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EUROPEAN UNION – JOINT RURAL DEVELOPMENT PROGRAMME (EU-JRDP)

Capitalization 3: Increasing Land and Water Productivity *Rehabilitation of Irrigation Infrastructure and Best Waste Management Practices*

Mario Margiotta (Team Leader - EU-JRDP), March 2021



The rehabilitation of the canals has directly benefited a total of 2,348 small farmers. 40 Water User Associations were organized to guarantee an equitable water distribution.



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Acronyms and Abbreviations

| | |
|-----------|--|
| AGS | Agristudio Consultancy firm |
| AICS | Italian Agency for Development Cooperation |
| ARC | Agricultural research Centre |
| CA | Command Areas (of the irrigation network) |
| CBOs | Community-Based Organizations |
| CCICREES | Climate Change Information Center & Renewable Energy & Expert Systems |
| CEDARE | Centre for Environment and Development for the Arab Region and Europe |
| EGP | Egyptian Pound |
| EIAS | Environmental Impact Assessment Study |
| ENPARD | European Neighbourhood Programme for Agriculture & Rural Development |
| ENPI | European Neighbourhood and Partnership Instrument |
| EU | European Union |
| EUD | European Union Delegation, Egypt |
| FiYIR | Fifth Year Implementation Report |
| GAP | Good Agricultural Practices |
| ICARDA | The International Center for Agricultural Research in the Dry Areas |
| ICPW | Irrigation Company for Public Works |
| IGA | Income Generating Activities |
| IPP | Integrated Production and Protection practices |
| EU-JRDP | EU-Joint Rural Development Programme |
| M | Million |
| M&E | Monitoring and Evaluation |
| MALR | Ministry of Agriculture and Land Reclamation |
| MFAIC | Italian Ministry of Foreign Affairs and International Cooperation |
| MoIC | Ministry of International Cooperation |
| MoLD | Ministry of Local Development |
| MTR | Mid-Term Review |
| MWRI | Ministry of Water Resources and Irrigation |
| NGO | Non-Government Organisation |
| NRM | Natural Resource Management |
| NWRC | National Water Research Center |
| PMU | Programme Management Unit |
| PRA | Participatory Rural Appraisal |
| PRAG | Practical Guide to contract procedures for European Union external actions |
| SAMSIMIFA | Sustainable Agricultural Mechanization System Improvement in Minya and Fa-youm |
| SEDNWCE | Social Economic Development of North West Coast of Egypt |
| SFA | Small Farmers' Association |

SFOs Small Farmer Organizations
SISAW Sustainable Investment in Solid and Agricultural Waste in Fayoum and Minya

ToR Terms of Reference
ToT Training of Trainers
TTC Toshka Trading and Contracting
WUAs Water Users Associations

Feddan 0.42 Ha
Meskas Tertiary canals
Marwas Irrigation canal at farmers' field level (furrows)
Tonnes Metric tons
t Tonnes
Fed Feddan

Executive summary

The European Union – Joint Rural Development Programme (EU-JRDP) is an “area-based” initiative taking place in three governorates, namely Matrouh, Minya and Fayoum and implemented by the Italian Ministry of Foreign Affairs and Cooperation and Development, through the Italian Embassy in Egypt with the technical assistance of the Italian Agency for Cooperation (AICS). The said action is funded by the European Union (€ 21.9 M) under the European Neighbourhood Programme for Agriculture and Rural Development (ENPARD) and co-funded in parallel by the AICS (€ 11.0 M) through: i) the “Sustainable Agricultural Mechanization System Improvement in Minya and Fayoum Governorates” (SAMSIMIFA) and ii) the “Social Economic Development of North West Coast of Egypt (SEDNWCE) in Matrouh. The main Egyptian Authorities are the MALR (Lead Ministry), the MWRI and MoLD. The Ministry of International Cooperation is the National Coordinator.

In connection with the capitalisation “*Increasing Land and Water Productivity - Rehabilitation of Irrigation Infrastructure and Best Waste Management Practices*”, EU-JRDP, during the period 2016-2020, i) awarded four contracts for works and supervision (total value € 6.50 M) to TTC (1), ICPW (1) and NWRC (1) for the rehabilitation of irrigation infrastructure, ii) provided one grant to ICARDA (EU contribution € 1.2 M) for irrigation management at farmers’ field level and iii) one grant to CEDARE (EU-contribution € 0.9 M) for irrigation waste management. All works were implemented in Minya and Fayoum.

The shortage of irrigation water, low efficiency and low quality and quantity of water, poor water management, insufficiency of modern irrigation technologies, inequitable water distribution among farmers and, pollution of water bodies due to agricultural and solid wastes are in fact the key challenges facing agricultural development in the old lands of Minya and Fayoum.

ICPW in Minya and TTC in Fayoum (under the supervision of NWRC) rehabilitated irrigation infrastructure at the level of the main canals (secondary canals) serving a total of 10,838 *feddans* (3,942 in Fayoum and 6,896 in Minya). In addition to the rehabilitation of the secondary canals, 3,554 *feddans* (out of the 10,838) serving 2,348 farmers benefitted also from the rehabilitation of *meskas* (tertiary canals) and part of these farmers (1,094) received support from ICARDA in terms of improved irrigation management practices at *marwas* level (irrigation canals at farmers’ field level) and rehabilitation of on-farm drains. ICARDA, together with EU-JRDP, provided technical training to 40 WUAs, CEDARE worked in irrigation waste management. A total of 5,053 people participated in awareness campaigns meetings on agricultural and solid waste management best practices.

To capitalise all interventions related with “*Increasing Land and Water Productivity - Rehabilitation of Irrigation Infrastructure and Best Waste Management Practices*”, implemented by TTC, ICWP, NWRC, CEDARE, ICARDA and EU-JRDP in Minya and Fayoum, the following two axes were identified:

- Axis 1: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions.
- Axis 2: solid waste practices – integrations with rehabilitation works of irrigation infrastructure.

The results of the study/conclusions are listed here below:

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

The works of rehabilitation of irrigation infrastructure promoted by EU-JRDP in Minya and Fayoum: i) increased the water flow, ii) reduced the pumping costs, iii) increased the water efficiency (+ 30%), iv) increased land value (+ 40%), v) improved the access to land plots (due to the increased quality and quantity of the service’s roads as effect of rehabilitation of the

canals). There is no degree of restriction on the use of water for irrigating any kind of crops. The use of local materials and the adoption of labour-intensive technologies during the rehabilitation works generated job opportunities within local rural communities. The rehabilitation of the main canals (especially those crossing the villages) with riprap (use of stones and cements) reduced the illegal discharge of human sewage into the canals and consequently the negative effect of pollution on water bodies.

