile without treatment impacting water quality.
- Institutional weakness and instability.

- Weak agricultural Research programs that are strongly driven by national objectives rather than by the research needs of the Gezira Scheme. However, the research focus has been more on technical aspects with no/or minimal consideration of their socio-economic impacts.
- Lack in uniformity in crop rotation that constrains tenant management choices concerning cultivated crops.
- Limited formal finance and Inadequate Land Tenure system.
- Inadequate agricultural marketing; the dominance of the state marketing had negative impacts on the development of crop yields and crop output.
- Inadequate extension service programs; the focus has largely been on commodity development rather than community development.
- Inadequate availability of agricultural inputs, including seeds, fertilizers, herbicides due to high cost.
- Low Productivity.

Gezira Irrigation Scheme Opportunities

In spite of these challenges, there are numerous BMPS opportunities that if taken, could enhance the productivity. Of these opportunities are the following:

- There are large opportunities for enhancing the productivity through improving irrigation efficiency, crop diversification and intensification, institutional development, research funds and improved extension programs.
- There are market prospects for products such as cotton, sorghum, groundnuts, wheat (provided that yields can be increased to levels that render it competitive against imported products).
- The resources available provide excellent conditions for livestock production and a variety of horticultural products. These prospects are very promising not only because of the location of the Gezira Scheme and the available transportation infrastructure but also because of expanding demand for livestock and horticultural exports in the nearby markets of Saudi Arabia and the Gulf countries.
- There are still large land reserves for future expansions.
- There are opportunities for enhancing international cooperation for improving productivity of the Gezira scheme (FAO, IFAD, WB, Italian Agency for Development and Cooperation (AICS).....etc).
- There are world-wide growing needs for exporting food products.

1.3 Purpose of the Local Event

The official launch of the project in May 2022 paved the way for implementation of the initial activities such as: (i) inventory and stock taking of the BMPs/I (A1.1) and (ii) evaluation of BMPs/I (A1.2 & A1.3). The local event was held to kick start implementation of the project activities in Sudan and comprised of: (i) dissemination event and meeting for BMPs evaluation; and (ii) site visit and site-specific brokerage meeting. The main objective of the WATDEV local event was to sensitize stakeholders about the project and kick start a dialogue and cooperation with local actors to stimulate the debate on how to improve water management in Agriculture.

2 Methodology

2.1 Workshop Methodology

Several local events will be conducted to apply the evaluation framework which will lead to the selection of the BMPs among the ones collected, described, and evaluated in the Repository suitable for implementation in the study areas. The process is articulated into 4 steps as follows:

- During the local meetings, an assessment and evaluation with the local's actors will be performed. Such evaluation is composed of: i) Group evaluation: with a set of question, it aims at qualitatively assess the working group, describing the group ability to collaborate and work together and the inclusiveness, the group consistency and cohesion in performing new processes and activities, the Group ability to share individual benefit with the whole community. ii) Evaluation of local community needs: this aims at evaluating the group flexibility (needs), by area of application of BMPs, to undergo changes.
- The outcomes of the local meetings, after a scoring procedure, will be plotted through spider-graphs showing the overall attitude of the local community to put in place management practices. In line with their preferences, a matching exercise will be performed to extract, among the practices collected (after a preliminary assessment) in the BMPs repository, the "candidate" ones.
- The candidate BMPs will be discussed in a Multi-Actor's Regional meeting, bringing together a number of stakeholders (identified by means of a specific Stakeholder Analysis) at regional level. This meeting will aim to validate the BMPs that are titled to be modelled afterward. The selected BMPs could be suitable to be applied in a certain study area, but not already known from the local farmers. For the application of this innovation, it would be useful to explore the feasibility of a public-private partnership able to support its implementation, by means of the second round of brokerage meetings. In any case, it would also be necessary to carry out a feasibility study, as well as an awareness and training campaign for local communities.

- The BMPs selected after the A1.3 Multi-Actors' Regional Meeting will be subjected to the integrated modelling process and the simulation of possible impact scenarios due to their upscaling/out scaling, from the areas of implementation to large-scale catchments within and possibly beyond the study areas.

2.2 Stakeholders

Based on the WATDEV approach, the target audiences for local brokerage meetings will be drawn from three (3) key stakeholder categories. These include: (i) Policy, (ii) Organization, and (iii) Financial/Economy. Based on this, the stakeholders expected to attend the local meetings will be comprise a mix of the following categories: Ministry of Agriculture, Gezira Scheme Board, Ministry of Irrigation and Water Resources - Irrigation services, Ministry of Finance and Economic Planning, Water Users' Organization, Hydraulics Research Center (HRC), Sudan Meteorological Authority (SMA), UNESCO-Chair in Water Resources, Higher Council for Environment and Natural Resources (HCENR), Water Management and Irrigation Institute (WMII), Faculty of Civil Engineering, University of Khartoum, Sudan University of Science & Technology , and College of Water and Environmental Engineering (See annex Stakeholders Matrix).

3 Workshop Sessions and Discussions

3.1 Dissemination and Evaluation of BMPs

On Day 1 of the local meeting, a dissemination event and BMP evaluation took place, which included remarks from the selected delegations as well as presentations on the project objectives and meeting agenda.

The first day was dedicated to discussions with stakeholders, understanding their challenges, knowledge sharing, and evaluating the BMPs.

3.1.1 Dissemination Event

a) The meeting first session: (welcome and opening Remarks)

Welcome remarks and participant introductions were featured in this session. The session was presided over by Prof. Gamal Abdo, the Director of the WRC, who gave a cordial welcome to all attendees and thanked them for making the time to attend this event. Additionally, he provided a brief overview of the project, the collaborators, and the premier institution, CIHEAM Bari. Participants then identified themselves by stating their names, backgrounds, and institutes. Following this, the welcoming address by Prof. Imdadeldin Aradaib (Vice-chancellor of the University of Khartoum), who welcomed the participants and thanked them on behalf of the University of Khartoum for their efforts and expressed full support of the university to this very important project.

The representative of the AICS office in Khartoum, Mr. Raimondo Cocco, thanked the University of Khartoum for organizing the program, provided a brief overview of international cooperation, and discussed the significance of the project for both the nation and the world in terms of food

security and agriculture. Mr. Moses Okede, from ASARECA, discussed the workshop's goals and schedule in addition to providing a brief overview of the project's purpose and anticipated outcomes.

b) Objectives and Agenda of the Meeting

Mr. Moses Okede, from ASARECA made a presentation in order to stimulate debate on how to improve agricultural water management and to share WATDEV project objectives. He further presenting the opportunities on how the project can meet local needs. He provided firstly an overview of the WATDEV project for potential stakeholders in Sudan - highlighting the project objectives and key results. More information has been shared regarding project implementation including project area and intended beneficiaries.

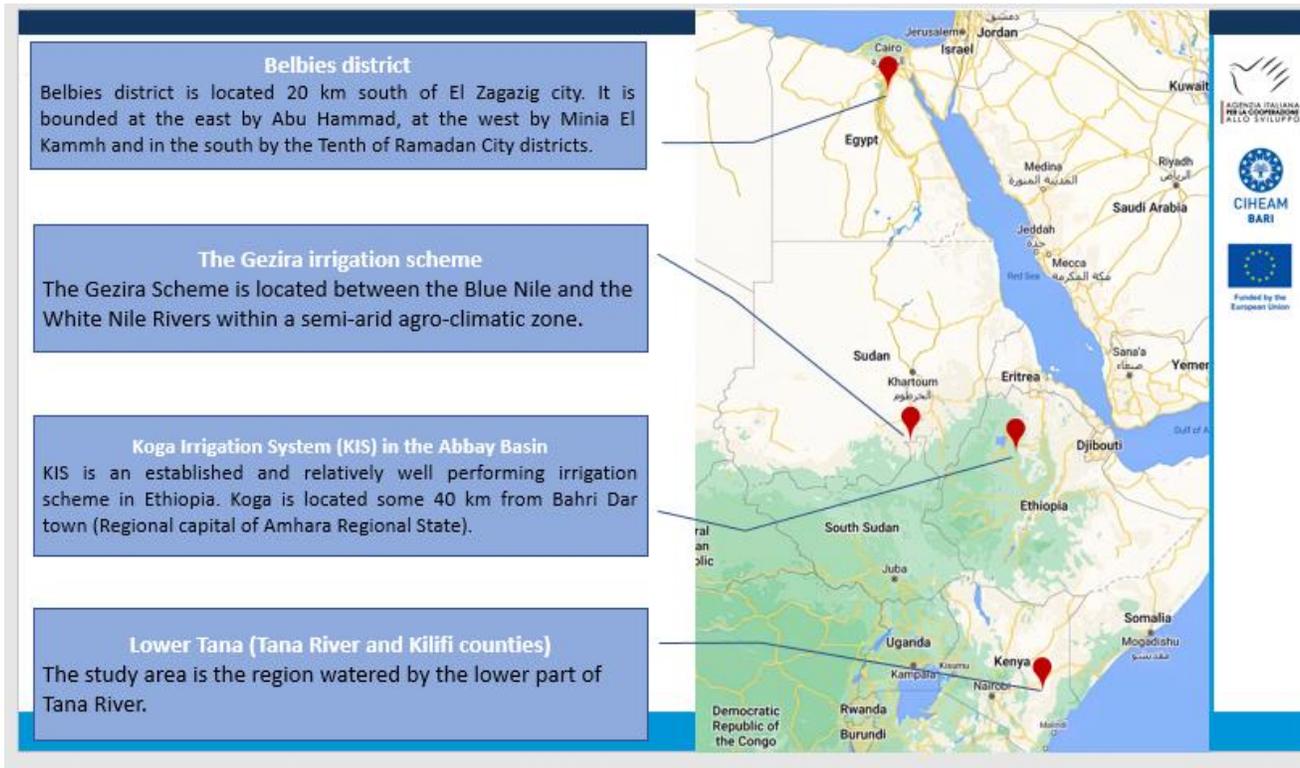
Stakeholder consultations were held on potential risk; and management strategies that the project needs is to improve in order to ensure sustainable land and water management, including community needs assessment in terms of implementing BMPs.

c) WATDEV Project

A presentation on the WATDEV project was given to prepare the stakeholders for a discussion by **Dr. Gaetano Ladisa**, according to the presentation, the overall goal of the WATDEV project is to improve the sustainability of agricultural water management and the climate change resilience of agroecosystems in East Africa and Egypt. The presentation mentioned a background of the project, the partnership, the objectives, case studies, the conceptual phases, and expected results.

The project's specific goals are to: (i) increase the knowledge and management of national ministries and research institutions in the agricultural sector; and (ii) improve the resource management abilities of farmers, local actors, cooperatives, and water users associations.

Case study areas:



Dr. Gaetano Ladisa also discussed the importance of this event for the following reasons: Multi-actors process linking together farmers, researchers and policy makers, needs-based research approach, and participatory approach in finding, selecting and applying BMPs. He also discussed the expected outcomes which were summarized as follows:

- Identify the best fitting Best Management Practices (BMPs) and innovations in project countries.
- Perform the BMPs /Innovations upscale and out scale scenarios.
- A modelling toolbox available for Researchers and Institutions.
- Strengthened knowledge and capacity building and established regional “Water Knowledge” Hub.

The presentation on the Best Management Practices (BMPs) collected and profiled, as part of activity 1.1 of WATDEV project, was provided by Ms. Alice Calvo of the Italian National Research Council (CNR). It included by the BMPs collected between 18 April 2022 and 31 August 2022 in the study areas of Egypt, Ethiopia, Kenya, and Sudan.

The following distribution of the BMPs was made:

Crops (36.63%) are followed by water (24%), soil (23.53%), and atmosphere (15.84%). The BMPs for soil focused primarily on conserving soil (33%), increasing water-holding capacity (28%), increasing soil organic matter (23%) and maintaining structure (16%). Water-related BMPs focused primarily on logging/salinization reduction (14%) and resistance to salinity (6%), surface water improvement (21%), groundwater improvement (17%), and water use efficiency (42%). Contrarily, the BMPs for crops focused primarily on increasing crop productivity (40%) as well as improving farmers' engagement (14%), food security/livelihoods (28%), and pest resistance (11%). BMPs for the atmosphere with a focus on climate variabilities resilience improvement (43%), evaporation/evapotranspiration reduction (28%), and greenhouse gas emission reduction/soil carbon sequestration improvement (22%), and methane/nitrous oxide losses reduction (7%).

Stakeholders were also informed that WATDEV will conduct research, analysis, and modeling on the application of agricultural management practices, conduct capacity building activities at various community and actor levels (from users to researchers and decision-makers), and address various issues and problems in the chosen study areas of (i) Belbies district in Egypt, (ii) Gezira irrigation scheme in Sudan, (iii) Koga irrigation system in the Abbay basin in Ethiopia, and (iv) the Lower Tana (Tana River and Kilifi counties) in Kenya.

The five phases of the project's implementation were also disclosed to the local actors: inventory and stocktaking of BMPs and innovations; (ii) evaluation and brokerage of BMPs and innovations; (iii) improvement of BMPs and innovations; (iv) modeling; and (v) legacy-toolbox (and parallel action Water Knowledge).

Information on the project activities to be carried out at the national level was given to the stakeholders.

The following activities will be carried out in stages: local meetings; (ii) matching the BMPs; (iii) regional meeting of Multi-Actors; (iv) selection/validation of BMPs; (v) awareness of BMPs; and (vi) modeling the scenarios.

3.1.2 Evaluation of Best Management Practices

a) The scope of the evaluation process

One of the main tasks completed on Day 1 of the WATDEV Local Meeting was the evaluation of BMPs. Mr. Moses Odeke gave a presentation on the scope of the evaluation exercise with regard to the potential Best Management Practices (BMPs) application sectors, such as: (i) Groundwater, (ii) Soil, (iii) Crop, (iv) Surface water, and (v) Air/Atmosphere; and focusing on the discussion on preservations, exploitation, and management of various BMPs under these sectors.

b) Scope of Evaluation Exercise

The discussion on local needs assessment exercise was facilitated by ASARECA, WRC, and Farmers. The stakeholders also talked about surface water irrigation systems, access, exploitation, and distribution as well as crop varieties and management techniques. Under BMPs related to

atmosphere, discussions on climate change, future awareness, and sustainable development were also covered. The following topics were also covered: economy, organization, and policy. The economy covered investment, substitution (alternatives), risk, and subsidies. The organization covered collaboration and exchange (willingness to learn and share ideas) (willingness to see new regulations introduced). The following are the main conclusions from the BMP evaluation:

i. Groundwater

Moses asked about its availability, easiness of access and exploitation, the farmers responded that it's good and not polluted nearly 100m deep. Also Moses asked about establishing investment in ground water, the farmers responded that they do not depend on groundwater for irrigation in the Gezira project, and ground water is not an issue they are using surface water.

ii. Soil

Participants defined soil management as the agricultural practices used to help protect the soil and enhance particular soil functions. They acknowledged that investing in soil is very important.

Participants acknowledged that investing in soil is very important, they also stated that it is important to analyze the soil and their properties. Previously regular investigation about the soil was carried out routinely by the government and the related institutions (Agricultural research center and Al-Gezira University) but now it is an individual action. Also mentioned that they have old data carried out in previous investigations but it hasn't been updated. The director of Environmental Research Center of Khartoum University stated that FAO has developed Atlas for Sudan soil covering the whole area including Gezira scheme. The Participants stated that the regular analysis of the soil will help in: Agricultural operations, Water requirements, Crop type identification, and Fertilizer type.

Some farmers indicated that the last soil check was undertaken 60 years ago and the farmers hope that the program will recommend the authorities to establish the action regularly even if once in five years.

Prof. Pandi stated that in Europe the soil was added to the political agenda, and mentioned that the soil ATLAS for Africa is good, problem of old data is also present in Europe. Also spoke about the integrated system between soil, water and crop, and recommend to establishing monitoring system geo reference like Europe.

One of the practices reported by farmers to improve the soil is that they choose crops with minimal irrigation and preparation needs. They also plant coriander around the project to protect it from pests.

iii. Crops

Farmers stated that the introduction of wheat as a crop had a negative effect, and they hope to go back to the days when they used to plant sorghum and millet.

Crop varieties and management: Various food crops are grown depending on the type of the soil and availability of the market. Production of local crop varieties is mainly influenced by the Market. Crops grown include: Wheat, sorghum, Tomato, Peanut, Millet, soya beans, Citrus, Mango.

Crop rotation: Farmers mentioned that there is not crop rotation due to the absence of law and governmental order had led to the scheme low productivity. The criteria for selecting crops is depending on market price.

Multi-cropping patterns: Multi-cropping is rare. Mono-cropping pattern is common among the farmers.

iv. Surface water

Exploitation, access and re-use: surface water is available and sufficient for agriculture. It is the first and best option in the study area.

Distribution and irrigation systems: Canals are the main means by which surface water is distributed. Water is distributed by gravity no need for pumps. However, distribution systems are old and need to be maintained to make them more effective for farmers further down who do not receive nowadays enough water. Participants emphasized the significance of water quality and distribution efficiency as key elements in surface water management.

Influence on cropping systems: Participants reported that availability of surface water determines the crop to be cultivated.

v. Atmosphere

Climate change: Participants shared their experiences on climate change and how it has affected their agricultural activities. They stated that that previously, they were aware of the precise arrival date of the water. Since they had time, they were prepared. Due to water delays brought on by climate change, they are currently unprepared for extreme events like floods, so they advise increasing the escape canals' capacity just in case.

Future awareness: Farmers are prepared to act collectively to reduce climate change. Farming is more challenging now than it was before, but it is unclear exactly what the future changes will be. Some people are making individual efforts to minimize the effects of climate change, such as covering the crops to minimize evapotranspiration water loss. Participants emphasized the significance of the weather forecasts in making decisions today and highlighted the need for increased awareness of effects management of the environment.

Sustainable development: Farmers regarded their practices as sustainable and desired a better future for future generations.

They promoted the switch to more effective irrigation from conventional irrigation (such as drip and sprinkler irrigation). They also stated that water usage should be efficient so that next generations can benefit from it.

vi. Economy

Investment: Farmers are willing to continue their agricultural activities because it is their source of income and they love it and it is a part of their history. Although it is not as profitable as they would like, agriculture still has an impact on the economy. Many farmers work in agriculture as a part of their culture and tradition, as a hobby or passion outside of the pursuit of financial gain, and because they care about the sustainability of the industry.

Willingness to Increase Agriculture's Contribution: The participants are willing to increase agriculture's contribution to their economy and well-being.

Substitution: Farmers stated that they will never give it up. Few of them have another source of income not only from farming. Some farmers have moved away from cultivation to other businesses due to the unstable market.

