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ENPI CBCMED
CROSS-BORDER COOPERATION IN THE MEDITERRANEAN

REGIONE AUTONOMA DELLA SARDEGNA

Final Project Evaluation Report of ENSIAP "Improving the Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan"

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Abstract

The project "Improving of Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan" (ENSIAP) has been funded under the framework of the Cross Border Cooperation Programme in the Mediterranean Basin (CBC Med).

The period of activity of the ENSIAP project was (42 month), from December 2011 to May 2015. The project, coordinated by the Institute for University Cooperation (Italy, Lazio) include three partners: (ì) National Centre for Agricultural Research and Extension - NCARE (Jordan, Al-Balqa) (ìì) Centre for Renewable Energy Sources and Saving - CRES (Greece, Attiki) and (ìì) Lebanese Ministry of Agriculture (Lebanon).

The project contributes to the promotion of environmental sustainability at the Mediterranean Basin level. The specific objectives and the related project activities have been developed along three main intervention axes to: (ì) reduce the environmental risk factors related to irrigated agriculture and introduction of photovoltaic (PV) water-pumping and PV energy generation at pilot-farm level aims at substitution of inefficient on-farm and fuel-based energy generation; (ìì) enhance capacities with regard to use of environmental friendly production methods and utilization of renewable energies in irrigated agriculture on regional, institutional and civil society levels; (ìì) enhance public awareness and civil society participation in issues related to agricultural production, use of RES, and environmental sustainability. In addition the project includes a communication and visibility strategy to enhance project sustainability (internet, mass-media, dissemination materials, field days).

The evaluation was planned and conducted in order to provide for ICU (Institute for University Cooperation) and the donor enough information to make an informed judgment on the true significance of the project and the achievement of its objectives and expected results in terms of appropriateness, efficiency, effectiveness, impact and sustainability. The trend analysis with evaluation questions have been used to define the results and impact of the project activities carried out during the project period with a quali-quantitative survey instead of a more quantitative survey, due to little amount of data collected during the implementation of the project. Particular attention has been paid to the involvement of the beneficiaries and stakeholders in the project activities and the entire sustainability of the project. Furthermore, the evaluation suggests key lessons and practical recommendations for future activities.

PROJECT DATA

Type of report	External Evaluation
Evaluation	Final
Type of contract	National
Contracting/Authority Agency	Sardinia Region
Grant Contract ID Number	45/2897 of 17.11.2011
Donor	ENPI CBC Med European Union
Project Title	Improving the Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan (ENSIAP)
Geographical area	Lebanon and Jordan
Responsible for the Contractor	Andrea Vigevani
Project Coordinator	**ICU** - Institute for University Cooperation (Italy)
Project partners	**NCARE** – National Centre for Agricultural Research and Extension (Jordan) **CRES** – Centre for Renewable Energy Sources and Saving (Greece) **MoA** – Lebanese Ministry of Agriculture (Lebanon)
M & E consultant	Maria Valentina Lasorella
Data Final Evaluation	4-16 October 2015

FINAL PROJECT APPRECIATION

The table below summarize, through the use of a score (from 1 to 4), the final appreciation earned by the evaluator for each criterion analysed during the final evaluation of ENSIAP project.

Criterion	**Score**
Appropriateness	4
Efficiency	3
Effectiveness	4
Impact	3
Sustainability	3

1=poor; 2=sufficient; 3= good; 4=excellent

LIST OF ACRONYMS

CRES	Centre for Renewable Energy Sources and Saving
du	Durum
EA	Extension Agent
EC	European Commission
ENPI-CBCMED	European Neighbourhood and Partnership Instrument – Cross-Border Cooperation in the Mediterranean
ENSIAP	Improving the environmental sustainability of irrigated agricultural production in Lebanon and Jordan
FAO	Food and Agriculture Organization of the United Nations
FC	Farmers' Cooperatives
GDP	Gross Domestic Product
ha	Hectare
ICPM	Integrated Crop Protection Management
ICU	Institute for University Cooperation
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
JMA	Joint Managing Authority
JUST	Jordanian University for Science and Technology (Jordan)
JVA	Jordan Valley Authority (Jordan)
KAC	King Abdullah Channel
KWh	Kilo-watt-hour
LARI	Lebanese Agricultural Research Institute (Lebanon)
LF	Logical Framework
LRA	Litani River Authority (Lebanon)
LT	Laboratory Technician
LU	Lebanese University
m^3	Cubic-metre
MC	Management Committee
MENA	Middle East North Africa
MEW	Ministry of Energy and Water
mm	Millimetre
MoA	Ministry of Agriculture
MS	Managerial Staff
NC	National Coordinator
NCARE	National Centre for Agricultural Research and Extension (Jordan)
NGO	Non-Governmental Organization
PA	Project Administrator and Financial Manager
PV	Photovoltaic
RES	Renewable Energy Sources
SC	Steering Committee
SPM	Senior Project Manager
TC	Technical Committee
UN	United Nations
USAID	United States Agency for International Development
USJ	Saint Joseph University (Lebanon)
V	Volt
WUA	Water Users Association

CHAPTER 1 - EVALUATION METHODOLOGY

This is the evaluation of ENSIAP project which has the aims to improve the Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan. The project is financed by the EU 2007-2013 ENPI CBC Mediterranean Sea Basin Programme which is a Cross-Border Cooperation initiative funded by the European Neighbourhood and Partnership Instrument (ENPI). The Programme objective is to promote the sustainable and cooperation process at the Mediterranean Basin level by dealing with the common challenges and enhancing its endogenous potential. It finances cooperation projects as a contribution to the economic, social, environmental and cultural development of the Mediterranean region. The coverage of this evaluation is the period of activity of the ENSIAP project (42 month), from December 2011 to May 2015.
The evaluation was planned and conducted in order to provide ICU (Institute for University Cooperation) and the donor with enough information to make an informed judgment on the true significance of the project and the achievement of its objectives and expected results in terms of appropriateness, efficiency, effectiveness, impact and sustainability. The evaluation provides an assessment of the achievements, performance, and impact of ENSIAP project. The sustainability of project's actions has been evaluated according to the field situation, the prospective planning and the institutional capabilities. Particular attention has been paid to direct consultation and the total involvement of the beneficiaries and stakeholders in the area, aiming also to identify the risks that could affect the sustainability of the project. Furthermore, the evaluation also intended to provide key lessons and practical recommendations for future actions.

Evaluation parameters

The evaluation has been carried out taking into account different aspects such as: time and human resources, activities, duration and budget. Considering the features of the ENSIAP and the objectives of the call for proposal the evaluation could appropriately be carried out according to the above specifications.

Preliminary documents and data review

The objective of this evaluation phase was to collect all relevant document and data to facilitate the following steps and create a shared knowledge framework. All relevant documents have been thoroughly examined. On one side the Logical Framework (LF) and the project proposal represent the baseline/expected results, on the other side mid-term monitoring and evaluation reports, financial reports, accounting documents, donor's official letters show the real project execution status during the implementation period.

Project staff meeting and discussion

The local staffs know intimately the daily life of project beneficiaries, and their unofficial problems with project actions. In the full respect of people privacy and without any other aim but pointing out risks of project failures, general staff meeting and individual speeches, especially with those employees dealing with farmers (local technicians, farmers trainers, etc.) have been carried out in order to understand major difficulties faced during the implementation phase, and the staff vision of the feeling, expectation and doubts of beneficiaries communities as well as no benefiting people living in the area.
Considering these aspects, in accordance with project local staff I have decided to meet and interviews the following target groups and beneficiaries of the project:

<u>Project partners</u>

- Local project staff of the Institute of Institute for University Cooperation (ICU);
- National Centre for Agricultural Research and Extension in Jordan (NCARE);
- Lebanese Ministry of Agriculture (MoA);
- The national Greek organisation for applied research CRES "Centre for Renewable Energy Sources and Saving".