All interviewed farmers confirmed in fact that i) the rehabilitation of the canals reduced the percentage of wasted water; ii) they have now appropriate water gates to ease the use of water for irrigation, iii) there are no more weeds along the canals and, iv) the water is distributed fairly among them. The farmers said also that the rehabilitation of the canals is increasing the land occupancy rate and improving the crop productivity as well as improving water quality, soil properties, crop quality and farmers' general health.

The creation of waters users' associations and the trainings that said associations are providing to their water users are changing small farmers' mind-sets based on inherited old practices and are facilitating the adoption of improved irrigation practices.

All that lead to an increase in income and marketing potential since the agricultural products are better managed now.

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure

In Minya and Fayoum, well-integrated waste management activities have i) reduced the negative effects of pollution on water bodies and generated job opportunities within local communities and ii) promoted hygiene practices and income opportunities to the benefit of women' groups. In the concerned villages, solid wastes were reduced by almost 60-70%. The centres for waste management and the start-ups are nowadays filling a void in the waste value chain, which will benefit the whole local community, in terms of income and environmental and health benefits.

The main recommendations per each axis of intervention are listed here below:

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

- To scale out the EU-JRDP participatory approach/empowering existing irrigation bodies and WUAs.
- To scale out the EU-JRDP approach of associating water's users since the design phase of the rehabilitation of irrigation infrastructures.
- To scale up the methodological approach based on the provision of legal instruments and legal competences of irrigation bodies and final beneficiaries.
- To promote the rehabilitation works envisaging i) the employment of local labour and the use local materials and equipment to generate job opportunities at local level.
- To reinforce the management capacity of WUAs to better maintain *meskas*.
- To maintain, at farmers' field level, both open and covered drains with low-cost machineries that need to be provided.
- To train WUA's water users to improving the distribution and regulation of water at the level of the entire length of *meskas*.
- To maintain and clean the rehabilitated canals at least once a year.
- To associate WUAs in the cleaning operation of the canals (cf. recommendations for axis 2).
- To reinforce the management capacity of WUAs to better deliver services to water users.

- To promote good governance principles among WUAs:
 - ✓ To make WUAs democratic through establishment of appropriate water management and governance structures.
 - ✓ To increase participation within the WUAs including assigning quotas for participation by women.
 - ✓ To promote good leadership to better promote WUA both internally (among members) and externally (relationships with third parties).
 - ✓ To better define policies and procedures governing the WUAs.

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure

- To scale out the EU-JRDP i) innovative participatory approach/empowering existing irrigation bodies and ii) integrated approach based on the rehabilitation of infrastructures and the promotion of waste management practices and income generation opportunities.
- To prioritize behaviour changes of the use of pesticides and chemical fertilizers that need to be replaced with composting (to be produced locally) and integrated pest management practices.
- To enhance working partnerships with local entrepreneurs and community associations and facilitate the development of new public policies and policy-related innovations.
- To promote better environmental hygiene practices in association with income generating opportunities.
- To increase involvement of women when promoting the use of wastes to be reused for agricultural production and income generation.
- To expand the start-ups and the construction of gasification and compost units in other areas.

Background information

The European Union – Joint Rural Development Programme (EU-JRDP) is an “area-based” initiative taking place in three governorates, namely Matrouh, Minya and Fayoum and implemented by the Italian Ministry of Foreign Affairs and Cooperation and Development, through the Italian Embassy in Egypt with the technical assistance of the Italian Agency for Cooperation (AICS). The said action is funded by the European Union (€ 21.9 M) under the European Neighbourhood Programme for Agriculture and Rural Development (ENPARD) and co-funded in parallel by the AICS (€ 11.0 M) through: i) the “Sustainable Agricultural Mechanization System Improvement in Minya and Fayoum Governorates” (SAMSIMIFA) and ii) the “Social Economic Development of North West Coast of Egypt (SEDNWCE) in Matrouh. The main Egyptian Authorities are the MALR (Lead Ministry), the MWRI and MoLD. The Ministry of International Cooperation is the National Coordinator.

In connection with the capitalisation “*Increasing Land and Water Productivity - Rehabilitation of Irrigation Infrastructure and Best Waste Management Practices*”, EU-JRDP, during the period 2016-2020, i) awarded four contracts for works and supervision (total value € 6.50 M) to TTC (1), ICPW (1) and NWRC (1) for the rehabilitation of irrigation infrastructure, ii) provided one grant to ICARDA (EU contribution € 1.2 M) for irrigation management at farmers’ field level and iii) one grant to CEDARE (EU-contribution € 0.9 M) for irrigation waste management (SISAW project). All works were implemented in Minya and Fayoum.

The shortage of irrigation water, low efficiency and low quality and quantity of water, poor water management, insufficiency of modern irrigation technologies, inequitable water distribution among farmers and, pollution of water bodies due to agricultural and solid wastes are in fact the key challenges facing agricultural development in the old lands¹ of Minya and Fayoum.

ICPW in Minya and TTC in Fayoum (under the supervision of NWRC) rehabilitated irrigation infrastructure at the level of the main canals (secondary canals) serving a total of 10,838 *feddans* (3,942 in Fayoum and 6,896 in Minya). In addition to the rehabilitation of the secondary canals, 3,554 *feddans* (out of the 10,838) serving 2,348 farmers benefitted also from the rehabilitation of *meskas* (tertiary canals) and part of these farmers (1,094) received support from ICARDA in terms of improved irrigation management practices at *marwas* level (irrigation canals at farmers’ field level) and rehabilitation of on-farm drains. ICARDA, together with EU-JRDP, provided technical training to 40 WUAs (22 in Fayoum and 18 in Minya) serving the totality of the farmers that benefitted from the rehabilitation of *meskas* (2,348 farmers). In connection with the rehabilitation of irrigation infrastructures, CEDARE worked in irrigation waste management. A total of 5,053 people participated in awareness campaigns meetings on agricultural and solid waste management best practices.

ICPW, TTC, NWRC and ICARDA operated in the same irrigation command areas of Minya and Fayoum. ICARDA worked in two locations inside the irrigation areas rehabilitated by TTC (Biahmou and Awlad Mohamad) and two locations in the irrigation areas rehabilitated by ICPW (Hafez El-Sharkia). CEDARE targeted eight villages inside the same command areas rehabilitated by TTC and ICPW (villages of Qal-amshah, Minshat Ramzy Abou Defeya and Hafez El-Sharkia in Fayoum and villages of Abou-Korkas El-Bald, Dani-Mohamed Sharawy, and Al-Hawasleia in Minya).