Risk: Investing in production is something that people are willing to do even though the market instability. This is the main risk. Crop failure or reduced harvests caused by a variety of factors represent the other risk. Government assistance in the form of subsidies, credit, or loans is indicated as being necessary by local stakeholders so they can: (i) purchase or invest in new irrigation technologies; and (ii) support or pay for on-farm agricultural production practices.

Subsidies: Farmers stated they needed low-interest loans from the government in order to adopt new technologies because they could not afford to pay for them out of pocket.

vii. Organization

Collaboration: Participants agreed that working together in a group is much more beneficial than doing so individually. Farmers have already joined a number of organizations, Example (Tayba society) and they are excited to join more. They emphasized the following advantages of belonging to an organization: improved incomes, reduce expenses, more productive agriculture, and working together to solve problems.

Exchange: Exchange of information and knowledge was a priority among the community members and they regularly shared within their communities. The local stakeholder meeting also provided a platform to further such exchanges.

viii. Policy

Compliance: Local stakeholders indicated that they must abide by current laws. The degree of local law compliance is high. Participants consider local ordinances and regulations to be crucial for maintaining order and encouraging the adoption of specific practices.

Change: Participants expressed a willingness to adopt new policies that would help them perform their tasks more effectively.

They want to have a better understanding of the rules and laws that have a positive impact on their daily lives and activities. They stated that some regulations should be canceled because it does not give the farmers their full rights.

3.1.3 Wrap-up (Day 1) and Conclusion:

Dr. Ahmed Elshaikh presented the many contributions, expectations, and suggestions of the participants. The group's expectations and needs are matched with the BMPs that WATDEV obtained through reflection on potential future BMP brokerage.

Finally, the session exposed the importance of active participation of several stakeholders from various backgrounds and institutions. The debate was quite fruitful, with major contributions from a variety of participants, particularly the farmers, who gave engaging insights into their everyday struggles and routines.

Following the discussion, the following issues could be highlighted as suggestions for further actions:

- Increasing the capacity and awareness about climate change and its impact on agricultural.
- Giving more attention to irrigation water management in Gezira scheme.
- Adding value for the crops to enhance the farmer income.
- Linking between the soil elements and crops quality as BMP.

Professor Gamal Abdo concluded by thanking the participants for their enthusiastic involvement on the first day and informing them about the fieldwork and meeting with farmers scheduled for the next day at their training facility.

3.1.4 Brokerage of the Best Management Practices

The reflection on the brokerage of BMPs was done by the team of experts from (WRC, ASARECA, and CIHEAM-Bari) who discussed and jointly filled the group evaluation form according to the reflections of the participants in the workshop (Annex5: Part 1). After the field visit, and a lunch break, the group of experts eventually met, reflected and discussed what happened over the two days before proceeding to fill the group evaluation form. Online participants from CIHEAM-Bari also participated in the exercise.

Participants expressed their satisfaction with the exercise throughout the reflections and discussions, particularly because they could relate to some of the events from Day 1 and this enhanced the discussions. Some of the key messages that emerged from the expert group's discussions and reflections are highlighted below:

- The group is able to collaborate because they share interests and are driven by a desire to improve their standard of living through farming. Additionally, because they finance comparable farming businesses, they deal with comparable difficulties.

- In terms of group cohesion, there was a strong sense that there was some degree of interconnectivity among the members based on how they interacted within the group, shared their struggles and experiences, and demonstrated a willingness to not only discuss these problems together but also come up with solutions. It was clear from this that the group could cooperate. Members of the group were also kind of engaged in terms of the objectives or priorities of the group. It was noted that there was a sense of inclusive because members could express their opinions on the matters on which the group should concentrate. This aids in setting the group's agenda as a whole.
- The group could share the BMPs or any other benefit with other community members. Because of the strong belief that community members form strong relationships with one another, which was viewed by group members as essential for the exchange of ideas, innovations and BMPS.
- The members' involvement and interest in the creation of new knowledge was felt to be very strong. Members have developed new knowledge through their own innovation-based experimentation.

3.2 Site Visit and Site-specific Brokerage Meeting:

Site visit to Hydraulic Research Center (HRC), Tayba Society (Farmers Training Center), Gezira scheme and Site-specific brokerage meeting was held on Day 2 of the meeting.

3.2.1 Site Visit:

The second day of the workshop started with a visit to Gezira scheme, and meeting with farmers within the scheme. They talked about challenges facing the scheme. The participants then visited a Farmers Training Center. Then they visited the Hydraulics Research Center (HRC), Ministry of Irrigation and Water Resources.

- The second day of the workshop started with a visit to the study area (Gezira scheme) to explore and discuss existing project. (The crops – canal system). Also meeting with the local stakeholders and discussed the practices done in the field.
- The participants then visited a Farmers Training Center (Tayba Training Center). The engineers on the center made a presentation showing the role of the center in teaching farmers, and preparing them, also its community roles.
- The participants then visited the Hydraulic research center in wad-medani (HRC), Prof Abu Obieda talked about the history of HRC and the recent projects involved in with regard to Gezira scheme.

4 Annex:

4.1 Annex 1 – Meeting Agenda



**Sudan Local Stakeholders Meeting on BMPs Evaluation & Site-Specific Brokerage Meeting
Sudan, October 22 -23, 2022**

Meeting Agenda

| Saturday 22th October 2022 - Dissemination Event & Meeting for BMPs Evaluation | |
|--|--|
| Welcome and introduction Chair – Prof. Gamal Abdo | |
| 8.30-9:00am | ☐ Participants arrival and registration |
| 9.00-9.45am | <ul style="list-style-type: none"> • Welcome remarks – Prof. Gamal Abdo (WRC) • Welcome remarks – AICS (Khartoum) representative • Prof. Imdadeldin Aradaib (UofK vice-chancellor) • Objectives and agenda – ASARECA |
| Preparing the ground for discussion Chair – Dr. Babikir Barsi | |
| 09.45-10.30am | <ul style="list-style-type: none"> • The WATDEV Project: Objectives, methods and expected results – Dr. Gaetano Ladisa (CIHEAM Bari) • Overview of activities in the country and presentation of Local stakeholders – Dr. Ahmed Hayaty (WRC) |
| 10.30-11.00am | Coffee break & Group photo |
| The BMP evaluation’s exercises Chair – Prof. Abdin Salih | |
| 11.00-1.00pm | Presentation of Exercise’s Scopes (Support to Fill the Needs Evaluation Sheet) – ASARECA Facilitated discussion – Lead Facilitator: WRC Co-facilitators – ASARECA and CIHEAM Bari |
| 1.00-2.00pm | Lunch Break |
| Wrap-up and Conclusion Chair – Prof. Gamal Abdo | |
| 2.00-3.00pm | <ul style="list-style-type: none"> • Plenary discussions – WRC/ASARECA/CIHEAM Bari • Reflection on potentials future brokerage on BMP/I to orient matching between group expectations/needs and WATDEV collected BMP/I • Next event: Site-Specific Brokerage Event – WRC, ASARECA |
| 3.00-3.45pm | Workshop evaluation – WRC, ASARECA, CIHEAM |
| 3.45-4.00pm | Wrap-up and Closure |
| Sunday 23th October 2022 – Field visit | |
| 7.00am – Departure for Gezira irrigation scheme | |
| 10.00-12.00pm | <ul style="list-style-type: none"> • Field visit to Gezira scheme • Meeting with farmers within the scheme • Visiting Farmers Training Center |
| 12.00-1.00pm | Lunch break (Hydraulic Research Center HRC) |
| 1.00-2.30pm | <ul style="list-style-type: none"> • Wrap-up • Drive Back |



4.2 Annex 2: Attendance sheet:







Project WATDEV

Event title

event subtitle (activity code)

dates and place of the whole event

Attendance sheet - date

| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | SIGNATURE | |
|------------------------------|---------------------------------|--------------------------------------|---------------------------------|-------------------------------|---|-----------------|
| | | | | | 22/10 (Day One) | 23/10 (Day Two) |
| Amr el Bahh | Abnewel | Gazira shere | sudan | |  | |
| Mohamed Ali | AB EG | caire | sudan | |  | |
| Gazira Bahh | BAK | Hadis | Qadafi | |  | |
| Maria Mohamed | | izara | Sudan | adool@watev.org |  | |
| Wahid Isidly Ibrahim | | Gazira shere | Sudan | |  | |
| M AHAD | ETSAHIT | ALSD | | AZAZAG11@gmail.com |  | |
| Mohamed | Phmed | Siddiq | | Wad El Siddiq |  | |
| O.S.Meh | Salih | NAMALBERT | | 0125606666 |  | |
| G. Abdo | Gamil | WLC | | 0122123825 |  | |
| OSMAN | ELBADR | ELGEZIRAS | Sudan | 0912163444 |  | |
| Osama | | WRC | Sudan | |  | |
| Osama | Amr | WQC | | | | |



Project WATDEV

Event title

event subtitle (activity code)

dates and place of the whole event

Attendance sheet - date

| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | SIGNATURE | |
|------------------------------|---------------------------------|--------------------------------------|---------------------------------|-------------------------------|-----------------|-----------------|
| | | | | | 22/10 (Day One) | 23/10 (Day Two) |
| Razza Mohamed | Mutasda | WRC | Sudan | razzamustafa@gmail.com | | |
| Fauz | IBRAHIM | WRC | SUDAN | Fauz.Abusamir@gmail.com | | |
| Mohammed | Salah | WRC | Sudan | mohammed.salaha@gmail.com | | |
| Mahm | Raoof | WRC | Sudan | mahmuraof@gmail.com | | |
| MARLEED | MOHAMMED | WRC | Sudan | marleed.mohammed@gmail.com | | |
| Hisham | Shergadi | IES/ajk | Sudan | hishamshergadi@gmail.com | | |
| Mustafa | IBRAHIM | WRC | / | mustafabrahim3@gmail.com | | |
| H. OUSAIM | RESAWIZ | AICS | Sudan | CRISTINA.RESAWIZ@AICS.GOV.IT | | |
| PAITONDO | COCCO | AICS | SODAN | PAITONDO.COCCO@AICS.GOV.IT | | |
| Elbadly Shaafiq | | WRC | Sudan | elbadlyshaafiq@gmail.com | | |
| Ishraga Osman | Osman | WRC | Sudan | essokrab@hotmail.com | | |
| MOHAMMED | HIRGHANI | WRC | Sudan | md.a.hirghani@gmail.com | | |
| Mhadiga | Mohammed | WRC | Sudan | mhadiga.im3@gmail.com | | |



Project WATDEV

Event title

event subtitle (activity code)

dates and place of the whole event

| Attendance sheet - date | | | | | | SIGNATURE | |
|------------------------------|---------------------------------|--------------------------------------|---------------------------------|-------------------------------|-----------------|-----------------|--|
| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | 22/10 (Day One) | 23/10 (Day Two) | |
| Hammond | Ahmed | VOFK | Sudan | malib@vofk.edu | | | |
| Ali | Rabah | VOFK | Sudan | rabahs.phot@vofk.edu | | | |
| Abdur | Salih | WRC | Sudan | abdensalihal@gmail.com | | | |
| Mena | Mohamed | UNESCO WH | Sudan | menamensrad7a@gmail.com | | | |
| Mohamed | Ibrahim | MWRI | Sudan | mhund093070@gmail.com | | | |
| Hassan | Abdelbasset | MWRI | Sudan | alraihan9999@gmail.com | | | |
| Omer | Taha | MDA | Sudan | obobesh1979@gmail.com | | | |
| Ahmed | Elshaiikh | VOFK | Sudan | ahmedhagatya@live.com | | | |
| Hohamed | Sigam | WRC | Sudan | mohamedsigam1@gmail.com | | | |
| Eyad | Eldiviny | WRC | Sudan | Eyadkani38@gmail.com | | | |
| AHMED | ABOBAKER | WRC | Sudan | ahmedabobaker201@gmail.com | | | |
| SAWA | ABO AHM | WRC | Sudan | Sawa.Shalqan@gmail.com | | | |



Project WATDEV

Event title

event subtitle (activity code)

dates and place of the whole event

Attendance sheet - date

| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | SIGNATURE | |
|------------------------------|---------------------------------|--------------------------------------|---------------------------------|-------------------------------|-----------------|-----------------|
| | | | | | 22/10 (Day One) | 23/10 (Day Two) |
| IBRAHIM | Mohammed | Asareca | Sudan | ibrahim@asareca.org | | |
| BLAISE | AMONY | ASARECA | UGANDA | blaise.amony@asareca.org | | |
| TOSES ODIKE | ODIKE | ASARECA | UGANDA | m.oderke@asareca.org | | |
| PANDI | ZBULLI | CIHEAM-B | ITALY | pandilibull@ciheam.it | | |
| GIUSEPPE | SARACINO | CIHEAM BARI | KENYA | SARACINO@CIHEAM.IT | | |
| GAETHMO | LAHISA | CIHEAM BARI | ITALY | gaethmo@ciheam.it | | |
| TAKWEIM | GAAPAR | ZGCI/DARAU A | SUDAN | TAKWEIM.GAAPAR@ZGCI.COM | | |
| Mohammed | BARSI | WR C | SUDAN | mohammed.barsi@wr-c.com | | |
| Kamal | Abdallah | Shasan Group | Sudan | abdallah@shasan.com | | |
| Sabker | Bawi | WR C | Sudan | sabker@wr-c.com | | |
| Xabi Odiak | Alwaf | HRC | Sudan | xabi@hrc.com | | |

4.3 Annex 3 – Concept Note:



EVENT CONCEPT NOTE

Activity number: A1.2 / A1.3

Name/title of the event:

Meeting with local Stakeholders on BMPs evaluation & Site-specific brokerage meeting

Event code (if any): n/a

1. Background

Irrigation has been practiced in Northern Sudan for generations with numerous indications such as reservoirs and distribution facilities (Dows). However, modern irrigation systems were introduced in 1911 when an experimental farm was established at Tayba village, almost within the current location of Gezira scheme. The scheme is the largest irrigation schemes in the region with a total area of 880,000 hectares (ha) ^[1]. It is also a major sources of foreign currency (cotton export), and food security (wheat, sorghum, vegetables) for Sudan. It has huge infrastructure with a value estimated at US \$ 8 billion. The scheme had played a vital role in the history of irrigation in Sudan and Africa and has become a model for many irrigation schemes in sub-Saharan Africa ^[3] in terms of design and operation system ^[4]. These facts reflect the historical importance of the scheme, and therefore, any research efforts to improve water management in the scheme are not only beneficial to the project, but also to other similar projects at the national and regional level.

Besides ease of accessibility and safety, there is a vast experience especially in terms of irrigation and agriculture within the scheme coupled with huge volume of research conducted by various research institutions, such as the Agricultural Research Corporation (ARC), the Hydraulic Research Centre in the Ministry of Irrigation and Water Resources, and the Gezira University Irrigation Management Institute as well as other research actors from abroad. Therefore, a huge volume of information is available especially on the technical, economic, social, institutional and policy aspects of the scheme as well as the scheme's performance with regards to cropping intensity, cropped areas, yields and outputs and the constraints facing the scheme and their Impacts.

2. Event Objectives

The main aim of the event is to carry out a participatory evaluation of the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences (knowledge, capability, decision process, policies, management system, social assets, etc.) associated. This will define the base for BMPs' implementation at either farmer or community level along with BMPs' suitability (need based BMPs selection). Specifically, the local meetings will be held to undertake:

- (i) Community evaluation of local community needs in terms of application of the BMPs
- (ii) Group evaluation to qualitatively assess the working group in terms of:
 - the group's ability to collaborate and work together and the inclusiveness,
 - the group's consistency and cohesion in performing new processes and activities, and
 - The group's ability to share individual benefits with the whole community.

The outcomes of this evaluation will be subjected to analysis using spider-graphs to show the overall attitude of the local community with respect to the management practices. Based on the community preferences, a matching exercise will be performed to identify, candidate practices in the BMPs repository.

3. Target audience

Based on the WATDEV approach, the target audiences for local brokerage meetings will be drawn from three (3) key stakeholder categories. These include: (i) Policy, (ii) Organization, and (iii) Financial/Economy. Based on this, the stakeholders expected to attend the local meetings will be comprise a mix of the following categories:

Policy

- Gezira Board (the executive team and the scheme council).



- Ministry of Irrigation and Water Resources (MIWR), Irrigation Operation Department.
- Hydraulics Research Center (HRC).
- Ministry of Agriculture – Policies and Planning Directorate.
- Agricultural Research Corporation (ARC) – Wad-Madni.

Organization

- Representative of water users' organization.
- Gezira scheme landowners' representative.
- Dr. Ahmed Adam (Irrigation expert, retired, elected representatives).
- Water Youth Parliament for Water (Gezira State).

Financial/Economy

- Ministry of Finance.
- Private sectors: CTC, Dal food- Dairy & Beverage Sector, Mahjoub Sons Co.
- Sudan Agriculture Bank.

4. Expected Outputs

The key outputs from the local meeting will include:

- i) Preliminary list of Stakeholders involved in each study area.
- ii) Completed "Group Evaluation Sheet";
- iii) Completed "Needs Evaluation Sheet";
- iv) Meeting report (Report on site-level brokerage meeting in Sudan).

5. Method

The present events are linked to the Activities falling under Result R1 "Best fitting MBPs and innovations in project countries". In particular, the local events are aimed at applying an evaluation framework that will lead to the selection of the BMPs – among the ones collected, described, and evaluated in the Repository – suitable for implementation in the study areas. Figure 1 (below) shows the whole process/methodology that will be followed in the implementation of the local meetings (1) up to the Multi-Actors' regional meeting (3) through matching and selection of BMPs (2) is shown. Figure 1 also shows how steps from 1 to 3 will feed step 4 other activities planned in WATDEV (awareness, training, feasibility, modelling, etc.).