<u>Project beneficiaries</u>

- Farmers selected for the implementation of the pilot projects in the Bekaa and the Jordan Valley (direct beneficiaries);

- All potential farmers which have access to information and support in adoption of new technologies in irrigated agriculture in the target regions (Bekaa in Lebanon, Jordan Valley in Jordan) (indirect beneficiaries);
- The human resources employed in management and Extension agent of the local partners MoA and NCARE.

Others project stakeholders

- Lebanese Agricultural Research Institute (LARI);
- Representativeness of local management committees leading with the agricultural/energy related interventions.
- Providers of irrigation equipment.

Definition of Methodology

The methodology selected for the ENSIAP evaluation is based on a integration between group assessments called MAPP - Method for Impact Assessment for Poverty reduction Project combined with Evaluation questions that have been formulated in reference to five evaluation criteria (appropriateness, efficiency, effectiveness, impact and sustainability) in accordance to the principles of Cross-border cooperation (CBC) initiative funded by the European Neighbourhood and Partnership Instrument (ENPI). The integration between these two methods has been chosen to have the possibility to integrate quantitative and qualitative information.

The MAPP methodology, which is concentrate on poverty reduction resolution, is not completely indicate for the objectives of ENSIAP Project for this reason it was necessary the integration with evaluation questions. The method selected is based on a dualistic approach, on one site the MAPP theorises the poverty reduction and social development as raising of the standard of living, facilitating access to resources, expansion of knowledge, and exercise of rights. On the other side the analysis at social, economic and environmental (sustainability criteria) level can only be described on the basis of a number of criteria which are of changing importance for the quality of life, depending of which factor happens to be at the minimum level.

Due to limited quantitative data collected during the project implementation period the assessment design has been based on before/after comparisons of the activities developed

in the project and the actual life circumstances of people in the project region as gathered from group discussions. The design takes into account the dynamics of economic, environmental and social development through the evaluation of each year of the project cycle. The objective of the analysis was to emphasize target groups' opinion at *farm, institutional and civil society level*, about project activities, their relevance to their life, their effectiveness in solving daily problems and the extent of their participation to design and decisional realisation of the project. The correlations between project activities and impacts are evaluated through a Trend analysis.

Trend Analysis

The preliminary issue is the selection of key impact indicator to be measured. The indicators cover all the different aspects of beneficiaries' life and they present the different points of view through which we analysed the impact of project activities. Trend matrix and influence matrix have been used whereas list of activities assess different aspects of each activity.

The trend matrix shows how beneficiary's life changed within the project implementation period: a five-point assessment scale is set up ranging from very negative to very positive. If the assessment changes from one year to the next, the reasons for the change are discussed and recorded.

Table 1. Matrix used for the evaluation

Indicators[1]	**2011**	**2012**	**2013**	**2014**	**2015**
Standard of living					
Family income	1-5	1-5	1-5	1-5	1-5
Family health	1-5	1-5	1-5	1-5	1-5
Agricultural management					
Agricultural yields	1-5	1-5	1-5	1-5	1-5
Land management (decrease soil erosion),	1-5	1-5	1-5	1-5	1-5
Soil and groundwater pollution (nutrient leaching),	1-5	1-5	1-5	1-5	1-5
Fertirrigation - NUE	1-5	1-5	1-5	1-5	1-5
Reduce agricultural inputs	1-5	1-5	1-5	1-5	1-5
Access to water					
Temporal access (people)	1-5	1-5	1-5	1-5	1-5
Temporal access (crop production)	1-5	1-5	1-5	1-5	1-5
Increase the WUE	1-5	1-5	1-5	1-5	1-5

Water saving in agriculture practices	1-5	1-5	1-5	1-5	1-5
Energy access	1-5	1-5	1-5	1-5	1-5
Electric power availability in anytime	1-5	1-5	1-5	1-5	1-5
Access to electric power for irrigation in agriculture	1-5	1-5	1-5	1-5	1-5
Other basic services					
Additional Electric power for family uses	1-5	1-5	1-5	1-5	1-5
Cost in daily life	1-5	1-5	1-5	1-5	1-5
Knowledge					
Knowledge about Best Agricultural Practices (BAP)	1-5	1-5	1-5	1-5	1-5
Knowledge about sustainable agriculture	1-5	1-5	1-5	1-5	1-5
Knowledge about PV systems and RES	1-5	1-5	1-5	1-5	1-5

1. Indicators have been selected base on project target indicators

With the aid of this instrument a full picture has been created on the assessment changes from the beginning to the end of the project. This instrument constitutes an important component for drawing up the effects of project implementation.

With this analysis is possible to register for each year if the relevance of the activity to project beneficiaries was great or minimal and even if there was negative impact. The trend analysis was used as first mean to introduce the evaluator the communities and it was filled on the basis of the opinion of the whole project beneficiaries, represented by farmers, technical staff, extension agent, project partners (at farm and institutional level).

The mean data coming out from the trend analysis coupled with the table of activities gives a picture of the activities implementation and the effect of these on the life of beneficiaries for the final influence matrix.

Influence matrix of activities

Impact can be determined by means of a matrix in which, again, an eight-point scale (from -4 to + 4) is used to assess the degree of impact of each project activity according to each indicator.

Table 2. Influence matrix used for the evaluation

Indicator[1]	Modern Drip irrigation system	Installation PV system	Capacity building	Training for farmers /EA	Training on BAP	Training on RES and PV system	Agricultural training programme
Standard of living							
Family income	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4

Family health	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Agricultural management							
Agricultural yields	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Land management (decrease soil erosion),	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Soil and groundwater pollution (nutrient leaching),	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Fertirrigation - NUE	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Reduce agricultural inputs	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Access to water							
Temporal access (people)	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Temporal access (crop production)	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Increase the WUE	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Water saving in agriculture practices	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Energy access							
Electric power availability in anytime	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Access to electric power for irrigation in agriculture	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Other basic services							
Additional Electric power for family uses	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Cost in daily life	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Knowledge							
Knowledge about Best Agricultural Practices (BAP)	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Knowledge about sustainable agriculture	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4	-4 ÷ 4
Key: 0= no impact,1= little impact, 2= some impact, 3= great impact, 4=very great impact; - = negative							

1.Indicators have been selected base on project target indicators

The influence matrix goal is to quantify the effectiveness of the implemented activity on the basis of different indicators considered crucial to target groups. The figures obtained will indicate the net impact of activities as perceived by the target groups. High horizontal-line totals (passive totals) indicate that were influenced by a large number of project measures; low horizontal-line totals were influenced by few project measures.

The totals of the columns or vertical lines (active totals) indicate which activity affects the most criteria and/or which activity has little or no impact. By this matrix is also possible to single out the negative impact of some activities in specific sector for the life.

This information is quite difficult to be assessed with direct interview cause is common an adulating behaviour of beneficiaries groups towards project partners that makes difficult to obtain objective data: disaggregating the question as it happens following the matrix cells, is possible to achieve answers and opinion less filtrated by intention of local communities. As for list of activity, the influence matrix (Chapter 3) has been compiled by the beneficiaries' interviews (see target groups).

CHAPTER 2 –RESULTS OF THE EVALUATION

Project title - Improving the Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan.