All above-mentioned initiatives contributed to improving the efficiency of irrigation systems and water management and to introduce best practices of waste management reducing pollution on the water bodies. In addition, CEDARE converted agricultural and solid wastes into income generating opportunities. 1,654 part time jobs for women were created for the collection and sorting of agricultural and household wastes.

¹ The old lands of Egypt are those located in the narrow green valley and the Nile Delta. The old lands are home to more than 90% of Egypt’s population. Land ownership is fragmented, with average land tenure around 1 feddan (0.42 hectare). Subsistence farming is practiced in most areas. The EU-JRDP was implemented in the old lands of Fayoum and Minya.

Scope and objectives of the study

The Operational Capitalization study is aiming at:

- Selecting best practices that proved to improve sustainability.
- Providing solutions for implementing similar projects in the future.
- Capitalizing experiences and knowledge for implementation of similar projects in the future.
- Addressing a list of lessons learned (positive and negative).
- Recommending actions to be undertaken in the future which will serve to improve the sustainability.

This Operational Capitalisation represents therefore a formalised way to document, analyse and archive, best practices, lessons learned and recommendations and to make use of them when drafting similar projects.

The final goal of this Operational Capitalisation study is therefore to improve future project sustainability at policy, regulatory, legislative, and environmental levels.

This Operational Capitalisation study shall be provided to competent governmental entities as well as to interested development partners.

Axes of intervention

To capitalise all interventions related with “*Increasing Land and Water Productivity - Rehabilitation of Irrigation Infrastructure and Best Waste Management Practices*”, implemented by TTC, ICWP, NWRC, CEDARE, ICARDA and EU-JRDP in Minya and Fayoum, the following two axes were identified:

- Axis 1: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions.
- Axis 2: solid waste practices – integrations with rehabilitation works of irrigation infrastructure.

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

Definitions

- Scale out and scale up: Scale out means “scaling horizontally” the results that proved to be successful to cover wider geographical areas for greater outreach at micro-level (e.g., gradual rollout of activities in similar areas). Scale up means “scaling vertically” the successful concepts to cover broader impact through improved institutionalization, legislation, policies, development plans, improving the business environment.
- Labour-intensive technologies: labour-intensive or employment intensive refers to works where labour is the dominant resource (ILO, 1998).
- Land productivity: it refers to a ratio of a volume measure of output (e.g., quantity of crops produced) to a volume measure of input use (e.g., land).
- Irrigation water productivity: defined as the yield produced per unit of irrigation water use. And is used for both agricultural production and water use efficiency. It is a comprehensive indicator for revealing the management level of both irrigation and crop.
- Agriculture water management technologies: technologies that include irrigation, soil, land, and ecosystem conservation practices, such as drainage and watershed management, fisheries management, technologies for lifting, storing, and conveying water.
- Good Agricultural Practices: GAPs are "practices that address environmental, economic and social sustainability for on- farm processes, and result in safe and quality food and non-food agricultural products" (FAO COAG 2003, GAP paper). The concept of GAPs may serve as a

reference tool for deciding, at each step of the value chain process, on practices that are environmentally sustainable and socially acceptable. When promoting/adopting GAPs, the capacities of rural associations, both farmers and non-farmers, should be reinforced.

- Old lands: The old lands of Egypt are those located in the narrow green valley and the Nile Delta. The old lands are home to more than 90% of Egypt's population. Land ownership is fragmented, with average land tenure around 1 *feddan* (0.42 hectare). Subsistence farming is practiced in most areas.
- Water Users Association (WUA) is a non-profit organization that is initiated and managed by the group of water users along one or more hydrological sub-systems canals regardless of the type of farms involved (IWMI).
- Meskas and marwas: the *meska* is a distributor irrigation canal (tertiary canal) serving a WUA while the *marwa* is an irrigation canal at farmers' field level (furrows). Whereas a *meska* serves an area of about 100 to 350 *feddans*, a *marwa* typically serves an area of 3 to 5 *feddans*. As *meskas* represent a higher level of irrigation channels than *marwas*, improvement of *marwas* should follow *meskas* improvement. Irrigation *meskas* require constant maintenance and cleaning to ensure both desired water quality and quantity are served to the land. Maintenance mainly consider the hydraulic area across the length, while cleaning consider any pollutants that affects the *meskas*' water or any unwanted weeds inside of it.
- Open drain maintenance: re-engineering a deficient open drain (on-farm drains) to return it to the original design. This is carried out to achieve the improvement of crop-water productivity at the farm level and avoid soil degradation.
- Rehabilitation of marwas: re-engineering a deficient *marwa* to return it to the original design to provide adequate and more efficient delivery of irrigation water to farmer fields.
- An agricultural road or farm track is a service road that serves predominantly agricultural or forestry purposes and has only local significance. Agricultural roads are typically unpaved roads or covered with gravel, but in some cases asphalt roads are agricultural roads.
- Weed removal from the irrigation canals. Irrigation canals require regular monitoring as they are often a source for new weed incursions. Weed seeds can enter farms from irrigation water and any new weeds emerging, need to be removed prior to seed set. Retaining irrigation water on farm can help to limit any potential spread.
- Land occupancy rate is the ratio of used land to the total amount of available land.

Implemented works

In connection with the first axis (*rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions*):

TTC and ICPW:

- Rehabilitated canals in the selected Command Areas (CAs) and Sub Command Areas (SAs) of Bahr Awlad Mohamed and Bahr Biahmu in Fayoum and Hafez Al Sharkia in Minya,
- Rehabilitated 18 traditional open *meskas* in two CAs and SAs, installing pumping station, improving of irrigation facilities in Fayoum,
- Replaced 17 traditional open *meskas* with pipeline *meskas*, construction of 5 elevated open *meskas*, installation of new pumping stations, rehabilitation of hydraulic regulators, improvement of irrigation facilities in Minya.

NWRC:

- Design and the supervision of the irrigation infrastructural works implemented by TTC and ICPW.

ICARDA:

- Maintained on-farm drains (11,000 meters of open drains in Fayoum). This activity was not required in Minya due to the absence of open field drains as the areas are covered by tile drainage.
- Rehabilitated 12,300 meters of *marwas*.

ICARDA and EU-JRDP:

- Formed and trained 40 WUAs² (22 Minya + 18 Fayoum). WUAs are playing an important role on water management and *meskas* cleaning.
- Improved the governance aspects of WUAs for better operation and maintenance of the *meskas* and pump stations, better water allocation along *meskas*, better equity of water distribution, better resolution of conflicts among users on water use.
- Assisted WUAs to open bank accounts.
- Prepared and distributed training manuals (online) and handbooks as tools to ensure sustainable technical, financial, institutional, environmental, and administrative management. The handbooks were conceived to help WUAs to i) find solutions for future irrigation problems in sustainable manner, ii) mobilise and manage financial resources, iii) have access to qualitative manpower through policy and processes to adhere with.

