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Water Governance for Climate-Resilient Agriculture in Mediterranean Countries

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Abstract: Effective water governance is the key to achieving water security and sustainable water management. This study promotes water efficiency and supports the shift towards climate-resilient agriculture in Mediterranean countries through the development and implementation of water management adaptation strategies in three Farmers' Organizations (F.ORs) located in Mediterranean areas. An integrated water governance scheme is presented, which can be applied at the F.OR level for a more effective implementation of the water management adaptation strategy. The proposed water governance scheme has been adopted by three F.ORs (two in Crete, Greece, and one in Basilicata, Italy). The water management system that is developed as a tool for the implementation is presented, and the lessons learnt during the implementation are discussed. Experience from the pilot implementation of the proposed strategy in the three participating F.ORs indicated that systematic monitoring and evaluation of the strategy can increase the implementation efficiency and save resources. Moreover, the significance of internal dissemination and transparency was highlighted. The result of this study is the proposed integrated water governance scheme, which constitutes a valuable tool for F.ORs' adaptation to climate change in terms of water efficiency.

Keywords: water governance; agricultural water management; climate change adaptation

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1. Introduction

The adaptation of agricultural water management is essential in order to deal with the challenges of climate change, as the agricultural sector is responsible for a major share of the global water use. The climate-induced changes in the water availability, the irrigation requirements, and the frequency of extreme events lead to challenges with regard to the sustainability of agriculture in the coming years [1–3]. Effective water governance emerges as a critical component in achieving water security and sustainable management in these changing conditions. Several studies have underscored its importance, especially in the Mediterranean region, which is characterized by water scarcity, demographic shifts, and significant impacts of climate change. For instance, Brouma and Scoullos [4] emphasized the need for robust governance structures in this region, considering its unique environmental and socio-political challenges. Moreover, Huitema et al. [5] provide a comprehensive assessment of adaptive water governance and its importance in addressing the uncertainties that are posed by climate change. Their study suggests that adaptive governance approaches, which are flexible and learning-oriented, can better manage the inherent complexities and uncertainties in water systems, while Akamani [6] highlighted the role of adaptive water governance in awareness, policy change, opportunities, and capacity building. Similarly, Cosgrove and Rijsberman [7] highlight the necessity of integrated water resource management as a holistic approach to deal with the interdependencies between water availability, water demand, and environmental needs. Their analysis points to integrated water resource management as a critical framework for achieving sustainable water management and governance, while Bilanova et al. [8] suggested that integrated water resource management

is primarily linked to sustainable water management and the health of water systems, with an emphasis on context-specific factors for policy optimization. The crucial role of water users' associations in the participative process of rolling out integrated water resource management principles is mentioned by Richards [9], indicating that challenges such as a lack of capacity and institutional issues need addressing to enhance their effectiveness. Finally, the work of Rogers and Hall [10] on effective water governance underscores the importance of stakeholder participation, transparency, and accountability. They argue that these elements are essential in building trust and ensuring that water governance is equitable and effective.

In recent years, the development of various adaptation strategies has highlighted the crucial role of farmers and Farmers' Organizations (F.ORs) in sustainable river basin management. These strategies acknowledge the vital contribution of these groups in managing water resources, particularly in response to the challenges that are posed by climate change. The effectiveness of these adaptation measures is greatly enhanced when coordinated by organizations such as F.ORs. These entities are capable of mobilizing resources and exerting significant influence over water use within their operational areas, thus playing a pivotal role in the implementation of sustainable practices. The importance of such coordination is underscored in studies like those of Iglesias and Garrote [11] and Hardelin and Lankoski [12], which explored the impact of organizational management in water governance. Additional studies further emphasize the importance of F.ORs in water management. Mazumder and Kabir [13] demonstrated how F.ORs can play a pivotal role in disseminating innovative and effective adaptation strategies to cope with soil salinity. Zhang et al. [14] indicated the critical role of F.ORs in enhancing the capacity of farmers to manage environmental risks and adapt their livelihood strategies accordingly. Meinzen-Dick et al. [15] discussed the role of collective action in managing water resources, particularly in agricultural settings. Their findings suggest that farmer-led initiatives can lead to more efficient and equitable water use. Molle et al. [16] examined the challenges and successes of water governance at the basin level. This research highlights the complexity of managing water resources in a way that balances the needs of different stakeholders, including farmers.

