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Project Evaluation Series
08/2020

Mid-term evaluation of the project "Monitoring water productivity by remote sensing as a tool to assess possibilities to reduce water productivity gaps"

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Project code: GCP/INT/229/NET

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Contents

Boxes, figures and tables

Boxes

Figures

Tables

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The evaluation benefited from the inputs of many stakeholders, including the resource partner, government officers, staff and consultants of the implementing partners in the pilot countries, farmers, academic institutions and private service providers. Their insight, knowledge, advice and comments made this evaluation possible. Their contributions were critical to the team's work and are deeply appreciated.

Acronyms and abbreviations

FAO	Food and Agriculture Organization of the United Nations
ICT	Information and communication technology
IHE	Delft Institute for Water Education
IWMI	International Water Management Institute
WA+	Water Accounting Plus
WaPOR	Water Productivity through Open access of Remotely sensed derived data

Executive summary

Introduction

1. This is the mid-term evaluation of the project "Monitoring water productivity by remote sensing as a tool to assess possibilities to reduce water productivity gaps" (GCP/INT/229/NET). Through the setting and implementation of a publicly accessible near real time, pixel database (called Water Productivity through Open access of Remotely sensed derived data, or for short "WaPOR") allowing the monitoring of agricultural water productivity, the project aims to enable "An action framework to provide workable solutions, available for stakeholders at different scales - from the policy level to the farm level -, to sustainably increase agricultural land and water productivity" (project Outcome). The project was approved in March 2015 for a duration of 48 months and then extended until 31 January 2021. The total project budget (including the supplementary funding after the extension) is USD 12 471 245 and the resource partner is the Government of the Kingdom of the Netherlands.

2. The purpose of the evaluation was two-fold: i) to provide the resource partner and the Food and Agriculture Organization of the United Nations (FAO) with inputs to shape their decision-making on the funding for a possible second phase of the project; and ii) to provide key project stakeholders with suggestions for possible corrective actions to address particular issues or problems in design, implementation and management; and reinforce initiatives that demonstrate the potential for success. The main intended audience and users of the evaluation are the Ministry of Foreign Affairs of the Netherlands, the executing agency (FAO), the external partners involved in project implementation and the national stakeholders responsible for water management at different levels.

3. The evaluation covers all project components and assessed project results at continental (Africa and Near East), national (21 beneficiary countries) and subnational (eight river basins/irrigation schemes) levels, with particular attention to the countries where the pilot actions foreseen in the project were expected to be developed (Ethiopia, Lebanon and Mali). The evaluation team visited one project country (Ethiopia). The implementation period covered by the evaluation goes from March 2015 (project start) to March 2020 (drafting of the evaluation report).

4. The main evaluation questions (EQ) were:

   i. **EQ1.** To what extent is the project aligned to the water-related Sustainable Development Goals, FAO Strategic Objective 2, the Near East and North Africa's Water Scarcity Initiative, overarching regional and national water policies and strategies, and to the country needs?

   ii. **EQ2.** What results have been achieved so far, and what is still outstanding?

   iii. **EQ3.** What are the main factors affecting effectiveness that could prevent future progress towards and the eventual achievement of the project's intended longer term impacts?

   iv. **EQ4.** To what extent are steps being taken to ensure the sustainability of the intervention?

   v. **EQ5.** To what extent is the project being implemented efficiently?

5. The evaluation adopted a consultative and transparent approach with internal and external stakeholders throughout the process. Triangulation of evidence was used to validate the findings and support the analysis. Data collection methods included desk research and review (remote and in-person), semi-structured interviews with various stakeholders and key informants, the conduct of an e-survey and a field mission in Ethiopia.

Main findings

6. The main findings of the evaluation are presented below, grouped by evaluation question (EQs).

EQ1. Alignment and relevance

7. The project is strongly aligned to the Global Objectives, particularly with Sustainable Development Goal (SDG) 6 "Ensure availability and sustainable management of water and sanitation for all" and suitable to contribute to the achievement and measurement of SDG Target 6.4 which addresses water use and scarcity. The project also links to the "Near East and North Africa Water Scarcity Initiative" focussing on "increasing agricultural water productivity in rainfed and irrigated systems". The project strategically supports the sustainable development of African and Near Eastern countries that rely on the efficient use of water resources for improving their agricultural performance, particularly in the smallholder rainfed agriculture and in the established or future irrigation schemes. The WaPOR database builds upon and complements existing FAO water-related data systems and models, and the project shows a strong effort to search for complementarity and synergies with existing initiatives and projects. The selection of regions, countries and river basins appears to be largely strategic and relevant.

EQ2. Results

8. Despite relevant technical challenges, the project has satisfactorily set the WaPOR database, which is currently operational at continental level (all African and Near Eastern countries covered by the 250 m spatial resolution data), national level (21 beneficiary countries can access the WaPOR database at 100 m resolution) and subnational level with a spatial resolution of about 30 m, so far including eight areas of interest (river basins or irrigation schemes). Despite initial delays, Water Accounting Plus (WA+) reports based on remote sensing have been completed for three river basins as planned (Litani in Lebanon, Awash in Ethiopia and Jordan basin). Capacity development of national stakeholders has been partially achieved. A remarkable number of people have been exposed to WaPOR trainings, but capacity building was not related to projects on the ground and the opportunity was missed to build capacity in the system. As for the pilot actions to be developed in the three pilot areas (Ethiopia, Lebanon and Mali), results are generally below initial expectations. Security reasons have strongly hampered field activities in Lebanon and Mali, and only in Ethiopia stakeholders mapping and needs assessment was followed by a gap analysis and the successful application and testing of some possible workable solutions to increase water productivity. Overall, the existence, capacity and willingness of national information and communication technology (ICT) service providers to provide ICT

applications for farmers using WaPOR database is an assumption that did not hold so far.

EQ3. Effectiveness

9. Main factors affecting project effectiveness are:

i. **Project design.** The project was ambitious in its design and expected results, to be achieved in a too-short time span (complexity of setting up the database from continental to national and farmers level, large geographical reach, density of information, etc.).

ii. **Capacity building.** Trainings delivered so far were mainly "introductory", of short duration and not connected to cases or local validation. Capacity building effectiveness is overall challenged by different shortcomings in the process of planning, implementation, monitoring and evaluation of the trainings and in the definition of the main target groups.

iii. **WaPOR outreach through pilot actions.** Pilot action in Ethiopia (Koga irrigation scheme) shows that there is room and potential for improving and progressively scaling up the pilot initiative. However, a clear strategy is not yet in place to progress from the pilot action towards a more structured and systemic outreach of the intervention. The situation is multifaceted in the Bekaa Valley of Lebanon where affiliated external factors limit WaPOR outreach and there is the need of a quick decision on the future WaPOR outreach strategy in the Valley. There is also room to increase the effectiveness of WaPOR outreach in Mali (Office du Niger), where the pilot action remained incomplete, due to security concerns, yet the interest of the Office du Niger for using WaPOR in its irrigation scheme keeps high.

iv. **Outreach through WaPOR practitioners.** Outreach is happening through a number of applications partly developed under other initiatives not directly promoted or financed by the project, which is a positive finding; more so, when observing the large spectrum of ongoing WaPOR applications related to the improvement of water productivity.

v. **Outreach through other projects and initiatives.** Promising partnerships with other projects and initiatives are ongoing, providing an entry point to expand WaPOR outreach and increasing WaPOR national uptake, e.g. the FAO Regional Project for implementing the 2030 Agenda for water efficiency/productivity, and water sustainability in Near East and North Africa (NENA) countries.

vi. **Field outreach and gender.** There is no evidence of gender mainstreaming in the project so far, both in project design and in its field outreach through the pilot actions. There is room for combining WaPOR data with ground level data, so as to address the problem of women access to quality land and water, and of water productivity.

vii. **Communication and knowledge building.** Though WaPOR presents promising elements for creating knowledge in areas related to water management, it is still premature to assess project capacity to create such knowledge through lessons learned, problem solving and knowledge sharing, and WaPOR networking.

viii. **Institutional uptake and national ownership.** The process of progressive local involvement and participation, institutional uptake and national ownership has started to happen, though at a variable extent among the countries, and overall in need of firm steps for improvement and consolidation. There is need to focus on a demand-driven approach based on national/local problem solving.

ix. **Partnership and implementing arrangements.** The implementation of capacity building and field pilot actions in different countries would have been hardly possible without the external partners (Delft Institute for Water Education, IHE Delft; and International Water Management Institute, IWMI) and their recognized know-how. There is currently the need to find more decentralized and nationally owned implementing structures of the project and, at the same time, to improve project monitoring capacity.

EQ 4. Sustainability

10. WaPOR appeal and interest crucially depend on how far the project can go in proving its applicability and effectiveness at field level, which is only starting to happen now. The envisaged WaPOR "action framework" needs a process of institutional uptake and progressive national ownership, which is an essential condition for the institutional sustainability of the intervention. The exceedingly exogenous implementing structure of the project needs to be amended to increase proximity with the countries and to foster national engagement and uptake. Another important factor of sustainability is to maintain users' confidence in the quality of WaPOR data, which has steadily improved over time and needs to become a continuous process. As applications develop and WaPOR continues to establish itself as a reference data set, the importance of a financially sustainable and reliable presence of WaPOR increases. Financial continuity is important. While a resource partner could ensure financial sustainability in the short-term, long-term financial sustainability remains an overall concern to be addressed in a systematic way, rather than on a dispersed projects-focussed base, by exploring possible options (e.g. a pool funding among different players).

EQ 5. Efficiency

11. The project shows a good rate of expenditures, the main fraction of which (around 65 percent) is devoted to "Contracts" (FRAME Consortium, IHE Delft and IWMI). The operations related to the establishment and running of the database received the bulk of the budget and it could be expected that, given the current need of implementing the system in the field, a possible follow-up project would take into account future priorities in its budgeting. Overall, the project was less time-efficient than originally planned. There was an over-optimistic forecast in the project design and work plan concerning the setting of a state-of-the-art database system while, at the same time, external factors caused hindrances and delays, particularly in the pilot actions in Lebanon and Mali. The initial budget was probably underestimated as well.

Conclusions

Conclusion 1. The project is well aligned with, and relevant to Global Objectives, FAO Objectives, regional initiatives on water scarcity and the overarching national water policies and strategies of the beneficiary countries. WaPOR database use for measuring SDG Target 6.4 has not been tested.

Conclusion 2. The project has successfully set-up the WaPOR database using remote sensing and IC technologies for the monitoring of agricultural water productivity. There is an emerging use of the database for research and field implementation purposes. However, capacity building activities and pilot actions developed in three pilot countries were so far not able to adequately underpin the field implementation of the system, test its usability and applicability.

Conclusion 3. The development of an action framework at national level, enabling a process of WaPOR capacity building, participatory decision-making and implementation of workable solutions for improving water productivity, is at an early stage and in need of decisive steps to make effective a "demand-driven" approach based on national/local needs, priorities and opportunities. There is also need for an increased operational capacity of the project to respond to that demand.

Conclusion 4. The quality of WaPOR database is key to maintain users' confidence and needs to be continuously improved (technical sustainability). Financial aspects to ensure the continuity of the intervention are being addressed in the short-term and also discussed in the perspective of a medium-/long-term financial sustainability. Efforts are ongoing to search for complementarities and partnerships with other initiatives and projects. Substantive steps have to be taken to ensure WaPOR institutional sustainability at national level.

Conclusion 5. The project was less time-efficient than originally planned. Cost-effectiveness can increase if project effectiveness improves at national/field level.

Recommendations

Recommendation 1. It is recommended to increase the involvement and ownership of the national and local stakeholders in project implementation.

Recommendation 2. Capacity building activities should be action-centred, i.e. directly linked to field applications of WaPOR for increasing water productivity in real cases. For this purpose, national stakeholders should be progressively involved in planning and implementation of capacity building activities, with particular focus on problem owners and national service providers involved around major water systems.

Recommendation 3. It is recommended to enhance the project capacity of monitoring field activities and their Impact, and of knowledge building (collection, networking and treatment of information), so as to steer and readjust/enforce activities and results, to take stock of applications being developed and capitalize on lessons learned, and to make profitable use of inputs and feedbacks received by WaPOR users on WaPOR usability and applicability.

Recommendation 4. The project should look for opportunities to cross-check WaPOR data on water productivity with ground data on women access and use of water resources (both in rainfed and irrigated land) enabling further gender analysis on water use and productivity.

Recommendation 5. The project should assess to what extent the use of WaPOR data is instrumental to feeding the monitoring system for Target 6.4 of SDG6, as expected.

Recommendation 6. FAO, together with the resource partner, should develop an open financing mechanism for WaPOR that is independent of dispersed project funding and secures the continuity, upgrading and further development of WaPOR.

Recommendation 7. The project, together with main international and national stakeholders, should develop a strategic vision at global and country level to roll-out WaPOR and optimize its impact on water management on the ground.

1. Introduction

1. This is the mid-term evaluation of the project "Monitoring water productivity by remote sensing as a tool to assess possibilities to reduce water productivity gaps" (GCP/INT/229/NET).

1.1 Purpose of the evaluation

2. Based on rules of the Food and Agriculture Organization of the United Nations (FAO), this mid-term evaluation is carried out since i) the project passed the mid-point of the project budget; ii) Office of Evaluation (OED) guidelines require the conduct of a mid-term evaluation for projects of USD 4 million and above; and iii) the project document (ProDoc) emphasized and requested this particular evaluation.

3. According to the evaluation terms of reference (TOR), this mid-term evaluation serves two immediate purposes:

   i. Accountability and decision-making, by providing the resource partner, the Government of the Kingdom of the Netherlands, and the project executing agency (FAO) with important inputs to shape their decision-making on the funding for a possible second phase of the project.

   ii. Improvement, by providing key project stakeholders with suggestions for possible corrective actions, for the remaining time of the current project as well as a possible second phase, to: i) address particular issues or problems in design, implementation and management; and ii) reinforce initiatives that demonstrate the potential for success.

1.2 Intender users

4. The main audience and intended users of the evaluation are:

   i. The Ministry of Foreign Affairs of the Netherlands that will use the mid-term evaluation for accountability purposes and for decision-making regarding its future involvement in project funding.

   ii. The executing agency (FAO), notably the project management team, the budget holder (Land and Water Division, CBL), where the project team is based), other members of the project task force at FAO headquarters and FAO decentralized offices (at country and regional level). These actors will use the evaluation findings to optimize and finalize project activities; to plan for consolidation and sustainability of results achieved; and to improve the formulation and implementation of similar projects, including a possible second phase of the current project already in discussion with the resource partner.

   iii. The external partners involved in project implementation (see section 2.3) and the international experts of the Consultative Group that could use the evaluation findings to optimize their involvement in the project and for future planning.

   iv. National stakeholders, notably the ministries and public institutions responsible for water management at national, subnational (e.g. river basins authorities) and

irrigation schemes levels, actual and potential beneficiaries of project results achieved so far and/or interested in further developing its activities.

v. Other donors, organizations and institutions interested in making use of project's achievements so far, in cooperating and/or supporting future activities and/or implementing similar projects.

1.3 Scope and objective of the evaluation

5. The project is essentially focussed on the setting and implementation of a digital database built upon remote sensing and information technologies that can monitor and report on agricultural water productivity over Africa and Near East, and accessible through the FAO Water Productivity through Open access of Remotely sensed derived data portal (WaPOR).

6. **Scope.** The evaluation covers all four project components (see section 2.2) and assessed project results at continental (Africa and Near East), national (21 beneficiary countries) and subnational (eight river basins/irrigation schemes) levels. The implementation period covered by the evaluation goes from project start (March 2015) to March 2020 (drafting of the final report).

7. The evaluation was launched in September 2019 and the field mission was fielded in February 2020, hence relatively close to the project end date (31/01/2021), for reasons mentioned in section 1.5 on Limitations. It therefore resembles a final evaluation in scope and objectives. More so, since FAO and the resource partner, the Dutch Ministry of Foreign Affairs, have already started the discussions for a possible follow-up project, which would be the second phase of the current one. In this context, the Project Task Force (PTF) and the Resource Partner asked the evaluation team to include conclusions and recommendations that could inform the decision-making about this possible second phase of the project.

8. The terms of reference of the evaluation identified five key evaluation questions (EQs) to be answered:

1. To what extent is the project aligned to the water-related Sustainable Development Goals, FAO Strategic Objectives 2, the Near East and North Africa's Water Scarcity Initiative, overarching regional and national water policies and strategies, and to the country needs?
2. What results have been achieved so far, and what is still outstanding?
3. What are the main factors affecting effectiveness that could prevent future progress towards and the eventual achievement of the project's intended longer term impacts?
4. To what extent are steps being taken to ensure the sustainability of the intervention?
5. To what extent is the project being implemented efficiently?

9. **Objective.** Following indications in the TOR, the evaluation assessed the performance and progress of the project towards the expected objectives and project outcomes. In the assessment, the evaluation analysed i) the alignment of the intervention to overall

objectives, FAO objectives and beneficiaries priorities; ii) results achieved; iii) factors affecting progress; iv) potential sustainability; v) efficiency of the results achieved; and vi) cross-cutting dimensions.

10. The evaluation paid particular attention to the main factors that contributed to – or hindered – the adequate implementation of the planned activities and the achievement of results, including the realism, coherence and comprehensiveness of project design. These elements are also described and discussed through the reconstructed theory of change (TOC) of the project (section 2.4).

11. Project relevance has been analysed, together with the alignment with the main policies and objectives in the area of water productivity and management at international, regional and national levels, and the relation with the FAO Strategic Objectives (SOs) and of the Dutch Government.

12. The level of involvement and quality of participation of main project stakeholders was assessed to understand their specific role, as well as the effectiveness of the overall institutional framework of implementation adopted by the project. The analysis included the implementing agency (FAO), the resource partner, the foreseen Steering Committee and the Consultative Group, national stakeholders and project external implementing partners (signatories of a formal letter of agreement (LOA) with FAO).