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure

Definitions:

- Solid and agricultural waste management: it refers to not only manage and reduce solid and agricultural waste, but also to initiatives that would generate income for more people as the sector of solid waste management will require more hands to work.
- Water Users Association (WUA) is a non-profit organization that is initiated and managed by the group of water users along one or more hydrological sub-systems canals regardless of the type of farms involved (IWMI).
- Gasification: The gasification is a process in which solid wastes are burned in the absence of oxygen and are converted into elemental state of matter (gas / liquid / solid) where the carbon atom covers the solid and turns into organic carbon. Then the hydrogen compound is left with carbon gas to be reconstituted to form Synthetic Gases (SYNGAS) that are after converted into electricity (GENSET process).
- Compost unit: the unit installed in Abu Qurqas (Minya) aiming at recycling the agricultural waste produced in the Minya governorate and eliminate the burning activities, reducing the open dumpsites and thus improve environmental and human health. The unit aims also at producing natural fertilizers rich with minerals and nutrients.
- Start-up: young enterprise or business promoted by one or more person to develop a unique product or service and bring it to market.
- Part time jobs: persons working 50 to 100 working days a year. The average daily wage for each working day ranged between 100 and 150 EGP.

Implemented works

In connection with the second axis (*agricultural and solid waste practices – integrations with rehabilitation works of irrigation infrastructure*):

² The WUAs were established by EU-JRDP following the infrastructure rehabilitation of several canals and *meskas* through the irrigation improvement component of the project. The WUAs play a significant role on water management at branch canal and *meskas* levels to ensure better water supply service, operation and maintenance of the *meskas* and pump stations, water allocation along *meskas* to maintain equity of water distribution, resolve the conflict among users on water use, and other services as deemed necessary.

CEDARE:

- Organised 317 awareness campaigns meetings, on agricultural waste management, public participation, challenges, and opportunities of a proper waste management system for a total of 5,053 people (2,207 males and 2,846 females), including school students.
- Removed more than 60 % of waste dumps in water canals and village streets. Vegetables were planted on top of the cleaned canal banks by local communities (with their own funds) as previously agreed with the local development unit in the concerned villages; people are now eager to take the visitor to the renewed sites.
- Created 1,654 part time jobs for women for the collection and sorting of agricultural and household wastes, and 12 full-time jobs for men as garbage collectors.
- Installed a gasification unit in Qalhan village (Fayoum) with a processing capacity of 2.5 tonnes/day.
- Installed a compost unit in Abu Qurqas (Minya) aiming at recycling the agricultural waste. The compost unit is expected to receive approximately 20,000 tonnes/year of agricultural waste from the three villages of the study.
- Created 30 start-ups the collection and processing of agricultural and non-agricultural residues, which provide an income to 17 men and 13 women.

Methodology of the study and data analyses

The Capitalization was carried out as follows:

- Annual reports and evaluation reports (EU-JRDP, ICARDA, CEDARE),
- Field visits made by the capitalization consultant (surveys of 119 beneficiaries to measure the impact of all implemented activities in the irrigation rehabilitated areas³).
- Analysis of the evaluation study of irrigation water quality and quantity in Minya and Fayoum⁴.
- Analysis of data collected from the AGS's surveys carried out in the two governorates (93 interviews in Minya and 114 for Fayoum)⁵.
- Analysis of results obtained from baseline, group discussions and surveys carried out by the grantees.
- Field assessments made by EU-JRDP staff in the two governorates.

³ Capitalization of environmental impact of the EU-JRDP's irrigation and waste management intervention. Mohamed Abdelhamid Eizeldin Elsayed, February 2021.

⁴ Evaluation study for irrigation water quality, quantity and pump stations in Fayoum and Minya. Mansour Yacoub. January 2021.

⁵ AGS developed a methodological approach for data collection based on the use of open-access tools and software such as: i) field forms/questionnaires: specific field forms and questionnaires have been developed, based on the identified indicators; five thematic field forms have been produced for the Governorate of Matrouh and three for Minya and 3 for Fayoum; ii) Geopaparazzi: this user-friendly, highly customisable app is the software where the field forms are uploaded. All answers are automatically saved and georeferenced, reducing the chances of mistakes; iii) QGIS: one of the most widely used GIS open-source software, QGIS allows to produce highly customised maps from a variety of datasets. In Matrouh, in total 480 respondents have been interviewed out of which 88 are directly related with this axis of intervention. 362 and 420 respondents have been selected respectively for the Governorates of Minya and Fayoum out of which 93 for Minya and 114 for Fayoum are directly related with this axis of intervention.

Results of the study/conclusions: driving forces for each axis of intervention

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

Results

Results of the interviews made by the capitalization consultant⁶

Did you benefit from EU-JRDP activities? If yes which agency? (119 interviews)

| Implementing agencies | Total interviews | Total replies | % |
|----------------------------|------------------|---------------|-----|
| EU-JRDP (Minya and Fayoum) | 119 | 119 | 100 |
| ICARDA (Minya and Fayoum) | 119 | 84 | 71 |
| TTC (Fayoum) | 119 | 45 | 38 |
| ICPW (Minya) | 119 | 39 | 33 |

Which kind of intervention you benefited most?) (119 interviews)

| Type of activities | Total interviews | Total replies | % |
|---|------------------|---------------|----|
| Rehabilitation of canals and <i>meskas</i> | 119 | 84 | 71 |
| Rehabilitation of <i>marwas</i> | 119 | 43 | 36 |
| Drainage network improvement (farmers' lands) | 119 | 28 | 24 |

What are the main benefits for canals and meskas rehabilitation? (84 interviews)

| Benefits | Number interviews | Number replies | % |
|--|-------------------|----------------|-----|
| Irrigation water control | 84 | 84 | 100 |
| Easy access of water to all parts of the field | 84 | 74 | 88 |
| Reducing labour | 84 | 71 | 84 |
| Reducing effort and increasing irrigation efficiency | 84 | 71 | 84 |

What is the best irrigation improvement intervention from EU-JRDP? (119 interviews)

| Type of intervention | Total interviews | Total replies | % |
|--|------------------|---------------|----|
| Rehabilitation of canals and <i>meskas</i> | 119 | 66 | 56 |
| <i>Marwas</i> rehabilitation | 119 | 7 | 6 |
| Open field drains maintenance | 119 | 2 | 2 |

⁶ Capitalization of environmental impact of the EU-JRDP's irrigation and waste management intervention. Mohamed Abdelhamid Eizeldin Elsayed, February 2021.