Considering the above, this study aims to present an integrated water governance scheme for application in agriculture. The proposed water governance scheme is organized at the F.OR level by developing a water management adaptation strategy (WMAS) and establishing an Agricultural Water Management System (AWMS) for a more effective implementation of the adaptation strategy. The proposed water governance scheme has been adopted by three F.ORs (two in Crete, Greece, and one in Basilicata, Italy). The present paper constitutes a guidance tool for scientists working on farming, either individually or under other operation/management schemes, on how to organize an AWMS conforming to the requirements that are set by the voluntary European Water Stewardship (EWS) standard. The remainder of the paper is organized as follows: In the next section, the methodology for establishing a WMAS at the F.OR level and developing an AWMS is described. Following this, the implementation of the developed AWMS in three Mediterranean F.ORs is presented, and the lessons learnt are discussed. Finally, the main conclusions of this study are presented.

2. Materials and Methods

2.1. Formulation of Water Management Adaptation Strategy (WMAS)

An integrated water governance scheme based on the development and implementation of a water management adaptation strategy (WMAS) at the F.OR level is presented in this paper. According to the proposed governance scheme, each organization can define its own strategy for achieving their goals related to agricultural water management. To this end, a water management system for implementation in agriculture (AWMS) is proposed. This AWMS can be used as a tool by any organization in order to elaborate and develop its

own WMAS. The proposed AWMS is based on the requirements of the European Water Stewardship (EWS) standard of the European Water Partnership [17,18].

The standard EWS is a tool for the improvement of water management in various sectors, ranging from industry to agriculture. The EWS standard is organized into 4 principles, 15 criteria, and 46 indicators (major and minor). When applying the EWS standard in agriculture, there are several uncertainties that need to be included and many particularities resulting from the various practices applied. According to this, the effective implementation of the EWS standard in agriculture requires the adaptation of the principles and indicators of the standard, considering that they were mainly developed to address the industrial sector.

The standard is based on three technical principles: (a) water abstraction in terms of water quantity, (b) water status in terms of water quality, and (c) restoration and preservation of areas of High Conservation Value (HCV). Each of the three principles initially requires an analysis of the current situation, as well as a risk analysis, and results in specific actions that need to be taken in order to prevent or mitigate the risks. The actions arising from this analysis are considered in the overall strategy of the organization. Moreover, the fourth principle of the standard requires equitable and transparent water governance by addressing some fundamental water stewardship concepts. More specifically, the need to engage with stakeholders, the importance of internal and external transparency, and the need for continuous improvement and integrated resource management are highlighted.

According to the above, a WMAS was developed for each of the three F.ORs participating in this study following an evaluation of their current situation with regard to (a) the management structure of the F.OR; (b) the status of water resources in the area; and (c) the agricultural practices applied to the orchards in the area. Based on the abovementioned evaluation, a WMAS was formulated, comprising three distinctive priority axes, each consisting of corresponding measures and sub-measures. A more elaborate description of the WMAS and its priority axes is presented in Figure 1.