13. The evaluation is aware of the possible second phase of the project that is being discussed between FAO and the resource partner. Conclusions and recommendations have been drawn by this evaluation in that perspective.

1.4 Methodology

14. The evaluation team was composed of a team leader and a core team member with a mix of skills fulfilling the requirements of the TOR in different areas, such as projects evaluation of rural development, agricultural land and water management, usage of remote sensing, capacity and institutional building, gender and equity issues. A national consultant integrated the core team during the country visit in Ethiopia. The team worked under the supervision and the methodological guidance of an Evaluation Manager from the FAO Office of Evaluation (OED).

15. The evaluation adhered to the United Nations Evaluation Group (*UNEG*) Norms and Standards for Evaluation (2016) and was in line with the Office of Evaluation (OED) Evaluation Manual (2015) and methodological guidelines and practices. The evaluation has adopted a consultative and transparent approach with internal and external stakeholders throughout the evaluation process. The key evaluation questions outlined above as well as the complementary sub-questions listed in the evaluation matrix represented the main guiding document orienting the evaluation team (see Bibliography). The questions have been posed to project stakeholders and partners, according to their specificity and interest. Whenever possible, triangulation of information has been used to refine and/or consolidate the information received.

16. Data collection methods included desk research and review (remote and in-person), semi-structured interviews with various stakeholders and key informants at FAO headquarters and in the project countries, the conduct of an e-survey as well as focus

group discussions and direct observations during the evaluation mission in Ethiopia. The evaluation matrix in Appendix 2 indicates the methods used for each evaluation question. A list of people interviewed is provided in Appendix 1.

17. The evaluation also had frequent email exchanges with the project management team (the Chief Technical Adviser and the Technical Officer based in FAO/Rome), mostly to answer/clarify questions that emerged during the evaluation process, or to review specific outputs such as for example the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis prepared by the evaluation team, or to revise and comment on the preliminary findings report (see paragraph 21). These exchanges were extremely useful for the evaluation.

18. **The SWOT analysis** has been a useful instrument and was progressively revised through the inputs received throughout the evaluation exercise. Its "final" version is presented in Annex 1. A reconstruction of the project **theory of change (TOC)** served to frame main factors, drivers and assumptions that influenced project results (see EQ3 above). The TOC process started at the inception phase of the evaluation and was further enhanced during the evaluation exercise. The TOC is presented in section 2.4.

19. Through the interaction with project partner Delft Institute for Water Education (IHE Delft), the opportunity arose to receive the mailing list of more than 200 participants (from various countries) of the trainings implemented by the Institute in the framework of the project, as well as a in the framework of a sister project on water productivity database training for Directorate-General for International Cooperation (DGIS) focus countries in Africa and the Middle East funded by the Dutch Government. The evaluation team decided, therefore, to conduct a **Questionnaire Survey** (not originally planned) and 80 people responded from nine countries. The survey was an interesting additional tool to understand the profile of the beneficiaries of the capacity building activities of the project and potential users of the WaPOR database, as well as their opinion on the training received and their perception on the applicability of the database. The results and usage of the survey are presented in Annex 2 and commented in section 3.3.1 (Capacity building).

20. On a special request from the resource partner and the Project Task Force, the evaluation team prepared a **report with preliminary findings** based on the data collection exercise conducted in November and early December 2019, which was presented on 20 December 2019. This report served as an important input for the first discussion round within the Dutch Ministry of Foreign Affairs on the financing of the second phase of the project, which was scheduled for early January 2020.

21. The **country visit to Ethiopia** was highly relevant in providing a quite comprehensive picture of water management issues and potential, the level of involvement and participation of national and local stakeholders, as well as a fresh view of the priorities and concerns of existing WaPOR stakeholders regarding water productivity and the role of WaPOR. The evaluation team held interviews and focus group discussions with potential and actual project stakeholders and partners and conducted a field visit to the water productivity field activity within the Koga irrigation scheme. Here the team held separate focus group discussions with farmers as well as development officers, extensionists and irrigation managers of the Scheme. The focus group discussions provided valuable insights on how local actors look at existing challenges, expectations

and potential for water productivity improvement. A specific learning note on the project in Ethiopia is presented in Annex 3.

22. For the two other pilot countries, the team collected information through **email and Skype interviews with main stakeholders** in Lebanon and Mali, namely the Lebanese Agricultural Research Institute (LARI) and International Water Management Institute (IWMI) officers in Lebanon, and the Office du Niger and the non-governmental organization (NGO) "AKVO" in Mali. Relevant stakeholders in Sudan were interviewed by an evaluation team member during **the Water Sector Conference held in Khartoum, Sudan** on 19-20 February 2020.

23. Overall, stakeholders' availability and engagement in the evaluation has been remarkable, showing a real interest in project implementation and in the setting of the WaPOR database. Their contribution and their frankness have been most useful to understand strong and weak points of the project.

1.5 Limitations

24. There have been delays in planning and conducting the evaluation due to the lack of capacity in the FAO Office of Evaluation (OED) in the originally planned period. Due to prevailing security concerns evaluation country visits could not be considered to all three project countries with field level activities (Mali, Ethiopia and Lebanon). Mali was dropped during the evaluation design due to already known prevailing security concerns. Country visits were planned to Lebanon and Ethiopia for end-November 2019, however due to unforeseen yet prevailing security concerns the visit to Lebanon had to be cancelled.

25. The country visit to Ethiopia had to be postponed to end-February 2020, due to a request from the Ethiopia FAO Representative so as not to overlap and interfere with other end-of-year priorities, among which the Ordinary Session of the Assembly of Heads of State and Government of the African Union (AU) in Addis Ababa from 21 January to 10 February 2020. Due to these constraints, the delivery of the draft and final evaluation report has been delayed for nearly two months relatively to what originally planned.

26. The field mission to Ethiopia was very useful. The impossibility to visit the other two focus countries (Lebanon and Mali) is a limitation of the evaluation.

1.6 Structure of the report

27. Following this introduction, Chapter 2 presents the background and context of the project. Main findings are presented in Chapter 3, grouped by evaluation questions. Lastly, conclusions and recommendations are found in Chapter 4.

2. Background and context of the project

2.1 Context and objective of the project

28. While population growth and economic development are putting unprecedented pressure on renewable, but finite water resources, especially in arid regions, scarce land and water resources are affecting food security and sustainable water management. With agriculture being responsible for around 70 percent of all freshwater withdrawals worldwide, and up to 95 percent in several developing countries (AQUASTAT, 2014), careful and systematic monitoring of water productivity[1] in agriculture represents a key factor for improving water management. For decades FAO has been supporting the development and implementation of policies, guidelines and programmes to improve water management all over the world.

29. FAO has also designed and set various models and databases that are used by research organizations, development agencies and private sector companies to calculate water productivity at different spatial scales. However, as explained in the project document "none of those tools can be used in an operational way to assess and monitor water productivity rapidly, routinely and consistently in time and space at affordable costs. Therefore, there is a need to develop an improved methodology to monitor water productivity at low costs, on near real time, that can be applied at different spatial scales and that can be used as a reliable information base for agricultural water management decisions".

30. **Project objective and purpose.** Based on this context and rationale, the current project aims to generate a publicly accessible near real time, solid and validated pixel database, called WaPOR, using remote sensing and information and communication technologies (ICTs), allowing the monitoring of agricultural water productivity. As explained in the project document, WaPOR:

    i. by providing near real time pixel information, should open the door for service-providers to assist farmers in obtaining more reliable yields and improving their livelihoods;

    ii. by analysing temporal and spatial data available in the WaPOR database, should allow irrigation authorities to have access to information to modernize their irrigation schemes;

    iii. should enable government agencies to use this information to promote and increase the efficient use of their natural resources and monitor the net uptake of carbon dioxide.

[1] Water productivity is defined as the quantity or value of output in relation to the quantity of water beneficially consumed to produce this output. In agriculture, it can be expressed as the amount of product (biomass or yield) per unit of water consumed by the crop (evapotranspiration) (kg/m³).

2.2 Project design, levels of intervention and beneficiaries

31. To reach the objective, the project design was structured around four components:

i. **Component 1:** An open access, operational, near real time spatial database.

ii. **Component 2:** Assessment of water and land productivity.

iii. **Component 3:** Assessment of the consequences and sustainability of possible increases in water productivity by means of water accounting.

iv. **Component 4:** Capacity development of stakeholders to increase water productivity sustainably.

32. The project components, outcomes and activities can be seen in the project logical framework (Annex 4) and will be discussed in more detail in sections 2.4 (theory of change) and 3.2 (Evaluation question 2).

33. In short, Component 1 refers to the setting of the WaPOR database, allowing the assessment of land and water productivity (Component 2), so as to permit a first identification of productivity gaps to be tackled. With the first two in place, the project foresees water accounting in some selected areas, the identification of possible scenarios for water productivity improvement (Component 3) and the planning and implementation of capacity development and outreach activities (Component 4).

34. The structure of the WaPOR database and the process of its implementation occurred, as planned in the project design, at three levels, namely:

i. Level 1: **Continental level** with a spatial resolution of about 250 m. This level includes the whole of Africa and Near East, i.e. the area comprised between 30W, -40S, 65E, 40N.

ii. Level 2: **Country level** with a spatial resolution of about 100 m. It currently includes 21 countries (they were 15 in the project design): Benin, Burundi, Egypt, Ethiopia, Ghana, Iraq, Jordan, Kenya, Lebanon, Mali, Morocco, Mozambique, Niger, Rwanda, South Sudan, Sudan, Syrian Arab Republic, Tunisia, Uganda, West Bank and Gaza Strip, and Yemen. Water accounting of river basins have also been executed at this level (100 m resolution) so far.

iii. Level 3: **Subnational level** with a spatial resolution of about 30 m. It currently includes eight areas (there were three in the project design), namely: Awash basin (Ethiopia), Bekaa Valley (Lebanon, Litani basin), Busia county (Kenya), Gezira irrigation scheme (Sudan, Nile basin), Koga irrigation scheme (Ethiopia, Nile basin), Lamego irrigation scheme (Mozambique, Pungwe basin), Office du Niger (Mali, Niger basin) and Zankalon (Egypt, Nile Delta).

35. The project targets different types of beneficiaries. Detailed information in space and time is supposed to directly support the decision-making process of relevant national stakeholders, like national government institutions dealing with water and agriculture, national planners and decision makers. Basin authorities and managers of public and private irrigation schemes are a particularly important group of beneficiaries: they are supposed to benefit from increased ability to monitor agricultural water productivity and improve the operational management of available water resources with a variety

of other possible applications. A related group of beneficiaries are investors in rainfed, spate and conventional irrigation systems, since WaPOR could also be used to assess the impact of investment in terms of evapotranspiration and biomass (soil and moisture conservation techniques, water harvesting, etc.).

36. Research institutions, other existing projects, NGOs and private service providers could make direct use of the open-access system to develop specialized ICTs solutions that enable locally relevant use of the data from the database, according to their needs and priorities.

37. The Government of the Netherlands is also an important beneficiary since water management, and particularly the increase of water productivity, is a key-sector of its international cooperation policy, as substantiated by their interest in funding the project. As stated in the project document, "agricultural water productivity in Dutch supported projects should increase by at least 25 percent".

38. The ultimate beneficiaries of the project are the water users, farmers and local communities, who should benefit from information and decision support systems contributing to better water use for agricultural production. The ProDoc envisaged attention to gender.

39. Capacity development activities at field level were aiming to specifically target farmer communities in Ethiopia (Koga scheme, both irrigated and rainfed), Lebanon (farmers in irrigated areas of the Bekaa Valley) and – to a lesser extent due to security conditions – Mali (Office du Niger). The project seems currently oriented to redirect IWMI activities in Egypt (Zankalon irrigation scheme) in substitution for Mali.

2.3 Implementation and management arrangements

40. The project is implemented under FAO's overall technical and methodological coordination and managed by a Chief Technical Officer assisted by a Technical Officer, both stationed at FAO Land and Water Division (CBL) of which the Director is the Budget Holder. The project is receiving the support of the FAO decentralized offices at regional and national level, and of the Information Technology Division (CIO) involved in the implementation and operationalization of the spatial database.

41. **Implementing partners.** Three main implementing partners have developed specific components of the project through letters of agreements or contracts signed with FAO, namely:

    i. The FRAME Consortium_that was appointed through a public tender for the development and implementation of the online platform (WaPOR) that provides free access to satellite-based data for monitoring and reporting on agriculture water productivity over Africa and the Near East.

    ii. The IHE Delft Institute for Water Education (formerly UNESCO-IHE) based in Delft - the Netherlands, responsible for all activities under Component/Output 3 (water accounting), for the quality control of key deliverables (WaPOR database and assessment outcomes validation) and also directly responsible for Activity 4.9 regarding the development and piloting of training curricula targeting technical staff at ministries, research and academia.

iii. The IWMI, a Consortium of International Agricultural Research Centers (CGIAR, formerly Consultative Group on International Agricultural Research) institute (based in Sri Lanka with decentralized offices in Africa), is responsible for the implementation of most of the activities for Component/Output 4 addressing capacity needs assessment and identification of locally relevant, ICT-based solutions to increase land and water productivity at field level.

42. To implement activities in project countries, additional partnerships were sought:

i. The expertise of selected Dutch Water Authorities and AgriProFocus members involved in the Dutch-funded programme "Geodata for Agriculture and Water (G4AW) facility" was sought to assure that local organizations have access to the data produced by the project.

ii. AKVO in Mali, for field data collection activities, PlantVillage – Penn State University, for field data collection and testing of FAMEWS/PlantVillage app in Kenya, Lebanese Agricultural Research Institute through IWMI for improving ICT solutions in Bekaa Valley.

43. **Steering Committee.** The Project Steering Committee consists of representatives of FAO, IHE Delft and the resource partner. Its role is to oversee the project and to provide strategic directions.

44. **Consultative Group.** The project design envisaged exchanges with a Consultative Group to ensure scientific soundness, sustainability and usability of project deliverables. This group is supposed to meet on demand and consists of international experts from the above mentioned institutions, stakeholders at different levels including the African Minister's Council on Water (AMCOW), actual and potential users of the project outputs, and representatives of the different units within FAO (headquarters departments, [sub]regional offices, country offices) that are in one way or another involved or interested in the project.

45. The project's governance structure, as foreseen at design, is illustrated in Annex 6.

46. The main features of the project are summarized in the following Table:

Table 1: Basic project information

Project ID number	**GCP/INT/229/NET**
Recipient countries in Africa and the Near East	Benin, Burundi, Egypt, Ethiopia, Ghana, Iraq, Jordan, Kenya, Lebanon, Mali, Morocco, Mozambique, Niger, Rwanda, South Sudan, Sudan, Syrian Arab Republic, Tunisia, Uganda, West Bank and Gaza Strip, Yemen.
Executing Agency / Budget Holder	FAO (Land and Water Division, CBL)
Implementing partners	FRAME Consortium, IHE-Delft, IWMI
Resource partner	The Netherlands, Ministry of Foreign Affairs
Focal area	Water and Land Productivity

Project ID number	GCP/INT/229/NET
Approval date	09 March 2015
Date of project start and planned duration	18 March 2015 (48 months)
Current end date (after extension)	31 January 2021
Initial budget	USD 9 992 590
Additional budget with extension	USD 2 478 655
Total budget	USD 12 471 245

Source: Field Programme management Information System (FPMIS)

2.4 Theory of change

47. The evaluation team reconstructed a preliminary theory of change at the inception phase of the evaluation, which has been gradually revised all along the evaluation exercise taking into account the findings and inputs received from the project stakeholders.

2.4.1 Overview of project activities, expected sequence and results

48. The TOC was not elaborated, as such, in the project document, because it was not requested at the time of project formulation. Nevertheless, the ProDoc provides the rationale of the project and the logical sequence of activities and expected results.

49. The project is essentially conceived as a "problem solving" process around the issue of water productivity (WP): how to know and measure WP (hence, the database), how to identify WP gaps (problem identification) and how to address them through appropriate and effective solutions (the pilot actions). The overall logical pathway of the project is clear and consistent.

50. Following this rationale, the project logical framework (Annex 4) identified three levels of expected results (Impact, Outcome and Outputs) as summarised in the following Table.

Table 2: Expected project results as defined in the logical framework

Level of results	Definition of results
Impact	More sustainable, productive and climate change resilient agricultural practices with a reduced impact on the environment in general and on freshwater resources in particular.
Outcome	An action framework to provide workable solutions, available for stakeholders at different scales - from the policy level to the farm level -, to sustainably increase agricultural land and water productivity.
Outputs	Output 1: An open access, operational, near real time spatial database.
	Output 2: Assessment of water and land productivity.
	Output 3: Assessment of the consequences and sustainability of possible increases in water productivity by means of water accounting.
	Output 4: Capacity development of stakeholders to increase water productivity sustainably.

Source: Project document

51. Based on the above information, the evaluation team set-up the following overall logical pathway of change, which sets the red line for the Theory of Change.

i. The setting of a remote sensing database (WaPOR), the assessment of water productivity and of existing productivity gaps, the identification of possible ways of WP improvement and subsequent capacity building actions **(Outputs level)** enabling:

ii. The implementation of actions (at different levels, from policymakers to farmers) intended **to increase water productivity** (the substantive expected change expressed in the **project Outcome**), hence contributing to:

iii. More sustainable and productive patterns of water use and management (as expressed in the **project impact**).

2.4.2 The intermediate stages and the assumptions

52. Based on the above pathway, the evaluation team further developed the theory of change by illustrating significant assumptions that are expected to contribute to the realization of the so-called intermediate stages, before the project can reach its main outcome and ultimately impact.