What are the main benefits from the rehabilitation of canals and meskas (Minya) (45 interviews)

| Impact | Total interviews | Total replies | % |
|--|------------------|---------------|----|
| Increase water quantity | 45 | 36 | 80 |
| Enhance water quality | 45 | 36 | 80 |
| Increase the cultivated area in the summer | 45 | 35 | 78 |
| Ease of using irrigation water through the gates on each <i>meskas</i> | 45 | 35 | 78 |
| Improve fair distribution of water | 45 | 35 | 78 |
| Provide new service roads on the side of each canal | 45 | 35 | 78 |
| Facilitate weeds disposal | 45 | 32 | 71 |
| Reduce irrigation costs per <i>feddan</i> | 45 | 32 | 71 |

What are the main benefits from the rehabilitation of canals and meskas (Fayoum) (39 interviews)

| Main benefits | Total interviews | Total replies | % |
|--|------------------|---------------|----|
| Increase the cultivated area in the summer | 39 | 37 | 95 |
| Promote fair distribution of water | 39 | 35 | 90 |
| Facilitate weeds disposal | 39 | 32 | 82 |
| Increase water quantity | 39 | 30 | 77 |
| Enhance water quality | 39 | 29 | 74 |
| Provide new service's roads on the side of each canal | 39 | 26 | 67 |
| Reduce irrigation costs per <i>feddan</i> | 39 | 22 | 56 |
| Better use of irrigation water through the gates on each <i>meskas</i> | 39 | 20 | 51 |

Is your farm more accessible because the service roads were improved? (84 interviews)

| Answers | Total interviews | Total replies | % |
|---------|------------------|---------------|-----|
| Yes | 84 | 84 | 100 |
| No | 84 | 0 | 0 |

Which are the main benefits you obtained from the improved service's roads (84 interviews)

| Types of benefits | Total interviews | Total replies | % |
|--|------------------|---------------|----|
| Ease of transporting crops after harvest | 84 | 82 | 98 |
| Improving access to agricultural equipment | 84 | 74 | 88 |
| Improving the marketing potential of agricultural products | 84 | 67 | 80 |

Presence of aquatic weeds in the irrigation canal? (84 interviews)

| Presence of weeds (%) | Before | | | | | After | | | | |
|-----------------------|-------------------------------|-------------------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|------------------------------|-------------------------------|
| | Over 100% of the canal length | Over 75 % of the canal length | Over 50% of the canal length | Over 25% of the canal length | No weeds (0% of canal length) | Over 100% of the canal length | Over 75 % of the canal length | Over 50% of the canal length | Over 25% of the canal length | No weeds (0% of canal length) |
| Total interviews | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| Total replies | 55 | 26 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 84 |
| % | 66 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |

What is the land occupancy rate in your farm in summer? (84 interviews)

| Land occupancy rate | Before | | | | After | | | |
|---------------------|-----------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|
| | 100 % of land is cultivated | 75 % of land is cultivated | 50 % of land is cultivated | 25 % of land is cultivated | 100 % of land is cultivated | 75 % of land is cultivated | 50 % of land is cultivated | 25 % of land is cultivated |
| Total questions | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| Total replies | 33 | 45 | 6 | 0 | 84 | 0 | 0 | 0 |
| % | 39 | 54 | 7 | 0.0 | 100 | 0 | 0 | 0 |

Are you satisfied with the irrigation rehabilitation works? If yes explain reasons? (84 interviews)

| Questions | Total interviews | Total yes | Total no | % |
|---|------------------|-----------|----------|-----|
| Are you satisfied with the rehabilitation of canals and <i>meskas</i> ? | 84 | 84 | 0 | 100 |
| If yes which is the main reasons of satisfaction? | | | | |
| • Saved the water and the quantity increased | 84 | 84 | N/A | 100 |
| • The land is completely cultivated | 84 | 84 | N/A | 100 |
| • The price per <i>feddan</i> of agricultural land increased | 84 | 84 | N/A | 100 |

Are you satisfied with the water distribution among the farmers? (average 84 interviews)

| Degree of satisfaction | Before | | | | After | | | |
|------------------------|--------|--------|--------|------|-------|--------|--------|------|
| | Full | Almost | Medium | Weak | Full | Almost | Medium | Weak |
| % | 0 | 16 | 84 | 0 | 100 | 0 | 0 | 0 |

Did you benefit from training provided by EU-JRDP? (119 interviews)

| Trainings WUAs | Total interviews | Total replies | % |
|----------------------------------|------------------|---------------|----|
| Training to the benefit of WUAs. | 119 | 44 | 37 |

Can you explain what was the main benefit of the training you received? (44 interviews)

| Main benefits | Total interviews | Total replies | % |
|---|------------------|---------------|----|
| Facilitate the establishment of a timetable for fair water distribution | 44 | 28 | 64 |
| Gain new experiences in managing the WUAs | 44 | 23 | 52 |

Can you list the positive and negative aspects of the training you received? (44 interviews)

| Positive and negative aspects of the training received | Total interviews | Total replies | % |
|---|------------------|---------------|-----|
| I learned better water management practices through supply service, operation, and maintenance of the <i>meskas</i> | 44 | 44 | 100 |
| I assisted the president of WUA to set up a plan of water distribution among the farmers | 44 | 44 | 100 |
| I am better equipped to solve conflicts among water users | 44 | 37 | 84 |
| The trainings were not useful | 44 | 0 | 0 |

Results of the calculations made by the capitalization consultant⁷

The consultant calculated that:

- The average increase of water quality (47.7%) was higher than the average increase in water quantity (42.3%) (cf. graph)
- The air is less polluted due to the reduced exhaust emissions from the diesel pumps. The number of farmers using movable pump decreased in fact from 89% (before the intervention) to zero (after the intervention).
- The costs of production for one *feddan* reduced of 43.6%. This was mainly due to the decreased pumping costs and the increased use of gravity irrigation (cf. table).