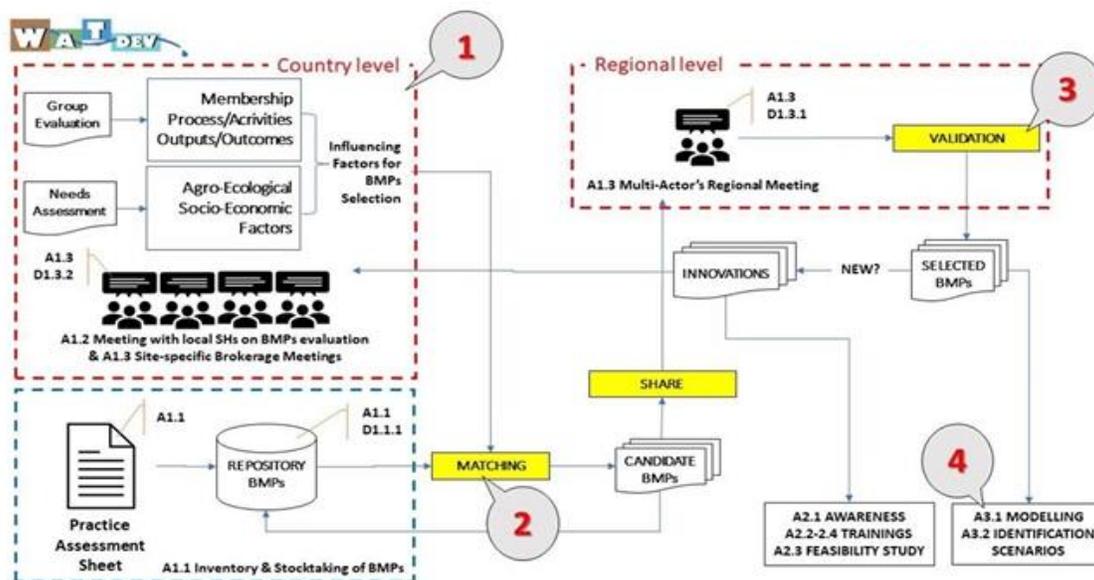


Figure 1 – Flowchart of the process, from A1.2 – A1.3 events and matching work (1, 2) to A1.3 Multi-Actors' Regional meeting (3) and beyond (4)

As in the figure 1, the process is articulated into 4 steps as follows.

- I. During the local meetings, an assessment and evaluation with the local's actors will be performed. Such evaluation is composed of:
 - i) **Group evaluation:** with a set of question, it aims at qualitatively assess the working group, describing the group ability to collaborate and work together and the inclusiveness, the group consistency and cohesion in performing new processes and activities, the Group ability to share individual benefit with the whole community.
 - ii) **Evaluation of local community needs:** this aims at evaluating the group flexibility (needs), by area of application of BMPs, to undergo changes.
- II. The outcomes of the local meetings, after a scoring procedure, will be plotted through spider-graphs (see figure 2) showing the overall attitude of the local community to put in place management practices. In line with their preferences, a matching exercise will be performed to extract, among the practices collected (after a preliminary assessment) in the BMPs repository, the “candidate” ones.

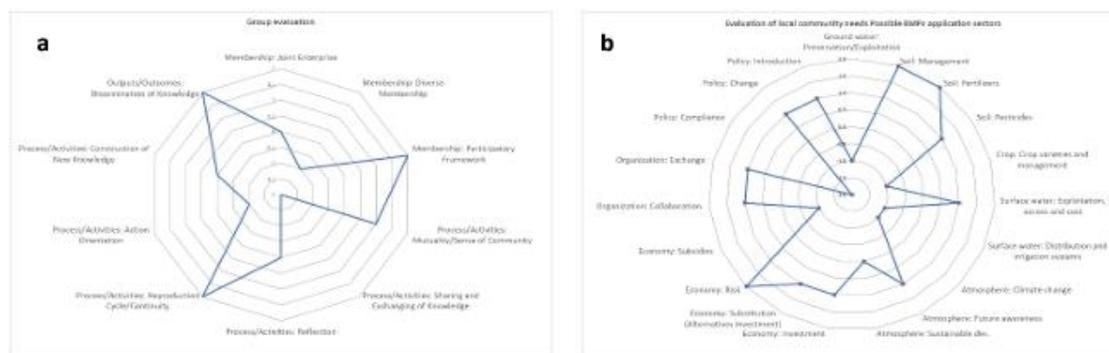


Figure 2 – Spider graphs displaying examples of Group evaluation (a) and Needs evaluation (b).



- III. The candidate BMPs will be discussed in the A1.3 Multi-Actor’s Regional meeting, bringing together a number of stakeholders (identified by means of a specific Stakeholder Analysis) at regional level. This meeting will aim to validate the BMPs that are titled to be modelled afterword (Activity 3.1). The selected BMPs could be suitable to be applied in a certain study area, but not already known from the local farmers. For the application of this innovation, it could be useful to explore the feasibility of a public-private partnership able to support its implementation, by means of the second round of brokerage meetings (Activity 1.3). In any case, it would also be necessary to carry out a feasibility study (Activity 2.3) as well as an awareness (Activity 2.1) and training campaign (Activity 2.2-2.4) for local communities.
- IV. The BMPs selected after the A1.3 Multi-Actors’ Regional Meeting will be subjected to the integrated modelling process and the simulation of possible impact scenarios due to their upscaling/out scaling, from the areas of implementation to large-scale catchments within - and possibly beyond - the study areas.

6. Venue and date

The local meetings in Sudan will be held from 22nd- 23rd October, 2022. The venue of the meeting will be at the **Grand Holiday Villa Hotel** in Khartoum (will be confirmed later).

Field visit will be held on the 24th of October, to the case study area (Gezira scheme).

7. Invited participants

a. Panellists:

| | | |
|-------------------|----------------------------|------------------------------|
| Abdin M. A. Salih | abdeensalih@gmail.com | Water research Center (WRC) |
| Rashid Hassan | rashid.hassan657@gmail.com | National Academy of Sciences |
| Babiker Barsi | babiker.barsi@gmail.com | Water research Center (WRC) |
| Elamin AbdelMaged | elamin_elamin@yahoo.com | Faculty of Agriculture, UofK |
| | | |

b. Speakers/ Facilitators:

| | | |
|-------------------------------|--|------------------------------|
| Imad AlDin Aredeeb (Speakers) | Vice-Chancellor - University of Khartoum | University of Khartoum |
| Omer Marzoug (Speakers) | Governor of Gezira Scheme | Gezira Scheme |
| Gamal M. Abdo (Speakers) | Gabdo2000@gmail.com | Water research Center (WRC) |
| Adil Elkhider | adil-elkhidir@yahoo.com | Water research Center (WRC) |
| Mahmoud Fadul Elmoula | mfahmed@yahoo.com | Faculty of Agriculture, UofK |
| Ahmed Elshaikh | ahmedhayaty@live.com | Water research Center (WRC) |



8. Communication

Information about the meeting and its scope will be shared through:

- WATDEV website
- Local partners' websites
- WATDEV Social media channels (Facebook, Twitter, LinkedIn, Instagram)
- Direct email
- Local media and newspapers

An information leaflet illustrating the Project's objectives and expected results will be provided in English and in Local language.

9. Venue

- Meeting with local Stakeholders on BMPs evaluation - **Water Research Centre meeting room, University of Khartoum.**
- Site-specific brokerage meeting – **Grand Holiday Villa (to be confirmed later).**

10. Organizers/Collaborators

- **Water Research Center (WRC), University of Khartoum.**



- **CIHEAM-Bari.**
- **Italian Agency for Development and Cooperation (AICS).**



11. Contact person(s)

- Ahmed Elshaikh Hayaty, Water Research Center, University of Khartoum, Phone: 00249111154007 - Email: ahmedhayaty@live.com.
- Gamal Abdo, Water Research Center, University of Khartoum, Phone: 00249122123825 - Email: gabdo2000@yahoo.com.

**4.4 Annex 4 – Event Pictures:
Day 1: (WRC)**







Day 2 – Field Visit



Day 2 – Farmers Training Center:



Day 2 – Hydraulic Research Center (HRC):



4.5 Annex 5: LMES: Local Meeting Evaluation Sheets

Part 1 : Group evaluation:

-2: No; -1: Relatively No; 0: Equally mixed; 1: Relatively yes; 2: Yes

| Type | Criterion | Question | Score |
|--------------------------------|---|---|--------------|
| Membership | <i>Joint Enterprise</i> | Do members share a competence that distinguishes them from others? Yes. Members have distinct competencies that are representative of the various sectors they represent. | 2 |
| | | Do the members share a common sense of purpose? Yes. Members are united in their goal to enhance their livelihoods through farming. | 2 |
| | | Do members appear to have similar interests? Some of them appear to have similar interests, while others appear to be dispersed. Equally Mixed. Some of them appear to have similar interests to invest in Agriculture, while others appear to be dispersed in opinions and interests. | 0 |
| | | Do members report similar problems or experiences? Relatively Yes. They make investments in similar agriculture operations and face similar problems and perspectives That's why they actively participate in interactive information sharing. in order to solve their problems. | 1 |
| | <i>Diverse Membership</i> | Do the members of the community represent a variety of stakeholders? Yes. The members are drawn from the different sectors represented in the community. | 2 |
| | Does the community transcend organizational and geographical boundaries? Relatively No. community members interact with other members within the group. However, members have very rare interact and engagement with other members and actors outside the group. | -1 | |
| Participatory Framework | | Are members actively involved in setting goals? Yes. Members are given the chance to express their opinions regarding the priorities on which the group should concentrate. This helps set the agenda and goals. | 2 |
| | | Are members responsible for devising a strategy or plan of action? Relatively No. Despite the fact that members shared their opinions on the group's priorities, there was no proof that they were responsible for creating strategy or an action plan. | -1 |
| | | Do members assist in running the community? | 2 |
| | Are members of the community internally motivated? | 2 | |

| | | | |
|---------------------------|--|--|---|
| | | Yes. Members are motivated and show strong desire to invest in agriculture. | |
| Process/Activities | <i>Mutuality/Sense of Community</i> | Do the members of the community build relationships with each other? Yes. This is regarded as essential for the sharing of experience, ideas, and other types of information. | 2 |
| | | Do the members engage in joint activities and discussions? Yes. When they encounter difficulties, they talk about them and work together to find solutions. | 2 |
| | | Do the members offer each other help when needed? Yes. When they run into difficulties, they talk about them and work together to find solutions. | 2 |
| | | Do members report encounters across geographical or organizational boundaries? Relatively Yes | 1 |
| | | Do the members report feeling a sense of “belonging” within the community? Yes. Members strongly feel like they belong to the community. Members feel a strong sense of responsibility for their investments in the community and lands. The community is the first place to turn for assistance or a solution in cases of farming-related problems. | 2 |
| | <i>Sharing and Exchanging of Knowledge</i> | Do members engage in narration, or sharing their experiences through stories? Relatively Yes. Members share thier own experience through stories, As an example one member shared his success story of using organig fertilizers that raised the yield by 10% more than chimecal fertilizers. | 1 |
| | | Do members spend a significant amount of time sharing and exchanging knowledge? Yes. Members participate in knowledge sharing and exchange. Members are also interested in participating in group activities on an increasing basis. | 2 |
| | | Do members view the community as a forum for the free-flow of ideas and information? Yes. A community is similar to a forum where people can exchange experiences. Participants share their experiences with one another. | 2 |
| | | Do members view their interactions in the community as a conversation, as opposed to a series of 1-sided reports? Yes. Interaction is mostly participatory where all partners contribute as opposed to presentation of 1 – sided reports | 2 |
| | | Do the members believe that they learn useful information from their interactions with others in the community? Yes. Members think that sharing | 2 |

| | | |
|--------------------------------------|---|----|
| | experiences within the community is essential for problem-solving and for enhancing their investments in the future. | |
| | Do members report any coaching or mentoring from others in the Community of practice community? No. Implicitly coaching and Mentoring is at very low level. | -2 |
| <i>Reflection</i> | Do the members of the community engage in collaborative reflection on their individual and each other's experiences and concerns? Relatively Yes. They engage in interactive sharing of knowledge and experiences, which improves their relationships with one another and the group as a whole. | 1 |
| | Do members feel like their own level of self-reflection has been increased by participating in the community? Yes. They share their own experiences. | 2 |
| <i>Reproduction Cycle/Continuity</i> | Do members believe that the Community of practice will extend beyond the current time/place/members? Yes. | 2 |
| | Do new members join? Relatively Yes. The numbers of members is constantly and noticeably increasing. | 1 |
| | Do members of the Community of practice believe it will be useful | |
| | ...6 months from now? | |
| | ...1 year from now? Yes. potentially in a year. In order to use the CoP as a platform for exchanging knowledge, information, and BMPs, it is necessary to increase awareness of the CoP, what it will accomplish, who the stakeholders are, and build trust among the participants. | |
| | ...3 years from now? | |
| | Does the level of activity of the Community of practice ebb and flow over time? Yes. The CoP will definitely change as members come to understand its purposes and roles in the future. | 2 |
| | Do members spend the majority of their time analyzing real-life situations or problems? Yes. Members interact frequently, especially about issues relating to farming and how that is affecting their livelihoods, and they frequently work together to find solutions. | 2 |
| <i>Action Orientation</i> | Do the members of the community express a desire to initiate change? Relatively Yes. Members share new fertilizing and soil management practices with others with a hope of influencing them. | 1 |
| | Do the members of the community express a desire solve common problems? Yes. Members engage in | 2 |

| | | |
|--------------------------------------|--|---|
| | interactive discussion about shared difficulties and exchange knowledge about solutions. | |
| | Is the community successful in turning principles/values of the field into realized policies and practices? Members claim to be able to switch from conventional to modern irrigation and soil preparation techniques, but opinions on whether they have been able to establish these as accepted practices or policies were divided. | 0 |
| <i>Construction of New Knowledge</i> | Is the community successful in turning principles/values of the field into realized policies and practices? | |
| | Do members report that their previous understanding/knowledge has been transformed through participation in the community? Yes. Members of the community are better able to use water efficiently, and to use fertilizers effectively which leads to increased production on their farms. | 2 |
| | Do the members report generating new knowledge as a group through their interactions in the community? Yes. Through their local experimentation, farmers have been able to generate new knowledge regarding soil preparation . they now know how to use modern machines to prepare soil also they gained experience in using fertilizers and insecticides. | 1 |
| | Are members confident that they have developed a common knowledge base that they can refer to in the future? An information base has been created. Farmers are able to predict the yields they will likely receive after a certain amount of time based on the knowledge that is currently available (in years). | 1 |
| Outputs/Outcomes | <i>Dissemination of Knowledge</i> | |
| | Do members feel connected with others in their field, outside of the community of practice itself? Yes. Members feel connected to the farmers/actors outside thier community. | 2 |

Part 2: Evaluation of local community needs: Possible BMPs application sectors :

Show comments to have further indications on how to perform single point discussion and the aspect intended to assess.

| Score | Interpretation |
|-------|---|
| -2: | No need (or change) is required (accepted) |
| -1: | Limited need (or change) is felt (possible) |
| 0: | Equally accepted, but not considered as priority |
| 1: | Relatively important where changes are welcome |
| 2: | Priority where the need for change is felt and critical |

| Target of changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|--|-------|
| Ground water | <i>Preservation</i> | <p>If already in exploited: Discuss its extend, importance and sufficiency and willingness to preserve it by managing it use (reduction) or invest in alternatives. <u>Importance:</u> The majority of ground water sources are wells dug into the earth to draw water from aquifers. Most people use ground water for domestic purposes. Based on the views shared by the participants nearly 1% of ground water only used for domestic use. <u>Availability:</u> Nearly 100 meters deep, ground water is readily available and unpolluted. Ground water is used mainly when there is shortage in surface water. <u>Preservation:</u> The community members' desire to protect the environment is obvious. This has been demonstrated by their readiness to adopt cutting-edge irrigation technologies and systems over inefficient conventional ones like flooding.</p> | 0 |
| | <i>Exploitation</i> | <p>If not exploited:</p> <ul style="list-style-type: none"> Discuss its availability, easiness of access and exploitation and willingness to invest in it. | |
| Soil | <i>Management</i> | <p>Definition and role of soil management Based on the participants' discussions, it was decided that the proper and brief definition of soil management is the use of relevant/appropriate practices that preserve the soil's health (including its organic matter and biodiversity) and improve its functionality. Discuss the importance given to soil management: It is possible to analyze the soil and their properties. Previously regular investigation about the soil was carried out by the government and the related institutions (Agricultural research center and alqazira university) but now it is an individual action.</p> | 1 |

| | | |
|--------------------|---|---|
| | <p>FAO recently developed Atlas for sudan soil covering the hole area including algazira scheme. (The director of Environmental Research center).</p> <p>Participants understand that fertilizer application, both organic and inorganic, is essential for boosting the productivity of their crops. They also acknowledge the possibility of environmental harm from long-term fertilizer use.</p> <p>Examples of soil management practices Examples shared include: (i) use of cover crops, (ii) use of manure, (iii)use of compost, (iv) use of fertilizers, (v)organic manure, (vi)natural Insecticide (Coriander) and (vii) shallow tillage to break the hard pans and aerate the soils. Discuss the need to learn new practices Stakeholders noted that farmers are willing to learn new practices. They gave an example of using modern machines of soil tillage.</p> | |
| <i>Fertilizers</i> | <p>If already in use:</p> <p>Discuss how important is the use of fertilizers in the profitability of their farms Their farm's productivity is increased by the use of fertilizer because they can produce a lot of tons per unit area. This results in the farmers earning more money. Discuss the willingness to reduce chemical fertilizer or use alternatives to preserve productivity at longer term Participants are willing to adopt organic fertilizer as an alternative because they are aware that using chemical fertilizers has negative long-term effects. They said that they had an experiment with the Chinese each had 5 feddans to plant They used the organic fertilizer while the chinese used the chemical fertilizer the participants yield was more than chinese by 10%.</p> | 1 |
| | <p>If not already in use:</p> <ul style="list-style-type: none"> • Discuss the cost and easiness of access • Discuss the willingness to invest/introduce fertilizers in their farming | |
| <i>Pesticides</i> | <p>If already in use:</p> <p>Discuss their importance for the crop productivity and the presence of local diseases risks Participants believe that using pesticides is essential for the production of crops. However, they are also aware of the long-term effects that chemical pesticides have on the quality of the crop.</p> | 1 |