Location(s) of the project - Lebanon and Jordan

Donor - EU 2007-2013 ENPI CBC Mediterranean Sea Basin Programme

Total duration of the project - 42 months

2.1 Regional Context

ENSIAP project "Improving of Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan" aims at promoting environmental sustainability at the Mediterranean Basin level reducing the negative environmental impact of agriculture on natural resources and climate change. The project aspires to introduce environmental sustainable agricultural production methods and use of renewable energies, in the main agricultural areas of Jordan and Lebanon. Both in Lebanon and Jordan the increase of the domestic and industrial water demands has led to a significant reduction of water available for irrigation purposes. This is a key issue for such countries in which agriculture accounts the 80% of the water used. Nevertheless this is not the sole problem: the aquifers are overexploited, the use of environmental-friendly irrigation methods is still limited and the water and soils are being polluted through inappropriate production methods with regard to fertilization and plant protection practices. Considering the need to strengthen policies at national and regional level, the ENSIAP project implemented a series of activities as a contribution to the reduction of the negative environmental impact of irrigated agriculture on natural resources and climate change. In particular, the project will use an approach on three levels: **at farm level**, through introduction of innovative and resource conserving agricultural practices including the use of renewable energy sources (RES) supported by training activities; **at institutional level**, through capacity building in best agricultural practices and support to institutional networking on a regional basis with special focus on use of RES in irrigated agriculture; **at civil society**

level, through public awareness raising activities on water and environmental issues, including the appropriate use of RES.

2.2 Appropriateness

Evaluation question - The Project interventions can meet the project needs?

The project is implemented by ICU in collaboration with NCARE, MoA and CRES. As per the project document, the activities are planned under the priority 2 (Promotion of environmental sustainability at the basin level) and Measure 2.1: (Prevention and reduction of risk factors for the environment and enhancement of natural common heritage) have been implemented within the ENPI-CBCMED framework.

The promotion of environmental sustainability at the Mediterranean Basin level have been realized in both targets territories, Lebanon and Jordan, where selected and adapted solutions have been adopted on the territorial context to reach the overall goal of the project.

The project adopts different lines of intervention to reduce the negative environmental impact of agriculture on natural resources (water and soil) and climate change. These are irrigation methods with increased water-use efficiency, introduction of environmental-friendly and resource-conserving production methods and, lastly the spread of renewable energies in irrigated agriculture. The lines of intervention resulting in enhanced public awareness and capacities of the partner institutions, better regional collaboration of stakeholders involved, and increased farmers' incomes in Lebanon and Jordan. In both countries a specific sub-project have been developed with a defined solution at farm level, and strengthening collaboration on environmentally sound methods in agriculture at institutional and local level.

The LF presented by the project document is well organized concerning the general and specific objectives which are in line with the principles of Cross-border cooperation (CBC) initiative. The LF is divided in six activities, some of which are well allocated and complementary between the sub-activities. The work Plan present detailed indicators for project implementation and monitoring that are related to each specific activity. Thus, the final evaluation of the actions has adopted such indicators, integrated with the performance indicators identified in the work-plans established with the beneficiaries.

2.3 Efficiency

Evaluation question - Project results / objectives: have the project purposes been achieved and to what extent?

The partnership between MoA and NCARE and in a more horizontal way with CRES allowed ICU to effectively load the implementation of the project. The partnership established between MoA, NCARE and ICU in preview projects was reflected in the integration of professional staff and experts from the three Institutes.

The financial resources management is transparent and the costs are traceable. The decision to use resources for the benefit of specific activities has always been taken following the clear, obvious and justifiable chain of events on the project and with the only purpose of allowing the best performance of the activities with the best guarantee of lasting positive impacts. The local staff has shown a great capacity to implement the activities, including good professionals profile in technical PV systems and equipment irrigation design.

After an initial lack of coordination in Lebanon due to project leader replacement, ICU staff, Managing authorities, Ministry of Agriculture and Research Institute such as LARI "Lebanese Agricultural Research Institute" have built a great political and technical coordination aimed at good management and sustainability of the project.

On the other hand, the coordination in Jordan was efficient from the beginning and the relationship with local authorities and project partners' such as NCARE was professionals and with high impact in terms of activities done.

Table 3. Project implementation delays compared to project work plan

Activities	Description of Activities	Delay in months vs work plan
A.0	**Pre-implementation and logistics activities**	
A.0.1	Project launching and set-up in Lebanon and Jordan. Office opening: location selection, purchase of furniture and necessary consumable, internet and telephone connection, temporary transport settlement;	0
A.0.2	Tender preparation and launching for office equipment and computers purchase;	0
A.0.3	Tender preparation, launching and follow up for vehicles purchase;	0
A.0.4	Selection and recruitment of local project staff – initial staff training and operative organisation;	0

A.0.5	Establishment of Management, Steering and Local Technical Committee: operative planning involving all project partners;	0
A.1	**Reduced negative environmental impact of irrigated agriculture**	
A.1.1	Planning and launching the technical and socio-economic survey of target beneficiaries (assessment of water, fertilizer, pesticide, and energy inputs used in on-farm agricultural practices, assessment of socio-economic parameters at on-farm level);	+1
A.1.1.1	Data and information collection – questionnaire for farmers;	+1
A.1.1.2	Data and information elaboration - survey writing and editing;	+1
A.1.2	Planning, preparation and launching the tender for the establishment of an improved irrigation system (pump, filtration, fertigation unit, drip-lines) for demonstration and research plots at NCARE and MoA research stations;	+6
A.1.2.1	Tender follow up – equipment delivery to NCARE and MoA research stations	+6
A.1.2.2	Equipment installation – technical assistance and supervision;	+6
A.1.3	Planning, preparation and launching a tender for the establishment of an improved irrigation system (pump, filtration, fertigation unit, drip-lines) for pilot farms in the Jordan Valley (Jordan) and the Bekaa (Lebanon);	0
A.1.3.1	Farmers selection planning and engagement of beneficiary farmers in Jordan and Lebanon	0
A.1.3.2	Signature of contracts with farmers and cooperation agreement with Farmer Association	0
A.1.3.3	Delivery of equipment to beneficiary farmers and /or Farmer Associations	0
A.1.3.4	Equipment's installation – technical assistance and supervision;	+6
A.1.4	Collection and analysis of economic and environmental data for the systems installed at on-farm level in the target areas,	+6
A.1.4.1	Preparation of final report on economic feasibility and environmental sustainability of established solutions	+6
A.2	**Use of renewable energies in irrigated agriculture**	
A.2.1	Planning, preparation and launching a tender for an improved irrigation system using photovoltaic energy for water-pumping (PV1) and energy generation (PV2) in demonstration and research plots at NCARE research station (Jordan).	+2
A.2.1.1	Tender follow up – equipment delivery to NCARE research stations;	+2
A.2.1.2	Equipment installation – technical assistance and supervision;	+4
A.2.2	Planning, preparation and launching a tender for the purchase of photovoltaic water-pumping systems for pilot farms in the Jordan Valley	+6
A.2.2.1	Farmers selection planning and engagement of beneficiary farmers in Jordan and Lebanon	0
A.2.2.2	Signature of contracts with farmers and cooperation agreement with Farmer Association	0
A.2.2.3	Delivery of equipment to beneficiary farmers and /or Farmer Associations	+6
A.2.2.4	Equipment's installation – technical assistance and supervision;	+6