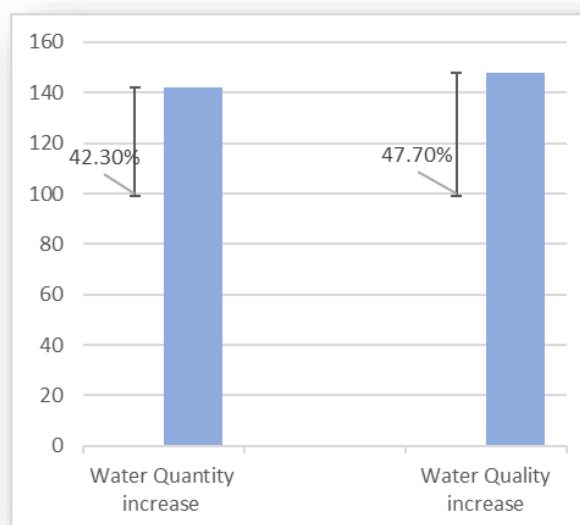


Table: costs reduction associated with irrigation methods (average 84 interviews)

| Irrigation Method | Before | | | After | | | | % of cost reduction |
|---------------------|---------|--------------|-------|---------|--------------|--------------|-------|-------------------------------------|
| | Gravity | Movable Pump | Total | Gravity | Movable Pump | Pump station | Total | |
| Out of 84 | 9 | 75 | 84 | 45 | 0 | 39 | 84 | Gravity - 40.6% Pumping - 14.1 % |
| % | 11 | 89 | 100 | 54 | 0 | 46 | 100 | |
| Cost/Fed/Year (EGP) | 756 | 1,871 | N/A | 449 | 0 | 1,608 | N/A | |

- The value of agricultural lands has increased of about 40% (from 675,000 EGP/*feddan* before the rehabilitation to 955,300 after the rehabilitation). This was mainly the consequence of i) the improvement of the quality of the service's roads that better facilitated the access to farming plots and, ii) the improved crop productivity/quality.
- The improvement of service's roads facilitated the access to farming plots with agricultural equipment (+88%).
- After the rehabilitation, the costs for removing the aquatic weeds from the irrigation canals were reduced by 90% (from 809 to 73 EGP per *feddan*).
- The costs for cleaning the *meskas* reduced also. Nowadays in fact is sufficient to clean the *meskas* once a year and not four times a year.
- The land occupancy rate for agricultural production during the summer increased from 39% (before rehabilitation) to 100% (after rehabilitation). The farmers therefore can grow more crops especially during the hot season with a consequent increase in income.

⁷ Capitalization of environmental impact of the EU-JRDP's irrigation and waste management intervention. Mohamed Abdelhamid Eizeldin Elsayed, February 2021.

Results of field assessments made by EU-JRDP staff:

In Minya and Fayoum:

- The use of local materials and the adoption of labour-intensive technologies during the rehabilitation works generated job opportunities within local rural communities.
- The rehabilitation of the main canals (especially those crossing the villages) with riprap (use of stones and cements) is reducing the illegal discharge of human sewage into the canals and consequently the negative effect of pollution on water bodies.

Results of interviews made during the AGS's surveys⁸.

In Fayoum (average of 114 interviews):

- The intensification rate of cultivated lands (farmed areas) increased by 31.25% during the summer and 10% during the winter.
- The water needs to reach farmers' plots decreased of about 60 % (-53 minutes for lands located at the beginning of the *meskas* to -83 minutes for the lands located at the end of the *meskas*).

In Minya (average 93 interviews)⁹:

- The time the water needs to reach the farmers' plots reduced of about 270% (reduction of 211 minutes for lands located at the beginning of the *meskas* to reduction of 298 minutes for the lands located at the end of the *meskas*).

Results of interviews made during the final evaluation of ICARDA beneficiaries¹⁰.

In Minya (average of 100 interviews) and Fayoum (average of 142 interviews):

- The *marwa* rehabilitation has contributed to reduce the time the water needs to reach the farmers' plots (average – 25%).
- The *marwa* rehabilitation and the on-farm drainage network improvement have contributed to increase water productivity (average + 44%).
- *The marwa* improvement helped to delineate land boundaries and resulted in less disputes about land ownership.
- Social disputes reduced drastically in relation with the uneven distribution of water.
- The environmental impact of the interventions was rated very positive for the following reasons: i) reduction of fertilizer use (-16%), ii) reduction of the use of movable diesel pumps (-25%), iii) reduction of nutrients reaching the drainage water,
- 80% of beneficiaries declared that they are nowadays committed to using the proposed new technologies in the future.

⁸ AGS developed a methodological approach for data collection based on the use of open-access tools and software such as: i) field forms/questionnaires: specific field forms and questionnaires have been developed, based on the identified indicators; five thematic field forms have been produced for the Governorate of Matrouh and three for Minya and 3 for Fayoum; ii) Geopaparazzi: this user-friendly, highly customisable app is the software where the field forms are uploaded. All answers are automatically saved and georeferenced, reducing the chances of mistakes; iii) QGIS: one of the most widely used GIS open-source software, QGIS allows to produce highly customised maps from a variety of datasets. In Matrouh, in total 480 respondents have been interviewed out of which 88 are directly related with this axis of intervention. 362 and 420 respondents have been selected respectively for the Governorates of Minya and Fayoum out of which 93 for Minya and 114 for Fayoum are directly related with this axis of intervention.

⁹ The intensification rate was not calculated because the interviews were carried out soon after the completion of the rehabilitation works and before the cultivation season.

¹⁰ Source: ICARDA Final evaluation. Ashraf Ghanem, October 2020.

Results of the analysis carried out during the evaluation study of the irrigation water quality and quantity¹¹

- The salinity, sodium, and chloride hazard values of the irrigation water in the canals in both Fayoum and Minya are below the limits indicated in the FAO guidelines¹².
- The quantity of water is sufficient to satisfy the water needs of concerned farmers. In fact:

In Bahr Awlad Mohamed (Fayoum):

- ✓ The discharge of water after rehabilitation increased to 1.252 m³/s.
- ✓ The water levels in the section (0 - 2,390 Km before the wire) increased.
- ✓ The flow in the canals increased at a rate of 10% to 15%.

In Hafez El Sharkia (Fayoum):

- ✓ The discharge of water after rehabilitation increased to 1.6 m³/s.

In Bahr Biahmou (Minya):

- ✓ The discharge of water after rehabilitation increased to 0.767 m³/s.
- ✓ The quantity of water entering the *meskas* is uniform and sufficient to satisfy farmers' needs.

- In Minya, the amount of water produced at the pumping station exceeds the amount of water demanded in all *meska*. The efficiency of the pumping stations is in fact very high (95%) and ranges from a minimum of 92.6% to a maximum of 95.8%.

Conclusions

The works of rehabilitation of irrigation infrastructure promoted by EU-JRDP in Minya and Fayoum: i) increased the water flow, ii) reduced the pumping costs, iii) increased the water efficiency (+ 30%), iv) increased land value (+ 40%), v) improved the access to land plots (due to the increased quality and quantity of the service's roads as effect of rehabilitation of the canals). There is no degree of restriction on the use of water for irrigating any kind of crops. The use of local materials and the adoption of labour-intensive technologies during the rehabilitation works generated job opportunities within local rural communities. The rehabilitation of the main canals (especially those crossing the villages) with riprap (use of stones and cements) reduced the illegal discharge of human sewage into the canals and consequently the negative effect of pollution on water bodies.