| | | | |
|----------------------|---------------------------------------|---|---|
| | | <p>Although they boost productivity, chemical pesticides are not recommended because they degrade crop quality. They use sort of aromatic plants that protect crops example (coriander).</p> <p>Discuss willingness of adoption of alternatives such as biopesticides and/or soil management practices</p> <p>Because of the detrimental effects and the high cost of chemical pesticides, they want to adopt organic pesticides.</p> <p>They also avoiding the use of chemical pesticides by preparing the land correctly.</p> | |
| | | <p>If not already in use:</p> <ul style="list-style-type: none"> • Discuss their availability, access easiness and presence of local diseases • Willingness to invest in biopesticides to improve productivity | |
| Crop | <i>Crop varieties and management</i> | <p>Initiate talk on food culture and local varieties cultivated</p> <p>Food culture and local varieties cultivated: Various crops are grown in the study area. Food crops mainly include: Wheat , sorghum , Tomato , Peanut , Millet , soia beans, Citrus , Mango , Banana. All grown locally.</p> <p>Discuss crop rotation and its benefits</p> <p><u>Crop rotations:</u> In the past, the government actively encouraged farming communities to practice crop rotations. Currently, there is no rotation practiced by the farmers (no crop rotation). Crop production is determined by the existence of a market.</p> <p>Discuss multi-cropping pattern and its benefits</p> <p><u>Multi-cropping patterns:</u> Multi-cropping is rare. Mono-cropping pattern is common among the farmers.</p> <p>Discuss market opportunities and choice of crop</p> <p>Due to their numerous market-related issues, the local communities grow crops that have market. The market is not stable. It is the most significant factor in crop selection. Farmers produce according to what the market wants.</p> | 2 |
| Surface water | <i>Exploitation, access and reuse</i> | <p>If already in exploited:</p> <p>Discuss its extend, importance and sufficiency and willingness to find/invest in other surface resource alternatives.</p> <p><u>Extent and Importance:</u> Surface water is widely exploited for both domestic and agricultural use. It's considered as very important. It's usually considered as the first and best option to use</p> <p>Sufficiency: Surface Water is available and sufficient. There is no need to use ground water.</p> <p>Surface Water use should be controlled and rationalized .</p> | 2 |
| | | If not already exploited: | |

| | | | |
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| | | <ul style="list-style-type: none"> Discuss its potential relevance for crop productivity enhancement, easiness of access, the trade off such investment | |
| | <i>Distribution and irrigation systems</i> | <p>If already existing:</p> <p>Discuss the existing distribution systems, efficiency and influence on cropping patterns (choice of crop)</p> <p>Existing distribution systems: The major distribution system for surface water is by through canals. Water is distributed naturally by land slopes (Gravity) .</p> <p>Efficiency: The distribution system comprising of canals is efficient.</p> <p>Influence on cropping systems: The pattern of cropping is affected by the distribution of water.</p> <p>This means that farmers must take into account the crop's water requirements before growing it.</p> <p>Before making the decision to plant or grow the crop, the water requirements of the crop are carefully considered.</p> <p>Crops that require less irrigations are commonly grown due to water accessing issues related to government policies.</p> | 2 |
| | | <p>If not already existing:</p> <ul style="list-style-type: none"> Discuss the feasibility, fundings (typology and actors), water management and influence on cropping patterns (choice of crop) | |
| Atmosphere | <i>Climate change</i> | <p>Introduce and define “climate change” as a fact.</p> <p>Request the opinion and observation on changes in agricultural practices and pattern from previous generations up to now.</p> <p>Climate change was defined as the long term changes in temperature and weather. Participants noted that Before, they were aware of the precise arrival date of the water (15 March). Since they had time, they were prepared. Due to water delays brought on by climate change , they are currently unprepared for extreme events like floods, so they advise increasing the escape canals' capacity just in case.</p> <p>Discuss the concerns and issues encountered due to climate changes and willingness to undertake actions</p> <p><u>Concerns:</u> There were concerns about climate change. Specifically, climate change causes: (i) extreme events like floods (ii) shift in production patterns, (iii) reduced production due to heat waves and (iv) reduced water affects production.</p> <p><u>Willing to take actions:</u> Farmers are willing or motivated to take action to mitigate effects of climate change since climate change directly affects agricultural production and hence livelihoods that depend on it. Some of the potential actions include: (i) increase escape canals capacity to</p> | 2 |

| | | | |
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| | | mitigate floods; (ii) use of heat resistant crops, (iii) adjusting the irrigation schedule according weather forecasting. | |
| | <i>Future awareness</i> | <p>Discuss probable future scenarios (suggested by locals) in term of farming viability, resources availability and access and political/social/economic changes</p> <p>Participants assumed and discussed how climate change might affect their way of life in the future and came to the conclusion that the effects of climate change would be worse in the future. To manage the effects of climate change, they will need more knowledge in that area.</p> <p>Participants stated that It will be a huge disaster if no action is done in the sake of change. Water should be used in away that the coming generations can benefit from.</p> <p>Discuss willingness to undertake actions collectively/individually from now to prevent or mitigate those future risks</p> <p>The participants are willing to act as a group to reduce potential risks.</p> | 1 |
| | <i>Sustainable dev.</i> | <p>Introduce and define sustainability in terms of agroecological understanding and its benefit for the future generation. Sustainability was defined as way of managing natural resources (water and land) in such a way that the future generations are also able to benefit from it.</p> <p>Discuss the willingness and motivation to resources economic (saving) and management to preserve the resources for future generations</p> <p>The participants are willing and driven to preserve and use the resources responsibly. The local stakeholders are willing to:</p> <p>(I) engage in sustainable management to protect/conservate natural resources for future generations; (ii) improve irrigation systems to manage available water and to reduce losses ; (iii) use renewable energy; and (iv) implement other measures as necessary to achieve these goals.</p> | - |
| Economy | <i>Investment</i> | <p>Discuss the vocation of the land owned by local and contribution of agriculture to the locals and local economy and wellbeing, along with willingness to enhance it</p> <p><u>Vocation of land and contribution to agriculture:</u> The stakeholders in the local community consider the land to be an essential part of their wellbeing because it supports their livelihoods (through agricultural production), local economy, and history. They treasure their home. Agriculture is the most appropriate land use and is a part of their culture and history. The local economy greatly benefits from the agricultural sector. The majority of family income is generated by agriculture.</p> <p>Some of the lands are owned by the government and the other is by individuals. The individual's part was inherited by their</p> | -2 |

| | | | |
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| | | <p>children some of them bought their part this action generated a conflict about the land ownership.</p> <p><u>Willingness to Increase Agriculture's Contribution:</u> The participants are willing to increase agriculture's contribution to their economy and well-being. The priority for change, though, is insignificant.</p> | |
| | <i>Substitution (Alternatives)</i> | <p>Discuss willingness to complement/replace land use economical outcome with other practice</p> <p>They stated that they will never give it up. few of them have another source of income not only from farming.</p> | - |
| | <i>Risk</i> | <p>Assess the relevance of farming for singular families and its contribution to year to year budgeting.</p> <p>Farming is the primary source of income for rural families. The income from farming operations covers all of the annual expenses for the household.</p> <p>Discuss the willingness, and interest, to invest in potential solution that have the promises to increase revenue (financial) at short or long term</p> <p>Investing in production is something that people are willing to do even though the market instability. this is the main risk. Crop failure or reduced harvests caused by a variety of factors represent the other risk.</p> <p>Government assistance in the form of subsidies, credit, or loans is indicated as being necessary by local stakeholders so they can: (I) purchase or invest in new irrigation technologies; and (ii) support or pay for on-farm agricultural production practices.</p> | 1 |
| | <i>Subsidies</i> | <p>Discuss the willingness to follow rules and management practices, be part of a cooperation in exchange of subsidies</p> <p>Subsidies are essential and are primarily required to maintain investment and reduce risk. There is a willingness to follow the guidelines controlling the subsidies.</p> | 0 |
| Organization | <i>Collaboration</i> | <p>If already part of a cooperation/group/organization: Discuss their feeling of belonging, security and benefit and their willingness to continue to be part of the aggregation</p> <p><u>Belonging, security and benefit:</u> There is many bodies representing the farmers: (i) Farmers union law (ii) Agriculture professions law (iii) Cooperative organizations.</p> <p>Some of the local participants were already part of a group and were positive about being part of the groups /organizations. They feel comfort. because they can discuse all of their worries within the framework of group.</p> <p>Working in group Reduce the cost of financing and marketing</p> | 1 |

| | | | |
|---------------|---------------------|---|---|
| | | <p>If already not part of a cooperation/group/organization:</p> <ul style="list-style-type: none"> • Discuss their willing to be part of one and their interest to do so | |
| | <i>Exchange</i> | <p>Discuss the benefit perceived from repeating actions/initiative from neighboring farms and their willingness to learn and share experiences</p> <p>Repeating positive actions or initiatives was regarded as positive and advantageous.</p> <p>Additionally, it was believed that whenever there was a chance, this should be given top priority.</p> <p>Additionally, they are open to learning and exchanging ideas. However, the government or other development actors need to manage or support the process of sharing initiatives or promising best practices.</p> | 1 |
| Policy | <i>Compliance</i> | <p>Discuss the importance given to local regulation and their impact on their farming systems</p> <p>Local stakeholders indicated that they must abide by current laws. The degree of local law compliance is high.</p> <p>Participants consider local ordinances and regulations to be crucial for maintaining order and encouraging the adoption of specific practices.</p> | - |
| | <i>Change</i> | <p>Discuss their willing to change a fraction/part or totally the regulation system of their that manage their activities</p> <p>Local stakeholders know that they should follow and comply with existing regulations. However, there are some regulations that need to be changed. Example some of the farmers stated that some of the old regulations should be canceled because it does not give the farmers their full rights.</p> | - |
| | <i>Introduction</i> | <p>Discuss their willingness to see new regulations to be introduced/facilitated</p> <p>In general, farmers are wary of imposing new laws. Instead, more education and awareness campaigns should be done regarding both already-in-place and upcoming regulations.</p> | - |

6.4. Annex 4 - Ethiopia Local Stakeholder Meeting Report



**Minutes of the
Meeting with Local Stakeholders on Evaluation and Site-specific
Brokerage of Best Management Practices, Bahir Dar- Ethiopia**

**Date: October 26-27, 2022
Hybrid (Physical and Virtual)**

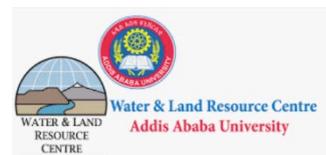


Meeting Report

By

**ASARECA, WATER LAND RESOURCES CENTER/ADDIS ABABA UNIVERSITY,
CIHEAM Bari, CNR**

November, 2022



Summary

| | |
|---|---------------|
| List of Figures..... | ii |
| Acronyms | iii |
| 1. Introduction..... | - 1 - |
| 1.1 Background | - 1 - |
| 1.2 Project Area..... | - 1 - |
| 1.3 Purpose of the Local Event | - 2 - |
| 2. Methodology | - 3 - |
| 2.1 Workshop Methodology | - 3 - |
| 2.2 Stakeholders | - 3 - |
| 3. Workshop Sessions and discussions | - 4 - |
| 3.1 Dissemination and Evaluation of BMPs..... | - 4 - |
| 3.1.1 Opening Session | - 4 - |
| 3.1.2 Evaluation of Best Management Practices | - 8 - |
| 3.1.3 Wrap-up (Day 1) and Conclusion..... | - 14 - |
| 3.2 Site Visit and Site-specific Brokerage Meeting at Koga Irrigation Scheme | - 15 - |
| 3.2.1 Site Visit | - 15 - |
| 3.2.2 Wrap-up of the field visit (Day 2) | - 17 - |
| 3.2.3 Brokerage of the Best Management Practices | - 18 - |
| 4 ANNEXES | - 20 - |
| 4.1 ANNEX 1 - Meeting Agenda..... | - 20 - |
| 4.2 ANNEX 2 - Attendance Sheet | - 21 - |
| 4.3 ANNEX 3 - LMES: Local Meeting Evaluation Sheet | - 23 - |
| 4.3.1. - Group Evaluation | - 23 - |
| 4.3.2. Evaluation of local community needs: Possible BMPs application sectors..... | - 28 - |

List of Figures

| | |
|--|--------|
| Figure 1: The Study area: Koga Catchment and irrigation Scheme | - 2 - |
| Figure 2: Her Excellency Dr Almaz Gizew delivering a welcome address and opening remark for the workshop participants | - 4 - |
| Figure 3: Flow chart of WATDEV project activities | - 6 - |
| Figure 4: Components of Best Management Practices..... | - 7 - |
| Figure 5: Maize crop destroyed by intense hailstorm falling on the mid of October 2022, substantially would reduce the production. It is an example of the negative impact of climate variability..... | - 12 - |
| Figure 6: Koga Dam/Reservoir and its environs..... | - 15 - |
| Figure 7: Different stages in the of Avocado fruits grading process..... | - 16 - |
| Figure 8: Small holder farmer operating plastic (green) house for tomato farm during rainy months. This technology helps the tomato not to be destroyed by the intense rain during rainy months .. | - 16 - |
| Figure 9: An example of Avocado farm..... | - 17 - |
| Figure 10: Participants had their lunch at the Avocado farm of Mr Tilahun Fekade..... | - 17 - |

Acronyms

| | |
|----------------|---|
| AAU | Addis Ababa University |
| AICS | Italian Agency for Development Cooperation |
| ASARECA | Association for Strengthening Agricultural Research in Eastern and Central Africa |
| BMPs | Best Management Practices |
| BOA | Bureau of Agriculture |
| CIHEAM Bari | International Centre for Advanced Mediterranean Agronomic Studies – Institute of Bari |
| CNR | Italian National Research Council |
| EU | European Union |
| EUR | Euro |
| IGAs | Income Generating Activities |
| IWM | Irrigation Water Management |
| SLM | Sustainable Land Management |
| SWC | Soil and Water Conservation |
| WATDEV | Climate Smart Water Management and Sustainable Development for Food and Agriculture in East Africa |
| WLRC | Water and Lands Resources Centre |

1. Introduction

1.1 Background

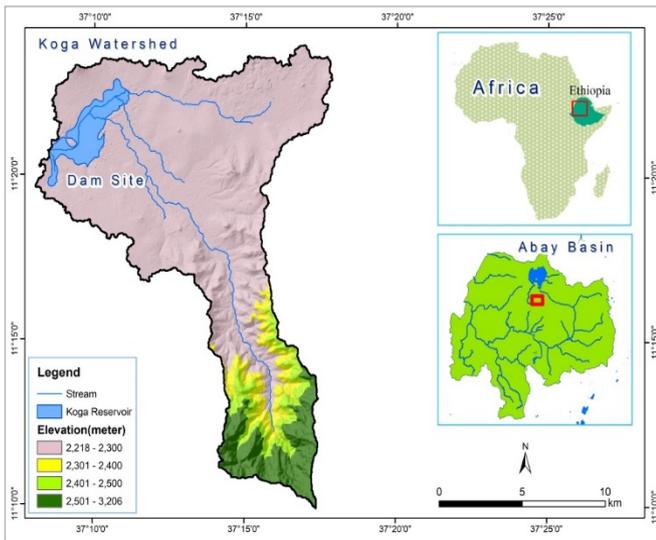
The Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa (WATDEV) project promotes innovation at the water, energy, and agriculture nexus to enhance economic development and resilience to climate change in Kenya, Ethiopia, Sudan and Egypt. The project seeks to develop an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people's resilience to climate through innovative research, modelling, and capacity building approaches. Water scarcity and climate change represent a serious threat to agricultural production and food security in Eastern and Northern African countries. To address this challenge, the project aims to enhance the sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Eastern Africa and Egypt. It has two main specific objectives: (i) Research institutions to improve their knowledge and management on water in agriculture; (ii) Farmers and local actors to implement innovative/sustainable solutions and skills on water management. For this study case study areas in the respective countries have been identified.

CIHEAM-Bari is leading the implementation of the project in collaboration with other European (Finnish Environment Institute, National Research Council- Italy, and International Soil Reference and Information Centre) and African partners (Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Kenya Agricultural and Livestock Research Organization (KALRO), Water Resources and Land Council (WRC) from Sudan, National Water Research Centre (NWRC), University of Cairo, and Water and Land Resource Centre (WLRC) of Addis Ababa University). ASARECA is coordinating the implementation of the project activities in the four target countries.

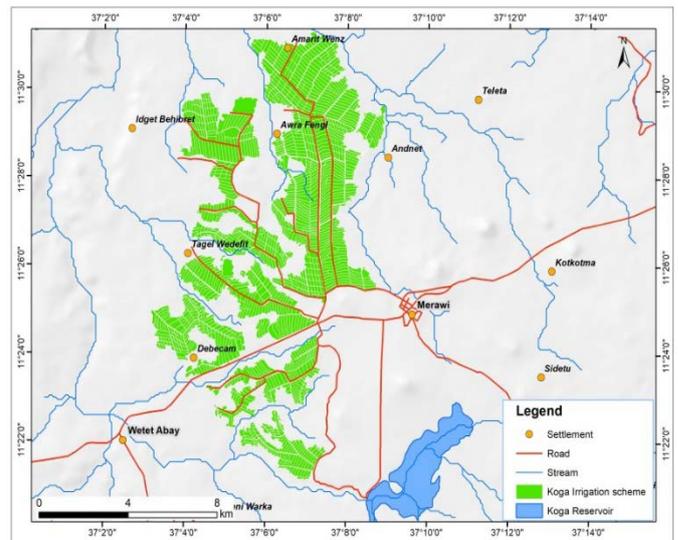
This report is the outcome of the first local level stakeholders meeting on evaluation and site-specific brokerage of best management practices on irrigation water management in Ethiopian case study, i.e., Koga Irrigation Scheme, Amhara regional state.

1.2 Project Area

The first local stakeholders meeting for the sake of evaluating best management practices of irrigation water management in the Ethiopian case was conducted for Koga Irrigation Development and Catchment Management (KIDCM) project site. This site is located in the Koga River Valley, in the Gilgel Abbay catchment, Lake Tana Sub-basin, Abbay Basin. The site will be useful in compiling lessons learnt and scaling BMPs on: (i) irrigation water management (IWM), (ii) sustainable land management (SLM), and (iii) creating linkages between SLM and IWM. KIDCM is a key development project in the area initiated by government that aims to improve the livelihoods of farmers through provision of agricultural irrigation water delivered through a large-scale irrigation scheme. The feasibility study and technical proposal for Koga Watershed Management and Irrigation Development was conducted between 1992 and 1995. The project started with the construction of infrastructure in 2002 and was completed in 2010. The dam was commissioned in 2011 to irrigate about 7000 ha. Administratively, both catchment and command area are in West Gojam Zone, Amhara Regional State (Figure 1)



A) The Koga catchment area and the reservoir



B) The Koga irrigation scheme command area

Figure 1: The Study area: Koga Catchment and irrigation Scheme

1.3 Purpose of the Local Event

The purposes of the meeting were to:

- (i) formally launch the project in the study area;
- (ii) create awareness of the project to the stakeholders;
- (iii) gather feedback from stakeholders on the current/existing BMPs in the study area; and
- (iv) identify challenges, opportunities, and areas of improvement in the irrigation water management and sustainable land management in the target area.