53. As outlined in the previous section (2.4.1), there is a logical and temporal sequence from Output 1 to 4, through an "If…then…" chain (cause-effect): "if Output 1 is delivered then Output 2 can be delivered, if Output 2 is delivered then Output 3 can be….", etc. The phase of "problem identification" is key and Outputs 1 and 2 lay the foundation of the WaPOR methodology. Outputs 3 and 4 link the phase of problem identification to the "problem solving" phase (from Outputs to Outcome). Output 4 is deemed crucial for all stakeholders since it refers to building capacity at national, subnational (basin) and local level in order to provide and develop the "workable solutions".

54. The achievement of the project Outcome (the sustainable increase of land and water productivity) is a complex process, since "workable solutions" have to be found, discussed, provided and developed. This process is progressively defined through the implementation of an operational methodology, defined in the ProDoc as an **action framework,** which is basically a **process of decision-making and decision-implementation, as visualized in Figure 1**.

55. The implementation of this methodology should progressively support the achievement of the project outcome through a sequence of intermediate stages (the yellow boxes in Figure 1), and the enabling of relevant assumptions (the green boxes in Figure 1).

56. The TOC has reconstructed the following pathway from the action framework to the main project Outcome as follows:

i. **Intermediate Stage 1: Improved decision-making capacity of all stakeholders in place.** If actions have to be taken and/or solutions have to be provided to increase water productivity, all stakeholders involved need to have capacity to meaningfully participate in the decision-making process described above.

ii. **Intermediate Stage 2: Workable solutions are identified and provided** at basin and irrigation scheme levels for filling the observed gaps of land and water productivity.

iii. **Intermediate Stage 3: Workable solutions are implemented.**

57. There are, however, relevant **assumptions to hold** for the achievement of the intermediate stages and the main project Outcome. These can be visualized in the right part of Figure 1 (green boxes). Decision-making capacity of national stakeholders at all levels can be improved (Intermediate Stage 1) and workable solutions can be provided (Intermediate Stage 2) based on some **assumptions** (some of them not explicit in the ProDoc):

i. the capacity building activities under Output 4 have generated an increased capacity of national stakeholders at key levels (not significantly in place, as discussed in section 3.3.2);

ii. a critical mass/pool of national experts exist to give technically sound contributions (partially in place in Ethiopia, as discussed in section 3.3.2);

iii. adequate two-way communication capacity is equally in place to warrant stakeholders' participation at different levels (from planners to water users; between demand and supply for water productivity analyses) (not in place, as discussed in sections 3.3.4 and 3.3.5);

iv. ICT solutions/applications exist to enable locally relevant use of the data from the spatial database (to be run on smartphones, tablets, PC's) (not in place so far, see section 3.3.4);

v. National ICT-applications providers (from public and private sectors) exist to provide the ICT solutions mentioned above (not in place or explored by the project so far, see section 3.3.4).

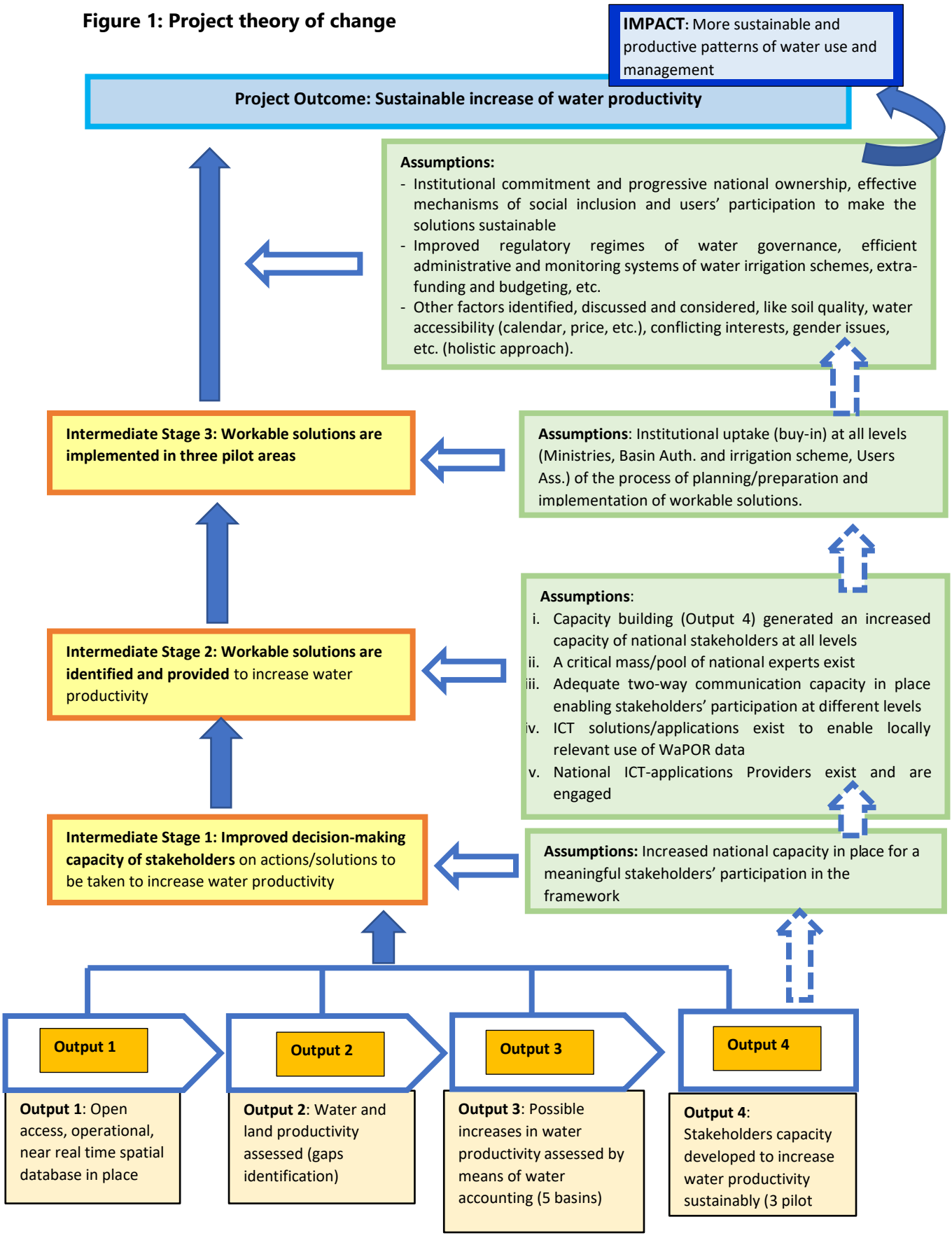
58. Based on the above, the implementation of workable solutions (intermediate stage 3), but also the institutional sustainability of the WaPOR methodology, is based on the **assumption** that a solid process of institutional uptake (buy-in) and national ownership is in place at all levels (ministries, basin authorities, irrigation scheme managers, investors and water users). Depending on the solution to be adopted, this may imply improved regulatory regimes of water governance, more efficient administrative and monitoring systems, adequate attention for water management, ability to make operational changes towards better management (institutional, motivational, financial), among others. In this perspective, a crucial assumption is that the interest and willingness of the country to decidedly pursue the improvement of water management at different levels is not lacking.

59. The substantive step from Intermediate Stage 3 to project Outcome depends on a number of key assumptions that are summarized in the upper green box of Figure 1. Whereas few of them are discussed in this report (in Chapters 3 and 4, e.g. "national

ownership") many others are beyond the scope of the project evaluation, being related to the overall governance mechanisms of water management in the countries (policies, regulatory regimes, administrative systems), to other policies (e.g. social inclusion, land tenure), or to physical factors (e.g. soil quality, water and soil conservation measures in place, etc.).

60. Unfavourable **external conditions**, mainly due to the security situation in pilot countries, have strongly affected project implementation, yet they were not considered as an assumption to hold at project design stage.

Figure 1: Project theory of change



Source: Evaluation team (based on the ProDoc)

3. Findings

3.1 Evaluation question 1. To what extent is the project aligned to the water-related Sustainable Development Goals, FAO Strategic Objective 2, the Near East and North Africa's Water Scarcity Initiative, overarching regional and national water policies and strategies, and to the country needs?

3.1.1 Project alignment and relevance

61. **The project is strongly aligned to the Global Objectives**, particularly Sustainable Development Goal (SDG) 6 "Ensure availability and sustainable management of water and sanitation for all" and its Target 6.4 addressing water scarcity, water-use efficiency and securing environmental water requirements. In fact, WaPOR was intended to be a main instrument in tracing the progress on this particular SDG target. With its focus on increased land and water productivity, the project is also strongly aligned with SDG 2 "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" particularly Target 2.4 "Sustainable food production and resilient agricultural practices" and its Indicator 2.4.1 "the proportion of agricultural area under productive and sustainable agriculture".

62. More specifically, the project has been found relevant in:

i. Providing an open access tool for measuring water productivity on a wide geographic basis, with a good temporal resolutions (every ten days) and a good level of validation and quality control, which makes the tool suitable to contribute to the achievement and measurement of SDG Target 6.4 which addresses water use and scarcity.

ii. Linking directly to FAO Strategic Objective 2 "Make agriculture, forestry and fisheries more productive and sustainable". More particularly, it links with the major area of work (MAW) "Sustainable Intensification through Resource Use Efficiency" and the corporate areas for resource mobilization (CARM) "Doing more with less – sustainable intensification of agriculture".

iii. Linking with the "Near East and North Africa Water Scarcity Initiative", particularly in two areas of work of the Initiative: "increasing agricultural water productivity in rainfed and irrigated systems" and "benchmarking, monitoring and reporting agricultural water productivity". The initiative specifically emphasizes the introduction of innovations and tools to measure results in support of decision-making processes, taking advantage of latest technologies (e.g. satellite remote sensing).

iv. Strategically supporting the sustainable development of 21 African and Near Eastern countries that rely on the efficient use of water resources for improving their agricultural performance, particularly in the smallholder rainfed agriculture and in the established or future irrigation schemes.

v. Capturing the needs and priorities of a large number of ultimate beneficiaries that rely on improved water management and water productivity (both in rainfed

and irrigated agriculture) to achieve and improve households food and nutritional security, and to enhance their climate resilience.

3.1.2 Project complementarities and synergies

63. The recent evaluation carried out by the Office of Evaluation (OED) on FAO's work on statistics (2019-2020) noted that statistics remain core to the FAO mandate and that FAO has ample experience in collecting and processing statistical data related to food and agriculture, and in hosting databases, software and tools to monitor and manage the related data.

64. **The WaPOR database builds upon and complements existing FAO water-related data systems and models**, particularly those related to water outlined in the Box below.

Box 1: Main FAO water-related data systems and models

i. FAO's global information system of water and agriculture AQUASTAT, which monitors and reports on water resources and agricultural water use in all member countries, and its complementary spatial database AQUAMAPS.

ii. AquaCrop model developed by the Land and Water Division (CBL), which simulates the yield response of herbaceous crops to water. It is mainly used to evaluate the impact of different management practices or climate scenarios on crop yield.

iii. CropWat computer programme produced by CBL as well, which allows the calculation of crop water and irrigation requirements based on soil, climate and crop data.

iv. The Agricultural Stress Index System (ASIS) that monitors agricultural areas with a high likelihood of water stress/drought at global, regional and country level (drought hotspots).

v. FAO Hand in Hand Geospatial Platform, which is an evidence-based, country-led and country-owned initiative of FAO to accelerate agricultural transformation and sustainable rural development to eradicate poverty (SDG1) and end hunger and all forms of malnutrition (SDG2), integrating data from across FAO on soil, land, water, climate, fisheries, livestock, crops, forestry, trade, social and economics, etc.

Source: Evaluation team

65. **Overall, the project shows a strong effort to search for complementarity and synergies with existing initiatives and projects, and for implementing new partnerships to enlarge the "WaPOR community".** The project team has developed an intense activity of information, communication, awareness raising and advocacy in various occasions, such as fora, workshops, international meetings, particularly from 2018 onward, to explore the possibility of partnerships and synergies both within FAO and with other institutions, organizations and projects. This activity has started opening opportunities of collaboration and partnership in some countries or basins beside the original pilot ones.

66. This has been the case, for instance, for the Zankalon areas in Egypt that was added under request of the FAO Regional Office in Cairo, so as to cooperate with the regional project "Implementing the 2030 Agenda on water efficiency/productivity and water sustainability in Near East and North Africa (NENA) countries" (GCP/RNE/009/SWE), funded by the Swedish International Development Cooperation Agency (SIDA) in

support of the FAO Regional Initiative on Water Scarcity previously mentioned in paragraph 59.

67. Other countries have manifested their interest in developing the WaPOR methodology to increase Water Productivity, such as Sudan, which was added after the project extension in 2019, while the FAO project "Strengthening Water Governance to Support Food Security and Prevent Water Scarcity" (GCP/GLO/907/GER) funded by the German Government has started implementing water accounting using WaPOR data in three countries (Rwanda, Senegal and Sri Lanka). There is also a recent partnership established with the PlantVillage initiative, a research and development unit of Penn State University, in Kenya, as discussed in section 3.3.2 (WaPOR Outreach).

3.1.3 Selection criteria of the WaPOR scope, countries and river basins

68. **The selection of regions, countries and river basins appear to be largely strategic and relevant.** The Near East, Northern Africa, Sahelian and Horn of Africa regions (where the majority of the 21 participant countries are located, see section 2.2) are among those more in need of improved water management, due to their climatic conditions and to the presence of important national and transnational river basins (e.g. Niger, Nile, Awash, Jordan, Litani). These rivers provide water not only for large irrigation systems but are also essential to respond to the crucial water needs of the population, to sustain economic activities and for environmental sustainability.

69. The selection of countries has also been oriented by the Government of the Netherlands so as to include the countries where the resource partner is prioritizing its international cooperation, with emphasis on the water sector. It has to be noticed, however, that the whole African continent and Near East region is contemplated in the WaPOR database at "continental" level (see Level 1 in section 2.2).

70. Within this relevant and geographically widespread context, the project design contemplated to develop pilot actions in three countries/river basins. Three countries were selected so as to include one Sahelian country (Mali), one from the Horn of Africa (Ethiopia) and one from the Near East (Lebanon) with strategically relevant basins or irrigation schemes with potential for improvement. Unfortunately, the security conditions of pilot countries (particularly Mali and Lebanon) have seriously challenged the initial countries' selection of the project.

71. On the account of the above, readjustments had to be done, as described in section 3.2. Criteria for prioritizing additional countries have been managed by the project with flexibility, taking into account the emerging opportunities of cooperation and/or the specific requests of implementing the WaPOR framework from other countries, institutions and projects, eventually widening the group of focus-countries from three to eight (see Level 3 in section 2.2).

72. Overall, when looking at the whole group of the 21 beneficiary countries, it is evident that a considerable number of them are deeply affected by security concerns and even by situations of recent or ongoing wars. These conditions dramatically increase the suffering and vulnerability of the population, situations of increased water scarcity and food insecurity, increased pressure and conflicts around water resources, internally displaced population and high number of immigrants/refugees from neighbouring

countries. The efforts and the willingness of the project to work in difficult areas as long as possible, is therefore admirable.

73. Whereas there are water challenges in many countries, WaPOR seems particularly effective to assess relatively large water systems – more so in systems with single crops. These limitations particularly apply for Level 1 and Level 2 data, whereas Level 3 data by virtue of the higher resolution offer more scope: for smaller systems and more diverse cropping patterns.

3.2 Evaluation question 2. What results have been achieved so far, and what is still outstanding?

74. This question has been answered by following the sequence of the four Outputs to be delivered by the project.

3.2.1 Delivery of Output 1

Output 1 (from LogFrame)	**Indicators** (from LogFrame)
An open access, operational, near real time spatial database	- Databases on continental; country/river basin and field scale available, accessible and being used - All digital data layers foreseen in the ProDoc, are available and up to date.

75. **Output 1 has been satisfactorily delivered.** The Beta Version of the FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data (the WaPOR database) has been available since April 2017. Version 1 was put online since 2018 and extensively tested (see below). The upgraded Version 2 is available as of June 2019. The FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data (the WaPOR database) was online in April 2017 and an upgraded Version 2 is available as of June 2019. The system includes variables such as water productivity, reference evapotranspiration, actual evapotranspiration and interception, precipitation, net primary production, total biomass, a seasonal phenology layer and land cover classification. All layers are published in near real time (temporal resolution ten days). Some layers are published daily (e.g. precipitation).

76. All 21 beneficiary countries can access the WaPOR database at 100 m resolution (Level 2), whereas all African and Near Eastern countries are covered by the 250 m data (Level 1). Crop maps foreseen at Level 3 (irrigation scheme) with a resolution of 30 are published for the Bekaa Valley (Litani basin, Lebanon) and for the Koga irrigation scheme (Abbay/Blue Nile basin, Ethiopia) while other three crops maps (Awash basin – Ethiopia, Office du Niger – Mali and Zankalon – Egypt) are estimated to be online by April-May 2020.

77. The database methodology has been revised and published by FAO for Levels 1, 2 and 3 (2018). Quality controls were organized and thoroughly carried out at different steps, from a first control by the FRAME Consortium before delivery to FAO, through a second one on Google Cloud for data consistency, and eventually by ITC-Twente (University of Twente's Faculty of Geo-Information Science and Earth Observation) and by IHE Delft, and reported (2019). Quality controls done by ITC-Twente included ground data sets, albeit to a limited extent. Data quality control undertaken by the FRAME

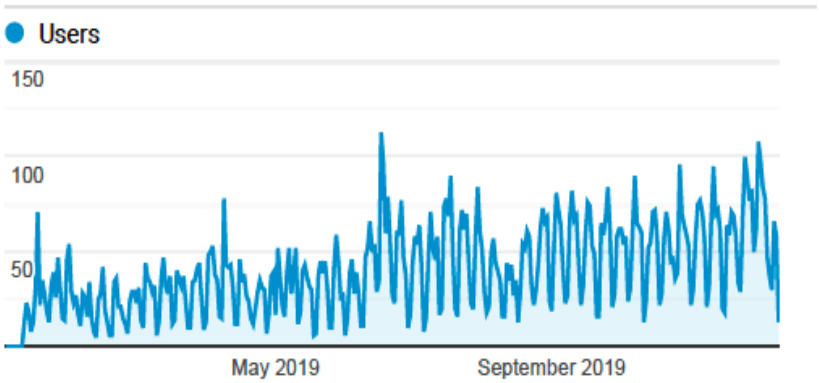
Consortium included two ground truth field survey campaigns used for validation in Bekaa Valley (2017) and Awash basin (2018). During the project extension phase, a large ground truth survey campaign in the subnational area of Gezira, Sudan, is currently ongoing.