A.2.3	Planning, tender preparation launching for the establishment of a photovoltaic system (PV3) providing energy for an improved irrigation system and on-farm use (selection of solar panel and pump, water storage facilities, energy storage, necessary modification to irrigation system) for demonstration and research plots at MoA research station (Lebanon).	+6
A.2.3.1	Tender follow up – equipment delivery to MoA research stations	0
A.2.3.2	Equipment installation – technical assistance and supervision	+4
A.2.4	Planning, preparation and launching the procedures for the purchase of the stand-alone photovoltaic plants as power source for the installed fertigation system in Lebanon	+6
A.2.4.1	Farmers selection planning and engagement of beneficiary farmers in Lebanon	+6
A.2.4.2	Signature of contracts with farmers	+6
A.2.4.3	Delivery of equipment to beneficiary farmers	+6
A.2.4.4	Equipments installation – technical assistance and supervision	+6
A.2.5	Planning, preparation and launching the procedures for the purchase of demonstrative photovoltaic irrigation system to be installed at NCARE headquarter – Jordan	+6
A.2.5.1	Equipments installation – technical assistance and supervision	+6
A.2.6	Data collection for economic, environmental and performance study of the systems using renewable energy installed in the target areas,	+6
A.2.6.1	Reporting and research writing and publication on RES solutions	+6
A.3	**Institutional capacity building for NCARE and MoA**	
A.3.1	Assessment of existing capacities and training needs of MoA and NCARE with regard to environmental issues, use of renewable energies, and integrated agricultural production methods (managerial, extension services, and laboratory staff level) and development of a capacity improvement strategy together with the partner institutions.	+1
A.3.2	Development of training modules and materials for MoA and NCARE staff related to best agricultural practices, environmental issues, and use of renewable energies	+1
A.3.3	Training of managerial staff, extension agents, and laboratory technicians on best agricultural practices and use of renewable energies.	+4
A.3.4	Training reporting and evaluation	+2
A.4	**Farmers training**	
A.4.1	Development of farmers training modules and materials (written and audio-visual, in Arabic and English) related to best agricultural practices, environmental issues, and use of renewable energies	+2
A.4.2	Farmers training through farmers classes, field days, workshops, and seminars	+2
A.4.3	Training reporting and evaluation	0
A.5	**Foster international collaboration on use of renewable energies in agriculture**	
A.5.1	Establishment of 2 focal points within the local partner institutions and establishment of a network linking the project with research institutions, international organisms and agencies, NGOs, and private sector companies working in rural development and agriculture.	0

A.5.1.1	Focal points training on renewable energies applications in agriculture – technical assistance, supervision	0
A.5.2	Participation of project staff (and presentation of the project) in international seminars, workshops, and conferences	0
A.5.3	Organization of 2 workshops on use of renewable energies in agriculture with international participation in Lebanon and Jordan	0
A.5.4	Training of project staff and renewable energies focal point of the local partners on use of renewable energies in agriculture at advanced research institutions in Europe	0
A.6	**Dissemination of project results and public awareness rising for environmental issues and use of renewable energies**	
A.6.1	Development, on line setting and continuous update and maintenance of a project web-site	0
A.6.2	Preparation of dissemination materials on the project objectives, activities and results	0
A.6.3	Development of didactical material on environmental and agricultural issues related to the project activities for use as pedagogical / information modules and organization of visits to the demonstration plots for universities and schools in Lebanon and Jordan.	0
A.6.4	Dissemination of project activities to the broad public through newspaper articles, radio and TV broadcasting, for all events (workshops, seminars, conferences, field days) organized by the project.	0
A.6.5	Publication of the project Final Report (printed and on CD) for dissemination of project results to all stakeholders involved	0

The project was extended with a delay of 6 months. The extension was mainly related to Activity A.2. Use of renewable energies in irrigated agriculture, with specific regard to sub-activities A.2.2 Tender and A.2.4 Data collection for economic, environmental and performance study of the systems using renewable energy installed in the target areas, and to Activity A.4. Farmers training, only for the part related to the use of renewable energies sources (RES) in agriculture and to operation and maintenance of photo-voltaic (PV) pumping systems.

The extension of the project duration was necessary as a consequence of the delay by project partner CRES in the design, procurement, installation, testing and monitoring of 16 PV pumping systems to be installed in pilot farms in the Bakaa and Jordan Valley, meanly because difficulties in dealing with EU tendering procedures and award. CRES also informed that ICU assistance in those issues has not been immediate.

Delay in these activities generates an overall delay of 6 months in project implementation. Despite the delay in the execution of few project activities, the local ICU staff stayed always on site in the coordination and execution of project activities for the achievement of the final results. In addition, the delay of the activities was useful for additional installation of two PV systems in NCARE in Jordan and LARI station in Lebanon.

A concrete and collaborative approach with an integrating participatory method has been developed to reach the projects objective. The choice to develop a participatory work plan

per each beneficiary ensured the bottom–up approach and proper engagement of beneficiaries in respecting the timeline.

2.4 Effectiveness

Evaluation question - Results / Resources: To what extent has the project intervention contributed to achieve the project results and with which resources?

The project addresses similar issue in two countries presenting a very different situation with regards to agronomic and water management. Local institutions have the common goal to optimise water use and water distribution and a better definition of water management with a different approach related to field technical aspects. In Jordan water quality and soil salinity are major issues because the cost of the water is really cheap (0.004 JD in 2004 vs 0.01 JD in 2015). Similar situation is presented in Lebanon, where inundation and extension of the irrigated area are concerned. On the other hand, the cost of electricity in general and in particular the direct pumping of underground water is the major critical problem and expensive in both countries.

The implementation followed the project work plan. The project selected and sustained farmers in Jordan and Lebanon to install 40 irrigation pilot systems that conserve water and also improve the way which fertiliser is added to the soil. The technology involved includes sand and disk filtration units, hydraulic fertiliser injectors and a drip irrigation network. Three of these systems were installed in agricultural research centres, to facilitate demonstrations and training, and the other 37 have been installed in several farms, eight of them selected for the monitoring phase. A second set of pilot actions undertaken as part of ENSIAP involves establishment of 22 photovoltaic pumping systems. The provided equipment has been identified according to the real needs of beneficiaries and adopting simple and modern technologies. The maintenance of such equipment doesn’t present important troubles and the constant presence of extension agent facilitates the resolution of technical problems detected by farms. These systems allow partners to experiment the use of solar energy to power the pumps for the improved irrigation systems.

The training approach defined in collaboration with beneficiaries NCARE and MoA was also very practical, focusing only on themes pertinent with the project specific target, ensuring the active participation of beneficiaries and being mainly based on on-job

trainings and participative workshops for the technical staff and beneficiary farmers. This approach allowed a participatory assessment of problems and identification of solutions, which resulted very useful to design a baseline for each level of study (farm, institutional and civil society), on which project impacts have been evaluated.
Despite the already mentioned delays, the project has demonstrated good effectiveness in reaching its objectives. It contributed to increase farms incomes, saving money to pay energy; save water and fertilization products, thanks to the use of a drip irrigation system that helps in the localization of water and fertilizer. Moreover, the beneficiary's participation to trainings and on farm installation has been supported in the utilization of agronomic sustainability practices and the use of PV systems and drip irrigation systems. Due to delays in the PV system and drip irrigation installation little amount of data have been collected during the subsequent season.
In fact in Jordan and Bakaa valley the time cropping season of vegetables started approximately in April-March and only one year of utilized data have been collected by LARI and few farms in Lebanon.

The Lebanese security situation has resulted in a lack of technical synergies at the beginning of the project. The Lebanese implementation team lacked reactivity to transfer the technical tools and approaches developed in Jordan. Sharing of didactical documents (technical brochures) was a positive aspect.
A good partnership and collaboration have been established between MoA in Lebanon and NCARE in Jordan. The fact that the institutions have different organisation, prerogatives and objectives was pin-pointed as an obstacle but to give more sustainability to their partnership, MoA and NCARE are now finalizing a memorandum of understanding on shared activities with regard to extension and training in both countries.

The direct beneficiaries of the project can be divided on three different levels (farm, institutional and civil society).

At **farm level** the beneficiaries consist on selected farmers by ICU, MoA and NCARE technical staff on the basis of farmer's interest and real possibility to develop the pilot study and field activities.

NCARE and MoA have supported the beneficiaries in the target regions (Bekaa in Lebanon, Jordan Valley in Jordan by the adoption of new technologies in irrigated agriculture.

At **institutional level** the personnel of the partner institutions NCARE and MoA have been directly involved in the project activities and training and knowledge transfer on the sustainable agricultural practices. The access to information and support in adoption of new technologies in irrigated agriculture have been proved through the improved extension capacities of NCARE and MoA and information transfer to project farmers beneficiaries.

At **civil society level** the project goal have been reached by the development and distribution of dissemination materials for the broad public and an agricultural program comprising technical activities on best agronomic management and environmental issues to gain the attention of civil society to increase public awareness.