2. Methodology

2.1 Workshop Methodology

The WATDEV Local Meeting was held over a period of two days from 26th to 27th October 2022 (See workshop programme in ANNEX 1). The workshop was attended by both physical and online participants via zoom platform. It comprised of sessions on plenary discussions delivered through power point presentations, meetings to evaluate in a participatory manner, the local stakeholders' ability to work together to adopt (or adapt) farming practices as well as to disseminate/share the outcomes/experiences. The Local Meeting was facilitated by ASARECA and WLRC and was attended by various stakeholders. The second day was devoted to field work which included visit to: (i) Koga dam (reservoir); (ii) Irrigation water users' union cold storage facility as well as the Avocado quality grading plant, and office complex; (iii) irrigation distribution canals; and (iv) Avocado farms benefiting from the irrigation interventions. After the field visit, a meeting session was held to reflect on what stakeholders had seen, discuss challenges and opportunities and propose possible solutions to some of the challenges that had been highlighted during the field visit.

2.2 Stakeholders

The participants that attended the meeting were drawn from the following stakeholder categories: (i) policy and research; (ii) organization; (iii) research and academia and (iv) finance/economy. Participants from the policy and research category included: (i) Ministry of Water and Energy (MoWE); (ii) Bureau of Agriculture for the Amhara Regional State; (iii) Federal Parliament (Republic of Ethiopia); (iv) Ministry of Agriculture; and (v) Bureaus of Agriculture, Water and Cooperatives Development. Stakeholders from research and academia included: (i) Ethiopian Institute of Agriculture (EIARI); (ii) Bahir Dar University; (iii) Amhara Regional Agricultural Research Institute (ARARI); and Private Sector Research Consultants.

Participants from other stakeholder categories (Organization, and Finance/Economy) included: (i) Koga Dam Operators, Woreda (District) Agricultural and Irrigation Management Extension experts; (ii) Local Financial Institution; (iii) Irrigation Water Users Association; and (iv) Koga Farmers Union; Lead Farmers and Private Irrigation Companies. Furthermore, consortium members also participated in the meeting with a representation from the following institutions: (i) AICS Addis Ababa; (through zoom link), (ii) CIHEAM-Bari (through zoom link) (iii) ASARECA, (iii) Water and Land Resource Centre. Therefore, a total of 33 local stakeholders and 6 consortium members participated in the stakeholder local event.

3. Workshop Sessions and discussions

3.1 Dissemination and Evaluation of BMPs

Dissemination event and evaluation of BMPs were held on Day 1 of the local meeting. The focus of the day was discussion with the stakeholders, understanding their challenges and knowledge sharing and evaluation of the BMPs. Before embarking on BMPs discussion with stakeholders a few welcoming remarks were delivered by organizers and invited dignitaries.

3.1.1 Opening Session

Various stakeholders made remarks during the opening ceremony, and these are highlighted below.

(a) Welcome Remarks

Representative from WLRC, Addis Ababa University: Dr Tena Alamirew, the Deputy Director of Water and Land Resource Centre (WLRC), warmly welcomed the participants to the 2-day event and proceeded to make his remarks on behalf of Dr Gete Zeleke (the Director General). He welcomed all the participants and extended his sincere appreciation specifically to the participants who had come from as far as Addis Ababa, Bahir Dar, North Mecha Woreda, and Koga Irrigation Scheme to attend the meeting.

He provided a brief background of the WATDEV project in Ethiopia noting that the project will: (i) compile the irrigation water management best practices, (ii) promote the implementation of BMPs /innovations in the study areas, (iii) explore the possibilities of scaling BMPs, (iv) develop management tools, and (v) raise awareness and build the capacities of smallholder farmers and other stakeholders to adopt the best management practices that will be promoted by the project.

Dr Tena further noted that, the project will be implemented in the Koga catchment area comprising of the watershed located in the upstream area of Koga Reservoir and irrigation command area with a possibility of extending the project area to also include Becho plain groundwater irrigation area. Finally, he urged the participants to actively participate in the two-day event and share their experience so that best management practices will be compiled and shared among national and international practitioners.

(b) Official Opening

Representative from Bureau of Agriculture, Amhara Regional State: The Deputy Head of Agriculture Amhara Regional State (ARS) Bureau of Agriculture (BOA), welcomed participants to Bahir Dar - the ARS Capital. She delivered her opening remarks where she highlighted various issues in Agricultural Research for Development:



Figure 2: Her Excellency Dr Almaz Gizew delivering a welcome address and opening remark for the workshop participants

The Deputy Head of BOA noted that food and nutrition insecurity is prevalent in the Amhara Regional State, which requires concerted efforts by all the stakeholders including Government, Research, and Non-Governmental Organizations to transform agricultural practices focusing on opportunities in irrigation agriculture. Dr Almaz further noted that the Regional Government in partnership with the Federal Government have prioritized the development of the country's water resources for irrigation as a major entry point to stabilize food security especially at the time when global and regional food systems are vulnerable due to global food crises. The country is also undertaking extensive community mobilization to produce food at all levels using both irrigation as well as addressing land degradation challenges that are negatively impacting on food security.

The Deputy Head of BOA decried the rapid decline in the quality and quantity of the natural resources especially land, forest, and water, driven by soil erosion, deforestation, and pollution respectively. There is need for the government to collaborate with the local communities and other stakeholders to reverse the negative impacts and ensure that these resources are utilized in a sustainable manner. On a positive note, she observed that irrigation in ARS has a great potential to increase agricultural productivity, create jobs/employment, and ensure food security that is negatively impacted by effects of climate change such as: increasing rainfall variability, drought, floods, and hailstorms (see attached pictures). She noted that the ARS irrigation potential is estimated at 2.2 million ha, yet only 10.9% (approx. 240,000 ha) of land is under irrigation. Dr Almaz noted that the WATDEV project will be very critical and instrumental in promoting use of new irrigation infrastructure, and other technologies that promote efficient use of irrigation water thus and efficient increasing water productivity upscaling the best practices thereby contributing to sustainable food production and agricultural transformation in the country. This is consistent with the priorities of the Federal Government as articulated in various strategic plan documents such as the Growth and Transformation Plan 2 (GTP II).

Dr Almaz appreciated WATDEV initiative and conveyed a special vote of thanks to the donor partners funding WATDEV project (EU and AICS) as well as the project leaders (CIHEAM-BARI), and all other partners. She also thanked WLRC for supporting efforts towards ensuring sustainable land and water management by promoting adaptive and innovative solutions. She re-affirmed the commitment of the ARS Government to support the WATDEV project to ensure successful implementation of the project noting that the Regional BOA is fully committed to working with the project partners. She also pledged that the findings of the project will be used to support the sustainable transformation of agriculture in the region. The Deputy Head of BOA concluded her remarks by wishing participants a fruitful meeting and then declared the meeting officially opened.

(c) Remarks from Development Partners

Representative from AICS Addis-Ababa: The Programme Coordinator for Water and Sanitation, Environment and Energy; Ms. Silvia Vanzetti, noted that the project is delivering useful tools that will complement the programming activities of AICS-Ethiopia. She noted that AICS is currently supporting the Ministry of Water and Energy to implement an Integrated Water Resource Management Project that aims to build resilience to climate change effects and ensure sustainable, equitable, and efficient water management. The project is focussing on the Awash and Wabi-Shebele basins, as well as Afar Lowlands. AICS Addis Ababa is also joining forces with the Ministry of Agriculture to support work in the Coffee and Avocado values chains among other crops. In her concluding remarks, Ms. Vanzetti reiterated the fact that the anticipated tools will complement AICS-Addis Ababa initiatives especially in areas of water resource management noting that AICS-Addis Ababa is willing to extend the necessary support required for the smooth implementation of the project in Ethiopia.

(d) Objectives and Agenda of the Meeting

Dr Tena from WLRC made a presentation on the objectives of the meeting as well as the whole agenda for the 2-day event. He noted that, the idea was to raise awareness about the WATDEV project among the local stakeholders as well as identifying potential areas for deployment of the best management practices. Specifically, the meeting aimed at: (i) investigating the current state of agricultural water and soil practices applied in the study area; (ii) examining the community's gaps and needs; (iii) understanding the change targets; (iv) recognising the group's ability to adopt changes;

and (v) determining the community's priorities based on the intended changes. (Refer to the agenda in ANNEX 1).

(e) WATDEV Project

To prepare the stakeholders for a discussion, a presentation on the WATDEV project was made by Aymen Sawassi from CIHEAM-Bari, focusing on the **objectives, methods and expected results**.

It was emphasized that the WATDEV project aims to develop an in-depth understanding of small and large-scale water and agricultural resource dynamics and management while boosting people’s resilience to climate, through innovative research, modelling, and capacity building approaches. The rationale for the WATDEV project is the water scarcity and climate change that represent a serious threat on agricultural production and food security in many Eastern and Northern Africa countries for example Egypt, Kenya, Ethiopia and Sudan.

The general objective of the WATDEV project is to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt. Specific objectives of the project are: (i) National Ministries and Research Institutions improve their knowledge and management in the agricultural sector; and (ii) Farmers, local actors, cooperatives and Water Users’ Associations, implement innovative/sustainable solutions and improve their skills in resources management.

Furthermore, stakeholders were informed that WATDEV will carry out research, analysis and modelling the implementation of agricultural management practices, and conduct capacity building activities at different communities and actors levels (from users to researchers and decision-makers), and address different problems and concerns in the selected study areas of: (i) Belbies district in Egypt, (ii) Gezira irrigation scheme in Sudan, (iii) Koga irrigation system in the Abbay basin in Ethiopia, and (iv) the Lower Tana (Tana River and Kilifi counties) in Kenya.

The local actors were also informed that the project will be implemented in five phases: (i) inventory and stocktaking of BMPs/Innovations; (ii) BMPs/Innovations evaluation process and brokerage; (iii) BMPs/innovations enhancement; (iv) Modelling; and (v) Legacy–toolbox (and parallel action Water Knowledge). The stakeholders were provided with information on the project activities to be implemented at national level. These activities will be implemented in a step-by-step process and include: (i) local meetings; (ii) matching the BMPs; (iii) the multi-Actors’ regional meeting; (iv) Selection/validation of BMPs; (v) Awareness of BMPs; and (vi) Modelling the scenarios. The flow chart below shows the process flow (Figure 3):

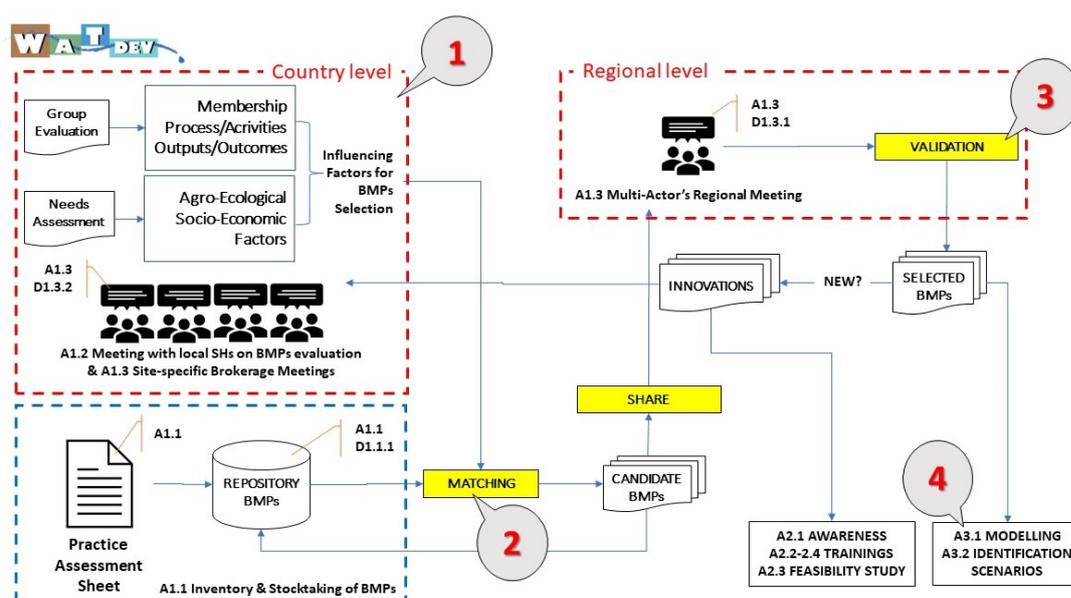


Figure 3: Flow chart of WATDEV project activities

With regards to the project results, it was noted that the WATDEV project is anticipated to deliver five key results namely: (i) Best fitting BMPs and Innovations selected by 4 countries (**R1**); (ii) Enhanced implementation of BMPs/innovations in study areas (**R2**); (iii) BMPs /Innovations upscale and outscale scenarios performed (**R3**); (iv) A water planning/management toolbox available for Researchers and Institutions (**R4**); and (v) Strengthened knowledge and capacity building and established regional “Water Knowledge” Hub (**R5**).

(f) Best Management Practices

The presentation on the Best Management Practices (BMPs) collected and profiled, as part of activity 1.1 of WATDEV project, was provided by Ms. Alice Calvo of the Italian National Research Council (CNR). It was noted that within the context of environmental exploitation systems for agricultural value creation, a BMP sits as an external component to the system as shown in the figure below (Figure 4):

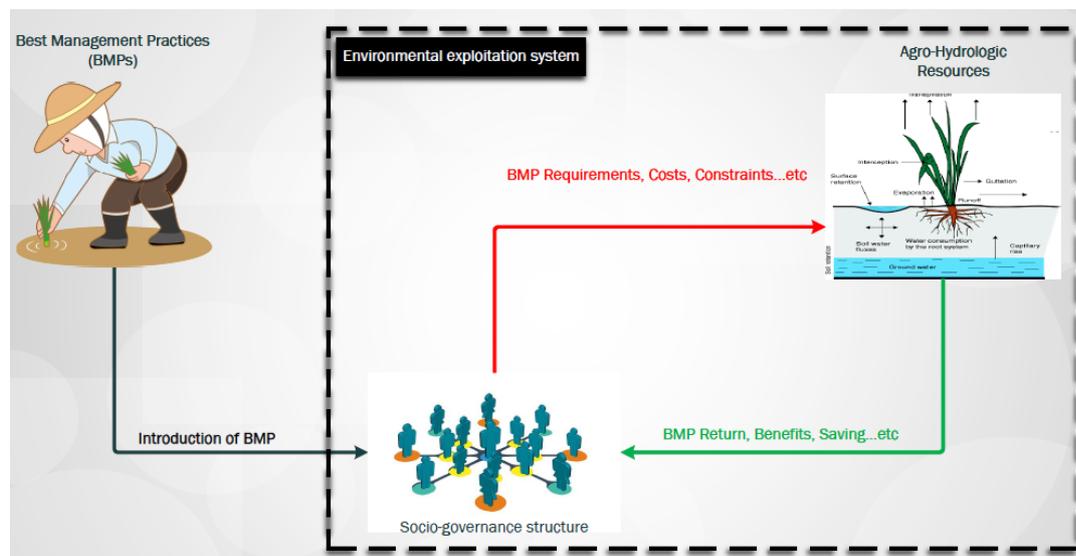


Figure 4: Components of Best Management Practices

The BMP aims are to enhance and improve, and in some cases correct, the positive balance between the Human and Environmental subsystems. BMP collections was following two major steps: (1) collection of projects through the **Project Description Sheet**, focussing on: (i) project location, (ii) methodological data of the project, (iii) scope of the project, and (iv) applied BMP; and (2) insight on each project through the **Practice Evaluation Sheet**, focusing on: (i) project description sheet information, (ii) socio-economic aspects of the project, (iii) agro ecological aspects of the project, and (iv) BMP description.

The BMPs collected in the study areas in Egypt, Ethiopia, Kenya and Sudan done between 18th April, 2022 and 31st August, 2022. The BMPs collected were distributed as follows: Crops (36.63%), Water (24%), Soil (23.53%), and Atmosphere (15.84%). The BMPs on soil were mainly on soil conservation (33%), water-holding improvement (28%), soil organic matter improvement (23%) and structure preservation (16%). BMPs related to water were mainly on water use efficiency (42%), surface water improvement (21%), groundwater improvement (17%), logging/salinization reduction (14%) and resistance to salinity (6%). On the other hand, the BMPs on crops were mainly on crop productivity improvement (40%), food security/livelihoods (28%), farmers’ engagement (14%), specific genotype use (11%) and enhancing resistance to pests (7%). BMPs related to the atmosphere focused on climate variabilities resilience improvement (43%), evaporation/evapotranspiration reduction (28%), greenhouse gas emission reduction/soil carbon sequestration improvement (22%), and methane/nitrous oxide losses reduction (7%).

3.1.2 Evaluation of Best Management Practices

(a) Scope of Evaluation Exercise

Evaluation of BMPs was one of the key activities undertaken during Day 1 of the WATDEV Local Meeting.

To set the stage for discussion, ASARECA made a presentation on the scope of the evaluation exercise with respect to the possible Best Management Practices (BMPs) application sectors such as: (i) Groundwater (ii) Soil, (iii) Crop, (iv) Surface water, and (v) Air/Atmosphere; and focussing on the discussion on preservations, exploitation, management of various BMPs under these sectors.

(b) Results of Evaluation Exercise

The discussion on local needs assessment exercise was facilitated by ASARECA and WLRC.

The discussion entailed an assessment of the community needs - with respect to the potential BMPs in the various application sectors; and filling in the community needs assessment form (ANNEX 3: Part 2). The discussion focussed on the possible best BMPs application sectors especially with respect to issues related to preservation, exploitation, management, and alternative solutions.

Specifically, preservation and exploitation were discussed in dealing with ground water; while discussions on soil focussed on soil management, fertilizer use and pesticides.

The stakeholders also held discussions on crop varieties and management practices under crops as well as exploitation, access, re-use, and distribution and irrigation systems under surface water. Discussions on climate change, future awareness, and sustainable development were also discussed under BMPs related to atmosphere. The other issues discussed included: economy focusing on investment, substitution (alternatives), risk, and subsidies; organization focusing on collaboration and exchange (willingness to learn and share ideas); and policy focusing on compliance, change, and introduction (willingness to see new regulations introduced).

The key findings from the evaluation of BMPs are highlighted below:

(i) Groundwater

Importance of groundwater:

The stakeholders noted that explained b that ground water is water resource obtainable from below the ground surface. It's usually exploited by digging shallow ponds or drilling deep boreholes. Stakeholders noted that ground water is very important in the target communities.

All the water used for domestic purposes (piped drinking water, washing and sewage) is ground water. Participants mentioned that ground water in Ethiopia has mainly been used so far for domestic purposes, but there are plans to use it also for irrigation agriculture. At national level, the demand for irrigation water is increasing and hence ground water is now becoming one of the major sources of water for irrigation particularly in the hot and dry lowlands and during dry season in other parts of the country.