78. **The project has had a strong exploratory character with many unexpected problems to solve, since there had never been a similar system before.** The setting of the database has experienced different technical challenges that have been largely overcome. The main non-delivery against the original plan concerned the crop maps. During the review workshop of 2018 it was eventually decided that the crop-specific classification for Level 2 (100 m. resolution) had to be abandoned, having recognized the technical challenges associated to it and its dependency on resource-intensive ground data collection activities. Crop distribution information will therefore be available only for five pilot areas at 30 m resolution, as previously mentioned. The lack of good quality images in Landsat archives for the years 2009-2013 has been an overall shortcoming of the system. A shortage of good quality field reference data (with a wide spatial and temporal coverage) also presented additional technical challenges for crop mapping at the subnational level.

79. **Against this setback, there have been a number of important positive developments that were not foreseen.** The first was making the WaPOR cloud-based, facilitating access globally. The second, still ongoing development is the expansion and formalization of the collaboration with the Copernicus programme that could make it possible in the (near) future to have data available at a much higher resolution (10 by 10 meters) opening up a number of new and more precise data. The third is data dissemination through application programming interface (APIs). This is a powerful innovative approach. No clear guidelines and uses cases were available at the time of project set-up to inform on the design of APIs, and the work done through this project paved the way for several similar tools developed at corporate level.

80. **The use of the WaPOR portal (as required by the first indicator) has increased over the last year**, as can be seen from Google Statistics, with around 75 users per day between May and September 2019 (see graphic below). The majority of the sessions may still be project-related with most users based in Italy and the Netherlands. Among the target countries, Ethiopia and Kenya register the largest number of sessions.

Figure 2: Use of the WaPOR portal



Source: Google Statistics

81. The evaluation team set-up a SWOT analysis on the technical and institutional aspects of WaPOR, based on the inputs received from stakeholder interviews and the e-survey. Overall, the main aspects that were emphasised by stakeholders are outlined below, while the full SWOT analysis can be found in Annex 1.

82. The main good aspects that were pointed out are:

i. innovative character of WaPOR that directly links biophysical parameters to water productivity;
ii. wide geographical basis;
iii. open access and neutral database;
iv. nearly real time database system, providing long-term series of data (hence also enabling to assess changes in water productivity);
v. good level of validation and quality control;
vi. flexibility and adaptive capacity to problems and needs at ground level, which makes the system useful for different purposes;
vii. increased availability and ease of access (fully cloud-based).

83. The main challenging aspects that were pointed out are:

i. downloading can be difficult in countries with low bandwidth;
ii. cloud cover can hinder visibility and data collection;
iii. requires moderate to high-level skill to use (not very user-friendly);
iv. problems of image resolution have so far impeded applications of WaPOR at micro-level (small and diverse irrigation schemes, individual farmers). The current Level 1 and Level 2 data sets limit the applicability of WaPOR in assessing relatively small water system and systems with highly fragmented land use;
v. difficulty to classify land uses
vi. verification and validation should continue, so as to improve accuracy and reliability.

3.2.2 Delivery of Output 2

Output 2 (from LogFrame)	**Indicators** (from LogFrame)
Assessment of water and land productivity	- Digital data layers with calculated water productivity score on country scale - Digital data layers with calculated crop water productivity for three major crops on country and river basin scale - Digital data layers with calculated crop water productivity on the scale of irrigation scheme - Consistent dataset and analyses available describing the performance of water management in agricultural projects in terms of crop water productivity and economic water productivity

84. **Output 2 has been delivered to a variable extent.** Water productivity layers have been published regularly at continental (annual) and national level (seasonal). Seasonal water productivity for Level 2 (national) better captures the biomass production and water consumed during the growing cycle of vegetation, hence improving the accuracy of the water productivity assessment.

85. Water productivity at subnational level (Level 3, river basins) is currently fully available under the updated version (Version 2) of WaPOR. An API that allows for user-defined water productivity calculations, have also been developed.

86. **Crop maps planned in the ProDoc (see second indicator) for three main cereal crops at Level 2 (national level, 100 m resolution) will not become available** – missing out on a large number of relevant applications (such as comparing crop performance over the years and between areas). The service provider did submit some preliminary results in that sense, but the project team did not consider the quality good enough for publishing on WaPOR portal. Some remedial actions are ongoing and being tested (e.g. the possibility for users to upload their own data and parameters to run context-specific analyses).

87. The project has, nevertheless, started producing crop maps at Level 3 (subnational, 30 m resolution), as requested (see third indicator). This activity was delayed for logistic challenges in ground data collection also coupled to security concerns, but crop maps at Level 3 (30 m resolution) are now available, as mentioned under previous Output, for the Bekaa Valley (Lebanon) and the Koga Scheme (Ethiopia) and will be soon available for three other areas in Egypt, Ethiopia and Mali.

88. **Spatial resolution at field level (30 m) shows promising use at irrigation schemes level (Level 3)**, where the WaPOR system enables the computation of crop water productivity over user-defined areas and seasons, hence potentially supporting informed decision-making on agriculture and water interventions, particularly for the irrigation managers. Even 100 m resolution in large single crop systems can deliver promising application, particularly because, by combining WaPOR with other data sets, data can be scaled down.

89. Related to the above, as for the last (fourth) indicator, irrigation scheme performance assessment in terms of crop water productivity and economic water productivity was originally planned to take place in the Office du Niger (Mali), which was not possible due to prevailing security conditions. It has to be stressed, in fact, that to assess economic water productivity, field data on yields and prices are required. Due to the unfeasibility of carrying out this analysis in Mali, the project looked for alternatives. The most promising alternative seems to be to implement these activities in Sudan, included in the project extension (2019-2021) due to the large potential for improving water productivity in the Gezira Scheme (covering more than 1 Mha).

90. Although not explicitly formulated in the LogFrame, the ProDoc emphasizes that assessing water productivity should lead to the identification of "productivity gaps", so as to define and plan activities of improvement of water productivity at field level. As a matter of fact, **despite some promising ongoing activities in Ethiopia, the overall use of WaPOR to assess water productivity gaps has been so far quite limited**. Most applications are still at diagnostic level (understanding water productivity scores) rather than analysis level (understanding the reasons for high or low performance) let alone prescriptive.

91. There is actually an ongoing diagnostic work in Ethiopia and in other countries comparing water productivity in large sugar cane estates where, due to the homogeneous mono-crop situation, Level 2 of WaPOR assessment (100 m resolution) could unearth new insights in one of the most important and politically sensitive crops in Ethiopia.

3.2.3 Delivery of Output 3

Output 3 (from LogFrame)	**Indicators** (from LogFrame)
Assessment of the consequences and sustainability of possible increases in water productivity by means of water accounting	- Measurement, reporting and verification mechanism is operational - Water accounting sheets are operational to monitor regularly water flows - Scenarios have been developed, modelled and reported

92. **Output 3 was formulated in the ProDoc as a composite output, incorporating different aspects and levels of deliverables, which have been produced by the project to a variable extent.** The implementing partner responsible for the development of this project component is IHE Delft (see section 2.3), through a letter of agreement signed with FAO.

93. The Water Accounting Plus (WA+) reports based on remote sensing have been completed by IHE Delft for three basins as planned (Litani basin in Lebanon, Awash basin in Ethiopia and Jordan basin). The first one (Litani) has been published by FAO, while the other two (Awash and Jordan) have been finalized and are under final review for publication. Moreover, a supplementary fourth basin WA has also been undertaken for Niger basin (Rapid Water Accounting) and a first draft has been produced (January 2020). The use of remote sensing (e.g. WaPOR) could in principle accelerate water accounting over conventional methods – hence the name Water Accounting Plus.

94. **The Water Accounting Plus reports have been produced with significant delays against what was originally planned.** In fact, Output 3 has been particularly affected in the first years of the project by delivery delays, mainly related to staff turnover of the implementing partner IHE Delft. Things have significantly improved at IHE Delft in the last years allowing the accelerated completion of deliverables in 2019. On this basis, the implementing partner has been granted a one-year no-cost extension of the agreement with the project, to finalize outputs.

95. **Several countries have expressed interest and asked for support on applying the WA+ methodology.** The FAO project "KnoWat: Strengthening Water Governance to Support Food Security and Prevent Water Scarcity" (GCP/GLO/907/GER) is willing to start the implementation of water accounting using WaPOR data in three countries (Rwanda, Senegal, Sri Lanka). The FAO/SIDA regional project, mentioned in section 3.1.2, "Implementing the 2030 Agenda for water efficiency/productivity and water sustainability in NENA countries (GCP/RNE/009/SWE)", also refers to WaPOR data for input in their water accounting activities, which are then complemented with other more traditional data sources and, in the case of KnoWat project, water tenure assessment.

96. WaPOR, by providing important inputs required for WA+, consistently and over ten years (or more), can be a powerful tool to ease and speed-up the usually lengthy process of data inputs for water accounting. For this reason, the use of WA+ is raising increased interest at national and projects level.

97. On the other hand, however, it is not evident[2] which has been the interaction and involvement of national stakeholders (water/basin authorities, water users, academic and research centers, etc.) in the preparation of the WA+ reports. Also not evident yet, is the process for making the WA+ tool an operational instrument for increased water productivity, as foreseen in Output 3 and its indicators. In fact, WA+ appears most relevant for strategic analysis of water use in a basin or a country, in order to understand and decide where water resources are used at this large geographical scales, i.e. at a high-level of decision makers. There seems to be more to gain in applying WaPOR at operational level, i.e. in improving water management within small and large water systems/schemes. The issue is further discussed in section 3.3.5.

98. The evaluation noted that there is little information regarding the use of the Water Accounting Sheets prepared for the Litani, Awash and Jordan basins (second indicator above). Regarding the definition of possible "scenarios" (third indicator), they have not been produced because remote sensing-based water accounting, which is suitable for describing current and past situations, requires additional tools to perform scenario-based analyses.

99. As stated in the ProDoc narrative, Output 3 "consists mainly of water accounting/auditing" where "particular issues relating to governance, institutions, finance, accessibility and uncertainty will be analysed". Therefore, it was overambitious to include water accounting at Output level.

100. To address this challenge, the project and the implementing partner IHE Delft have more realistically agreed that deliverables by the end of the project should include a complete report for each basin, where the results are described and discussed also in terms of longer term impacts and water management implications. This should be ideally complemented by a systematic engagement of interested parties in the basin, which is not yet the case.

3.2.4 Delivery of Output 4

Output 4 (from LogFrame)	**Indicators** (from LogFrame)
Capacity development of stakeholders to increase water productivity sustainably	- Workshops (target: ten) on irrigation modernization to increase land, water and economic productivity of irrigation systems, leading to irrigation modernization plans (target: in 80 percent of the cases) - National governments and river basin commission use water accounting by remote sensing technology to monitor their water availability and use (target: eight countries mainstream water accounting in their institutions) - Amount of people using ICT services for water management (target: 60 000 stakeholders make use of ICT services for agricultural water management)

101. **Output 4 has been partially delivered by the two implementing partners.** IHE Delft is in charge of training activities and curricula, and the International Water Management Institute is responsible for all activities of capacity building at field level

[2] From reports and interviews.

in three pilot basins. As already mentioned, both institutions signed a letter of agreement with FAO that were extended without supplementary funding subsequent to the project extension. The three pilot countries and basins initially expected in this Output were: Ethiopia (Koga irrigation scheme in the Abay - Blue Nile basin), Lebanon (Bekaa Valley in the Litani basin) and Mali (Office du Niger).

102. As an introductory observation, the evaluation has remarked that the second indicator could have been more appropriately placed at Outcome level (effectiveness) because it implies a process of institutional uptake and national ownership, which is an assumption to hold in the achievement of Project Outcome (see TOC, section 2.4.2). As for the third indicator, it obviously relates to the effects of the Output, hence at Outcome level, and seems therefore conceptually misplaced and disproportionately high in its target.

103. A second preliminary observation is that this component started more or less in parallel with the other components, such as Component/Output 1, whereas, as described in the TOC (section 2.4.2) and visualized in its Figure 1, there should have been a logical and time-sequence between Outputs. In fact, Output 4 would disseminate and develop capacity in a tool that, however, was only mature by mid-2019.

104. Regarding the training activities developed by IHE Delft (see first indicator above), short workshops were carried out from 2017 to July 2019 in Ethiopia and in Lebanon regarding WaPOR introduction (two days), remote sensing and Geographic Information System (GIS) (four days), water productivity (three-four days) and water accounting (three days). Due to security concerns, only the first workshop (two days) was organized in Mali. A total of 96 participants (50 in Ethiopia, 34 in Lebanon and 12 in Mali), received at least one of the five trainings, according to IHE-Delft report (FAO WaPOR training, November 2019). However, the report says that only very few participants (four in Ethiopia and none in Lebanon) attained all of the trainings in the respective countries. **A general drawback has been that the trainings were not related to projects on the ground or other engagements from WaPOR (such as validation), and the opportunity was missed to build capacity in the system**. These issues are further discussed in section 3.3.2.

105. Using the training materials developed under the project, IHE Delft has also implemented a WaPOR introductory training (two days) in 13 additional countries (Africa and Near East) bringing the total to 240 participants. Gender-disaggregated data are available and show a minimal presence of female participants in all training events.

106. The ten foreseen training workshops on "irrigation modernization and multiple use of water services" (see first indicator above) have so far not been implemented and have shifted to 2020, taking into account the delays in this activity related to the security conditions in Mali, which was originally identified as priority area for this, but also to the mentioned staff issues at IHE-Delft in the first phase of the project. This target will not probably be reached by the end of the project.

107. **Upon request to the project team, supplementary trainings were carried out**, such as the WaPOR introductory training for Syrian experts (Rome, September 2018) which led to an assessment of damages to irrigation sector and a follow-up training in Syrian

Arab Republic (with financial support from Japanese Cooperation). Moreover, it has to be acknowledged that many other training activities concerning WaPOR were implemented by IHE Delft in the context of the overall cooperation between IHE Delft and the Dutch Ministry of Foreign Affairs, benefiting different water-related projects funded by the Dutch Government. Similarly, supplementary short WaPOR training activities were directly organized by the project in support of other FAO projects, such as the FAO/SIDA regional project for Near East and North Africa countries, with workshops held in Tunisia and Jordan, among others.

108. According to the record maintained by the project of all WaPOR trainings implemented, the number of participants largely exceed 500. Ethiopia, Lebanon and Rwanda show the highest number of participants. **Unfortunately, there is fragmentation and dispersion of data regarding the trainings and relevant information on trainees' profile, training objectives, trainers' reports, etc. has not been compiled and systematized. In general, there has not been any systematic follow-up to the trainings, too**. Despite this drawback, trainings have obviously contributed to widely 'sow the seed' and familiarize a large number of people with the opportunities given by WaPOR.

109. **An activity of "piloting training curricula" was also foreseen in the project, but proved to be ambitious.** The idea was to develop a capacity development plan in the three pilot countries (Ethiopia, Lebanon, Mali) with increasing level of complexity, which would result in the creation of a WaPOR pool of national experts, a sort of "training of trainers" (as expressed in the ProDoc). In reality, though the idea was indeed appealing and relevant for the sustainability of the intervention, it proved too ambitious, since there was little continuity, both on the service provider side (IHE Delft) and on the trainees side (turn over at national level). The overall effectiveness of training activities is discussed in section 3.3.2.

110. As for the bulk of capacity building activities to be developed in the field by the implementing partner IWMI, technical reports "Stakeholder mapping and needs assessment" were produced and reported in Ethiopia (Koga irrigation scheme, December 2017) and in Lebanon (Litani basin, May 2018), and one was drafted in Mali (Office du Niger), currently under revision by FAO.

111. IWMI was also expected to undertake field activities in each of these three countries to bring WaPOR directly to the target group of farmers, including the possible use of ICT application for farmers. Main findings from the field activities in the three countries are described below. A more detailed learning note on Ethiopia is included in Annex 3.

Box 2: Main findings from field activities in Ethiopia, Lebanon and Mali

Ethiopia

In Ethiopia, the IWMI report (2017) showed that the land within the Koga Scheme (identified as "pilot area" is typically used for both irrigated and rainfed production. The irrigation system meant to irrigate 7 000 ha, but only 5 000 ha are in use. The report highlighted "the suboptimal management of irrigation water" and the fact that the farmers "are relatively 'new' to irrigation". The common understanding of farmers is that "more water means more yields".

There is, therefore, large room for improving water productivity and potentially making use of WaPOR system to support plans of improved water management in the Koga scheme.

The IWMI field activity was to work with farmers directly. As remarked by the technical IWMI report mentioned above, due to high illiteracy and almost zero penetration of smartphones, ICT applications among farmers were impractical. Instead, the field work of IWMI in Koga irrigation scheme focussed on introducing farmers to the use of tools detecting soil humidity, in particular the Wetting Front Detector and the Chameleon Water Sensor. These were used by selected farmers (in two blocks in Koga) to understand the need for irrigation – both sensor giving signals when the field was saturated still or in need of irrigation. The focus was on wheat, which occupies almost 70 percent of cropped area in Koga.