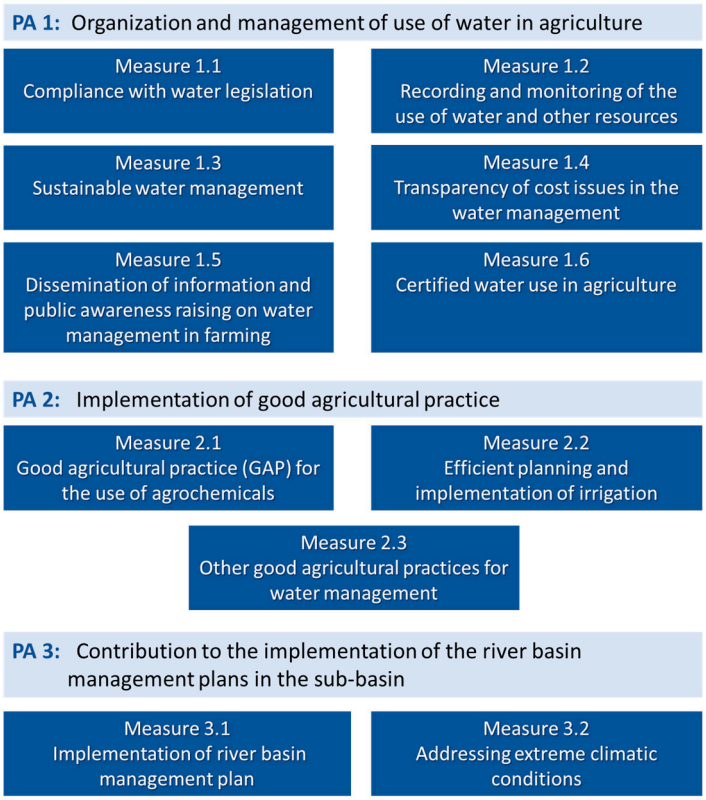

Figure 1. Diagram of the WMAS developed at the F.OR level.

2.2. Development of the Agricultural Water Management System (AWMS)

After formulating the WMAS for each F.OR, the AWMS that will be used for its implementation can be developed. Defining the governance structure of the organization, including the set of actions and measures that need to be taken by the F.OR's management, is of crucial importance for a more effective implementation of the AWMS regarding water management. To this end, three departments were defined in each F.OR, and the responsibilities for water were assigned in the organization, as presented in Figure 2.

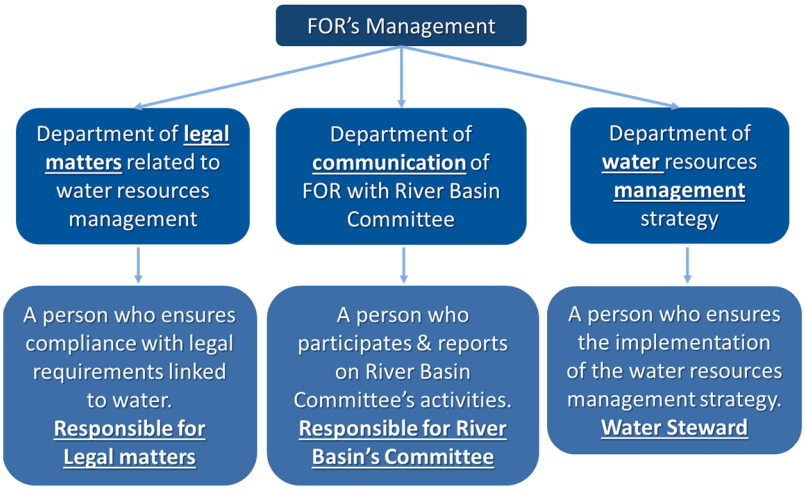

Figure 2. Governance scheme for agricultural water management.

According to the responsibilities of the three distinctive departments, three roles are assigned in each one. The first role is the person who is responsible for legal matters relating to water, who undertakes the responsibility to keep up with legislation and identify the points that are relevant to the organization's water management strategy, as well as to monitor and record all relevant legal aspects through a defined procedure. The second assigned role is the person who is responsible for contact with the River Basin Committee and communicating its activities. Finally, the role of Water Steward (WS) is assigned (third role), who is the person who ensures the implementation of the organization's WMAS. The three people assigned to these roles communicate with each other and regularly report to the F.OR's management in order to ensure the efficient implementation of the AWMS. It should also be noted that these roles can be assigned to the same person, depending on the structure of the organization.