The exploitation of groundwater for irrigation is now part of the national agenda to ensure food self-sufficiency and food security. In the project area, ground water is not used for irrigation. However, one of the farmers has established a ground water well to supplement water from the Koga irrigation scheme. During the meeting, farmers expressed the need to develop ground water sources to augment the existing surface water for irrigation and to augment water shortages during dry years.

Sufficiency and quality of ground water

Stakeholders noted that the area is rich in groundwater because the area is found in the foot slope of the recharge area. The quality is generally acceptable and based on previous experience of ground water utilization in other places parts of the country, groundwater contamination is not a major problem. However, drilling of boreholes close to each other in some places is likely to result in unsustainable use of ground water. In this regard, participants highlighted the need for appropriate policy measures and strategies to provide guidance on sustainable management and exploitation of ground water both within the target area as well as the entire country.

Preservation and efficient use

Stakeholders raised a concern that there was no appropriate regulation to space ground water wells or boreholes. To preserve the ground water sources, there is need to put in place a regulation/bylaw or use policy to avoid depletion of the ground water as a result of digging ground water wells or bore holes close to each other. Stakeholders also noted that there need to conserve the water recharge in the mountainous and highland areas by protecting and conserving the highland areas.

This can be achieved through **Sustainable Land Management (SLM)** strategy including: (i) terracing, (ii) gully rehabilitation, (iii) area closure, (iv) soil fertility management practices such as composting, (v) stabilizing terraces with biological materials and (vi) reforestation. This would lead to the achievement of the following benefits: soil fertility improvement, reduction of soil erosion, improvement of vegetation cover, improvement of biomass (fodder and non-fodder), carbon sequestration and reduction in siltation of the reservoir.

(ii) Soil

Soil management: Stakeholders noted that soil management is the application of appropriate agricultural practices to the soil to protect it and improve its health and specific soil functions.

The stakeholders understand soil management as protecting the health of the soil and value it as a way of maintaining the health of the whole production system. Farmers noted that upstream there is a challenge of soil erosion resulting into sedimentation of the reservoir.

On the other hand, soil acidity is a major problem. Farmers were able to identify the following soil management practices: (i) compost manure application, (ii) manure application, (iii) green manure, (iv) liming; (v) application of chemical fertilizer; (vi) chemical fertilizer application; (vii) irrigation; and (viii) crop rotation. The stakeholders noted that soil management is very important in to ensure that they can harvest good yields from their plots. Soil management is particularly important given that most of the soil is infertile because it has been intensively utilized, hence the need to apply soil amendments to improve its fertility. Farmers are willing to learn new practices on soil fertility management such as compost manure preparation and application. Farmers noted that they are not well skilled in the preparation of compost. They are also need training in application of right amount of fertilizer; micro-dosing and application of chemical fertilizers through irrigation water (fertigation) to maximize uptake of the nutrients by the crops.

(iii) Fertilizers

Stakeholders noted that they are currently using chemical fertilizers to improve soil fertility noting that it's difficult to get good yields without application especially in some crops such as maize highlighting the importance of chemical fertilizers. The farmers also reported that they are using quick liming to reduce soil acidity and organic manures to improve the soil fertility.

Challenges associated with chemical fertilizer application is with regards to application of the right amount and type of fertilizer. Although quick liming is one of the best management practices for addressing soil acidity, there are currently few farmers who are practicing it. Researchers participating in the meeting, proposed various recommendations that centre around implementation of integrated soil fertility management. These include combination of green manuring, organic fertilizer (compost) and industrial fertilizer in the right combination. There is on-going work in this regard by Ethiopia Agricultural Research Institute to determine appropriate fertilizer combinations with respect to the application of a combination of compost and inorganic fertilizer l.

After the best management practice (combination of fertilizer) has been released by the researchers, it should be disseminated for wider adoption. The issue of conservation agriculture, as one of the aspects for soil management was also raised. Overall, farmers have the opinion/perception that chemical fertilizers are detrimental to the soil's health and are willing to change to organic fertilizers if there is a proper extension and technical support to support the adoption and use of bio-fertilizers.

(iv) Pesticides

Participants reported that they are using chemical pesticides mainly because they are effective despite being aware of their negative impacts on the environment. They emphatically noted that "without chemical pesticide application, crop production is almost impossible".

Most farmers buy and apply the chemical pesticides on their own without technical guidance from the experts. This possible a challenge of overuse and misuse of the pesticides since farmers do not have the capacity to identify/select appropriate type of pesticide and do not have knowledge on the appropriate dose to use.

Similarly, farmers have the perception that chemicals (including chemical pesticides) in general are detrimental to the soil and the environment noting that they are willing to apply alternative methods (bio-pesticides) if found effective. Some bio-pesticides combination of animal urine and herbs have been developed to control some pests. Researchers also advised farmers to use integrated pest management than using inorganic pesticides.

(v) Crops

Crop Varieties and Management

Farmers in the target area grow a variety of crops including Teff, Lupin, Maize, Wheat, Fruits (Avocado) and horticultural crops (Tomatoes, Cabbage, Potato and Onions). Maize is the most important crop that is cultivated.

Avocado is becoming the most favoured fruit crop for the market. Wheat is grown under irrigation, while maize is cultivated under rain-fed conditions. Cereals grown in order of importance include Maize, Millet, Wheat, and Teff. Wheat was introduced recently and is grown during the dry season using irrigation. Maize and millet are dominant crops under rain fed condition.

Crop Rotations

Farmers noted that they practice crop rotation on a limited basis and practice is dying out.

The common rotations practiced include Maize-Wheat- Horticultural Crops, Wheat- Pepper etc.

They grow maize during the rainy season and when its harvested, wheat is grown under irrigation.

In the past the practice of crop rotations was strong, but this has been weakened by use of chemical fertilizers¹. Farmers exhibited a strong awareness of crop rotation as one of agronomic practices.

For example, a farm planted with potato will not be planted by pepper sequentially and vice versa. Farmers observed that crop rotation is between wheat and pepper. The reasons for crop rotation were given as follows: (i) increase productivity, (ii) to break the cycle of plant disease and pest cycles, and (iii) for nutrient cycling to improve soil fertility.

Multi-Cropping Patterns

Multi-cropping is practiced but on a limited basis mainly with fruit trees and cereals. When Avocado seedlings are planted, cereal crops such as maize and millet are grown between the rows of Avocado until when the seedlings are fully grown, and their canopy completely covers the area between the rows. Some farmers intercrop lupines with others, preferably a legume which is good for nitrogen fixation and used as green manuring.

Market Opportunities and Choice of Crop

There are significant challenges related with marketing of crop produce especially the horticultural crops (onions, tomatoes, and cabbages). The intermediaries (middlemen) fix low prices for the farmers. This situation is further exacerbated by the fact that farmers produce onions or tomato at the same time resulting in a market glut because they harvest at same time. This further has a ripple effect that causes reduction of the prices due to reduced demand.

For the crops that are perishable and have short shelf life there is no good technology to store them until the price has improved or until when the demand for the products goes up.

Cereal crops, on the other hand, did not face significant marketing problems. Similarly, fruits, such as the recently introduced Avocado fruit have also faced market fluctuations.

¹ The thinking here is that with use of chemical fertilizers, you get instant results in terms of increasing soil fertility as opposed to use of crop rotations despite other benefits delivered by rotations

Farmers and agriculture extension agents noted that such marketing challenges have occurred due to lack of contract farming which should be introduced to address the problem.

The challenges highlighted above provide an opportunity to introduce specific marketing innovations such as: (i) contract farming, (ii) warehouse receipt system, (iii) organization of farmers to undertake collective or group marketing in order to leverage on bargaining power as well as economies of scale (it is related to post harvest problem); (iv) introduction of cold storage facilities for prolonged shelf life (Fig.5); (v) agro-processing/value addition (for example processing of tomato to tomato paste) and (vi) marketing cooperatives or production alliances that seek best markets for their farmers.

(vi) Surface Water

Exploitation, Access, and Re-use

The main source of irrigation is surface water, that is stored in the reservoir. The source of the reservoir's water is from: (i) Koga River and streams in highland areas, (ii) water from other tributaries, (iii) run off/flood water from the slopes, and (iv) rainwater. Surface water is very important because it's the only source of water for irrigation in the Koga area. Farmers closer to the reservoir have access to enough water, while those downstream have limited access.

There is enough water available, but the problem is equitable distribution and utilization of water between the upstream and downstream farmers.

Distribution and Irrigation Systems

The major distribution system for surface water is through canals. The canals are divided into primary, secondary, tertiary, and quaternary. The first two are major canals that bring water into farm blocks from the reservoirs. There are also night-time storage dams to make the distribution efficient.

However, distribution systems are not efficient for farmers downstream who do not receive enough water. Distribution systems are not efficient because of several problems including: (i) poor organization of the users, (ii) physical management of the water system, (iii) water theft, (iv) equity and conflict, (v) poor governance, and (vi) poor/dilapidated infrastructure which is affecting access.

For instance, there is a frequent change in leadership of the community leaders responsible for water management. There is therefore a need to change the systems and make them more efficient.

In this regard, the Koga scheme is in the process of establishing Water Users Association to address the management issues. Participants therefore emphasized the importance of enhancing efficiency of distribution as important aspects in surface water management.

Other than the challenges highlighted above, the other problem relates to operation and maintenance where it was noted that timely maintenance is generally weak.

To enhance the efficiency in utilization of the surface water resources, stakeholders proposed the introduction of a policy instrument or regulation on water tariffing to ensure that utilization is based on demand and need (**Water management by tariff**).

(vii) Atmosphere

Climate Change

Participants have explained that they already feel the impact of climate change and variability.

For example, historically, months of *Meskerem* (September) and *Tikimt* (October) were generally cold, now they are warm and hot. Rainfall pattern has changed, i.e., in some days the rainfall becomes very intense with hailstorm which damages the crops (Fig 6). On other instances, the rainfall amount is low. The onset (starting) and cessation of rainfall are fluctuating. As a result, change in cropping calendar has been observed. For instance, the maize planting date has shifted from late April to the month of June. The months of January and February have now become generally too hot resulting into frequent heat stress which is affecting crop productivity.

The rainfall pattern has also shifted from bimodal to mono modal rainfall pattern in many parts of the country.



Figure 5: Maize crop destroyed by intense hailstorm falling on the mid of October 2022, substantially would reduce the production. It is an example of the negative impact of climate variability

Future Awareness

Stakeholders reiterated that the future is full of uncertainties especially since agricultural patterns are being affected by climate change. Hence, adaptation mechanisms must be practiced.

First, there has been a shift from bi-modal to mono-modal type of rainfall and farming. Currently, the bi-modal type of rainfall is disappearing. Stakeholders reflected on the potential future scenarios and noted the following: (i) there is likely to be increased farming variability attributed to increased heat stress, droughts/floods and increased rainfall variability; (ii) uncertainty of rainfall which affects production and calls for the need to build resilience to contribute towards mitigation, carbon sequestration, enhancing crop and livestock productivity and development of the irrigation sector; and (iii) emergence of new pests and diseases (as a result of climate change) is likely to worsen.

Farmers are currently practising various practices to adapt to the effects of climate change. Some of these best practices include: (i) use of early maturing crops, (ii) deployment of SWCs to improve soil and water conservation (in general on improving the land management and re-greening the mountains as climate change mitigation and adaptation mechanisms), (iii) irrigation, (iv) having good and proactive policies to support adaptation to the negative impacts of climate change and variability; and (v) working toward enhancing resilience related activities.

Sustainable Development

The stakeholders showed willingness and motivation to efficiently utilize natural resources to preserve them for future generations. For instance, the farmers are willing to implement interventions that result into sustainable land management such as: (i) use of organic soil management practices for long term sustainability; (ii) conservation of highland areas; (iii) use of bio-pesticides; (iv) awareness creation on sustainability and sustainable resource management; and (v) introduction of land use policies to implement appropriate SWC practices.

For example, a bylaw on free range grazing should be introduced to protect grazing livestock from destroying SWC structures/investments thereby contributing to improved soil and land management in highland areas.

(viii) Economy

Vocation and Investment

Agriculture is the major economic activity of the farmers in the project area and contributes significantly to the household, regional and national economies. This is followed by tree planting (forestation) and other sectors. Its contribution for livelihood and economy at all scales from household to national level is very big.

In this regard, participants recommended the integration of livestock, apiculture, and tree planting with the existing farming practices. Participants further recommended production of high value crops as well as crops that could serve as import substitution. Stakeholders expressed willingness to enhance the contribution of the agriculture to their wellbeing by engaging in production of high value commodities.

Substitution

Farmers expressed willingness to complement incomes from their land. For instance, they are willing to diversify into other Income Generating Activities (IGAs) such as transport business using tricycle taxis, real estate (building small houses for rentals) and planting of eucalyptus trees for fuel wood, charcoal and building poles.

Risk

Stakeholders noted that there are more risks associated to rainfed agriculture than irrigation agriculture. Farmers have embraced irrigation agriculture during dry months of the year mainly through their farmer association and agricultural extension agents.

Farmers are willing to be part of a farmers' cooperative or union to help them with marketing of their crop produce as well as other crop production challenges.

Participants considered low revenues from agricultural production a risk due to unreliable market of vegetables. They indicated that farmers cannot control the market and quite often invest in production of certain crops without knowing the market dynamics and yet sometimes prices change rapidly which poses a big risk.

Subsidies

Stakeholders noted that farmers are already part of a cooperative or union and are getting government support in terms of water for irrigation. Thus, farmers would be willing to continue to be part of an organization or grouping where they can get help (in form of subsidies) either from government or development partners.

Participants further noted that subsidies towards ground water development as well as access to other improved technologies is needed. Alternative solutions suggested included organizing farmers in groups/cooperatives and facilitating access credit for such developments.

(ix) Organization

Collaboration

Stakeholders agreed that there are benefits in being part of a group. Farmers are already part certain groupings including: (i) the irrigation water users' associations, and (ii) farmers' union. The associations collectively formed irrigation producer's union which has greatly benefited farmers through provision of pre-requisite infrastructure such as cold storage facility as well as to creating market linkages for them.

However, capacities of associations as well as the union need to be strengthened to address the varied needs of the farmers to better manage the water resource, introduce better technologies and create conducive and dependable market linkages (for example through organizing contract farming arrangement). On the other hand, government has enacted several laws that could potentially benefit

the farmers. Some of these laws include: (i) irrigation users' proclamation, (ii) watershed users' association proclamation and (iii) cooperatives development law.

These laws should be implemented together with capacity development of grassroots institutions to benefit farmers.

Exchange

Stakeholders appreciated sharing of knowledge and information to support dissemination of best practices. The local stakeholder meeting also provided a platform to further such exchanges.

The information flow/exchange, however, should be further strengthened.

(x) Policy

Introduction

Stakeholders noted that there are a couple of regulations, laws, and policies that they would want introduced to facilitate efforts towards sustainable land management.

Some of the policies or regulations they want introduced include: (i) regulation/policy for water tariffing, (ii) regulation/bylaw on free range grazing to avoid destruction of soil and water conservation structures by grazing animals; and (iii) regulation or policy on location or minimum distance between ground water wells or boreholes to promote preservation/sustainable use of groundwater and avoid depletion.

Compliance

Stakeholders noted that farmers appreciate the importance of complying with the regulations or laws.

Farmers are complying with the with policies and laws of the government as well as bylaws of the associations and farmers' Union. For instance, farmers are complying with export regulations/standards of the Avocado fruit starting from seedling preparation to grading and packaging of the fruits.

Change

Participants indicated that they are willing to adopt changes in land use policy, improvement on market linkages, input supply, improvement on water distribution system and practices, integration of agriculture with livestock and other income sources and related best practices.

3.1.3 Wrap-up (Day 1) and Conclusion

The main facilitators Dr Tena Alamirew and Mr. Moses Odeke thanked the participants for their active participation during the first day and briefed them about the next day's field work and group discussion at Koga Irrigation Users Union Hall.

3.2 Site Visit and Site-specific Brokerage Meeting at Koga Irrigation Scheme

The second day was devoted for site visit to Koga Irrigation Dam, Irrigation Users Union Cold Storage Facility and Irrigation farms and Site-specific brokerage meeting.

3.2.1 Site Visit

(a) The Koga Dam

The stakeholders visited the Koga Irrigation dam/reservoir.

The dam Administration Manager, Mr Hibret Andualem, took participants around the dam area and briefed them on the different aspects of the dam including history of its construction, engineering work, its capacity, the day-to-day management, and maintenance as well as the challenges. (Figure 6).

Among the challenges discussed was the degradation of the upstream areas which is negatively impacting the reservoir through siltation. Participants were able to see how the buffer of the dam needs attention as well as how water stored in the dam is silted, which is detrimental to the reservoir's storage capacity.



Figure 6: Koga Dam/Reservoir and its environs

(b) Site visit to the Union's Cold Store

Dr Tilahun Mulugeta, the horticulturist from the Woreda Department of Agriculture who is the in-charge of extension services for Avocado growing in the area and quality control took the participants through the fruit grading process as well as the cold store. Figure 7 shows Avocado fruits to be graded.



Figure 7: Different stages in the of Avocado fruits grading process

(c) Site visit to Irrigation farms

The participants then visited the irrigation farms where they were able to see the primary, secondary, tertiary, and quaternary canals; the night storage ponds; and several farms.

The first farm visited was the small holder tomato farm under the greenhouse. This farm was initiated few years ago and now is considered as one of the best practice/model farms for small holder farmers to produce tomato under green house during rainy season (Figure 9). Currently, several farmers have adopted this technology.



Figure 8: Small holder farmer operating plastic (green) house for tomato farm during rainy months. This technology helps the tomato not to be destroyed by the intense rain during rainy months

Stakeholders visited the Avocado Farm owned by a young farmer Mr Tilahun Fekede. During the visit, participants were discussed various good agronomic practices pertaining to Avocado production such as: (i) variety selection, (ii) seedling management, (iii) agronomic practices, (iv) bio-fertilizer, (v) bio-pesticide applications, (vi) soil liming; (vii) picking fruit, (viii) transportation to the cold store for grading and (ix) marketing.



Figure 9: An example of Avocado farm



Figure 10: Participants had their lunch at the Avocado farm of Mr Tilahun Fekade

3.2.2 Wrap-up of the field visit (Day 2)

After the field visit participants convened in the Irrigation Water Users' Union Office/Hall and reflected on several issues pertaining to the field visit. WLRC and ASARECA thanked the participants for their actively sharing information during the meeting.