Overall, some 200 sensors were distributed and farmers were taught how to read the data. That brought about a more productive use of water by avoiding over-irrigation and by watering the crops at the appropriate moment. IWMI has worked with 1 016 farmers (including control farmers) to use these instruments for better field water management, which led to around 25 percent increase in water productivity, both because irrigation cycles were lengthened and hence water consumption reduced (with 20 percent) and because yields went up (10-25 percent).

This is a remarkable result – achieved in one-two years engagement with farmers, with no investment in hardware or inputs, just by managing things better. The improved water management practices helped to contribute to higher production and better food security, and to water saving. For example, in the Koga field activity the water saved was used to expand the area irrigated within the subcommand areas. Moreover, the scheme management was informed that water supplies to the night storage could be reduced.

A second result is in the human capital. There are now knowledgeable farmers that could represent champions/resource persons for future activities of water productivity improvement. There is interest on the side of the irrigation scheme managers and extensionists, based on the significant and promising results. An interesting collaboration between IWMI and the University of Bahir Dar was also developed, with four Master of Science students actively working in the Koga Scheme doing researches related to crops and water productivity. All in all the field activity was very encouraging.

However, the field activity also has some missed opportunities. First, farmers and extensionists have confidence in the continuation and upscale of the current intervention, as they also receive much interest from farmers of other areas. With only few months left for completing the activities (the letter of agreement with IWMI is going to end by August 2020), a strategy for their consolidation, possible replication and upscaling (the scheme totally includes 10 000 farmers over an area of 7 000 ha) has not yet been adequately addressed by FAO and IWMI. Furthermore, the project did not yet prepare and discuss any action plan in that perspective with the local or regional stakeholders, i.e. the regional Bureau of Agriculture, the irrigation scheme managers and the water users associations in Koga. Having removed the water sensors and wetting detectors have conveyed the message that project activities were over and raised concerns and disappointment among farmers.

Although some of the data, collected by the students mentioned above, were shared with FAO and the team to assist with the production and validation of the Koga Level 3 land cover map,

the opportunity was missed to undertake a WaPOR analysis for Koga irrigation scheme. Actually, WaPOR would have lent itself well for a system-wide analysis because in Koga there are only two major crops: wheat and vegetables. In fact, interviews with Koga system managers suggested that in the current system of water distribution there are easy wins that could have been detected with WaPOR.

The field visit to the pilot area of Koga has also shown that evident expectations exist from farmers, managers and extensionists regarding a concluding IWMI activity of data devolution and discussion. As per the letter of agreement, the "Technical Report summarizing results and recommendations" and the "Technical Guidance document for the implementation of the results" should be delivered by IWMI by the end of August 2020, and IWMI is also planning to share them with partners in Koga during the final workshop in August 2020. The latter is a key activity that should allow local partners in Koga (farmers, extensionists and managers), regional and national stakeholders, FAO project team and IWMI to jointly assess results obtained so far and plan how to take the field activity further in combination with the WaPOR analysis, hence setting an outstanding example for irrigation systems management in Ethiopia.

Lebanon

In Lebanon, the main trust was to develop a new functionality under the application that Lebanese Agricultural Research Institute is promoting among farmers in the Bekaa Valley. The ideas was to use the evapotranspiration (ET) values of WaPOR for irrigation advice to farmers in the Bekaa Valley when to irrigate or not. One obstacle was the quality of reference ET data (ET0); these proved not reliable when compared with the ET0 data obtained by local weather stations network in the Valley (Mean Bias Error / MBE between 0.95 and 1.5 mm/day).

Concerning the possibility of upgrading the Lebanese Agricultural Research Institute Application for irrigation management of three main crops grown in the Bekaa Valley (grapes, wheat and potatoes) through WaPOR database, LARI eventually did not consider it suitable for their purposes, since "WaPOR data at 30 m resolution are available for the Upper Litani only and not for the whole Bekaa Valley. In addition, they are available at ten day-basis, a long interval which limits their use for irrigation management", said a LARI officer to the evaluation team.

Moreover, according to an IWMI officer, the institutional framework of irrigation management in Litani basin is not fully conducive to workable solutions, particularly the division of responsibility and overlapping functions between the Ministry of Agriculture that has the mandate for water management at field level, and the river basin authorities (of the Ministry of Energy and Water),. i.e. the overall governance bodies in Litani basin.

In Bekaa Valley there are several institutions and projects working on agriculture and water management. Mention was made by IWMI to a big project financed by the United States Agency for International Development (USAID) to support the Bekaa Water Establishment, which has produced a master plan of irrigation in the Valley, maps, and calculation of water efficiency, among others. However, there is no linkage between FAO WaPOR project and the USAID project. Moreover, the linkage between IWMI intervention and the initial activities of capacity building (2016-18) implemented by IHE Delft is not clear, as well as with the WA+ prepared by the project in Litani basin.

Three conclusive workshops are planned by IWMI to be held by June 2020 (one with the national institutions in the basin, one specifically with LARI and a third one with the farmers), which should hopefully provide some elements for decision-making at project level.

Mali

Foreseen IWMI activities in Mali were strongly hindered by security situation coupled with the lack of IWMI staff/office in the country. Nevertheless, the national counterpart Office du Niger took the initiative of directly carrying out two seasonal data collections in the field (2018) and to orient the partner Institute of Rural Economy (IER) for developing the capacity needs assessment foreseen by the project. A capacity building event was organized by IER and Office du Niger in Mali (October 2019) to present the findings of the report mentioned above. However, the project seems currently oriented to redirect IWMI activities in Egypt (Zankalon irrigation scheme) in substitution for Mali.

In absence of the implementing partner IWMI in the country, the project could possibly explore alternative modalities for implementing the activities foreseen, by ensuring a distance technical assistance and monitoring of the activities to be directly implemented by the national counterpart (Office du Niger).

The national counterpart (Office du Niger) has informed the evaluation team that the Office remains highly interested in directly keeping on the field activities planned by the project. More specifically, Office du Niger: i) would like to have a feedback from the project regarding the WaPOR data collections of 2018; ii) is willing to participate in the validation of WaPOR data by comparing them with the Office du Niger statistical data collected on the ground (the irrigation scheme dates from 1920); and iii) is ready to implement any pilot activity leading to increase water productivity in the basin.

The evaluation team considers that the opportunity of introducing WaPOR system in one of the largest irrigation scheme (100 000 ha) of West Africa remains highly appealing for the project, particularly considering the interest of the national counterpart.

112. **As described above, the results obtained so far by the pilot actions in the three selected areas provide a mixed picture, yet generally below initial expectations.** The reports produced by IWMI in the pilot countries regarding "Stakeholder mapping and needs assessment" represent a basic step in the "gap analysis" foreseen by the project (see Output 2). However, as summarized above, only in one case (Ethiopia) the analysis was followed by the capacity building, application and testing of some possible "workable solutions".

113. In the case of Ethiopia, the project was not able to adequately follow the progress of activities in the field and give the appropriate steps to ensure the institutional uptake of the pilot action by local, regional and national stakeholders, which is obviously jeopardizing the effectiveness and sustainability of the intervention in Koga irrigation scheme, as described above.

114. The narrative of the ProDoc regarding Output 4 puts a strong emphasis on the "implementation of the specialized ICT solutions to improve water productivity". By the text, it is clear that the ICT solutions to be developed "consist of applications that can be run on (smart)phones, tablets, and/or PC's. They may include SMS-alerts,

smartphone apps and computer software". In fact, since the project was not designed to directly provide ICT applications to operationalize the use of WaPOR database, **the implementation of ICT solutions relies on the existence, capacity and willingness of national ICT service providers to provide such applications, which is an assumption that did not hold so far**. The issue is also described and discussed in the project theory of change (particularly in sub-section 2.4.2).

115. A "communication and advocacy strategy" was also foreseen under Output 4, though not reflected in any of the Outputs Indicators of the LogFrame. This component of Output 4 was reformulated by the project Team as "Outreach and Knowledge Management Strategy" and a recent report (October 2019) has been finalized by the project. **Actually, an intense activity of information and awareness raising at international, regional and national level has been developed by the project team through the organization of meetings and events, assiduous participation in workshops, the updating and the quality of the WaPOR portal, documents publications, leaflets, etc.**.

116. The internal communication/coordination between partners, a relevant part of the "Outreach and Knowledge Management Strategy" of the project, deserves some attention in certain aspects. The Steering Committee and the Consultative Group foreseen in the project did not meet regularly and the interaction among stakeholders, including resource partner, has mostly developed "on demand" and according to priorities.

117. This aspect did not probably influence the quality of the results achieved, mainly because the "informal" interaction among stakeholders (including the Dutch Government) has never been lacking. Nevertheless, institutional moments where relevant decisions are taken (such as the selection, shifting or enlargement of the pilot countries) could have benefited from some formal instruments of decision-making and agreement (e.g. at least with minutes), obviously involving the national counterparts as well.

118. Project progress reports have been produced on a yearly basis but not always with sufficient insights (based on the progress reports made available to the evaluation team). Admittedly, the FAO format is also not very conducive to a systematic and effective project monitoring. As a result, it is not clear which regular and systematic mechanisms of project monitoring and evaluation (M&E), coordination and steering have been implemented by the project, particularly regarding the M&E of activities developed by external partners (IHE and IWMI). Moreover, the findings show that coordination between project components has also been limited with few synergies among them.

3.3 Evaluation question 3. What are the main factors affecting effectiveness that could prevent future progress towards and the eventual achievement of the project's intended longer term impacts?

119. Project effectiveness refers to the effects of the Outputs delivery, i.e. the systemic or behavioural changes (Outcomes) produced by the Outputs, eventually contributing to the achievement of long-term objectives of development (Impact). Main issues related to project effectiveness have been grouped and discussed as follows: i) project design; ii) capacity building; iii) WaPOR outreach in the field, transformational change and gender issues; iv) communication and knowledge building; v) institutional uptake and national ownership; and vi) partnership and implementing arrangements.

3.3.1 Project design

120. The theory of change has shown that the ProDoc had a logical coherence in the sequence of steps to be followed for the attainment of the project Outcome. Unfortunately, the definition of the Outcome itself was not fully clear, mixing different levels of results and target groups (see Table 2 in section 2.4.1). The LogFrame did not bring any further light, since the Outcome Indicator was vague and unmeasurable (see LogFrame in Annex 4).

121. As a result, there is the impression that the project design was essentially focussed on the delivery of immediate results (Outputs) and on the well-detailed project work plan, without a clear perspective of the pathway from Outputs to Outcome. A vision as to what the project wants to achieve and how, in the medium- long-run, is not so clear. The evaluation attempted to overcome this shortcoming through the reconstructed theory of change, as discussed in section 2.4.2 and schematized in Figure 1. The reconstructed TOC shows that the project design did not consistently and realistically assess the existence/absence of possible driving factors and of the many underlying assumptions to hold for project effectiveness.

122. **In the opinion of the evaluation team – but also in the general opinion of the main stakeholders interviewed – the project was ambitious in its design and expected results.** What made the project ambitious in a too-short time span is:

i. the remarkable technical and institutional complexity of setting up the database;
ii. aiming to implement it from continental to national and farmers level;
iii. the large geographical reach of the project;
iv. the density of information;
v. the perspective of making the data relevant to water management on the ground.

123. In looking back at project implementation, it needs to be remembered that the central feature of the project, the WaPOR database, was non-existent at the start. Outreach activities under Outputs 3 and 4, however, started at the same time. This helped to create a receptiveness for the system and to put water productivity on the agenda, but real-life applications necessarily had to follow later. **With the version 2.0 of WaPOR (June 2019) it became possible to confidently take WaPOR to the field. The**

performance of the different project components needs to be also looked at from this angle.

3.3.2 Capacity building

124. **It is hard to assess project effectiveness of the training under Output 4.** The FAO WaPOR training report (IHE Delft Institute for Water Education, 2019) does not discuss the entry profile of the participants (Who are they? What is their linkage with water productivity? Which is their position and function within their Institutions? etc.). Similarly, the exit profile/training objectives (know and know-how) of the modules are not discussed in the IHE report mentioned above. It is therefore not evident which was the training strategy and its objective.

125. **Based on the programme of the trainings (workshops) and on the interviews with trainees (Ethiopia) and stakeholders, it can be said that trainings delivered so far were mainly "introductory", of short duration and not connected to cases or local validation.** This is partly related to the timing of the project (see above). Participants have also been different from one workshop to another (participants' turnover). As a result, the creation of a solid pool of national experts (the ProDoc also refers to train possible "trainers") has not been achieved so far.

126. Through the email address of the participants (provided by IHE-Delft), the evaluation team launched an electronic survey with the trainees. Main findings from the survey are presented in Annex 2. The survey shows that the majority of participants to the trainings comes from the academic sector and uses WaPOR for "study and research". This emphasis on academic partners was in line with the original plan of working with partner universities. There is a core group of dedicated users: 16 percent accessed the database more than ten times. Most of the survey respondents, however, accessed WaPOR database no more than three times after the training (51 percent), or not at all (19 percent). 30 percent of respondents described themselves as operational water managers and 23 percent of respondents mentioned they had used WaPOR for improving water management.

127. **There is some follow-up to the training in Ethiopia.** In that country, in fact, some university professors that participated in WaPOR trainings have subsequently included WaPOR in their teaching programme and are coordinating researches at Master of Science level using WaPOR database. Moreover, the Small Scale and Micro Irrigation Support (SMIS) team of the Ministry of Agriculture has included WaPOR Water productivity among the indicators used in their Irrigation Information Management Database with FAO support.

128. The project was also intended to piloting training curricula under Output 4, which did not happen as described in previous section 3.2.4. Setting and developing training curricula in collaboration with national universities and/or research centers could have actually been a way of increasing national capacities more effectively, rather than having spot-interventions by external trainers, as occurred in the project.

129. It has also been remarked in different meetings held in Ethiopia that the shortage at ground level of water managers and extensionists represents a crucial bottleneck for improving water productivity in the field, hence the potential effectiveness of WaPOR system. Many large irrigation systems are understaffed and there is not much capacity

to manage water and to advise farmers. The FAO Country Office in Ethiopia has confirmed this finding and is actually implicated in the training of new irrigation extensionists (70 new graduated so far).

130. **Dedicated focus on training human resources at field level (mainly addressing irrigation scheme managers and irrigation extensionists) is considered by most of the interviewed national stakeholders in Ethiopia as a key factor that would improve WaPOR effectiveness.** This judgement is also in line with the opinion of most project stakeholders (not only in Ethiopia) that the main intended users of WaPOR, hence to be matched by capacity building, should be the managers and development officers at intermediate level (essentially in the irrigation schemes or large water harvesting programmes). It is argued, in fact, that positive changes in water management would very much happen at that level.

131. **Overall, capacity building effectiveness is challenged by different shortcomings in the process of planning, implementation, monitoring and evaluation of the trainings and in the definition of the main target groups of the trainings.** There have also been limited efforts to foster the institutional uptake and ownership of national stakeholders in the activities of capacity building. All these factors are crucial for progressing from the delivery of the workshops (Outputs) towards the improvement of individual, institutional and national capacities for a better water management.

3.3.3 WaPOR outreach

132. The evaluation found that **WaPOR outreach is happening with different modalities that provide interesting and diversified elements of analysis for drawing lessons and a possible route map for improving the field outreach of WaPOR in the next future**. They are outlined as follows:

a) Outreach through pilot actions/field activities in three countries
b) Outreach through WaPOR practitioners and transformational change
c) Outreach through other projects and initiatives
d) Field outreach and gender
e) Wrap up findings on WaPOR outreach

a) Outreach through pilot actions/field activities in three selected countries (Ethiopia, Lebanon and Mali)

133. As described and discussed in previous section 3.2.4 (delivery of Output 4), the project made an effort to reach out to farmers/water users and to connect them in WaPOR activities in the field, mainly through IWMI support in pilot areas of Ethiopia and Lebanon. The same was started in the Office du Niger in Mali, but activities were halted due to security concerns.

134. **The pilot action developed by IWMI in Ethiopia (Koga irrigation scheme) is the most advanced pilot action so far.** As summarized in section 3.2.4 (Output 4) and also described in the learning note in Annex 3, activities implemented by IWMI in coordination with the University of Bahir Dar did not lead to the direct application of WaPOR to increase water productivity at farmers level. However, they enabled the

interaction and involvement of a significant number of farmers of the Koga Scheme and of some development officers (extensionists) and irrigation managers, showing that there is room and potential for improving and progressively scaling up the pilot initiative to the whole of the Koga Scheme.

135. Nevertheless, as remarked in section 3.2.4, concerns exist on the side of the farmers, extensionists and managers regarding the effectiveness and sustainability of the pilot action. The question asked by one of the farmers in the focus group discussion is crucial: "How come projects only last 2-3 years and implement something really useful, yet they then stop and whatever is achieved goes away? How come the sensors were not maintained and introduced to other areas within the Koga system?"

136. In fact, **the pilot action has been implemented in a time-bound and resource-bound "project mode" without a clear and sustainable outreach strategy and vision on the future for this specific intervention.** The interaction between the implementing partner IWMI and the national, regional or local stakeholders in charge of the management of the irrigation scheme at different levels has been practically absent, from the Irrigation Commissioner to the Regional Bureau of Agriculture, the Koga Scheme Managers and the ultimate beneficiaries, the Water Users Associations.

137. At the onset of the intervention, a scaling collaboration was proposed with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the African Development Bank for IWMI's broader portfolio of work in this field. However, at less than one year from the end of the project, **a clear strategy is not yet in place to progress from the pilot action towards a more structured and systemic outreach of the discussed intervention in Koga, possibly improving and upscaling the action within the irrigation scheme. It is important to address this issue before the end of the current project so as not to lose the work done, time and resources invested, credibility and trust among national and local stakeholders.** Such strategy should include the continuation of the field activities with local and regional partners, the search for solutions to make the water sensors locally available, to keep-on the extension/advisory activities, and to start a WaPOR analysis of the scheme with local and regional stakeholders (100 m and 30 m data are currently available for Koga area).