Moreover, according to the WMAS, a set of actions is proposed to promote effective water governance forms through the implementation of five main governance actions (GAs). The GAs, which were proposed to be established as part of the AWMS by the F.ORs, are the following:

1. Compliance with legal requirements related to water use.
2. Identification and monitoring of the interrelation of water with other resources.
3. Internal and external transparency and raising awareness on water topics.
4. Emergency preparedness and a response plan addressing accidents, security incidents, emergency situations, disasters, etc.
5. Accounting and reporting mechanisms to promote economic transparency.

For the efficient implementation of each of these GAs, an action plan was developed, including a set of actions and measures, along with mechanisms for monitoring their implementation. In order to achieve effective and realistic action plans, they were developed after consultation and discussion between the participating F.ORs and the scientific partners of the project.

2.3. Pilot Areas

The above-described methodology was applied to three F.ORs, which are located in two areas in Crete, Greece (Platanias and Mirabello), and one in Basilicata, Italy (Metapontino), as seen in Figure 3. The common characteristic of the three F.ORs is the fact that orchards are cultivated. Nevertheless, olives are the major crop in the F.ORs in Crete, while orchard trees dominate in Metapontino. Moreover, irrigation water is provided from groundwater for the two Cretan F.ORs, while surface water provided through dams is used for irrigation in Metapontino. In addition, Mirabello exhibits the highest water scarcity of all three areas.

Figure 3. Location map of the three F.ORs (source: Google Earth).

In order to monitor the implementation of the AWMS in the three F.ORs, a series of customized forms were developed to be filled in and signed. This may not be required in all cases, since some F.ORs may already use adequate procedures which cover the monitoring requirements. The developed forms consist of a series of documents and records, which are filled in by the three F.ORs monthly or, in some cases, annually. This system of AWMS forms was used to monitor the implemented agricultural practices in ten orchards per pilot area. The WS of each organization was trained in collecting all the necessary information by the farmers and recording it in the AWMS forms. This system was organized in order to evaluate the water management practices and to effectively monitor the implementation of the strategy in each F.OR according to the principles and criteria of the WMAS.

2.4. Revision of the WMAS

Considering that each organization can define its own strategy towards achieving their goals related to agricultural water management, as well as the need for continuous improvement, the formulated WMAS can be revised and enhanced after an initial period of implementation. The potential revision of the WMAS should be based on the monitoring of the implementation through the AWMS and the evaluation of the results. Moreover, any feedback received through the internal and external transparency actions from the farmer

members of the F.OR and other stakeholders should be taken in to account. In this study, the revision of the WMAS of the three F.ORs was considered after 3 years of implementation. The proposed methodology for the revision of the WMAS is briefly described in Figure 4.

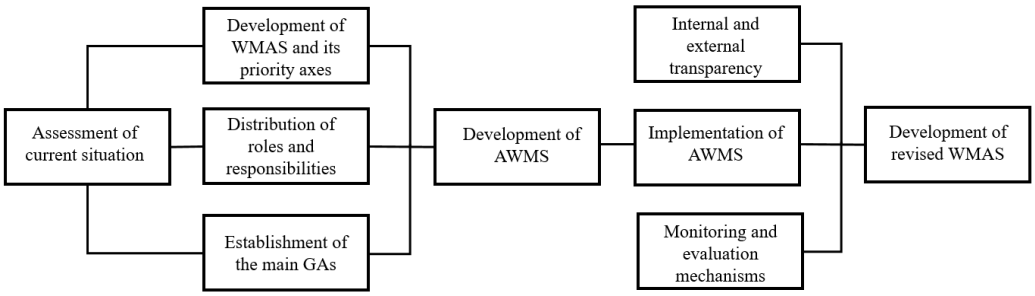

Figure 4. Methodology for the formulation of the WMAS at the F.OR level.