The approach defined in the project document also acknowledges a set of transversal values explicitly mentioned in the Lebanon and Jordan planning documents, demonstrating a complete coherence with the vision of development desired by decision makers and policy makers met during the evaluation phase in both countries. In addition, at horizontal level the project objective have point out poverty alleviation (increased incomes of farmers), principles of non-discrimination and gender equality (participatory approach at all project levels), and includes a communication and visibility strategy to enhance project sustainability (internet, media, dissemination materials, field days).

2.5 Impact

Evaluation question – Project objective/impact: To what extend have the project objectives been achieved?

The evaluation of performance indicators to define the impact of the project demands an extra time for checking after the end of the project because the impact in term of productivity have been not possible during the final evaluation phase. Only LARI (Lebanese Agricultural Research Institute) and few farmers in Lebanon provide quali-

quantitative data related to the yield production of the crop tested with the drip irrigation system with different ETP level (see additional documents).

For this reason a trend and influence analysis have been used to assess the impact of the project, which identifies poverty reduction and environmental, economic and social development as a rise in living standards, better access to resources and the expansion of knowledge. The assessment is based on a measure of before and after expressed by project beneficiaries: institutional and technical staff involved in the project and by people living in the project area and formulate their own expressions through personal or team interview (reported in chapter 3).

The correlation between the activities of the project and the impacts are evaluated by means of trend and influences matrix.

The main results of the evaluation are:

- Quality of life, measured in relation to major social and economic parameters, has a significantly increasing trend where project activities have been realized;
- The implementation of significant activities, first of all the PV systems supply, has spurred a surge across the different aspects of quality of life, in particular famers incomes due to PV system energy production;
- The supply of electricity have solved the problem connected with the energy scarcity and the high cost of energy, especially in Lebanon where the energy situation is critical;
- The productivity in same areas is still not enough due to an inappropriate land management, even before the project, not planned in a truly sustainable manner;
- The water resources in the area of intervention are still not managed in a good way and some areas (Jordan) are in a state of impoverishment due to waste water and no control systems: price of water is to low (0.01 JD per cubic litre in 2015) (Mohammad Ali Mudabber personal communication);
- The nutrient leaching due to high amount of nitrogen fertilization seems to be not a problems thanks to fertigation system which helps farmers in the management of nitrogen in agriculture;
- The greatest opportunities of income and saving money are generally invested to focus on further development of their activities and familiar welfare (e.g. education, better health situation, etc.);

- Awareness of the centrality of sustainability land management with respect to the various problems is strong, and the knowledge on Best agronomic practices and the use of RES system are improved;
- Participation in the activities of the project is considered very high by themselves and tiring even in post launch.

The results of the analysis emphasize as the farmers have acquired agricultural management and knowledge tool to make a more sustainable agricultural activity. However a major involvement at Institutional level is needed to manage the water resource in a more sustainable way (see Chapter 3 for additional information).

2.6 Sustainability

Evaluation question - Did the project activities ensure the sustainability in the long time?

The long-term sustainability of the project at farm, institutional and civil society level has been met through the combination of project results. ENSIAP paid particular attention in setting the bases for the future activities through a participatory approach boosting beneficiary's appropriation of project results.

During the whole intervention, the project has shown constant activities recognition by the beneficiaries (and the local authorities) as "their" project, and one in which they have actively participated in identifying and developing their solutions, and which responds to their needs.

To do this, the project actively engaged the beneficiaries throughout all of the stages of the project on different level: ***Institutional, civil society and farm level*** with (i) meetings for the participatory definition of needs, to raise awareness and guide the overall implementation strategy (ii) participatory training workshops to identify problems and solutions, and (iii) national workshops gathering all involved cooperatives with national stakeholders fostering the mutual exchange of experiences, needs and expectations.

To evaluate the long-term sustainability, internal and external factors of the project inherent the choice of local partners and target beneficiaries, quality and adequate implementation, economical, and ecological advantages of the solutions proposed by the project have been taken into account during the evaluation phase.

At **farm level** the development of best agricultural practices in two different environmental situations (Jordan and Lebanon) showed results that can be adapted to a wide range of environmental situation in the whole Mediterranean region and have a high potential for further diffusion. Multiplier effects on the use of efficient irrigation system and PV system are expected, in particular when continuous support to farmers by provision of qualified agricultural extension services through the local partners is guaranteed.

At **Institutional and civil society level** partner institutions MoA in Lebanon and NCARE in Jordan guarantee the project future implementation through their capacities and support to the final beneficiaries of the project and ensure the possibility of additional activities developed at local level with the extension of project results related to use of PV system, irrigation system and resource conserving agricultural production methods. Moreover, sustainability is reinforced thanks to the ability of local institutions to take over and continue the project activities, and by the willingness of local decision makers to support sustainability of project results through incorporation in their long-term policy for environmental sustainability of natural resources.

The sustainable use of natural resources, through propagation of agricultural methods that answer farmers' problems in the field, with increased farm incomes showed a good replication in the both target countries and the Mediterranean region in general.
Long-term sustainability and large-scale diffusion of the introduced methods related to use of renewable energy sources will depend a lot in the mid-term, on their long-term profitability, and on the evolution of framework policies related to subsidies for RES use in the energy sector in Lebanon and Jordan. For this reason a real involvement at Institutional level is needed to transfer the project output at national level. To date, the partner institution at national level used the results of the project in the definition of solutions in the energy sector on a larger scale and not limited just to agriculture. In fact, the sustainability of the system is guarantee by the use of PV system to produce electricity not only for agricultural purposes, but also in the daily life. The use of PV system without battery is the best solution for farmers to guarantee the long term profitability of the system due to the difficulty of farmers to purchase battery after 10 year. On the other hand the best solution for daily life and public building is the use of PV system with battery to store the energy during all year.

The dissemination of results and public awareness rising activities of the project have produced a long-term impact on the broad public and decision makers on local and national level and contribute to make the ENSPIA project as a whole more sustainable.

Another important aspect to be evaluated in the sustainability analysis is the concept of environmental sustainability. In this context the ENSIAP project play a crucial role. The project in fact introduces sustainable agricultural production methods that increase water-use efficiency and decrease fertilizer and agrochemical use significantly. These methods are crucial for the land management of the target areas in Jordan and Lebanon which are areas of intensive irrigated agriculture, covering 50 % of the agricultural production area in the respective countries. Intensive agricultural production with high inputs, fertilizers, and agrochemicals is the main polluting factor of groundwater resources and soils in the target areas. The use of drip irrigation system and fertilization system have a double effect on one site there is a parsimonious use of water, on the other side a better management of fertilization. In both circumstance the combination of economically and ecologically sound solutions for management of agricultural production under the prevailing environmental conditions have a high potential for diffusion and high impact to improve the ecological situation of the target countries.

The table below summarize, through the use of a score (from 1 to 4), the final appreciation earned by the evaluator for each criterion analysed during the final evaluation of ENSIAP project.

Criterion	**Score**
Appropriateness	4
Efficiency	3
Effectiveness	4
Impact	3
Sustainability	3

1=poor; 2=sufficient; 3= good; 4=excellent

CHAPTER 3 –TREND ANALYSIS OF KEY IMPACT INDICATORS

3.1 Introduction

The trend analysis has been used to define the effects of the activities carried out during the project period with a quali-quantitative survey instead of a more quantitative survey. In fact, little data have been collected from farmers and at Institutional level on the situation before, during and after the project intervention. For this reason, through the trend analysis is possible to have general conclusions on the impact on project beneficiaries.

The trend analysis have been carried out at Institutional, civil society and farm level interviewing local partners, technical staff of NCARE in Jordan and the Ministry of Agriculture in Lebanon. Eight representative farmers from Lebanon and Jordan beneficiaries of PV1, PV2 and PV3 system (with and without batteries) and irrigation system have been involved during the interviews to evaluate the impact of the ENSIAP project on six **key impact indicators**:

- Standard of living,
- Agricultural management,
- Access to water,
- Access to energy,
- Other basic services;
- Knowledge.