All interviewed farmers confirmed in fact that i) the rehabilitation of the canals reduced the percentage of wasted water; ii) they have now appropriate water gates to ease the use of water for irrigation, iii) there are no more weeds along the canals and, iv) the water is distributed fairly among them. The farmers said also that the rehabilitation of the canals is increasing the land occupancy rate and improving the crop productivity as well as improving water quality, soil properties, crop quality and farmers' general health.

The creation of waters users' associations and the trainings that said associations are providing to their water users are changing small farmers' mind-sets based on inherited old practices and are facilitating the adoption of improved irrigation practices.

All that lead to an increase in income and marketing potential since the agricultural products are better managed now.

¹¹ Evaluation study for irrigation water quality, quantity and pump stations in Fayoum and Minya. Mansour Yacoub. January 2021.

¹² <http://www.fao.org/3/T0234E/T0234E00.htm>

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure

Results

Results from the interviews carried out by the capitalization consultant¹³

Which kind of support in waste management did you receive from CEDARE (average of 119 interviews)

| Type of support | Total interviews | Total Replies | % |
|---|------------------|---------------|-----|
| Women's awareness campaigns in waste management | 67 | 67 | 100 |
| Cleaning of canals and of villages | 119 | 67 | 56 |
| Sustainable solid waste management technologies | 119 | 67 | 56 |
| Promotion of IGA and entrepreneurship in waste management | 119 | 51 | 43 |
| Creation of start-ups | 67 | 11 | 16 |

Are you satisfied with the support provided by CEDARE? (average of 67 interviews)

- All interviewees are satisfied for the following reasons: i) the support helped to manage waste in villages, ii) the support facilitated the creation of new job opportunities, iii) the villages are cleaner with a healthy environment.

What was the main impact of cleaning the canal? (average of 67 interviews)

- 71% said the canals and drains are cleaner.
- 70% said the waste disposal is better managed.
- 70 % said the overall pollution in the village decreased.
- 58% said the overall wellbeing is enhanced.

What was the main effects (positive and negative) of the proposed solid waste management practices? (average of 67 interviews)

- 95% said that the garbage is better managed at village level.
- 70% said that this was an opportunity to create jobs at local level.
- 19% said that the awareness at farmers' level was not sufficiently addressed.
- 6% said that the trainings provided in equipment's maintenance (start-ups) was not sufficient.

Which kind of sustainable waste management technologies you benefitted? (average of 67 interviews)

| Types of waste management technologies | Total interviews | Total Replies | % |
|--|------------------|---------------|----|
| Gasification units (Fayoum) | 67 | 42 | 63 |
| No benefits (average Minya and Fayoum) | 67 | 18 | 27 |
| Compost units (Minya) | 67 | 7 | 10 |

¹³ Capitalization of environmental impact of the EU-JRDP's irrigation and waste management intervention. Mohamed Abdelhamid Eizeldin Elsayed, February 2021.

Which kind of start-ups for waste management you benefitted? (average of 11 interviews)

| Types of start-ups projects | Total interviews | Total Replies | % |
|-----------------------------|------------------|---------------|----|
| Waste managing tricycles | 11 | 5 | 46 |
| Animal food crusher | 11 | 3 | 27 |
| Plastic crusher | 11 | 3 | 27 |

Results from the interviews carried out during the mid-term review of the CEDARE action¹⁴

- The innovative participatory approach adopted by the Contracting Authority throughout the whole sequence of project steps – from awareness raising campaigns to management organization and institutions building – has proved to be effective. Certainly, it has cost a huge work at root-based level, but the result is there, in terms of sustainable territorial governance. In Fayoum for instance, this is already acknowledged on site and surrounding medias as “the Fayoum model”.
- The SISAW message has been well received: village people and simple households have learnt how the promotion of better environmental hygiene practices can be associated to income generating opportunities.
- A further element for reconsidering the SISAW project dimension for its potentialities of replication and expansion derives from the demonstrative actions being made by women’s communities addressing villages located outside their target area.

Results obtained by CEDARE

- Garbage pollution has been largely removed in seven villages: 5,053 people (2,207 males and 2,846 females), including school students, participated in 317 awareness campaigns meetings.
- More than 60 percent of waste dumps in water canals and village streets were removed. Vegetables were planted on top of the cleaned channel banks and people are now eager to take the visitor to the renewed sites. The cleaning was carried out in a few weeks’ time.
- The centres for waste management and the start-ups are now producing several products (e.g., collected, sorted and washed waste, collected agricultural waste, recycled materials and compost). *“Some of these products have a local market, but certainly not all the quantities. Thus, this activity aims at introducing and marketing different Minya and Fayoum products generated from the waste management cycle and infrastructure, especially waste cubes, easy to stock and transport, that have to be inserted in special products cycle, e.g. Refuse Derived Fuel (RDF) or cement production. The compost unit will transform agricultural waste into soil fertilizers and compost needed for agricultural use¹⁵.”*

Conclusions

In Minya and Fayoum, well-integrated waste management activities have i) reduced the negative effects of pollution on water bodies and generated job opportunities within local communities and ii) promoted hygiene practices and income opportunities to the benefit of women’ groups. In the concerned villages, solid wastes were reduced by almost 60-70%. The centres for waste management and the start-ups are nowadays filling a void in the waste value chain, which will benefit the whole local community, in terms of income and environmental and health benefits.

¹⁴ Mid-term review of SISAW project. Plinio Corrado, August 2019.

¹⁵ Source: Report on “Organization of a Public Event Promoting Innovative Solid Waste Process Outputs Marketing Targeting Private Actors in Minya and Fayoum”. CEDARE Final report. March 2020

The main driving forces per each intervention axis

The main driving forces for each axis of intervention (cf. also table 1 in the following page), are summarised here below:

- First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions
 - ✓ Increase water quantity and quality.
 - ✓ Increase land occupancy rate especially during the summer.
 - ✓ Restore the use of gravity irrigation and eliminate the use of the diesel pumps.
 - ✓ Add value to products and lands.
 - ✓ Reduce pollution.
 - ✓ Create job at local level.

Promoting the establishment of WUAs and building their capacities (including preparation of manuals and institutional building) created ownership of enhanced infrastructure.

- Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure.
 - ✓ Opportunity of generating income through waste management.
 - ✓ Safe disposal of waste and better waste management practices.