138. **There is also room to increase the effectiveness of WaPOR outreach in Mali**, where IWMI withdrew (see section 3.2.4) and the pilot action remained incomplete. The interest of the main national stakeholder Office du Niger for improving water management and productivity by using WaPOR in the Office irrigation scheme keeps high, and there is, therefore, need and opportunity to respond to that demand for the same reasons outlined above in the case of Ethiopia.

139. **The situation is multifaceted in the Bekaa Valley/Lebanon where affiliated factors limit WaPOR outreach**, as also summarized in the conclusions and recommendations of the IWMI Lebanon Technical Report (2018). In Lebanon, for a long time all hope was vested in the LARI Application (see section 3.2.4 on Output 4), but this appears not to materialize. The three final workshops planned by IWMI in Lebanon have been repeatedly postponed due to the current sociopolitical situation (now planned to be held by June 2020), **yet there is the need of a quick decision on the future WaPOR outreach strategy in the Valley**.

140. The possibility of expanding WaPOR outreach with field activities in other countries is being explored by the FAO project team, as mentioned in section 3.1.2. Preliminary steps have been given for the planning of WaPOR field outreach in Sudan (Gezira scheme), Egypt (Zankalon scheme), Kenya (Busia) and Mozambique (Lamego), yet the process is still at an early stage. **There is, therefore, room for shaping a vision/strategy on how to create a national and local process of improved water management with the use of WaPOR in those countries.**

b) Outreach through WaPOR practitioners and transformational change

141. **The evaluation has found that outreach is happening through a number of applications partly developed under other initiatives, i.e. not directly promoted or financed by the project, which is a positive finding, and an indication of transformational change.** There are significant cases of field outreach that emerged recently (from 2019 onward), which coincided with the quality improvement of the WaPOR database under Component/Output 1 and 2 and improved access. Annex 5 provides an overview of these ongoing works referring to a large spectrum of applications.

142. The applications regard the improvement of water productivity – by identifying better performers and understanding the underlying parameters - but also several other applications, such as transparently managing water distribution in large irrigation systems; assessing the extent of over-/under-irrigation and the scope for investment in new diversion or in water saving; identifying the impact of investments in rain and flood dependent areas; making composite drought indexes; assessing carrying capacity in rangelands; measuring carbon sequestration in water systems.

143. The information provided in Annex 5 was collected and compiled by the evaluation team, since the project does not record and manage this kind of information. This deserves some consideration. WaPOR database is open-access and the project should have interest in knowing to what extent the database is used, by whom, with which purposes, problems, etc. This is relevant not only for the sake of project accountability (i.e. to prove cost-effectiveness), but also for the improvement of WaPOR database according to the users' needs, hence making WaPOR more and more "marketable" and increasing its outreach and transformational change.

144. The evaluation believes that, on the one hand, there has possibly been a certain underestimation of the "snowball" effect that WaPOR can trigger because of its open access and usability. On the other hand, as also discussed later under section 3.3.6, the project team may not have sufficient human resources to manage the overload of diversified work that the project entails, due to its large scope and complexity. It can be argued, nevertheless, that this kind of information could have been collected more systematically by the project itself through, for instance, a devoted consultant for the creation and follow-up of the "WaPOR community" in the web or through a more strategic consolidation of the current project team (as recommended by this report).

c) Outreach through other projects and initiatives

145. As mentioned in section 3.1.2, the project is establishing partnerships with other projects and initiatives. The PlantVillage initiative that the Penn University (USA) is

developing in Kenya in support of the smallholders rainfed agriculture is championing WaPOR in its projects (in Kenya and elsewhere in Africa), because they consider WaPOR a powerful instrument to provide open-access and reliable data for their extension/advisory work focussing on good practices of soil and moisture conservation (e.g. mulching, conservation agriculture). They are currently working on the creation of an ICT application (not yet operational, however) that would complement its farmers advisory services with WaPOR data, and the application is being tested with hundreds of farmers in Busia County (Kenya). The project has consequently included Busia among the "Level 3 areas" contemplated in the project extension from 2019 onward (see Level 3 in section 2.2).

146. The FAO regional project "Implementing the 2030 Agenda for water efficiency / productivity, and water sustainability in Near East and North Africa countries" has been cooperating with WaPOR on different aspects. They include, among others, the creation of crop maps and related training in seven countries (Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine and Tunisia), follow-up trainings and further actions in Algeria, Egypt, Palestine and Tunisia involving national ministries and institutions, the use of WaPOR for WA+ in Iran, and also the monitoring and validation on the ground of the remote sensing data.

147. **The above examples show that cooperation in NENA countries, as well as through other projects and initiatives, could prove relevant in providing an entry point to expand WaPOR outreach and in increasing WaPOR national uptake.**

d) Field outreach and gender

148. It is universally recognized that water use and management is a gender-sensitive issue and there is already an abundant literature on this regard. Men and women are differently affected by water insecurity, climate variability and drought. Women-headed households are particularly affected by difficult and unequal access to land and water resources, also related to discriminating land tenure patterns, both in rainfed and irrigated agriculture. A recent study of the International Food Policy Research Institute (IFPRI) carried out in Ethiopia shows the positive correlation between access to irrigation and nutritional security of women, by smoothing seasonal unbalances (Baye *et al*., 2019).

149. **Understanding gender roles, relations and inequalities in water resources management can increase project outreach and effectiveness.** There is no evidence, however, of gender mainstreaming in the project so far, both in the project design and in its field outreach through the pilot actions. Although gender-disaggregated data are available in the case of trainings participants (where women participation was extremely low) and foreseen in the "Stakeholders mapping and needs assessment" of pilot areas, the project has not produced so far a gender analysis on the field outreach of its activities.

150. The "common understanding", also confirmed during the field visit in Ethiopia, that women are poorly represented in the irrigation schemes because these are far from the villages and from the public services (e.g. schools and health centres for the children, etc.) should be more scientifically proven and analysed, so as to find out possible solutions. The more gender-balanced situation in the small-scale irrigation

schemes, as mentioned in some interviews in Ethiopia (and corroborated by some studies throughout Africa), is a relevant issue that could be verified and taken into account by the project in the future, for instance by giving more emphasis to small irrigation schemes.

151. **Overall, there is room for combining WaPOR data with ground level data, so as to understand the relevance of the problem in terms of women access to quality land and water, and of water productivity.** Particularly as WaPOR moves in to support improved management of water resources, practical hands-on understanding of what different measures mean for the well-being of women is important and should be addressed as part of the WaPOR community of practice.

e) Wrap up findings on WaPOR outreach

152. All the above findings demonstrate the potential of WaPOR as a useful instrument for improved water productivity and water management. They show **the positive effect of building upon possible synergies, which could enable an increased field outreach of the project and stimulate transformational change, without a significant increase of costs (increased efficiency/cost-effectiveness)**.

153. It is, nevertheless, relevant to highlight that the desirable increase of WaPOR outreach through different activities and national/regional partners in several countries, requires conditions that are not fully in place. It entails a **firm process of institutional uptake of the national stakeholders involved, through appropriate mechanisms of WaPOR national ownership and coordination**. Annex 3 is dedicated to this aspect. On the other hand, it requires increased project capacity to monitor and coordinate WaPOR outreach in an effective and systematic manner.

3.3.4 Communication and knowledge building for further replication and scaling up

154. All the above regarding capacity building and outreach effectiveness can also be related to the capacity of the project to create knowledge (in the broad sense of the term) in areas related to water management through the WaPOR system and its application. As clearly stated in the ProDoc, pilot actions "will provide knowledge and experience to replicate and scale-up similar future activities in other areas and countries". As discussed previously, however, these pilot actions, apart from Koga in Ethiopia, have not so far come off the ground, and in Ethiopia there is no planned scaling or knowledge sharing follow-up planned.

155. The overall impression is that particularly the knowledge building still has to start. This is also related to the stage of the project – with the database in a current validated version only available since 2019 for less than a year. The learning would have to come from applications of WaPOR around real life cases where WaPOR is used to analyse a water system and bring some change in terms of water productivity.

3.3.5 Institutional uptake and national ownership

156. As discussed and visualized in section 2.4 (theory of change), national stakeholders' participation and institutional uptake are core assumptions to hold in the development of an enabling action framework eventually leading to the project Outcome.

Institutional uptake and national capacity and ownership are therefore key factors of project effectiveness and of future sustainability of project results.

157. Particularly in the early stage of the project, WaPOR had to be "supply-driven" by developing a new continent-wide facility, that was never there before. At the current stage, with the database up and running, stronger capacity and engagement at national level is the way forward – connecting problem owners with local service providers, allowing to shift the focus on a **demand-driven approach based on national/local problem solving**. The process of progressive local involvement and participation, institutional uptake and national ownership has fortunately now started to happen, though at a quite variable extent among the countries, and overall in need of firm steps for improvement and consolidation.

158. WA+ is a case in point. It is an area that shows promising signs of interest in some countries, as discussed in section 3.2.3, but would **need to be embedded (preferably from an early stage) in a national process at the appropriate political level**. It is not evident from the WA reports which has been the involvement of national stakeholders, particularly the river basin organizations, in the WA produced by the project and the subsequent national uptaking for water use planning and management.

159. National ownership also depends on the **capacity and opportunities of WaPOR national stakeholders to liaise, exchange and coordinate around WaPOR applications, so as to create a critical mass of knowledge and experts at national level**. The field mission in Ethiopia actually shows that the existing WaPOR "community of users" is at present dispersed and not in synergy.

160. **Institutional uptake and national ownership can also be influenced by the level of FAO presence in the country and its previous engagement in the water sector.** This is evident, for instance, in the case of Ethiopia where there is a long-standing collaboration between FAO and federal, regional and basin authorities, particularly regarding the Awash basin. The FAO Country Office, has in its staff a dedicated National Irrigation/Water Resource Officer, and promotes and supports a National Platform on Agriculture Water Management (co-chaired by the Ministry of Agriculture) with a large participation of state and non-state actors (technical level), and the establishment of a national irrigation database.

161. One lesson that can be learned by the project is that **the implementation of WaPOR at country/field level needs a continuous dialogue and exchange with national stakeholders** (water management institutions, research and academic institutions, private sector, NGOs, farmers associations, etc.) **for jointly planning, implementing and monitoring the national setting of the system (a "demand-driven" approach), in view of full ownership of the countries on WaPOR implementation. Countries vary from one to another and this calls for the need of a country-tailored approach of engagement and capacity building**.

3.3.6 Partnership and implementing arrangements

162. The point of gravity in the current project phase was very much global, which is understandable given the challenge to make the WaPOR system operational, and

limited introduction and capacity building at country level. When looking at the ProDoc "Project governance structure" (see Annex 6), it appears that there was no structure, mechanism or procedures foreseen to involve representatives of pilot countries in project governance.

163. As outlined in section 2.3, the project has implemented three formal partnerships through two letters of agreements for the development of pilot in-country activities, i.e. Output 3 and 4 (with IHE Delft and IWMI) and one contract for setting the WaPOR database, i.e. Output 1 and 2 (with FRAME Consortium).

164. **Fully outsourcing the implementation of capacity building and field activities (Component/Output 4) to external partners (IHE Delft and IWMI) shows plus and minus points.** On the one hand, this modality has granted the project the support of globally recognized Institutions in their specific areas of intervention: high-level water education in the case of IHE Delft, and global experience in water research in the case of IWMI. This has created a larger network and has made the delivery of outputs possible, particularly in terms of large-scale training delivery and the implementation of field pilot actions in three different countries, which could have been hardly possible without the external partners.

165. On the other hand, it has had the risk of the different components going their own way and not adding up to a critical mass of action especially at country level.

166. The formal agreement (LOA) signed with the implementing partners is essentially based on outputs delivery, without setting a regular mechanism of communication and of progress monitoring, action steering and periodic readjustment between the project team and the implementing partners. FAO country offices were also not significantly involved in project design and implementation, which has limited the capacity of the project to monitor the field activities at national and local level.

167. **There has also been a limited capacity of the project in monitoring field activities at country level.** A systematic and effective monitoring system is not in place, hence making difficult for the project to identify and understand drivers of success and causes of under-achievements, which is crucial for improving its performance.

168. Most likely, a **more decentralized and nationally owned implementing structure of the project** is needed in the next future. This implies that the project has to conceive and adopt new forms of partnership and mechanisms of project implementation beyond and/or complementary to the current implementing structure, which is at global level only, and essentially exogenous. This view is shared, for instance, by the FAO Country Office in Ethiopia that believes there should be partnerships with national institutions, as this will better facilitate stakeholders' participation, institutional uptake and contribute to sustainability.

3.4 Evaluation question 4. To what extent are steps being taken to ensure the sustainability of the intervention?

169. **Practically all interviewed stakeholders seem confident of WaPOR's potential as a valuable instrument for water management at national level (for planners and decision makers), at basin and irrigation scheme level and even in flood-based and rainfed systems (for irrigation managers and funding agencies).** In principle, WaPOR offers the possibility to discuss agricultural water management with quantified and objective evidence, which is, according to the interviewees - including the resource partner - something that was largely missing in international water management and enhances WaPOR appeals and interest. This may represent a great opportunity for future sustainability of WaPOR.

170. **While these opinions are valuable, WaPOR appeal and interest crucially depend on how far the project can go in proving its applicability and effectiveness at field level, which is only starting to happen now, as discussed under previous EQs 2 and 3.** This has to happen, as discussed in the TOC (section 2.4), through the progressive setting of a WaPOR "action framework", which mainly consists of a process of institutional uptake and progressive national ownership, which is an essential condition for the institutional sustainability of WaPOR methodology.

171. The project has started a few initial steps in that direction, yet, overall, the process is admittedly at an early stage. It is important for the project to identify and address the main bottlenecks that have so far made the implementation of WaPOR at field level difficult, as well as the potential drivers. Based on the analysis carried out in previous sections, it appears that some issues can be pivotal for institutional sustainability, as discussed here below.

172. **The likelihood of institutional sustainability mostly depends on the interest and willingness of the country to decidedly pursue the improvement of water management at different levels**, which should be indicated by the presence of ongoing budgeted plans, programmes and projects particularly focussed on the upgrading of existing irrigation schemes that are currently underperforming. This aspect has also been underlined by national stakeholders met in Ethiopia.

173. **The exceedingly exogenous implementing structure of the project should be amended to increase proximity with the countries and to foster national uptake and ownership.** For example, the amplitude and dynamism of the overall institutional environment of a country is key to provide and sustain a favourable institutional framework of action to WaPOR. This institutional framework of action should not only engage water management institutions (usually governmental), but also research and academic institutions, the private sector, NGOs and farmers associations. In this framework, it is crucial that local ICT service providers exist and proactively work with local stakeholders on the design and implementation of demand-driven applications addressing different elements of water management. This can become a key factor of (un)sustainability for WaPOR methodology. (See the Assumptions at the bottom of the "green" pathway in Figure 1 of the TOC, section 2.4.2).

174. **Another important aspect is the confidence in the quality of data, which is considered fundamental to increase the institutional uptake and national**

ownership of WaPOR. The consensus opinion of the interviewed WaPOR users is that while the quality of data has improved over time, it needs to become a continuous process: many more gains can be made when combined with feedback from field applications and validation, as also discussed in section 3.3.4.

175. **As applications develop and WaPOR continues to establish itself as a reference data set, the importance of a financially sustainable and reliable presence of WaPOR increases.** Financial continuity is important. While a resource partner could ensure financial sustainability in the short-term (e.g. through the financing of a follow-up phase), the project is building a longer term interest for FAO to support WaPOR portal maintenance through the integration of WaPOR in the FAO Aquastat information system. The cost of maintaining, upgrading and improving the WaPOR facility is not unsurmountable and a good financial mechanism – not project dependent – should be in place to secure this (see Recommendation 7). The possibility of a "pool funding" among different international players is also regarded as an element to be considered for future financial sustainability.

176. There is also a promising development to make the WaPOR facility more powerful. In fact, opportunities are being explored for possible cooperating arrangements with the European Union Copernicus system and its technical applications. Discussions are also ongoing with Copernicus for contributing data at higher spatial resolution which could open an entire range of field applications.

3.5 Evaluation question 5. To what extent is the project being implemented efficiently?

177. **The project shows a good rate of expenditures**. At the end of November 2019 (i.e. at roughly 80 percent of its duration including extension), the project had spent 86 percent of its budget, i.e. USD 10.7 million of USD 12.5 million (including budget increase after project extension). Annex 7 presents the detailed Table of Expenditures provided by the project team. This Table shows that **the main fraction of expenditures is given to "Contracts"** (65 percent), which includes the FRAME Consortium (roughly close to 70 percent of the total of Contracts), plus IHE and IWMI sharing equitably the remaining 30 percent.

178. Around 15 percent of the budget went to the FAO project team ("Salaries"); "Consultants" represent a significant fraction of the budget (8.5 percent of the budget), mainly for consultancies regarding the developers team in the FAO Information Technology Division (CIO) that created and maintains the portal, the management of the cloud storage and publication of data, and the development of API, including water productivity calculation. Lesser amounts were spent from other budget lines, such as "Technical Support Service" of FAO, "Travels", "Procurement", etc. ("Training" that had in the original budget a high budget attribution was actually covered through the Budget line of "Contracts").

179. **Project accounting was maintained following the FAO format (Budget Lines – BL). Accounting by Component/Output was not required and not maintained.** A rough calculation based on the information provided by the project team indicates that the setting and functioning of WaPOR database (Components/Outputs 1 and 2) received around 50 percent of the total budget spent (70 percent of the Contracts/BL 5014 and

most of the Consultants/BL 5013, see Annex 7), whereas to Components/Outputs 3 and 4 (field-oriented activities) was allocated around 15-18 percent of the total budget (approximately 30 percent of the contracts/BL 5014).