During the discussions the following issues were highlighted:

1. Marketing. There is a challenge of marketing especially for the horticultural crops such as: potato, onions, and pepper where price setters are brokers. Marketing innovations such as contract farming could help address this challenge. Stakeholders argue that contract farming could enhance market linkages and could reduce the unnecessary involvement of brokers.

Stakeholders noted that establishing mechanisms of contract farming is critical for sustainable marketing.

2. How can the project or government support the farmers to be engaged in contract farming for specific value chains?
3. Farmers are interested and willing to embrace use of compost manure to improve their soil fertility status. There is a challenge in terms of compost preparation especially for those who don't own enough cattle for manure, they need to buy it and yet it is expensive. What are the available cheaper alternatives?
4. Farming is expensive for female headed households. How can these vulnerable categories be supported to enhance their farming operations and ensure inclusivity of all gender categories remunerative agricultural activities?
5. There are available opportunities for financial borrowing but high interest rates of 17% are prohibitive. Because of this, few farmers are interested in borrowing. How can the project or government support the farmers to negotiate for better interest rates?
6. Introduce appropriate technologies and enhance those started (e.g. small holder operating green house, solar power, climate resilient bundle of practices)
7. Introducing water pricing to raise enough amount to finance water infrastructure (dam and canal) maintenance and operation. This could sustain water resource management in the area for the introduction of improved methods and improved farm tools.
8. Focusing on cash crops (high value crops on the market) could be good to improve the wellbeing of framers
9. Introducing agro-processing at community level
10. Need to scale up mechanization of farming operations especially in cereals, utilization of crop residues to improve soil fertility and growing of fodder crops for livestock.
11. Key gaps exist especially in terms of: (i) appropriate technology (mechanization), improved varieties, and agro-processing.
12. Working on post-harvest technologies; enhancing organic/conservation/climate smart farming (vermicomposting, green manuring, minimum tillage, etc.),
13. Establishing strong irrigation water users' association. It is necessary to enhance institutions; in which they are key to development.

3.2.3 Brokerage of the Best Management Practices

The reflection on the brokerage of BMPs was done by the team of experts who discussed and jointly filled the group evaluation form according to the reflections of the participants in the workshop (ANNEX 3: Part 1). After the field visit, the group of experts eventually met, reflected and discussed what happened over the two days as well as the needs of community (ANNEX 3: Part 2).

Throughout the reflections and discussions, participants expressed the importance of the exercise especially as they were able to relate to some of the things that had happened in Day 1, and this added value to the discussions. On the wrap meeting of the visit on day 2, representative farmers raised their concerns, challenges, and areas they want support from different stakeholders.

Likewise, representatives coming from research and academia, federal and regional government sector institutions and those representing NGOs/CSO expressed different areas where they can support the Koga Irrigation Users' Association on while noting the importance of the whole exercise in soliciting the best management practices for scaling up.

Based on the discussions and reflections by the expert group, some of the key messages that emerged are highlighted below:

- The group can collaborate because they are already working within an arrangement of farmers' grouping and collaborating on other aspects such as production of Avocado for export.

- In terms of group cohesion, there was a feeling that there was weak connection among the members in terms of members interacting with each other within the group, as reflected by organizational weaknesses of the Irrigation Water User's Association. There is a strong willingness and motivation for members to work together but the group cohesion and interconnectedness needs to be strengthened.
- There was also some level of participatory engagement of the group members in terms of participation of group activities. However, there is little or no evidence of members participating in setting priorities or goals for the group.
- For the group to share potential BMPs they need to be sensitized on the importance of the BMPs and need to share with other farmers to benefit the whole community. They also need to be trained in the use of the technologies.
- There was a strong feeling that members are not very much involved and interested in generation of new knowledge. They largely depend on innovations that come from research.

4 ANNEXES

4.1 ANNEX 1 - Meeting Agenda

Project WatDev
Best Management Practices (BMPs)
Evaluation and Site-specific Brokerage

Meeting with local stakeholders
26-27 October 2022
Unison Hotel, Bahr Dar, Ethiopia

Programme

Wednesday 26 October 2022
Dissemination Event & Meeting for BMPs Evaluation

| Session 1 | Welcome and Introduction |
|---------------------|---|
| 08:30 am- 08:45 am | Participants arrival and registration (Organizers) |
| 08:45 am- 09:00 am | Participant Introduction (Organizers) |
| 09:00 am - 09:30 am | Welcome <ul style="list-style-type: none"> • Dr Gete Zeleke, (Water and Land Resource Centre, Director General) • Dr Hailemariam KeFYalew / Dr. Almaz Giziew (ANRS Bureau of Agriculture) • AICS Cairo - Ms. Margherita Tenedini • AICS Ethiopia - Ms. Silvia Vanzetto |
| 09:30 am- 9:45 am | <ul style="list-style-type: none"> • Objectives and Agenda (Mr. Moses Odeke, ASARECA) |
| 9:45 am- 10:00 am | <ul style="list-style-type: none"> • Brief introduction about WLRC (Dr. Amare) |
| Session 2 | Preparing the Ground for Discussion |
| 10:00 am - 10:20 am | The WATDEV Project: objectives, methods, and expected results (Dr. Gaetano Ladisa, CIHEAM Bari) |
| 10:20 am -10:45 am | <ul style="list-style-type: none"> • Overview of activities in the country (ASARECA) • Presentation of Local Stakeholders (ASARECA & WLRC) |
| 10:45 am- 11:00 am | Coffee break & Group photo |
| Session 3 | The Evaluation's Exercise |
| 11:00 am- 01:00 pm | Presentation of exercise's scopes (support to fill the Needs Evaluation Sheet) (ASARECA & WLRC) |
| 01:00pm - 02:00 pm | Lunch |

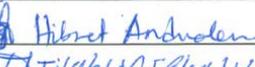
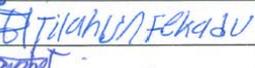
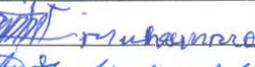
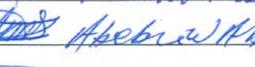
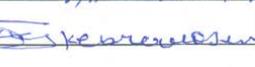
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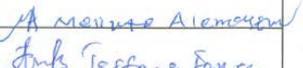
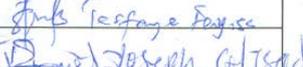
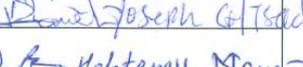
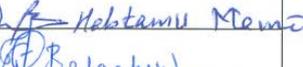
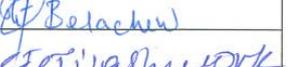
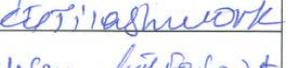
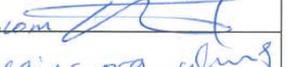
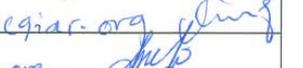
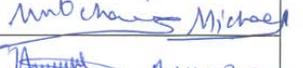
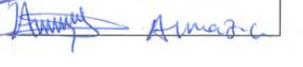
| 02:00 pm - 3:45 pm | • Facilitated discussion (continued) (ASARECA & WLRC) |
|---|--|
| 3:45 pm - 4:15 pm | Coffee break |
| Session 4 | Wrap-up and Conclusion |
| 4:15 pm -4:45 pm | • Wrap-up and closure (WLRC, CIHEAM Bari) |
| 4:45 pm - 5:30 pm | • Workshop Evaluation (WLRC, ASARECA, CIHEAM Bari) |
| Thursday 27 October 2022 | |
| Site Visit and Site-specific Brokerage Meeting Koga Irrigation Scheme, Merawi, Bahir Dar | |
| 7:30 am | Departure from the hotel to the study area |
| 9:00 am- 11:00 am | Site visit 1- <ul style="list-style-type: none"> • Dobre Yackob Integrated micro-Watershed Management (Upland of Koga Watershed) |
| 11:30 am-12:30 pm | Site Visit 2- Koga reservoir and headwork |
| 12:30 pm-1:00 pm | <ul style="list-style-type: none"> • Curtsey's Visit to Koga Irrigation Farmers Union Office and Cold Store |
| 1:10 pm- 2:00 pm | Field Lunch in Koga Irrigation Farm Site |
| 2:00 pm - 4:00 pm | Site visit 3: Visits to some irrigation Farms |
| 4:00 pm - 4:30 pm | • Wrap-up (WLRC & ASARECA) |
| 4:00 pm -5:00 pm | Drive Back to Bahir Dar |

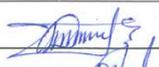
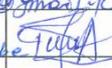
Water & Land Resource Centre
Addis Ababa University

Water and Land Resource Centre, Addis Ababa University (WLRC/ AWC)
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Addis Ababa
Ethiopia

4.2 ANNEX 2 - Attendance Sheet

|      | | | | | | |
|---|---------------------------------|--------------------------------------|---------------------------------|-------------------------------|-----------------------------------|---|
| Project WATDEV | | | | | | |
| BMPs Evaluation and Site Specific Brokerage | | | | | | |
| event subtitle (Activity 1.2 and 1.3) | | | | | | |
| 26-Oct-22 | | | | | | |
| Attendance sheet - date | | | | | | |
| NAME (IN CAPITAL LETTERS) | SURNAME (IN CAPITAL LETTERS) | ORGANIZATION (IN CAPITAL LETTERS) | COUNTRY (IN CAPITAL LETTERS) | EMAIL (IN CAPITAL LETTERS) | SIGNATURE (IN CAPITAL LETTERS) | |
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| 3 | TRINGO | MOLLA | KOGASRR | ETHIOP | - | 4.7.032.gop |
| 4 | ZEW.DU | KSFLE | KOGASRR | ETHIOP | - | 204.H122.656 |
| 5 | TAZEB | MEKSE | KOGASRR | ETHIOP | - | ITAK-10020 |
| 6 | HIBRET | ANDUALEM | KOGA IRR | ETHIOP | - |  |
| 7 | TILAHUN | FEKIDU | KOGA SRR | ETHIOP | - |  |
| 8 | MUHAMMED | HAMZA | KOGA IRR | ETHIOP | - |  |
| 9 | ABEBAYU | ABIE | KOASO | | |  |
| 10 | KEBREWOSSEM | ALEMU | | | |  |

| | | | | | | |
|---------|---------------|-------------|-------------------------------------|--------|----------------------------|---|
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| 12 DR. | TESFAYE | FEYISA | ARARI | | tesfayerhan98@yahoo.com |  |
| 13 | YOSEPH | GEBRETSADIK | BOA | | gomeyy9@gmail.com |  |
| 14. | HABTAMU | MAMO | Water works design | | mhabtamu18@yahoo.com |  |
| 15. | BELACHEN | TILAHUN | TANA SACCO | 1 | cb.belachen@yasho.com |  |
| 16. | DR. TILASHWOK | Chanie | Adei ARARI Consultant Irrigation | | tilashworkchanie@gmail.com |  |
| 17. | DR. FANTAW | ABEGAZ | ETAR/private | | fantaw2012@gmail.com |  |
| 18 DR. | DANIEL | BEKELE | ETAR/mekara | | tdanielbekele@gmail.com |  |
| 19. | ABEHAMM | BEYATIN | 5mecha Mercedes Admin. | | abrehab:40237@gmail.com |  |
| 20. DR. | ABEBECH | ABERA | BDU. | | abiti.aber@gmail.com |  |
| 21 DR. | Amare | HISLASSIE | IWMI | | a.haisllassie@cgiar.org |  |
| 22. DR. | Tena | Alamiro | WLRC-AAU | | tena.a@wlrc.ethi.org |  |
| 23. DR. | Amare | Bantider | WLRC-AAU | | amare.b@wlrc.ethi.org |  |
| 24. | ZELEKE | BELAY | MOX/irrigation | | zelebelay7ue@gmail.com |  |
| 25. | LIDYA | DAWIT | CIHEAM | | letodave42@gmail.com |  |
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| 27 DR. | ALMAZ | GESSEW | BOA | | almazbea2014@gmail.com |  |

| | | | | | | |
|----|------------|-------------|-----------|--|---------------------------|---|
| 28 | Deribaw | Shanko | WLRC-AAU | | deribaw.s@wlrc-eth.or |  |
| 29 | Mulugeta | Ferede | WLRC-AAU | | mulugeta.f@wlrc-eth-org |  |
| 30 | Dr. Ermias | Tefers | WLRC-AAU | | ermias-teferi@aa.u.edu.et |  |
| 31 | Dessalew | GETNET | WLRC-AAU | | DESSALEW21@gmail.com | |
| 32 | Tewachew | Abebe (Hon) | parlament | | tewacchewabebe@gmail.com |  |
| | TAMIR | MENGAW | WLRC | | tamir-mengaw@yaho.com |  |
| | | | | | | |
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4.3 ANNEX 3 - LMES: Local Meeting Evaluation Sheet

Guidelines:

The present documents serve to evaluate and assess meeting with local communities, and it is composed of two main parts with an assigned score according to the answers provided:

1. **Groupe evaluation:** synthetically describe the group compositions and members. With a set of question, it aims at qualitatively assess the working group, and it has to be compiled after the completion of the meeting.
2. **Evaluation of local community needs: Possible BMPs application sectors:** evaluate the group flexibility (needs), by area, to undergo changes. It serves as guide for the meeting discussion content.

For any enquiry or suggestion/clarification, please refer to:

4.3.1. - Group Evaluation

-2: No; -1: Relatively No; 0: Equally mixed; 1: Relatively yes; 2: Yes

| Type | Criterion | Question | Score |
|-------------------|---------------------------|--|-------|
| Membership | <i>Joint Enterprise</i> | Do members share a competence that distinguishes them from others? Farmers are already part of a farmers' union or cooperative. They have been collaborating together on various issues. So, the farmers have some level of skill and knowledge on how to work together and this is the competence that distinguishes them from other farmers | 1 |
| | | Do the members share a common sense of purpose? Yes, although from different perspectives, effective water management was an issue for the participants. | 1 |
| | | Do members appear to have similar interests? Yes, enhancing the effective water management is common, although farmers also complained due to market functionality. | 2 |
| | | Do members report similar problems or experiences? Yes, much of the problems reported were similar. But among the community members, issues for water scarcity tend to differ. That is primarily due to their relative location along the main canal reach. | 1 |
| | <i>Diverse Membership</i> | Do the members of the community represent a variety of stakeholders? Yes, participants comprise wide range of groups – farmers including women, research, policy, local leaders, private sector and financial actors | 2 |
| | | Does the community transcend organizational and geographical boundaries? Yes, the farming community transcends organizational and geographical boundaries. Farmers are from one local community, while researchers, private sector and financial actors are from different organizational and | 2 |

| | | | |
|---------------------------|-------------------------------------|--|----|
| | | geographical boundary. | |
| | <i>Participatory Framework</i> | Are members actively involved in setting goals? Yes. They are involved but not actively. All are not equally involved. There is also evidence that members are engage in participatory implementation of activities which shows their potential to delegate and take charge of responsibilities. | 1 |
| | | Are members responsible for devising a strategy or plan of action? Their ability to do this is sometimes limited since some actions such as crop selection is influenced by the government. | -1 |
| | | Do members assist in running the community? Experts are willing to share experience in addressing the community needs for better outcomes | -1 |
| | | Are members of the community internally motivated? Looking from the members' participation, yes they are motivated to take part in the group's activities due to various benefits such as: access to water, introduction of new crops and varieties, linkage to markets, better prices, access to technologies promoted through the group/farmer's union etc). | 2 |
| Process/Activities | <i>Mutuality/Sense of Community</i> | Do the members of the community build relationships with each other? In the Koga scheme farmers are organized in a water users' cooperatives and cooperatives are members of the Koga Irrigation Union. Farmers have a relationship with other members such as extension agents, researchers, agronomists who are part of the community and working in the community | 1 |
| | | Do the members engage in joint activities and discussions? Yes. Members engage in joint activities especially collective marketing of their products (e.g., Avocado); Agricultural input purchase and distribution; etc. | 2 |
| | | Do the members offer each other help when needed? Yes. They support each other especially during harvesting and knowledge and information exchange as well resolving social conflicts. | 1 |
| | | Do members report encounters across geographical or organizational boundaries? Yes, whenever they encounter crop production challenges, for example when they need additional agricultural inputs they engage the Woreda (district) Agricultural Officer. When they need water they talk to the dam administrator. For marketing they engage traders as far as Addis-Ababa, | 1 |
| | | Do the members report feeling a sense of "belonging" within the community? Yes, they explain that their future is intertwined with community and belonged to the scheme | 2 |

| | | | |
|--|--|--|---|
| | <i>Sharing and Exchanging of Knowledge</i> | Do members engage in narration, or sharing their experiences through stories? Yes. Members were freely sharing their experiences through their stories. For instance one farmer noted that he was facing a challenge inadequate water for irrigation and yet wanted to expand his farm. This prompted him to invested in digging underground well but did not enough money to buy the pump. | 2 |
| | | Do members spend a significant amount of time sharing and exchanging knowledge? Farmers share and exchange knowledge but do not spend most of their time sharing their experiences | 1 |
| | | Do members view the community as a forum for the free-flow of ideas and information? They are explaining their views freely even if sometimes they have divergent/conflicting views. | 1 |
| | | Do members view their interactions in the community as a conversation, as opposed to a series of 1-sided reports? Information sharing was not one sided. Members of the community interacted with each other freely. | 2 |
| | | Do the members believe that they learn useful information from their interactions with others in the community? Yes, in fact, the experience of farmers/irrigators was very informative for experts and policy maker to note. The farmers also learn from the researchers on how to manage soil acidity for improved soil health. | 1 |
| | | Do members report any coaching or mentoring from others in the Community of practice community? Yes, they acknowledged receiving training and mentoring from the the extension services (agronomy, marketing, farmer organization, water management) they get from Wereda experts | 2 |
| | <i>Reflection</i> | Do the members of the community engage in collaborative reflection on their individual and each other's experiences and concerns? Yes, They are collectively raising and discussing issues that concern members | 1 |
| | | Do members feel like their own level of self-reflection has been increased by participating in the community? Yes, members have raised a number of new issues and insights that were not shared before | 0 |
| | <i>Reproduction Cycle/Continuity</i> | Do members believe that the Community of practice will extend beyond the current time/place/members? Yes. The members believe that the community of practice will extend beyond the current time. | 2 |
| | | Do new members join? In terms of farmers, there is no possibility of new members joining, except other actors that provide market and credit facilities | 1 |

| | | | |
|--|--------------------------------------|--|----|
| | | Do members of the Community of practice believe it will be useful? Yes, the members believe that it's useful since its helping them to access services or help that they need for agricultural production | |
| | | ...6 months from now? | 0 |
| | | ...1 year from now? | 1 |
| | | ...3 years from now? | 2 |
| | | Does the level of activity of the Community of practice ebb and flow over time? It's anticipated that the level of activity of the community will evolve and increase over time. | 1 |
| | | Do members spend the majority of their time analyzing real-life situations or problems? No. There is no evidence to support the fact that majority of the members spend most of their time analysing real life situations | -2 |
| | <i>Action Orientation</i> | Do the members of the community express a desire to initiate change? Yes. Expressed their desire to initiate change to: (i) exploitation of other water sources, e.g., digging a water well; (ii) members requested government to come up with appropriate land use policy to control land degradation; (iii) policy regulating digging of boreholes; (iv) improving marketing channels; (v) discussion on agro-processing/value addition | 2 |
| | | Do the members of the community express a desire solve common problems? Yes, they expressed strong feeling to solve common problems such as marketing, and equitable water distribution, and agric. Input supply | 2 |
| | | Is the community successful in turning principles/values of the field into realized policies and practices? No. This is too early to tell | -2 |
| | <i>Construction of New Knowledge</i> | Do members report that their previous understanding/knowledge has been transformed through participation in the community? Yes. This was very much visible from the members as they were freely sharing new knowledge and information | 2 |
| | | Do the members report generate new knowledge as a group through their interactions in the community? Yes. Members reported experimental trials of bio-pesticides as well as trials of combinations of organic and inorganic fertilizers for improving soil fertility | 2 |
| | | Are members confident that they have developed a common knowledge base that they can refer to in the future? Members report generating knowledge that will be used to support their crop production activities | 1 |

| | | | |
|-------------------------|-----------------------------------|--|---|
| Outputs/Outcomes | <i>Dissemination of Knowledge</i> | <p>Do members feel connected with others in their field, outside of the community of practice itself?</p> <p>Members regularly share technologies with other members outside the scheme/community of practice. For example farmers share scions of improved Avocado varieties with other farmers outside the irrigation scheme (community of practice), linkage with other actors such as traders during marketing of their produce, those who hire land from the farmers as well as social cultural ties.</p> | 2 |
|-------------------------|-----------------------------------|--|---|