Table 1: Driving forces per each intervention axis

| Sector | First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions | Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure. |
|----------------------|--|--|
| Agricultural impact | <p>Documented impact on the increase of water quality and quantity, on the reduction of water losses and on the control of weed growth.</p> <p>Documented impact on the increase of land occupancy rate especially during the summer.</p> | <p>Documented impact on safe disposal of agricultural waste, on improving the properties of the agricultural soils and the environment.</p> |
| Economic Impact | <p>Constructing bridges crossing the canals and increasing the width of service's roads have improved the value of agricultural lands.</p> <p>Using local work supervision with additional responsibilities in relation to permits and authorizations has facilitated the finalization of implemented infrastructures.</p> <p>The use of local materials and the adoption of labour-intensive technologies during the rehabilitation works generated job opportunities within local rural communities.</p> | <p>Establishing start-ups of waste management had a significant impact in creating job opportunities for youth.</p> |
| Social Impact | <p>The impact on improving equitable water distribution and equitable regulation of water has reduced conflicts among farmers.</p> <p>The participatory methodology created good cooperation and effective participation of farmers and local authorities.</p> | <p>The adoption of a participatory methodology between farmers at the community level and local authorities was the biggest guarantee for sustainable waste management at the village level.</p> |
| Environmental Impact | <p>The reduction of weed growth created a clean and low-polluted environment conducive to improving the general health at local communities' level.</p> <p>The rehabilitation of the main canals (especially those crossing the villages) with riprap (use of stones and cements) reduced the illegal discharge of human sewage into the canals and consequently the negative effect of pollution on water bodies.</p> | <p>Waste management interventions had a positive effect towards safely disposing of garbage inside the villages and preserving the rehabilitated water canals from deterioration, which was reflected in the improvement of the working environment of the farmers and the preservation of their health.</p> |

Lessons learnt (positives and negatives) per axis

Capitalization of lessons learned (positives and negatives) are important to amend legislations and regulatory framework and improve sustainability at policy, regulatory, legislative, and environmental levels.

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

Positive lessons learnt (positive issues coming up):

- If irrigation authorities and beneficiaries during the work project cycle are not equipped with specific legal competences, there may arise conflicts during implementation.
- Involving farmers since the design phase represent an opportunity for residents to get rid of most pollution factors and facilitate the emergence of clean and healthy environment.
- Building bridges and enlarging service's roads along the canals increased the marketing opportunities for agricultural products, the value of agricultural lands, and reduced the crops' operating costs.
- If irrigation bodies are empowered with specific legal competences, the acceptance of implemented infrastructures by the final beneficiaries is facilitated.
- When water users' associations are created and are well trained, i) the engagement of farmers in the maintenance of the *meskas* will increase, ii) the distribution of water will be more equitable among water's users and, iii) the farmers' willingness to pay water fees will improve.
- If the good governance of WUAs is assured, the sustainability and ownership will increase.
- If water distribution is fair conflicts among water's users reduces.

Negative lessons learnt (what did not go as expected):

- If all *meskas* from the same canal are not rehabilitated, the efficiency of the irrigation will be reduced.
- If farmers along the rehabilitated canals are not all trained, the efficiency of the irrigation system will be reduced.

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure.

Positive lessons learnt (positive issues coming up):

- The adoption of the participatory approach among farmers and local authorities is a guarantee for sustainable waste management.
- Raising women's awareness on solid waste management and sorting it from homes is important to guarantee a positive impact on waste disposal.
- The adoption of Public-Private-Partnership facilitates behavioural changes and contributes to the development of new public policies and policy- related innovations.
- Establishing start-ups and constructing gasification and compost units leads to improving the environment and to creating permanent job opportunities at local level especially among young people.
- Awareness workshops for farmers and rural women concerning the applications of solid waste management best practices, led to the safe disposal of waste within villages.

Negative lessons learnt (what did not go as expected):

- The limited budget for implementing start-ups and related trainings on maintenance of the equipment provided to the start-ups may create sustainability issues in the future.

Recommendations for scaling up

First axis: rehabilitation of irrigation infrastructure - labour-intensive technologies and design and supervision from national institutions

Specific recommendations:

- To scale out the EU-JRDP participatory approach/empowering existing irrigation bodies and WUAs.
- To scale out the EU-JRDP approach of associating water's users since the design phase of the rehabilitation of irrigation infrastructures.
- To scale up the methodological approach based on the provision of legal instruments and legal competences of irrigation bodies and final beneficiaries.
- To promote the rehabilitation works envisaging i) the employment of local labour and the use local materials and equipment to generate job opportunities at local level.
- To reinforce the management capacity of WUAs to better maintain *meskas*.
- To maintain, at farmers' field level, both open and covered drains with low-cost machineries that need to be provided.
- To train WUA's water users to improving the distribution and regulation of water at the level of the entire length of *meskas*.
- To maintain and clean the rehabilitated canals at least once a year.
- To associate WUAs in the cleaning operation of the canals (cf. recommendations for axis 2).
- To reinforce the management capacity of WUAs to better deliver services to water users.
- To promote good governance principles among WUAs:
 - ✓ To make WUAs democratic through establishment of appropriate water management and governance structures.
 - ✓ To increase participation within the WUAs including assigning quotas for participation by women.
 - ✓ To promote good leadership to better promote WUA both internally (among members) and externally (relationships with third parties).
 - ✓ To better define policies and procedures governing the WUAs.

Second axis: solid waste practices – integrations with rehabilitation works of irrigation infrastructure

Specific recommendations:

- To scale out the EU-JRDP i) innovative participatory approach/empowering existing irrigation bodies and ii) integrated approach based on the rehabilitation of infrastructures and the promotion of waste management practices and income generation opportunities.
- To diversify the role of WUAs by increasing their involvement in i) canals and *meskas* maintenance, ii) management of equipment and machinery for irrigation, iii) management and maintenance of machinery for agricultural use. To be noted that the "traditional" method to remove garbage and other wastes from canals and *meskas* is by using excavators, which caused the enlargement of the canals and the consequent decrease in water level. Following the rehabilitation of canals and *meskas*, this method cannot be used anymore, and smaller, specialized machinery need to be used to avoid damaging the riprap of the canals. By purchasing such machinery, the WUA would be able to participate in the tenders regularly launched by the

Ministry of Agriculture/Irrigation. This will produce additional income for the WUA and its members and will improve sustainability.

- To prioritize behaviour changes of the use of pesticides and chemical fertilizers that need to be replaced with composting (to be produced locally) and integrated pest management practices.
- To enhance working partnerships with local entrepreneurs and community associations and to facilitate the development of new public policies and policy-relevant innovations.
- To promote better environmental hygiene practices in association with income generating opportunities.
- To increase involvement of women when promoting the use of wastes to be reused for agricultural production and income generation.
- To expand the start-ups and the construction of gasification and compost units in other areas.