As reported in the evaluation methodology the criteria selected for the trend analysis covers all the different aspects of beneficiaries' life. Basically they can be understood as directly expressing of the related "*Verifiable Indicators of Achievements*" reported in the LF.

As detailed before, the project can be considered in two sub-projects (Jordan and Lebanon) having specific partnership agreements. For this reason, the set of questions linked to the six **key impact indicators** have been answered separately for the two countries considering the beneficiaries at farm and at Institutional level.

The objective of the trend and influence matrix was to quantify how the implemented activities were relevant to the daily life of the target groups. In fact, the information collected during the interviews gives the possible to classify the perceived relative importance of each project activity and to draw conclusions about their spread throughout the beneficiaries. This modality allows a better understanding of the sub-projects achievements and impacts in their respective national contexts and a comparison between them.

3.1.1. Jordan Trend Analysis

Differences have been reported in the trend analysis if we compare the point of view at institutional and farmer level in the evaluation of the impact of project activities. Table 4 and 5 provide an overview about the project impact at farm and institutional level.

At **farm level**, the 6 farmers and 2 extension agents interviewed gave high impact on standard of living, saving money from the electricity produced by the PV system and the energy access at any time during the day (red points). As reported in table 4 (black points) no higher impact have been reported on regards to agricultural management and access to knowledge. On this regards a different sensibility to social and environmental aspect have been detected from the group of interviewed.

Table 4. Trend Analysis at farm level

Criteria	2011	2012	2013	2014	2015	Before	After	Impact (After-Before)
Standard of living								
Family income	2	3	4	5	5	2	5	**3**
Family health	3	3	3	4	4	3	4	1
Agricultural management								
Agricultural yield	3	3	3	4	4	3	4	1
Land management (decrease soil erosion),	3	3	3	4	4	3	4	1
Soil and groundwater pollution (nutrient leaching),	2	2	3	3	3	2	3	1
Fertirrigation - NUE	2	2	3	4	4	2	4	**2**
Reduce agricultural input	2	3	3	4	5	2	5	3

Access to water								
Temporal access (people)	3	3	3	3	3	3	3	0
Temporal access (crop production)	3	3	3	4	4	3	4	1
Increase the WUE	2	2	3	4	4	2	4	**2**
Water saving in agriculture practices	3	3	3	4	4	3	4	1
Energy access								
Electric power availability in anytime	2	2	3	5	5	2	5	**3**
Access to electric power for irrigation in agriculture	2	2	3	5	5	2	5	**3**
Other basic services								
Additional Electric power for family uses	3	3	3	4	5	3	5	2
Cost in daily life	3	3	3	4	5	3	5	2
Knowledge								
Knowledge about Best Agricultural Practices (BAP)	3	3	3	4	4	3	4	1
Knowledge about sustainable agriculture	3	3	3	4	4	3	4	1,5
Knowledge about PV systems and RES	2	3	3	4	4	2	4	2
Technical know-how (installation maintenance, repair)	3	3	3	4	4	3	4	1,5

1=very negative; 2=negative; 3=neutral; 4=positive; 5=very positive
a. Mean values of eight farmers interviewed.

An opposite situation has been reported at **Institutional level**. The technical parties of NCARE involved in the project reported a high impact on the agricultural management and access to water and energy as reported in red point in table 5. In fact NCARE team involved in the interview gave a higher score, comparing the first year of project to the last year of the project, to agricultural management, access to water and increase technical knowledge.

Table 5. Trend Analysis at Institutional level

Criteria	2011	2012	2013	2014	2015	Before	After	Impact
Standard of living								
Family income	3	4	4	4	4	3	4	1
Family health	3	3	3	3	3	3	3	0
Agricultural management								

Agricultural yield	3	4	4	4	5	3	5	2
Land management (decrease soil erosion),	2	3	4	4	5	2	4	2
Soil and groundwater pollution (nutrient leaching),	2	3	3	4	5	2	5	**3**
Fertirrigation - NUE	3	4	4	5	5	3	5	2
Reduce agricultural input	2	3	3	4	5	2	5	**3**
Access to water								
Temporal access (people)	3	3	3	3	3	3	3	0
Temporal access (crop production)	3	3	4	4	5	3	5	2
Increase the WUE	2	3	4	4	5	2	5	**3**
Water saving in agriculture practices	2	3	4	4	5	2	5	**3**
Energy access								
Electric power availability in anytime	2	3	4	4	5	2	5	**3**
Access to electric power for irrigation in agriculture	2	3	3	4	5	2	4	2
Other basic services								
Additional Electric power for family uses	2	3	3	4	5	2	5	**3**
Cost in daily life	2	3	3	4	4	2	4	2
Knowledge								
Knowledge about Best Agricultural Practices (BAP)	2	3	4	4	5	2	5	**3**
Knowledge about sustainable agriculture	2	3	3	4	4	2	4	2
Knowledge about PV systems and RES	2	3	3	4	4	2	5	2
Technical know-how (installation maintenance, repair)	2	3	3	4	4	2	4	2

1=very negative; 2=negative; 3=neutral; 4=positive; 5=very positive

The analysis at Institutional level point out as the environmental and social aspects are the most important in the project execution. Slightly importance has been reported on the impact on the standard of living and increase technical knowledge, because the initial condition of farmers selected were good in this term. In fact, in general, the idea of the interviewed is related to the fact that the reduction of agricultural inputs and the use of innovative irrigation systems can resolve the problems of pollution of the natural resources (soil and groundwater) due to the high use of fertilizers and agrochemicals which are a common problem in intensive irrigated agriculture in Jordan. Current practices and production methods in irrigated agriculture in Jordan are considered a major

factor in pollution of natural resources, in particular water and soil, for this reason is crucial the utilization of environmentally irrigation and agricultural practices. In addition, fossil-fuel based energy production for irrigation water pumping, supplied either through the public electricity grid (Jordan), or produced on-farm, using diesel generators with very low energy efficiency have a negative impact on climate change for this reason an alternative energy system is needed.

In conclusion, in Jordan the main problem of farmers in agriculture is related to water quality and energy consumed during the irrigation process. The water management consortium in Jordan defines the m^3 of water available for each single area. The cost of the water is really low, for this reason farmers are not interested in save the water, but are more interested in save money with the use of PV system and fertirrigation practices. On the other hand the peoples involved at Institutional level have a different precondition on the importance to save water in context where the water can become a limiting factor for human and agricultural uses. On this regards, a better impact have been done thanks to the use of irrigation drip lines and defined irrigation rounds which helps in save water and in the uniformity of water distribution and therefore, the possibility to optimize the fertilization, with the soluble fertilization distributed with the irrigation water.

3.1.2. Lebanon Trend Analysis

Six farmers in the Bakaa valley and two extension agents of MoA have been interviewed. Slightly differences have been described in the trend analysis if we compare the point of view at institutional and farmer level in the evaluation of the impact of project activities. The data reported in both tables (table 6 and 7) are mean values of beneficiaries belonging to farm and institutional level.

As reported in table 6 with red points, at farm level the analysis showed a good impact on standard of living, agricultural management, access to water and to energy, saving money from the electricity produced by the PV system and the energy access at any time during the day. Slightly importance has been done to agricultural management and access to knowledge.