4.3.2. Evaluation of local community needs: Possible BMPs application sectors

Show comments to have further indications on how to perform single point discussion and the aspect intended to assess.

| Score | Interpretation |
|-------|---|
| -2: | No need (or change) is required (accepted) |
| -1: | Limited need (or change) is felt (possible) |
| 0: | Equally accepted, but not considered as priority |
| 1: | Relatively important where changes are welcome |
| 2: | Priority where the need for change is felt and critical |

| Target of Changes | Flexibility Criterion | Points of discussion | Score |
|-------------------|-----------------------|---|-------|
| Ground water | Preservation | <p>If already in exploited:</p> <ul style="list-style-type: none"> Discuss its extent, importance and sufficiency and willingness to preserve it by managing its use (reduction) or invest in alternatives. <p>Extent of preservation There is shallow and deep aquifer groundwater potential with the capacity of up to 15 litres per second. Currently, the extent of exploitation is limited and restricted to domestic water supply.</p> <p>Importance The ground water is very important as it is used for domestic water supply. All the water used for domestic purposes is from shallow ground wells. There is a potential to exploit ground water for irrigation. Because of the importance of groundwater, there is a willingness to preserve it as demonstrated by the concern of stakeholders to reduce rampant and uncoordinated digging of boreholes to avoid over-exploitation of the ground water sources.</p> <p>Sufficiency The ground water sources are sufficient for domestic purposes, except that there is a problem of contamination from bacterial sources. Little has been exploited for irrigation purposes.</p> | -2 |
| | Exploitation | <p>If not exploited:</p> <ul style="list-style-type: none"> Discuss its availability, easiness of access and exploitation and willingness to invest in it. | |
| Soil | Management | <p>Definition and role of soil management</p> <p>The stakeholders understand soil management as protecting soil health and value it as a way of maintaining the health of the whole production system.</p> <p>Farmers noted that upstream there is a challenge of soil erosion resulting into sedimentation of the reservoir. On the other hand, soil acidity is a major problem in many parts of the project area.</p> <p>Examples of soil management practices</p> <p>Farmers were able to identify the following soil management</p> | 2 |

| | | | |
|--|---------------------------|---|----------|
| | | <p>practices: (i) Compost application, (ii) Manure application, (iii) Organic (green manure); (iv) Liming; (iv) Chemical fertilizer application; (v) Irrigation; and (vi) Crop rotation</p> <ul style="list-style-type: none"> • Discuss the importance given to soil management <p>The stakeholders consider soil management very important since it directly determines the crop yields. Farmers noted that it's impossible to get good yields without fertilizer application.</p> <ul style="list-style-type: none"> • Discuss the need to learn new practices <p>Generally, there is willingness among farmers to learn new practices especially pertaining to preparation of compost, preparation and application of bio-pesticides as well as training in application combination of chemical and organic fertilizers. Key challenges in soil and land management that require urgent attention include: (i)land degradation caused by excessive run-off/erosion and sedimentation of the dam; and (ii) soil acidity that is affecting most of the farms.</p> | |
| | <p><i>Fertilizers</i></p> | <p>If already in use:</p> <ul style="list-style-type: none"> • Discuss how important is the use of fertilizers in the profitability of their farms <p>Stakeholders mentioned that they are using chemical fertilizers as well as organic fertilizers (cattle and compost manure). Without fertilizer the farmers cannot get good yields especially in the maize crop. The continuous use of chemical fertilizers is making the soil acidic. This coupled with the high prices is making farmers to look for innovative solutions such as liming and application of organic manures. However, not many farmers are liming because of lack of adequate sensitization and training.</p> <p>.</p> <p>Discuss the willingness to reduce chemical fertilizer or use alternatives to preserve productivity at longer term</p> <p>Stakeholders view chemical fertilizers as toxic to the soil. However since the farmers do not get good yields without fertilizer application, they are compelled to use it. They are willing to use the alternative organic fertilizer. In fact, they are not sure whether manure could fully substitute inorganic fertilizer for the simple reason that some households don't own enough cattle for manure production. Researchers noted that they are developing an innovative solution which is a combination of compost and inorganic fertilizer as part of the solution to addressing low soil fertility. The trials for the new innovation has shown very good performance. The trials have also shown that proper compost preparation is required to give good results unlike where farmers are collecting and applying manures without proper composting (it is new practice).</p> <p>Overall, the application of organic fertilizers is not well developed. There is need for some intervention in terms of training in preparation and application of compost manure</p> | <p>1</p> |

| | | | |
|-------------|--------------------------------------|--|---|
| | | etc, use of green manure. This could be done gradually and not immediately. | |
| | | If not already in use: <ul style="list-style-type: none"> • Discuss the cost and easiness of access • Discuss the willingness to invest/introduce fertilizers in their farming | |
| | <i>Pesticides</i> | If already in use: <ul style="list-style-type: none"> • Discuss their importance for the crop productivity and the presence of local diseases risks <p>Chemical pesticides are extensively in use; however, they believe it is toxic to the environment and there is no trained entomologist who guide on the selection of appropriate pesticide and its application. Farmers do not have the knowledge and skills to choose the right type of chemicals and the recommended dose.</p> <p>Discuss willingness of adoption of alternatives such as bio-pesticides and/or soil management practices</p> <p>Few farmers try to use bio-pesticides (e.g., cow urine or Gomutra). Integrated pest management is the best recommendations by experts and farmers are welcoming this best management practice; they are willing to apply alternative pesticides. Overall, there is very limited use of bio-pesticides, misuse and overuse of chemical pesticides which is hazardous to the environment.</p> | 1 |
| | | If not already in use: <ul style="list-style-type: none"> • Discuss their availability, access easiness and presence of local diseases • Willingness to invest in bio-pesticides to improve productivity | |
| Crop | <i>Crop varieties and management</i> | Initiate talk on food culture and local varieties cultivated <ul style="list-style-type: none"> • Discuss crop rotation and its benefits <p>The benefit of crop rotation is well understood: (i) improve soil fertility through rotations with legumes (for nitrogen fixation), (ii) break pest/disease cycle (protect or reduce the impact of soil borne diseases); and (iii) recycle nutrients etc. In the past many farmers used to practice crop rotations compared to the current situation where only few farmers practice rotations. The common rotation is maize- wheat, with maize cultivated during the rain season and followed by wheat during the dry season where its grown under irrigation. The other rotation is fruit trees (Avocado-cereals especially maize) which is done when the Avocado trees are young until when the canopy closes in..</p> <ul style="list-style-type: none"> • Discuss multi-cropping pattern and its benefits <p>Multi cropping is very limited only observation in cases where Avocado trees are intercropped with maize while it's still young, until its canopy closes. Other multiple cropping patterns are not available</p> <ul style="list-style-type: none"> • Discuss market opportunities and choice of crop <p>Market for wheat and maize is not a problem. The Avocado</p> | 2 |

| | | | |
|----------------------|--|---|---|
| | | <p>fruit is mainly for export. In addition, the existence of cold store greatly helps to extend the shelf life of the Avocado fruits as market is being sought and reduces the chances of the product going bad during storage.</p> <p>Market was a serious problem for vegetable crops (in the last few years) because most farmers grew vegetables at once and the harvest time was also at the same time. This creates unbalanced supply with the demand during the harvest days. These vegetables also have short shelf life and easily perishables. For this staggering production is recommended to avoid market surplus and subsequent drop in prices. During the discussion stakeholders proposed contract farming as an innovation for addressing the challenges in the communities as well as provision of efficient market information.</p> | |
| Surface water | <i>Exploitation, access and reuse</i> | <p>If already in exploited:</p> <ul style="list-style-type: none"> • Discuss its extent, importance and sufficiency and willingness to find/invest in other surface resource alternatives. <p>Surface water is very important since it's the main source of irrigation water in the area. The main source is the surface water that is stored in the reservoir/dam. For the designed command area, the water in the storage is enough for much of the year, which calls for efficient utilization of the available water resources. This is because there is no equitable distribution of the available water resources. Downstream farms receive less water while those upstream farms get excess water. Therefore, efficient scheduling is required. In addition, supplementary water is required particularly when there is drought (and when there is shortage of water in the dam). Stakeholders also noted that rain water harvesting could be promoted to supplement available water resources. Overall, effective utilization of water, equitable distribution of water, water scarcity at the latter stage of the growing season, sedimentation of the dam are some of the key issues that need to be taken into consideration with respect to utilization and preservation of the surface water.</p> | 1 |
| | | <p>If not already exploited:</p> <ul style="list-style-type: none"> • Discuss its potential relevance for crop productivity enhancement, easiness of access, the trade off such investment | |
| | <i>Distribution and irrigation systems</i> | <p>If already existing:</p> <ul style="list-style-type: none"> • Discuss the existing distribution systems, efficiency and influence on cropping patterns (choice of crop) <p>The irrigation distribution system is generally entails use of furrow canals where water is channelled through primary, secondary, tertiary and quaternary canals. The primary and secondary channels are lined with concrete. These canals are administered by the dam administration (under the Irrigation Commission of the Ministry of Irrigation and Lowlands), while</p> | 1 |

| | | | |
|-------------------|-----------------------|---|---|
| | | <p>the extension services for the field water management is provided by the Woreda Department of Agriculture and the Irrigation cooperatives. Irrigation is mainly during the dry season of the year (Nov to May). During the main rainy season, the reservoir stores water from Koga river and tributaries in addition to the runoff and rain. Crop production activities in the months of June to September are rain fed. The system is not efficient because of the ineffectiveness of the administrative structures required to oversee the distribution of water to other parts of the scheme. This leads to poor mobilization and organization of the farmers. As a result, there are complaints of farmers receiving enough by downstream farmers.</p> | |
| | | <p>If not already existing:</p> <ul style="list-style-type: none"> • Discuss the feasibility, funding (typology and actors), water management and influence on cropping patterns (choice of crop) | |
| Atmosphere | <i>Climate change</i> | <p>Introduce and define “climate change” as a fact. Request the opinion and observation on changes in agricultural practices and pattern from previous generations up to now.</p> <p>Discuss the concerns and issues encountered due to climate changes and willingness to undertake actions</p> <p>Climate change and variability are explained by farmers and other stakeholders and they are facts of the day. Extreme events (drought, heavy rain (usually accompanied by heavy hailstorm, frost) are occurring interchangeably.</p> <p>The introduction of irrigation through the construction of the Koga dam/reservoir now is considered a blessing by the farmers because they have got enough water for irrigation during dry season. In fact, at the time of dry year (e.g., as in the year 2015/2016), the reservoir failed to store enough water. Then many farmers were forced to stop practicing irrigation which results in a crop failure.</p> <p>Farmers are very willing to take actions that can help them adapt to climate change and variability such as using early maturing crops and varieties, changing the cropping calendar, introducing alternative water source such as rain water harvesting, better and efficient water utilization technologies, use of alternative water source to augment available water (ground water), efficient watershed management (protecting the water recharge area) to enhance infiltration of rain water; watering the plot during frost to reduce crop damage by frost; diversification of the income sources such as integrating the crop cultivation with diary and fattening from the grasses that can be collected from the farm (particularly under the fruit trees and around the borders of the farms and canals.</p> <p>Having good policy in irrigation management, greening the</p> | 2 |

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| | | recharge area (particularly deforested hill sides); are all important aspects that need to be considered. | |
| | <i>Future awareness</i> | <p>Discuss probable future scenarios (suggested by locals) in term of farming viability, resources availability and access and political/social/economic changes</p> <p>Farmers anticipate that the effects of climate change will get worse in the future, hence need to put in place mechanisms for mitigating and adapting to effects of climate change. Stakeholders also noted that there is going to be more reliance on irrigation as the primary source of water agricultural production activities in the near future. Other options mentioned above will also be used for climate change mitigation..</p> <p>Discuss willingness to undertake actions collectively/individually from now to prevent or mitigate those future risks</p> <p>Farmers, through their association/union are willing to take part in the scheme management initiatives to mitigate against the impacts of climate change.</p> | 1 |
| | <i>Sustainable dev.</i> | <p>Introduce and define sustainability in terms of agro-ecological understanding and its benefit for the future generation.</p> <p>Discuss the willingness and motivation to resources economic (saving) and management to preserve the resources for future generations</p> <p>All stakeholders are aware and willing to contribute to measures that promote sustainable use of natural resources (e.gs measures towards practicing sustainable land management, application of organic fertilizer, implementation of organic and/or conservation farming, implementation of appropriate land use policy, and creating sense of ownership of best practices.</p> | 0 |
| Economy | <i>Investment</i> | <p>Discuss the vocation of the land owned by local and contribution of agriculture to the locals and local economy and wellbeing, along with willingness to enhance it</p> <p>Issues on integration of livestock, apiculture, diary production and tree planting on the existing land is required. Hence investing on such activities as other Income Generating Activities was raised by the stakeholders.</p> | 0 |
| | <i>Substitution (Alternatives)</i> | <p>Discuss willingness to complement/replace land use economical outcome with other practice</p> <p>Agriculture remains the single most important economic activity on the land owned by the farmers. There are other potential IGAs that farmers are willing to venture into and diversify their incomes. These include: (i) tree planting; (ii) transport business; and (iii) real estate (constructions of houses for rental).</p> | -1 |
| | <i>Risk</i> | <p>Assess the relevance of farming for singular families and its contribution to year to year budgeting.</p> <p>Farming for singular families is very important and a major contributor for their household budgets. This is especially for</p> | -1 |

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| | | <p>the case of female headed households.</p> <p>Discuss the willingness, and interest, to invest in potential solution that have the promises to increase revenue (financial) at short or long term</p> <p>This is very limited with very few farmers willing to invest in alternative solutions with expectation of increasing their incomes in the long term. The key challenge here is lack of capital to invest and high or prohibitive interest rates, making it difficult for farmers to access credit for investment. For instance, one young farmer in digging ground well for his farm to increase amount of water for irrigation on his farm in a bid to expand his avocado plantation. However, he could not complete because he lacked funding for installing the solar pump.</p> | |
| | <i>Subsidies</i> | <p>Discuss the willingness to follow rules and management practices, be part of a cooperation in exchange of subsidies</p> <p>They are already organized in farmer's union. They have also benefited from some subsidies such as the cold storage facility as well as water for irrigation. So farmers are members of the cooperatives and every farmer practicing irrigation is a member of the cooperative. The 12 cooperatives have formed a union which plays a role of facilitating linkage to the market as well as procuring agricultural inputs.</p> | 1 |
| Organization | <i>Collaboration</i> | <p>If already part of a cooperation/group/organization:</p> <ul style="list-style-type: none"> • Discuss their feeling of belonging, security and benefit and their willingness to continue to be part of the aggregation <p>Members are happy to be part of the cooperative and the farmers' union. By being part of the cooperative association everyone is benefiting from use of free water for irrigation, the cold store for storing their Avocado fruit; and linkage to the market. Farmers aspire to further strengthen their cooperatives and union so that it can be strong in linking farmers to the market as well as access to improved agricultural inputs.</p> | 0 |
| | | <p>If already not part of a cooperation/group/organization:</p> <ul style="list-style-type: none"> • Discuss their willing to be part of one and their interest to do so | |
| | <i>Exchange</i> | <p>Discuss the benefit perceived from repeating actions/initiative from neighbouring farms and their willingness to learn and share experiences</p> <p>Some framers are innovative and hence the neighbours learn after seeing the benefits of the innovation from the neighbouring lead farmers. (e.g., the greenhouse for production of tomato during the main rainy months; compost application, introduction of new crop variety). Farmers are therefore ready to learn and share knowledge and information from innovative farmers. Farmers are also</p> | 1 |

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| | | willing to adopt new best practices. | |
| Policy | <i>Compliance</i> | Discuss the importance given to local regulation and their impact on their farming systems There are significant issues with respect to compliance of water distribution regulations. This has resulted into unequitable distribution of water between the upstream and downstream farms. Enforcement of the water bylaws to ensure equitable water distribution is critical. Other policy areas for consideration with respect to compliance include: Cluster farming, product quality maintenance, water scheduling, maintenance of the tertiary and quaternary canals, fair water distribution between and the head and tail farms; water use efficiency; which are governed collectively by the bylaws of the irrigation water users' cooperatives , | 2 |
| | <i>Change</i> | Discuss their willingness to change a fraction/part or totally the regulation system of their that manage their activities There is no existing policy that needs to be changed. The only problem is weak enforcement of the existing regulations. | -2 |
| | <i>Introduction</i> | Discuss their willingness to see new regulations to be introduced/facilitated There are a couple of policies, laws and regulations that stakeholders want to be introduced. These include: (i) Contract farming; (ii) | 2 |