180. **Assuming that other budget lines (e.g. salaries professional, BL 5011) were proportionally shared among the four Components, it can be said that Outputs 1 and 2 received the bulk of the budget.** This is well explicable by the inherent technical complexity of the database setting and its related costs. It can be expected, given the current need of implementing the system in the field, that a possible follow-up project would take into account future priorities in its budgeting.

181. Efficiency also relates to cost effectiveness. Since, as described above, the cost of data production is relatively high, CE can only improve if the positive effects of WaPOR on water productivity at field level are increasing.

182. **Overall, the project was less time-efficient than originally planned**. On the one hand, there was also an over-optimistic forecast in the project design and work plan concerning the setting of a state-of-the-art database system (foreseen by June 2016, while the project became effective in 18 March 2015). The system was online in April 2017 and progressive improvements led to the current upgraded version 2 in June 2019. At the same time, some external factors caused hindrances and delays, as previously discussed, particularly in the pilot actions in Lebanon and Mali.

183. **The initial budget was probably underestimated**. In 2019, in fact, with the extension, the project was warranted a supplementary budget of USD 2.5 million (plus 25 percent of the initial budget). As explained in the extension document, the biggest share of the budget increase was requested for data production, in particular, to: i) extend data production for two years (2019 and 2020, which were not included due to a misalignment between initial funding agreements and contract with service provider); ii) develop a near real time methodology in substitution of PROBA-V satellite which is phasing out; and iii) add three countries to meet the agenda of the resource partner to intensify development efforts in Sahel, Horn of Africa and Iraq. Additional budget was also planned for supporting capacity development activities in the new areas.

4. Conclusions and recommendations

4.1 Conclusions

Conclusion 1 (related to EQ1). The project is well aligned with, and relevant to Global Objectives, FAO Objectives, regional initiatives on water scarcity and the overarching national water policies and strategies of the beneficiary countries. WaPOR database use for measuring SDG Target 6.4 has not been tested.

184. By providing an open access database system for measuring water productivity, the project is well aligned and relevant to SDG 6 and could contribute to measuring SDG Target 6.4 related to water use efficiency and water scarcity. The project is also well aligned and relevant to FAO SO2 by contributing to the sustainable intensification of water use and agriculture on a wide geographical basis (Africa and Near Est) particularly affected by water scarcity. Increasing water productivity is key for food and nutritional security and rural development policies and strategies of the 21 beneficiary countries that address the needs of the smallholders sector both in rainfed agriculture and in irrigation schemes.

Conclusion 2 (related to EQ2). The project has successfully set-up the WaPOR database using remote sensing and ICT for the monitoring of agricultural water productivity. There is an emerging use of the database for research and field implementation purposes. However, capacity building activities and pilot actions developed in three pilot countries were so far not able to adequately underpin the field implementation of the system, test its usability and applicability.

185. The project has established an open access and near real time database system to measure water productivity by remote sensing, which is currently operational at continental, national and subnational level. The database has undergone quality controls, data accuracy and reliability have been positively assessed and are constantly monitored and improved. Data use and analysis is giving promising results in academic and research contexts as well as in basin water accounting (WA+). WaPOR training activities mostly had an introductory character and were quite dispersed and fragmented with no evident linkage between trainings and field actions. Outreach activities in three pilot areas of Ethiopia, Lebanon and Mali assessed capacity building needs, but the implementation of subsequent field activities using WaPOR database was below expectations. They are currently in need of being systematized, assessed and followed-up both at project and country level.

Conclusion 3 (related to EQ3). The development of an action framework at national level, enabling a process of WaPOR capacity building, participatory decision-making and implementation of workable solutions for improving water productivity, is at an early stage and in need of decisive steps to make effective a "demand driven" approach based on national/local needs, priorities and opportunities. There is also need for an increased operational capacity of the project to respond to that demand.

186. Pilot field activities have overall been project-driven and are in need of a participatory assessment with national stakeholders to capitalize on lessons learned and to orient future actions. Moreover, there is need to take stock of promising and emerging initiatives in different countries and to discuss and prepare with main national

stakeholders a realistic, country-tailored "route map" for WaPOR application. Project capacity to adequately respond to the existing demands and/or opportunities at national level is a key issue to be addressed and improved. In that perspective, there is room for conceiving and putting in place a more decentralized, less exogenous implementing project structure.

Conclusion 4 (related to EQ4). The quality of WaPOR database is key to maintain users' confidence and needs to be continuously improved (technical sustainability). Financial aspects to ensure the continuity of the intervention are being addressed in the short-term and also discussed in the perspective of a medium/long-term financial sustainability. Efforts are ongoing to search for complementarities and partnerships with other initiatives and projects. Substantive steps have to be taken to ensure WaPOR institutional sustainability at national level.

187. The technical quality of the database is currently ensured by the project quality control, which is key to retain users' confidence and sustain its use. The maintenance of the WaPOR portal could be ensured by the integration of WaPOR in FAO Aquastat information system, but data production will probably have to rely on external funding. While the current resource partner may ensure financial continuity in the short-term, the project should also be looking for other opportunities in the medium- and long-term, to be done in a systematic way, rather than on a dispersed projects-focussed base.

188. Main challenges relate to the institutional sustainability of the WaPOR system at national level, which entails a process of progressive involvement and institutional uptake by water management institutions (ministries, river/basin authorities, irrigation scheme managers), agricultural extension/advisory systems, academic and research institutions, the private sector, NGOs, water users and farmers associations. The existence and proactivity of local service providers is essential to design and implement demand-driven applications.

Conclusion 5 (related to EQ5). The project was less time-efficient than originally planned. Cost effectiveness can increase if project effectiveness improves at national/field level.

189. Overall, there has been an underestimation in the project design of the diverse technical problems related to the setting of a state-of-the-art database system, and of relative costs. External factors, out of project control, also caused hindrances and delays in the implementation. As a result, a project extension was required and granted with supplementary funding.

190. In considering the cost effectiveness of the project, one also has to consider its ambitious scope – covering an entire continent and a major region – with ten year data at high granularity in time. The real cost effectiveness, however, depends on the application on the ground – which is an area where much can improve, especially now that the new version of WaPOR was released in June 2019.

4.2 Recommendations

Main focus of the recommendations

191. Recommendations derive from what is still outstanding for achieving the project Outcome, i.e. an action framework enabling improved water productivity and water management through the implementation of the WaPOR database. Issues of effectiveness and sustainability of the intervention are at the core of most of the recommendations, including Recommendation 7 that advocates for a strategic vision of WaPOR to frame project activities. Moreover, there are two specific recommendations on gender analysis (Recommendation 4) and on project relevance and alignment (Recommendation 5).

Main recipients and time frame of the recommendations

192. The recommendations are mainly addressed to the FAO project management team and implementing partners, to the FAO budget holder (Land and Water Division, CBL) and to the resource partner, the Ministry of Foreign Affairs of the Netherlands, that are currently taking preliminary steps to shape the envisaged extension of the current project and the possible design of a second phase.

193. Recommendations mostly refer to the need of promoting/strengthening national capacities, the emphasis on promoting applications on the ground, as well as securing the future availability of the asset (database). Therefore, FAO country and regional offices should also be considered recipients of these recommendations, as well as the national stakeholders already involved in existing or planned project activities at country level.

194. The current project and the planned extension/second phase should be regarded as a phased process of WaPOR implementation. Being so, all recommendations are conceived to be implemented as soon as possible, the sooner the better. Particular attention is drawn on Recommendation 1 that refers to unconcluded pilot activities in Ethiopia, Lebanon and Mali, as well as to ongoing preliminary steps for WaPOR field implementation recently started in other countries. Recommendation 7 refers to the design of a strategic vision for WaPOR implementation and consolidation, hence applicable as well in the ongoing process of conception and design of the extension/second phase.

Background/rationale for Recommendation 1

195. Based on Findings under section 3.3, Conclusion 3 (project effectiveness) has highlighted the need to improve national ownership of WaPOR activities through a "demand-driven" approach based on national/local needs, priorities and opportunities. Based on findings under section 3.3.5 (institutional uptake and national ownership), Conclusion 4 has also expressed concerns regarding the institutional sustainability of the project. The need for planning the continuity of the pilot actions and to progress towards a more structured and systemic outreach (for instance, the upscaling of the pilot action in Ethiopia) has also been highlighted under Finding 3.3.3 (a) on WaPOR outreach.

Recommendation 1. It is recommended to increase the involvement and ownership of the national and local stakeholders in project implementation.

Suggested actions:

i. a final joint assessment of current pilot actions and their main lessons learned (Ethiopia, Lebanon and Mali) with particular emphasis on Ethiopia for designing a scaling plan of improved water management in the Koga irrigation scheme;

ii. the identification and prioritization by national stakeholders of existing or planned national/local programmes, projects and initiatives to improve water productivity, where WaPOR could be profitably applied, to be started in the pilot focus countries;

iii. include, as much as possible, national stakeholders/service providers in the direct implementation of agreed WaPOR outreach activities aiming at improving water productivity.

Further proposals:

i. promote national stakeholders' interaction and partnership (e.g. public and private sectors, academic and agri-research sectors, water users associations) around real cases;

ii. connect specific needs of water productivity improvement (demand) with specific actors able to supply technical solutions and create "WaPOR success-cases";

iii. use the feedback from the real cases systematically and combine WaPOR database with ground level surveys and other data sets;

iv. foster national/local alliances, platforms or networks of WaPOR users (knowledge building);

v. involve FAO country offices in the processes outlined above;

vi. possibly foresee national/international expertise (consultants) to support the project team, FAO country offices and national/local WaPOR platforms/networks in the process above.

Background/rationale for Recommendation 2

196. Conclusion 2 has pointed out that capacity building and pilot actions did not so far systematically underpin WaPOR use and implementation at field level. Evaluation findings on project performance (sections 3.2.3, 3.2.4) and effectiveness (section 3.3.2) made the point that capacity building activities were not linked to field actions and anchored to actual cases. Local training providers (national experts, technical officers and advisers, academic and research centers, service providers) were not involved in planning and implementing training activities.

Recommendation 2. Capacity building activities should be action-centred, i.e. directly linked to field applications of WaPOR for increasing water productivity in real cases. For this purpose, national stakeholders should be progressively involved in planning and implementation of capacity building activities, with particular focus on problem owners and national service providers involved around major water systems.

Suggested actions:

i. training, planning and implementation should be based on identification and selection of priority actions for WaPOR application and match the concrete human resources involved in the actions;

ii. give particular focus on WaPOR application (e.g. data interpretation, linkage to water productivity, validation) rather than on the instrument (database);

iii. involve, as much as possible and applicable, national water and agriculture institutions, extension/advisory services, academic and agri-research centres, service providers in training planning;

iv. make an inventory of potential trainers (e.g. national experts, technical officers, former WaPOR trainees, WaPOR practitioners, professors and researchers) and of training/research institutions and service providers to be training focal points at national level for WaPOR;

v. contact former WaPOR trainees and check their current interest/capacity as potential trainers;

vi. adequately follow the national trainers with initial support and continuous backup from IHE Delft.

Background/rationale for Recommendation 3

197. Conclusion 3 regarding project effectiveness has highlighted the need of improved operational capacity of the project to adequately support the suitable increase of outreach activities related to WaPOR application in the field. Monitoring capacity has been found an area that should deserve attention (see section 3.2.4 on delivery of Output 4, section 3.3.3 point (e) on WaPOR Outreach and section 3.3.6 on implementing arrangements). The need for an increased learning capacity and knowledge building is particularly discussed in section 3.3.4 on communication and knowledge building.

Recommendation 3. It is recommended to enhance the project capacity of monitoring field activities and their impact, and of knowledge building (collection, networking and treatment of information), so as to steer and readjust/enforce activities and results, to take stock of applications being developed and capitalize on lessons learned, and to make profitable use of inputs and feedbacks received by WaPOR users on WaPOR usability and applicability.

Suggested actions:

i. implement a simple and effective monitoring and knowledge (M&K) system to monitor WaPOR application and impact, and receive and process feedback from the field;

ii. the M&K system should be based on the systematic procurement, collection and treatment of information on the progress and impact of outreach activities and about global WaPOR use, usability and applicability (a web "WaPOR Community of Users" could also be envisaged);

iii. a dedicated manager (e.g. "monitoring and impact manager", "outreach and knowledge manager") could integrate the project team at central level to develop the tasks delineated above and systematically promote WaPOR contributions;

iv. a WaPOR resource person/focal point could be identified at national level to foster national/local alliances, platforms or networks of WaPOR (as suggested under Recommendation 1), and support the implementation of project M&K system at national level;

v. the identification of the appropriate profile of "WaPOR focal point" should be commensurate to the amplitude, type and potential of WaPOR use and previously discussed with the respective FAO country office, in order to be appropriately country tailored.

Background/rationale for Recommendation 4

198. Although gender relations and gender mainstreaming are mentioned in the ProDoc under the section regarding beneficiaries and stakeholders, as well as in Component/Output 2 (Assessment of water and land productivity), there is no clear evidence of gender mainstreaming in the capacity building and outreach activities of the project, as discussed in section 3.3.3 (d) "Field Outreach and Gender".

Recommendation 4. The project should look for opportunities to cross-check WaPOR data on water productivity with ground data on women access and use of water resources (both in rainfed and irrigated land) enabling further gender analysis on water use and productivity.

Suggested actions:

i. keep on maintaining and improving the collection and monitoring of gender-disaggregated data in project activities;

ii. ensure that gender well-being is a central objective and concern in the future project design and in ground applications of WaPOR with potential major impact on water management;

iii. consider having a dedicated person working with the project team and proposed impact/monitoring manager to document and share these practical applications and experiences;

iv. especially liaise with extension/advisory services and water users associations that significantly include women-headed households (WHH) among their target groups.

Background/rationale for Recommendation 5

199. As described under section 3.1.1 (Alignment and relevance), the project, through the WaPOR database, is expected to significantly contribute to measure progress of Indicators 6.4.1 and 6.4.2, relatively to Target 6.4 (addressing water use and scarcity), hence to SDG 6. This Recommendation is directly linked to Conclusion 1.

Recommendation 5. The project should assess to what extent the use of WaPOR data is instrumental to feeding the monitoring system for Target 6.4 of SDG6, as expected.

Suggested actions:

i. find appropriate mechanisms through FAO country offices to integrate WaPOR data within the beneficiary countries' monitoring system for SDG 6 (Target 6.4) and Aquastat;

ii. in cooperation with other parties, develop a country level water productivity tracking in support of SDG 6.4.

Background/rationale for Recommendation 6

200. The evaluation TOR required the assessment of the financial sustainability of WaPOR after project closure. Financial continuity of WaPOR has been discussed in section 3.4 on Sustainability, which showed that some preliminary steps are being taken in that perspective, though in need to be constantly pursued to make them effective. Conclusion 4 on Sustainability underlined the need to look for financing mechanisms that do not directly depend on individual and separate projects, but rather focus on some forms of "pool funding".

Recommendation 6. FAO, together with the resource partner, should develop an open financing mechanism for WaPOR that is independent of dispersed project funding and secures the continuity, upgrading and further development of WaPOR.

Suggested actions:

i. initiate a study reviewing the options of supporting WaPOR as an international public good, as well as possible mechanisms (financial and institutional) to be made operational;

ii. one option to be considered is a pooled funding that can draw in financial contributions from various sources: national governments, interested donors but also contribution of private sector (WaPOR premier users and service providers).

Background/rationale for Recommendation 7

201. According to the evaluation TOR (see section 1.3), the conclusions and recommendations should give elements for decision-making regarding the envisaged second phase of the project. With the current funding drawing to a close and a new phase being considered, an important question is which future direction WaPOR could take. While current WaPOR outreach needs to be more systematic and effective (see section 3.3.3, Conclusion 3 and Recommendation 1), the need for a strategic and global vision enabling and encompassing the identification and implementation of different, country-tailored route maps is becoming more and more pressing. More so when, after a suboptimal experience so far in the pilot countries, new actions are now starting in other countries and basins (see last paragraph in section 3.3.3 (a).

Recommendation 7. The project, together with main international and national stakeholders, should develop a strategic vision at global and country level to roll out WaPOR and optimize its impact on water management on the ground.

Suggested actions:

i. engage a special consultant and core group to coordinate contributions to such a vision at global and country level. The vision should provide clarity on, among others:
   - geographical coverage over time
   - spatial detail over time
   - secured availability
   - validation process and quality control
   - promotion of country level autonomous processes of usage
   - central level support
   - role of users community and self control
   - quality control of service providers and applications
   - secure finance
   - institutional partnership

ii. widely share the vision among a large community of water managers, business persons and financial providers.