3. Results and Discussion

3.1. Action Plans for the GAs

The main objective of the proposed water governance scheme is to achieve equitable and transparent water governance. To this end, five main GAs are included in the developed AWMS, which are presented in Section 2.2. For each of them, an action plan is proposed, including a set of actions and measures, along with mechanisms for monitoring their implementation.

The main objective of the first GA, compliance with legal requirements related to water use, is to ensure that legal and other (e.g., contractual) requirements are not overlooked and that their implementation is controlled, monitored, and reported to the F.OR's management. The proposed action plan includes a procedure for keeping up with legal matters on water by collecting information on new legislation or other obligations of the F.OR and by monitoring the compliance of the F.OR with the existing water-related legislation and other obligations. The person assigned to the role of being responsible for legal matters implements the action plan for this GA. The action plan comprises two main mechanisms, the form for monitoring the legal requirements and the report on compliance. The form for monitoring the legal requirements (Figure 5) includes all relevant legislation (EU and national legislation and local decisions) that refers to water in the basin of interest to the F.OR. In this form, a brief description of the topics of interest of each law that is recorded is given, and each piece of legislation is ranked with respect to its importance to the F.OR from a scale of 1 to 3 (3 being the most important), considering how relevant the topics of interest are to the activity of the F.OR. Finally, the specific points of each legislation that require action by the F.OR are reported in the form, along with a deadline for implementing the required actions (e.g., sample checks). For the two Greek F.ORs, which are both located in Crete, the same legislation requirements apply. According to this, eighteen pieces of legislation were recorded and ranked accordingly. In more detail, six of the laws were ranked with high importance, six with moderate importance, and six with low importance. The proposed actions for compliance mostly concerned follow-up measures for ensuring (a) the F.OR's compliance with the requirements at the end of each year and (b) that the F.OR is kept updated with any new information that is available on the topics of interest for the corresponding legislation. For the Italian F.OR, different legal requirements apply. In an analogous manner, six pieces of legislation were recorded, one of which was ranked with an importance of 3, one with high importance, and the rest with moderate importance. The second mechanism of the action plan, which is reporting compliance, is communicated to an F.OR's management annually and is used for monitoring the compliance with the existing water-related legislation and other obligations. The report on compliance is developed according to the information recorded in the form for monitoring the legal requirements.

A/A	Date	Legislation	Articles	Topics of interest	Importance (1-3)	Organization's compliance	Action plan - Deadline
	Date of addition of the legislation in the Table	Report legislation	The articles of the legislation that are relevant	Brief description of the legislation. Reference of key points related to water	Importance assessment according to AWMS 1= less important 3= very important	Actions performed by F.OR to achieve compliance with the legislation	F.OR's action plan for compliance with legislation and deadline of its implementation

Figure 5. The form used for monitoring the legal requirements related to water.

With regard to the second GA, according to the action plan that was established, the interrelation of water with other resources is investigated by identifying (a) the interrelation of water with energy and (b) the interrelation of water with other resources than energy. The interrelation of water with energy can be expressed by the energy consumption during activities which are related to water management. To this end, the direct links of water with energy and the indirect links of water with energy consumption are examined. In the action plan, some indicators are proposed in order to quantify these two types of interrelation, including the energy consumption during specific activities. More specifically, the direct links of water with energy can be expressed by the energy consumption during the irrigation events, while the indirect links of water with energy can be expressed by the energy consumption during other activities within the plots, which could be indirectly linked to water use, such as pruning, mechanical weed control, harvesting, fertilization, and PPP application. The WS records all the relevant data that are required for the indicators in the AWMS forms. Monitoring these indicators provides an overall picture of the effect of the applied practices on the energy consumption. In general, the irrigated parcels indicated slightly higher energy consumption per ha, because more fuel was spent for pruning and weed management. Utilizing the available data, it can be concluded that the indirect relation of water with energy for other cultivation practices except from irrigation did not reveal any clear indirect connection to water management. Nevertheless, considering the interconnections of water with energy is crucial in planning nexus-coherent policy initiatives and investments to promote resource efficiency [19].