Table 6. Trend Analysis at farm level

Criteria	2011	2012	2013	2014	2015	Before	After	Impact
Standard of living								
Family income	3	3	4	5	5	3	5	**2**
Family health	3	3	3	3	3	3	3	0
Agricultural management								
Agricultural yield	3	3	3	4	5	3	5	1,5
Land management (decrease soil erosion),	3	3	3	4	4	3	4	1
Soil and groundwater pollution (nutrient leaching),	2	2	3	5	5	2	5	**3**
Fertirrigation - NUE	2	2	3	5	5	2	5	**3**
Reduce agricultural input	3	3	3	4	4	3	4	1
Access to water								
Temporal access (people)	2	2	3	5	5	2	5	**3**
Temporal access (crop production)	3	3	3	4	4	3	4	1
Increase the WUE	2	2	3	4	4	2	4	**2**
Water saving in agriculture practices	3	3	3	4	4	3	4	1

Energy access								
Electric power availability in anytime	2	2	3	5	5	2	5	**3**
Access to electric power for irrigation in agriculture	2	2	3	5	5	2	5	**3**
Other basic services								
Additional Electric power for family uses	3	3	3	4	4	3	4	1
Cost in daily life	3	3	3	4	4	3	4	1
Knowledge								
Knowledge about Best Agricultural Practices (BAP)	3	3	3	4	4	3	4	1
Knowledge about sustainable agriculture	3	3	3	4	4	3	4	1,5
Knowledge about PV systems and RES	2	3	3	4	4	2	4	**2**
Technical know-how (installation maintenance, repair)	3	3	3	4	4	3	4	1,5

1=very negative; 2=negative; 3=neutral; 4=positive; 5=very positive

In fact the general idea is that the project contributed to increase farms incomes, saving money to pay energy; save water and fertilization products, thanks to the use of a drip irrigation system that helps in the localization of water and fertilizer. Moreover, the beneficiary's participation to trainings and on farm installation has supported farmers in the definition and utilization of agronomic sustainability practices and the use of PV systems and drip irrigation systems.

Table 7. Trend Analysis at Institutional level

Criteria	2011	2012	2013	2014	2015	Before	After	Impact
Standard of living								
Family income	3	4	4	4	4	3	4	1
Family health	3	3	3	3	3	3	3	0
Agricultural management								
Agricultural yield	3	4	4	4	4	3	4	1
Land management (decrease soil erosion),	2	3	4	4	4	2	4	2
Soil and groundwater pollution (nutrient leaching),	3	3	3	3	3	3	3	0

Fertirrigation - NUE	3	4	4	5	5	3	5	**2**
Reduce agricultural input	3	3	3	4	4	3	4	1
Access to water								
Temporal access (people)	3	4	4	5	5	3	5	2
Temporal access (crop production)	3	3	4	4	4	3	4	1
Increase the WUE	3	3	4	4	4	3	4	1
Water saving in agriculture practices	3	3	4	4	4	3	4	1
Energy access								
Electric power availability in anytime	2	3	4	4	5	2	5	**3**
Access to electric power for irrigation in agriculture	0	0	0	0	0	0	0	0
Other basic services								
Additional Electric power for family uses	2	3	3	4	4	2	4	**2**
Cost in daily life	2	3	3	4	4	2	4	**2**
Knowledge								
Knowledge about Best Agricultural Practices (BAP)	3	3	4	4	5	3	5	**2**
Knowledge about sustainable agriculture	2	3	3	4	4	2	4	**2**
Knowledge about PV systems and RES	2	3	3	4	5	2	5	**3**
Technical know-how (installation maintenance, repair)	2	3	3	4	5	2	5	**3**

1=very negative; 2=negative; 3=neutral; 4=positive; 5=very positive

At **Institutional level** a different sensibility to social and environmental aspect has been detected from the group of interviewed. In fact in table 7 the red point (high impact) has been reported mainly for energy access and knowledge which are of a crucial importance in Lebanon where the access to energy is very critical. A reliable source of electricity is one of the essential elements for any economic sector and continues to play a critical importance as a key factor for poverty reduction. The electricity has proved a huge impact in promoting the efficiency of all practices related to agriculture, (grinding, pumps for irrigation) and further development in Lebanon is needed not only for agricultural purposes but also for public and private buildings.

3.1.3. Influence Matrix for Jordan and Lebanon at Institutional level

The influence matrix goal is to quantify the effectiveness of the implemented activity on the basis of different indicators considered crucial to target groups.

ICU technical staff and project partners NCARE and MoA have been involved for this analysis. The analysis has been initially extended to farmers, but due to the complex system and the effort in getting the influence matrix from farmers, this group has been excluded from this survey.

Only mean results at Institutional level for both countries are reported in this section. Representative partners from MoA and NCARE have been interview to evaluate the relation between indicators and project activities.

Table 8. Influence matrix at Institutional level

Indicator	Modern Drip irrigation system	Installation PV system	Capacity building	Training for farmers /Extension agencies	Training on BAP	Training on RES and PV systems	Agricultural training programme
Standard of living							
Family income	+2	0	-2	+2	+2	+4	0
Family health	+1	+2	0	+2	+2	+3	0
Agricultural management							
Agricultural yields	+4	+4	+2	+4	+4	+4	+4
Land management (decrease soil erosion)	+2	+1	+3	+3	+3	+1	+1
Soil and groundwater pollution (nutrient leaching),	0	0	+1	+4	+4	+3	+3
Fertirrigation - NUE	+4	+3	0	+2	+2	+2	+2
Reduce agricultural inputs	+4	+4	+2	+2	+2	+2	+2
Access to water							
Temporal access (people)	+3	+4	+2	+1	+1	+1	+3
Temporal access (crop production)	+3	+4	0	+1	+1	+1	+3

Increase the WUE	+2	+3	0	+1	+1	+1	+3
Water saving in agriculture practices	+3	+4	+2	+1	+1	+1	+3
Energy access							
Electric power availability in time	0	+4	0	+3	+3	+4	+4
Access to electric power service	+2	+2	+2	+2	+3	+4	+4
Other basic services							
Electric power availability in time	0	+4	0	0	+2	0	0
Access to electric energy power	0	+3	0	0	+2	0	0
Knowledge							
Knowledge about Best Agricultural Practices (BAP)	+4	+4	+2	+4	+4	+4	+4
Knowledge about sustainable agriculture	+4	+4	0	+2	+4	+4	+4
Knowledge about PV systems and RES	+4	+4	+2	+4	+4	+4	+4
Technical know-how (installation maintenance, repair)	+4	+4	+2	+4	+4	+4	+4

The horizontal-line totals indicate that the indicators have been influenced by a large number of project activities in a positive way. In fact, high score have been reported in the interaction between agricultural management with PV and drip irrigation installation activities, which indicate a strong relation between this indicator and the access to water and energy. A more sustainable agricultural management related to the access to water and energy have been resolved with the installation of PV and irrigation system with an accurate use of water and fertilizer and a good energy production that helps farmers in save money. It is interesting to notice as all activities have a high relationship with knowledge (Best agricultural practices, RES and PV system, etc.). These information are really important and underline exactly how is important the technological transfer in terms of knowledge to guarantee the use of technical instrument (PV and irrigation system) and the sustainability of the project in the long term. In fact, the mayor error in cooperation project can occurred when project activities are related only on the construction and installation of technical instruments without provide the sufficient knowledge to solve problems when such instrument is not working in a proper way.

In conclusion we can truly confirm that the final objectives of the project have been reached and the entire sustainability is guarantee thanks to technical and practical knowledge transfer which will permit to local farmers, technician, extension services, etc. to further implement agricultural and local development in the future.
Nerveless, due to low score reported on the effectiveness of indicators on the general project capacity building a further and future development on this area is needed.

CHAPTER 4 – PERSPECTIVES AND RECOMMENDATIONS

The evaluation has to look at the project with regards to the general development strategy of the funding agency. The intervention is embedded in a program that could give additional values to project results. The project strategy adapted by ICU and project partners has demonstrated to meet the direct objectives and the sustainability of their actions. In fact, water management and agricultural development are recognized as an important issue that must be tackled thought adapted programs that include long term views. The overall objective of the ENSIAP project targeted both economic and environmental improvement at farm, institutional and civil society level.

The establishment of the local focal point in the local partner institution, dissemination of project results, and public awareness rising activities of the project shave showed an impact on public and decision maker level that will support for sure in the future the use of RES in other sectors (industry, domestic use) on a national and regional scale.