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Appendix 1. People interviewed

Surname	Name	Function / Institution	Activity	Date
Bastiaanssen	Mr Wim	Consultant, professor at TU Delft (former focal-point IHE-Delft) Member of Consultative Group	Meeting	27/11/19
Beidah	Dr Oba	Coordinator Hydraulic Research Centre - on validation WaPOR for Ghezira / Sudan	Meeting	19/02/2020
Demissie Chukalla	Mr Abebe	Researcher IHE, involved in WaPOR trainings and applications	Meeting	28/11/19
Elmahdi	Mr Amgad	IWMI - Middle East and North Africa Coordinator - Responsible for IWMI/Project activities in Bekaa Valley (Lebanon)	Skype meeting	25/11/19
Hoogeveen	Mr Jippe	Project Coordinator / FAO (Land and Water Division, CBL)	Skype meeting and emails	21/11/2019 to March 2020
Hughes	Mr David	Professor Penn State University / PlantVillage programme – UN Fellow at FAO	Skype meeting	05/12/19
Karimi	Mr Poolad	Senior Researcher IHE, involved in WaPOR trainings and applications	Meeting	28/11/19
Kleijn	Mr Job	Consultant (former adviser of the DGIS)	Meeting	26/11/19
Kone	Mr Bakui	Project Focal Point - Office of Niger - Mali	e-mails	18-23/02/2020
Koulibaly	Mr Banzoumana	Project Manager AKVO – Mali	e-mails	18-19/02/2020
Mohamed	Prof Yasir	Minister of Water Resources and Irrigation of Sudan	Meeting	19/02/2020
Morteo	Mr Karl	Information Technology division - (CIO) FAO	Skype meeting	09/12/19
Mul	Ms Marloes	Senior Researcher IHE - Focal point IHE	Meeting	28/11/19
Nassif	Ms Marie-Heléne	IWMI Focal Point Lebanon	Skype meeting	13/02/2020
Peiser	Ms Livia	Project Tech. Officer / FAO (Land and Water Division, CBL)	Skype meeting and emails	07/12/2020 to March 2020
Rebelo	Ms Lisa Maria	Senior Researcher of IWMI (Internat. Water Management Institute) - Project Focal Point / Coordinator of IWMI/Project activities in Mali, Lebanon, Ethiopia	Skype meeting	25/11/19
Schmitter	Ms Petra	IWMI Research Group Leader (Agriculture Water Management) – Responsible for IWMI/Project activities in Koga (Ethiopia)	Skype meeting	25/11/19

Surname	Name	Function / Institution	Activity	Date
Seyoum	Mr Solomon	Researcher at IHE, involved in Water Accounting and WaPOR trainings	Meeting	28/11/19
Tran	Ms Bich	Researcher at IHE, involved in Water Accounting	Meeting	28/11/19
Tuinier	Ms Elseline	Coordinator of Aqua4Sudan program / Sudan	Meeting	19/02/2020
Vallée	Ms Domitille	FAO Reg. Office Cairo – Focal Point for SIDA/FAO Regional Project	e- mails	18/02/2020
van der Horst	Mr Aart	Senior Policy Adviser Water - DGIS / Min. of Foreign Affairs of the Netherlands (focal point for the Project of the donor counterpart)	Skype meeting	28/11/19
Wonink	Mr Steven	Managing Director Eleaf (FRAME Consortium)	Meeting	27/11/19
Yousra	Mr Mohamed	Manager at Aquadata (start up company) / Sudan	Meeting	19/02/2020
People interviewed in country visit ETHIOPIA (Addis Ababa)				
Abdii Alli	Mr Eliyas	Deputy Head, Irrigation and Agriculture Infrastructure / Oromia Bureau of Agriculture (OBoA)	Meeting	24/02/2020
Ager	Mr Martin	Land & Water Officer FAO Sub Regional Office for Eastern Africa	FAO Debriefing meeting	02/03/2020
Agide	Mr Zeleke	Irrigation Adviser / MoWIE	Meeting	25/02/2020
Alemayehu	Dr Taye	Senior Researcher Metameta (Private Service Provider)	Meeting	24/02/2020
Berhanu	Mr Belete	Head Civil Engineering and Environment Dept at Addis Ababa University (AAU)	Meeting	25/02/2020
Beyene	Mr Zeleke	Head of Small-Scale Irrigation Department / Ministry of Agriculture and Rural Development	Meeting	24/02/2020
Bisirat	Ms Ethiopia	Lecturer (AAU)	Meeting	25/02/2020
D'Amelio	Mr Jacopo	Programme Officer FAO Representation Ethiopia	Meeting	26/02/2020
Deferso	Mr Debebe	Director Basin Study and Research & Inf / MoWIE	Meeting	25/02/2020
Desalegn	Mr Temesigen	Land and Water Resource Director of Ethiopian Institute of Agricultural Research (EIAR)	Meeting	24/02/2020
Dufera	Mr Dinberu	Irrigation Engineer / OBoA	Meeting	24/02/2020
Eshete	Mr Taye	Deputy CEO Agriculture Operation / Ethiopian Sugar Corporation (ESC)	Meeting	26/02/2020
Girma	Mr Moti	Researcher Metameta (Private Service Provider)	Meeting	24/02/2020
Haile	Mr Ashebir	Irrigation Researcher EIAR	Meeting	24/02/2020
Haileslassie	Mr Amare	Principal Researcher IWMI	FAO Debriefing meeting	02/03/2020

Surname	Name	Function / Institution	Activity	Date
Lakew	Mr Zebene	Director Ground Water Directorate / Ministry of Water Irrigation and Electric (MoWIE)	Meeting	25/02/2020
Ludi	Ms Eva	Head of IWMI (Int. Water Management Institute) Ethiopia Office	Meeting	25/02/2020
Mehari	Mr Michael	Commissionaire of Irrigation Development Commission (IDC)	Meeting	25/02/2020
Tadese	Mr Adissu	Infrastructure Head / IDC	Meeting	25/02/2020
Tiruneh	Mr Yibeltal	Irrigation and Water Resources Officer / FAO Representation Ethiopia	Meeting and FAO debriefing	26/02/2020 and 02/03/2020
People interviewed in country visit ETHIOPIA (Bahir Dar / Amhara Region)				
Engidayehu	Mr Getachew	Director NRCM (Natural Resource and Community Mobilization) Amhara Bureau of Agriculture (ABoA)	Meeting	26-27/02/2020
Siltan	Mr Dagnenet	Professor Bahir Dar University (BDU)	Meeting	27/02/2020
Tegegn	Mr Desalegn	Researcher at IWMI (Koga irrigation scheme)	Meeting	26/02/2020
Group meeting at ABoA				
Abebe	Mr Mulugeta	Water Engineer ABoA	Group Meeting	27/02/2020
Amsalu	Mr Demelash	ABoW	Group Meeting	27/02/2020
Demissei	Mr Welelaw	Agronomist ABoW	Group Meeting	27/02/2020
Engidayehu	Mr Hailu	Expert Irrigation ABoA	Group Meeting	27/02/2020
G.Tsadik	Mr Yoseph	Expert Irrigation ABoA	Group Meeting	27/02/2020
Getinet	Mr Endager	Deputy Manager ABoA	Group Meeting	27/02/2020
Maru	Mr Welelaw	Irrigation Expert ABoWater (ABoW)	Group Meeting	27/02/2020
Miheret	Mr Esmelalem	Expert ABoA	Group Meeting	27/02/2020
Wondimu	Mr Yibelital	Director Irrigation ABoA	Group Meeting	27/02/2020
Yeshaneh	Mr Shimekash	Irrigation adviser ABoA	Group Meeting	27/02/2020
People interviewed in Koga irrigation scheme				
Group meeting in Koga with managers, developers, researchers				
Abebe	Mr Tewachew	Marketing Resp irrigation scheme (BoA)	Group Meeting	28/02/2020
Adugna	Mr Aleminew	Agronomist irrigation scheme (BoA)	Group Meeting	28/02/2020
Andualem	Mr Hibret	Water Expert irrigation scheme (Irr. Dev. Office)	Group Meeting	28/02/2020
Asres	Mr Sisay	Researcher PhD Student (BDU)	Group Meeting	28/02/2020
Atanaw	Mr Fasikaw	Professor at Bahir Dar University (BDU)	Group Meeting	28/02/2020

Surname	Name	Function / Institution	Activity	Date
Biru	Mr Abiot	Manager of Koga irrigation scheme (KIS) of the Bureau of Agriculture (BoA)	Group Meeting	28/02/2020
Desale	Mr Tewodros	Student Bahir Dar University	Group Meeting	28/02/2020
Desalegn	Mr Habtamu	Student Bahir Dar University	Group Meeting	28/02/2020
Enyew	Mr Alebachew	Student Bahir Dar University	Group Meeting	28/02/2020
Ewunet	Mr Mekuanint	Front Extension Agent Koga Irr. Scheme	Group Meeting	28/02/2020
Flatie	Mr Fentahun	Agronomist Dev. Agent Koga Irr. Scheme	Group Meeting	28/02/2020
Haileslassie	Mr Amare	Principal Researcher IWMI	Group Meeting	28/02/2020
Setargie	Mr Worku	Manager Water Infrastract. irrigation scheme (Dev. Branch Office)	Group Meeting	28/02/2020
Tadele	Mr Menwagaw	Student Bahir Dar University	Group Meeting	28/02/2020
Tegegn	Mr Desalegn	Researcher at IWMI (Koga Irr. Scheme)	Group Meeting	28/02/2020
Windiferaw	Mr Feleke	Agronomist irrigation scheme (BoA)	Group Meeting	28/02/2020
Zerihun	Mr Guadienew	Agronomist irrigation scheme (BoA)	Group Meeting	28/02/2020
Group meeting in Koga with farmers				
Ademe	Mr Awoke	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Adugna	Mr Alemu	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Alehegn	Mr Dagnew	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Alehegn	Mr Alemu	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Antigegn	Mr Adissu	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Asnakew	Mr Ewunetu	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Birhanu	Mr Yeshiwas	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Chane	Mr Yenesew	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Getie	Mr Getaneh	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Kebede	Mr Atanaw	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Kefale	Mr Tena	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Minale	Mr Wondmeneh	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Shibe	Mr Melkamu	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Takele	Mr Gashaw	Farmer Koga irrigation scheme	Group Meeting	28/02/2020

Surname	Name	Function / Institution	Activity	Date
Tamir	Ms Mantegbosh	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Tena	Mr Mekuanint	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Teshe	Mr Hunegnaw	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Workneh	Mr Gebre	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Yenealem	Ms Belayneh	Farmer Koga irrigation scheme	Group Meeting	28/02/2020
Yihun	Mr Molla	Farmer Koga irrigation scheme	Group Meeting	28/02/2020

Appendix 2. Evaluation matrix

Criteria	Background information	Evaluation question	Method / tools
Alignment and relevance of the intervention to global, regional and national objectives and priorities	- The project should contribute to support targeted countries in providing evidence-based indicators on water-related SDGs, particularly **SDG6** "Ensure availability and sustainable management of water and sanitation for all" and Indicator 6.4.1 "Change in water-use efficiency over time". - The project is related to FAO **SO2:** "Make agriculture forestry and fisheries more productive and sustainable". Within SO2, the project relates directly to the major area of work (MAW): "Sustainable Intensification through Resource Use Efficiency" and to Corporate Areas for Resource Mobilization (CARM) "Doing more with less – sustainable intensification of agriculture. - FAO has a long history and	**EQ1. To what extent is the project aligned and relevant to water-related Sustainable Development Goals, FAO Strategic Objective 2, the Near East and North Africa's Water Scarcity Initiative, overarching regional and national water policies and strategies, and to the country needs?** 1.1. Was the project design based on clearly identified needs and in complementarity with other ongoing initiatives? 1.2. Was the WaPOR solution identified based on a thorough review of other similar systems and tools developed by FAO or other agencies? If so, have complementarities and synergies been explored to avoid duplication? 1.3. Which is the specific "added value" and "comparative advantage" of the WaPOR methodology compared with similar methods and tools previously developed by FAO? 1.4 Were the selection criteria for the countries, river basins and irrigation schemes based on evidence-based analysis of needs and priorities?	**Desk review, interviews**

Criteria	Background information	Evaluation question	Method / tools
	accumulated **experience and knowledge** on water management, accounting and auditing, and has already developed **several tools** on different scales to analyse possible options and measures to increase water productivity. - Within the **Regional Initiative on Water Scarcity**, the project links to two 'focus areas of work': i) "increasing agricultural water productivity in rainfed and irrigated systems" and ii) "benchmarking, monitoring and reporting agricultural water productivity". - The Comprehensive Africa Agriculture Development Programme **(CAADP)** of the New Partnership for Africa's Development (NEPAD) / African Union includes improved water management in its Pillar 1		

Criteria	Background information	Evaluation question	Method / tools
Results achieved *(results achieved and factors affecting progress will be discussed in the same chapter)*	- Results achievement will be assessed against **expected results** as described and discussed in chapter 1.2 of the **ProDoc** (1.2.1 Impact and Outcome, 1.2.2 Outputs and 1.2.3 Activities), in the **Logical Framework** (App. 1 of the ProDoc) and in the **work plan** (app. 2 of the ProDoc) - A Table format has been provided to the project team, to be filled-in with Outputs delivery and activities Implementation - The ProDoc is emphasizing the need of an effective **communication strategy** "to ensure stakeholders' engagement and provide accurate access to relevant information and ownership"	**EQ2. What results have been achieved so far, and what is still outstanding?** **At Output level:** 2.1. Are the WaPOR database, productivity assessments, water accounting and monitoring mechanisms (e.g.MRV) in place and capable of providing accurate, comprehensive and useful data at the planned scales? **At Outcome level:** 2.2. To what extent are the national governments and river basin commissions using the water accounting by remote sensing technology to monitor their water availability and use, and how are the results and best practices from the database, assessments and field level activities contributing to (inter)national water and land management decision-making processes at national and local levels? 2.3. To what extent are the local stakeholders using the ICT services for water management, and how are the results and best practices translated into workable solutions for service providers assisting farmers (water users) to sustainably improve agricultural land and water productivity? 2.4. To what extent is the project's communication strategy effectively promoting the participation of the targeted stakeholders at all levels, promoting visibility of the project results and providing access to relevant information?	**Desk review, TOC, interviews, e-survey, focus-group discussions and direct observation**

Criteria	Background information	Evaluation question	Method / tools
Factors affecting progress *(results achieved and factors affecting progress will be discussed in the same chapter)*	The role of different factors in affecting progress and results achievement has to be framed within the project theory of change, particularly its driving forces and main assumptions to hold. Answers to these questions will help in understanding causes (why) of success and failures, in estimating the sustainability of results and in drawing lessons for the future.	**EQ3. What are the main factors affecting effectiveness that could prevent future progress towards and the eventual achievement of the project's intended longer term impacts?** 3.1 How adequate was the project design (e.g. LogFame coherence, linkages between components and activities) in supporting the activities and expected outcomes? 3.2. Did the project objective and design remain relevant over time? 3.3. To what extent is the project methodology operational, accessible, and understandable and useful to the targeted users? 3.4. Is the choice and range of implementing partners included in project, and their roles and capacities, clear and appropriate? 3.5. To what extent have FAO outputs and assistance contributed to project effectiveness and progress? 3.6. To what extent is the project following a right balance between ICT-related activities and field level activities? 3.7. To what extent are the M&E activities (e.g. indicators, guidelines) able to collect the necessary, timely, accurate and comparable data and information?	**Desk review, TOC and SWOT analysis, interviews, e-survey, focus group discussions, direct observation**
Potential sustainability	From the ProDoc: "In this project, the most important indicator for the project will be the viability of the database. All project outputs depend heavily on the availability and accurateness of the operational information originating from the spatial database" "A strategy will be developed to ensure a smooth transition	**EQ5. To what extent are steps being taken to ensure the sustainability of the intervention?** 4.1. What is the likelihood that the targeted stakeholders, at both national and local level, will take ownership of the implemented methodology and other project activities? 4.2. How far is the project in exploring alternative ways to keep the database up to date and operational beyond the closure date of the project? In close cooperation with the Consultative Group, possible financing mechanisms, including public–private partnerships and multi-donor groups, are said to be explored to cover the operational expenses of the project.	**Desk review, TOC and SWOT analysis, interviews, e-survey, focus group discussions**

Criteria	Background information	Evaluation question	Method / tools
	beyond the lifetime of the project…" "possible financing mechanisms, including Public – Private Partnerships and multidonor groups, will be assessed to cover the operational expenses of the project". "The project will receive advice from a Consultative Group to ensure scientific soundness, sustainability and usability of project deliverables"	4.3 What are the key risks that may affect the sustainability of the project results and benefits? 4.4 What is the potential for the project to be scaled up or expanded to other areas or countries?	
Efficiency of the results achieved	The project has been extended for 22 months and a supplementary funding has been allocated by the donor (plus USD 2 478 655)	**EQ5**. **To what extent is the project being implemented efficiently?** 5.1. To what extent have the achieved results followed the planned timeline? 5.2. To what extent were the management/implementing arrangements appropriate to deliver the achieved project results in an efficient manner? 5.3 To what extent has the project made the best use of the funding? 5.4. To what extent has the project made the best use of technical and knowledge inputs?	**Desk review, interviews**
Cross-cutting dimensions	**6. Transformational change.** Is there evidence that any of the project activities are generating knowledge, practice change and capacities in stakeholders outside of the immediate beneficiaries (e.g. in non-beneficiary farmers, in other projects and initiatives of the implementing partners, in the practices and capacities of the government agencies which were not directly involved in the project, in FAO units and offices which were not directly involved in the project)? **7. Targeting and stakeholder engagement.** Were the needs, constraints and opportunities of the different target groups taken into account at design? And during implementation? **8. Gender.** To what extent were gender equality considerations reflected in the project design and field level activities?		**Desk review, TOC and SWOT analysis, interviews, e-survey, focus group discussions, direct observation**

Criteria	Background information	Evaluation question	Method / tools
	10. Partnership arrangements. 10.1. To what extent is the project linking up with regional initiatives and similar water projects in the targeted countries? 10.2. To what extent is the project creating partnerships with specific private sector or civil society entities to enhance effectiveness and sustainability of results		

Annexes

Annex 1. SWOT Analysis
http://www.fao.org/3/cb0519en/cb0519en.pdf

Annex 2. Survey results
http://www.fao.org/3/cb0520en/cb0520en.pdf

Annex 3. Learning note
http://www.fao.org/3/cb0521en/cb0521en.pdf

Annex 4. Project logical framework
http://www.fao.org/3/cb0522en/cb0522en.pdf

Annex 5. Working list of WaPOR applications
http://www.fao.org/3/cb0523en/cb0523en.pdf

Annex 6. Project governance structure
http://www.fao.org/3/cb0524en/cb0524en.pdf

Annex 7. Status of expenditures
http://www.fao.org/3/cb0525en/cb0525en.pdf

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