Moreover, the various relations of water with other resources were identified in the established action plans, considering soil, land, fertilizers, manure, and tree biomass as other resources. The link between these resources and water is identified, and the way that specific agricultural practices optimize water management in relation to these resources is described. However, the interrelation of water with the abovementioned resources is indirect and dependent on many variables, and thus, it is very difficult to quantify this relation by monitoring specific indicators. This outcome agrees with the results of the study by Li et al. [20], where it was indicated that quantifying the relationships between water and other agricultural resources is challenging, mainly because of the complex interdependencies.

The third GA, internal and external transparency and raising awareness on water topics, aims to disseminate and communicate the adopted water management strategy to the F.OR's members and external stakeholders. Responsible for the implementation of the action plan is the Responsible for River Basins Committee. The action plan includes a dissemination calendar, presented in Figure 6, on internal and external transparency, where all related actions are recorded according to their contribution to five main categories: (a) training actions with regard to the water management strategy of the F.OR, (b) information and consultancy on requirements for water, nutrients, and PPPs, (c) training of the farming community in Good Agricultural Practices, (d) information and training for

farmers on mitigation of extreme weather events, and (e) participation in initiatives by local and regional authorities on management and protection of water resources. Internal and external transparency is straightforwardly related with the other GAs, as any updates on the corresponding action plans should be communicated to any affected stakeholders (e.g., newly published legal requirements should be communicated to the farmer members of the F.OR, or any proposed mitigation measures for extreme events should be disseminated to regional authorities).

DISSEMINATION CALENDAR ON INTERNAL AND EXTERNAL TRANSPARENCY							
PART A: EVENTS (INFORMATION, CONSULTATION, TRAINING, ETC.)							
DATE	TITLE OF THE EVENT	PLACE	ATTACHMENTS (Y/N)				
			BRIEF SUMMARY OF THE EVENT	PROGRAM	PARTICIPANT LIST	PHOTOS	PRESENTATION
PART B: PRESS RELEASES & INVITATION ANNOUNCEMENTS							
DATE	TITLE OF PRESS RELEASE		ATTACHMENTS (Y/N)				
			LINKS OF PUBLICATION	PRESS RELEASE / ANNOUNCEMENT		BRIEF DESCRIPTION	
PART C: INFORFMATION MATERIAL (LEAFLET, GUIDES, WEAKLY BULLETINS, ETC.)							
DATE	TYPE OF MATERIAL	TITLE OF MATERIAL	ATTACHMENTS (Y/N)				
			LINKS OF PUBLICATION	PLACE & NO. OF DISTRIBUTED MATERIAL		MATERIAL	BRIEF DESCRIPTION
PART D: OTHER ACTIONS (not included in any other category)							
DATE	TYPE OF ACTION	TITLE OF ACTION					ATTACHED BRIEF DESCRIPTION (Y / N)
RESPONSIBLE PERSON		SIGNATURE		DATE			

Figure 6. The dissemination calendar used for reporting communication, information, and training events.

Considering that effective dissemination of water management strategies is critical for addressing water scarcity and promoting sustainable agriculture [21], all the three F.ORs took several actions in terms of disseminating and communicating the adopted water management strategy to their members. These actions included, among others, the participation of the F.ORs in local events, the regular distribution of dissemination materials, and several press releases. Regarding the provision of information and consultancy on the requirements for water, as well as the awareness raising and training in Good Agricultural Practices for water use, several seminars and training events were organized. These events were aimed at the farming community, and the numerous F.OR members who attended received training on the abovementioned issues. Moreover, distribution of informative leaflets with the action plans for extreme events and meetings with the local Civil Protection authorities were organized, related to the mitigation of extreme weather events. Finally, the three F.ORs established regular communication with the local authorities and reported several meetings for the dissemination of the WMAS, and they received updates on related water issues and on water management initiatives.