Strategy in Jordan

The main axes to include in a strategy for follow-up actions in Jordan are:

a) use the project results to support their diffusion and continue in the collection of additional results data in the coming years to have a more solid long term data to be used in future projects ;

b) support applied research at NCARE to reach on-farm validation;

c) support the development of NCARE agricultural extension agent;

d) support Managing Authorities (agricultural and energy sectors) and irrigation local partners in the improvement of its infrastructure;

e) define a public support system to purchase PV system at farm level and public and private sectors.

In Jordan all the continuation of the activities will rely on NCARE and Agricultural services station capacities. Any future action should include NCARE services to further strengthen the institution.

Strategy in Lebanon

In Lebanon the development of the activities will rely on MoA and LARI capacities. Any future action should include MoA involvement and LARI services to further strengthen the institution. The main axes in Lebanon are:

a) support MoA, LARI and agricultural agencies in additional project implementation;
b) support the development energy and agricultural extension services;
c) support the MoA new agricultural service centre in the development of its activities;
d) support local farmers in the switch of water and energy tariffs from surface based to volume based;
e) define a public support system to introduce the use of PV system not only at farm level but above all in the public and private sectors.

The following perspectives are proposed to be developed as future actions in order to sustain the assets of the ENSIAP project and to valorise the generated potential impact. The future activities implementation and the results of the project can have a better impact if the various partner and actors involved in ENSIAP project and working in partnership continue in the technological transfer of project results. Additionally, recommendation and lesson learned have been provide at farmer, Institutional and civil society level, thanks to the several ENSIAP workshops.

Main perspectives in Jordan and Lebanon

1. Define actions that would help in the collection of data from farms with improved pilot studies on energy/irrigation/agricultural systems (use of GIS system or installation of meteorological stations, etc.).
2. Development of research plots with Research Institutes with farmer participation should be done. The installation of monitoring systems at farm level such as meteorological station, water irrigation consumption, farm diary will give the possibility to collect data for the evaluation of best agronomic practices in a defined area.
3. Define actions with the use of credit/micro-financing system to purchase irrigation and PV system equipment to provide sustainability in the long terms with a mayor emphasis on the economic aspects.
4. Provide actions to change the inefficient irrigation methods (surface, sprinkler irrigation) or often managed in a way that leads to water waste (drip irrigation) with a more efficient irrigation systems with efficient irrigation systems with high water-use efficient.
5. Use of Drive support systems (provision of the adapted recommendations) is able to answer precise technical demands and to better define the irrigation and fertilization schedule with the possibility to collect information at farm level through a database.
6. The support of MoA, LARI, NCARE and other national and local agencies in designing future actions based on the monitoring and follow up process. Precise objectives, action plan and related budget could be produced through adapted capacity building.
7. A better coordination of the agricultural extension service with the support of Agricultural agencies in Jordan and Lebanon is necessary.
8. A more appropriate definition of responsibilities must be clearly designed to make sure it creates no constraints on the project direct efficiency. Suffering delays related to the administrative process that allows using an infrastructure created by the same project is a time consuming non-sense that should not happen.

9. A commitment of the partner is necessary to ensure the availability of the personnel already trained in previews projects. Involvement and awareness of the local head staff is required.
10. The local partner (agencies) should be consulted in the selection of people hired under the project. This is especially true with regard to technical staff and local farmers and would avoid misunderstandings and increase the local involvement.

ANNEX I PROJECT PICTURES

Pictures collected during the final ENSIAP evaluation in Jordan

P 1/2. NCARE building (Deir Allah), entrance hall where is installed the counting panel for the electricity saved and produced by the PV system installed outside the building. / Information and visibility manual for the PV system management in one of the beneficiary farms in Jordan.

P 3/4. The Agricultural station in Jordan Valley. Meteorological data collection/ equipment presents in the station. / Interview with farmers beneficiary of PV system and extension agents


P 5/6. Meeting with ICU and NCARE staff, extension agency and farmers involved in ENSIAP project. / Equipment installed in one beneficiary farm


P 7/8. Meeting on field with farmers on the performance of the PV system with and without batteries and site survey to see the equipment (pump, irrigation system and PV system).

Pictures collected during the final ENSIAP evaluation in Lebanon


P 9/10. LARI station – Meeting with the direct and site survey on the PV system installation.

P 11/12. Meeting with beneficiary farmers to see the pilot equipment and evaluate the impact of the project on their agricultural activities.


P 13/14. Meeting with ICU and MoA staff, extension agent and farmers involved in ENSIAP project.


P 15/16. Meeting with farmers. On site survey on the equipment installed and evaluation of proper functionality

ANNEX II MAPS AND CARTOGRAPHY

Location of the project activities

Jordan

The Hashemite Kingdom of Jordan, extends its 89,300 km² to the east of the Jordan River, and is bordered by the Occupied Palestinian Territories in the West, the Syrian Arab Republic to the North, the Republic of Iraq and the Kingdom of Saudi Arabia to the East and South. In Jordan the project will concentrate on the Western parts constituting the main agricultural production area, namely the Jordan Rift Valley. The elevation of the Jordan Rift Valley varies from -212 m near Lake Tiberias in the North to +250 m in the region between Wadi Araba and the Gulf of Aqaba in the South, with a low of -408 m at Dead Sea level. The Jordan River is the major water course in the Jordan Rift Valley, and plays a crucial role for agricultural irrigation schemes.

The project location will be in the Jordan River Valley (the upper part of the Rift Valley between Lake Tiberias and the Dead Sea) and the project activities will focus on the Central and Southern parts of this area (approximately from 20 km North of Deir Allah to the Dead Sea). Its climatic and geological characteristics, fertile, flat-lying soils, the elevation below sea level, giving the area a great potential as a natural greenhouse for the production of off-season fruits and vegetables, determine the areas role as main production area for intensive irrigated agriculture in Jordan. Whereas the Northern part of the Jordan Valley is supplied with irrigation water from the Jordan and Yarmouk river, the central and southern parts use a mixture of surface water (Jordan and Yarmouk River) and treated wastewater from the Zarka River (Khirbet Es Samra treatment plant, via King Talal Dam). In both cases irrigation water is supplied through the 115 km long King Abdullah Channel. Until 2008 only the area South of Deir Allah was irrigated with treated wastewater for irrigation purposes. Since 2009 higher water demands for domestic use, led to increase use of treated wastewater for agricultural irrigation affecting areas North of Deir Allah. The lack of efficient Agricultural Extension Services support to farmers, to adapt their production methods (especially fertilization and irrigation management) to this new situation, leads to increasing problems of deterioration of groundwater and soil resources (salinity, fertilizers, and agrochemicals) and economical problems for farmers that used to plant high income crops that are salt sensitive (e.g. bananas, several vegetables).

Lebanon

The Republic of Lebanon, located at the Eastern coast of the Mediterranean, and bordered by the Syrian Arab Republic (North and East) and the Occupied Palestinian Territories (South), covers an area of 10.452 km^2. The project focuses on the South Eastern part of the country, namely the Bekaa plain with an average elevation between 850 and 1100m, bordered by the Mount Lebanon range on the Western, by the Anti Lebanon range on the Eastern side. The main water source for the whole Bekaa is the Litani River crossing nearly the entire North-South extension of the plain. More specifically the project area is the Southern part of the Bekaa plain, comprising left and right bank of the Litani, between Zahle and Marjeyoun (commonly known as Western Bekaa or Bekaa-Gharbi), with 40 villages on a total area of 422 km^2. The socio-economic parameters of the Western Bekaa are defined by high importance of the agricultural sector (31 %), high population growth (42 % between 1994 and 2009), a high unemployment rate (> 15 %), large family structure (> 3 children), high illiteracy rate (> 10 %), and an income level that is inferior to the average incomes in Lebanon.