With regard to the fourth GA, an emergency preparedness and response plan that can be used by F.ORs and their farmer members in order to maintain an efficient response to emergencies and extreme events is developed. Several natural hazards (frost, extreme heat, flood, drought, fire, etc.) and anthropogenic hazards (pollution caused by agricultural products, fire, etc.) are considered extreme events and emergencies for the F.OR. This action plan includes instructions for preventing the impacts of those situations for each of the different crops that are cultivated in the areas of interest, along with treatment measures for the damaged crops. The action plan that was established for this GA consists of an independent response plan for each of the considered extreme events, namely, frost, extreme heat, fire, pollution from agricultural products, floods, and droughts. Specialized

plans were developed for all the three F.ORs in an extended form but also in the form of a brochure. Responsible for the implementation of this action plan is the WS.

Finally, with regard to the last GA, accounting and reporting mechanisms to promote economic transparency, an action plan was formed in order to report any investments performed to improve water management. Responsible for the implementation of the action plan is the WS. Every investment that contributes to the implementation of the WMAS, including all its criteria, is considered a sustainable water management (SWM) investment. Moreover, the investments that are made as part of SWM have to be directly separated from the total investments in water management. In the frame of the action plan of this GA, a reporting mechanism was developed, which is presented in Figure 7. However, considering the abovementioned definition of investment, during the implementation period presented in this study, there were no investments related to water management in the three F.ORs.

FORM XXX-INV: Reporting & accounting for investments related to water resources							
No.	Investment Description	Type of investment	Is the investment considered to contribute to Sustainable Water Management (SWM)?		Cost recovery level (%)	Revenue generation (€)	% of investment in SWM in relation to total investments in water management [f]=100 × a]/[e]
			YES, Cost of investment (€) [a]	NO, Cost of investment (€) [b]			
		Capital investment, granting, loan or insurance service	The total cost of investment including related costs such as transaction costs must be reported	The total cost of investment including related costs such as transaction costs must be reported	Corresponds to regaining the value of the investment. Due to the fact that all reporting investments are related to water management, the cost recovery has to be related (when possible) to water price	The potential revenue generation resulting from the corresponding investment has to be reported in this field. Revenue is considered to be generated after full cost recovery	
Total cost of investments in SWM [c]			← sum of costs reported in column [a]				
Total cost of investments that do not contribute to SWM [d]				← sum of costs reported in column [a]			
Total cost of all water management investments [e]=[c]+[d]							
Total % of investment in SWM in relation to total investments in water management [g]=100 × [c]/[e]							
Name: Water Steward			Signature		Completed for year _____	Completion date: _____	

Figure 7. The form used for reporting investments related to water resources.

3.2. Evaluation of the Implementation and Revision of the WMAS

Overall, during the three years of implementation, it was found that the three F.ORs implemented the AWMS to a sufficient extent and followed the established action plans for the GAs. However, the monitoring procedures could still be improved, considering that sometimes, the related actions which took place were reported with some delay or after a reminder. Scientific consultation has proven valuable for the implementation of the AWMS, especially during the first period, when the assigned WDs were not yet fully accustomed to the monitoring mechanisms used. It should also be mentioned that for the Italian F.OR, the person assigned to the role of WS changed after the first implementation year, so additional time and effort was required for training the new WS. Therefore, it is not advised to change the person assigned to this role after such a short time, considering that the new WS requires additional training and a transitional period to undertake all the responsibilities.

Moreover, the action plans established for the GAs were fully implemented. During the first two implementation years, the initial action plans were updated, when necessary, in order to include suggestions from the WSs of the F.ORs and thus make them more efficient for them. Monitoring reports on the overall AWMS implementation were submitted periodically, and the results indicated that the reporting mechanisms can work efficiently. It is also noted that in all three F.ORs, the roles of the people who are responsible for legal matters about water, responsible for communication with the River Basin Committee,

and the WS were assigned to the same person, so communication between the different departments was not an issue.

After three years of AWMS implementation, the revision of the WMAS was considered according to the proposed methodology, taking into account the monitoring and evaluation mechanisms, as well as any suggestions derived from the internal and external dissemination activities. After an extended discussion between the scientific experts of the project and each F.OR, it was concluded that no revisions need to be made to the WMAS adopted by the F.OR. Moreover, the members of the board of each F.OR. communicated with their members to incorporate any suggestions on revising the WMAS. No new suggestions were submitted, and the members expressed their agreement with the current WMAS. Furthermore, more farmers expressed their interest in participating in the WMAS. According to this, the WMAS strategies have been extended to more farmers in the pilot areas by the adoption of the applied practices from more farms cultivating the same crops of the participating F.ORs or other perennial crops in the pilot sub-basins.

3.3. Lessons Learnt through the Implementation

The experience gathered through the pilot implementation of the proposed strategy (WMAS) in the three participating F.ORs indicated some critical points that could contribute to increasing the effectiveness of implementation in other cases related to open-field agriculture.

One major outcome drawn from the pilot implementation of the AWMS in the three F.ORs is that the application of the EWS standard at the F.OR level cannot be as straightforward as it is in industry, considering the complexity that arises from diverse management structures and varying land properties [22]. These organizations may have hundreds of farmer members, whose farms may be fragmented and scattered in the area of the F.OR's activity. Moreover, multiple water sources may be available in the area and managed by distinct entities, either public or private.

Furthermore, it was found that the systematic monitoring and evaluation of WMAS implementation were identified as crucial for increasing efficiency and conserving resources. The proposed strategy needs to be periodically monitored and evaluated, especially during the first steps of implementation. This will identify implementation gaps and errors and give the potential for prompt updates when necessary. During the implementation of the WMAS in the three F.ORs, there were some cases for which the monitoring mechanisms that were originally proposed were not sufficient to record all the required information. In such cases, the action plans were revised, and new mechanisms were introduced, reflecting a common theme in adaptive water management [23]. For example, after the first year of implementation, a communication gap was identified between the farmers and the F.OR's management with regard to the communication of legal requirements and compliance. Therefore, the corresponding action plan was updated by including a form aiming to bridge the abovementioned gap.

The significance of capitalizing on any previous experience with the implementation of other standards and consulting experts when needed is also highlighted. F.ORs with experience in the implementation of other standards such as Environmental Management Systems (EMSs), AGRO, or ISO standards, etc., indicated a higher potential in implementing the AWMS and, therefore, the EWS standard. This is attributed to the fact that they are familiar with using monitoring and evaluation processes and keeping records of their activities. During the establishment and the first steps of the AWMS and the GAs, all F.ORs needed substantial support from the scientific experts. Several consultation meetings were organized between the scientific experts and the F.ORs in order to discuss the progress of implementation of the GAs and to ensure that all the requested information was included in the forms. These meetings facilitated the implementation of the governance action plans, as necessary clarifications were given, and new suggestions were discussed.

Another major outcome was that internal dissemination and transparency is of crucial importance for the efficient implementation of the EWS, considering that all the members

of the F.OR need to be informed of the strategy and the necessary actions that need to be implemented. Several dissemination activities need to take place, so that all the involved members are kept informed throughout the process. In addition, regular communication is suggested between the WS and the members of the F.OR to enhance internal transparency surrounding the strategy and to facilitate the monitoring process. Finally, the benefits from the implementation of the AWMS and, subsequently, the EWS should be clearly connected to economic benefits or benefits related to crop yield. This is something that was asked for by the farmers, but it is not straightforward in most cases.

An important lesson learnt was that special attention should be given to communication and dissemination related to extreme climate events. Since the frequency of climate extremes, such as floods, droughts, heat waves, and frost events are increasing in the context of climate change, communicating the corresponding action plans before the critical period of each extreme was found to be an efficient way to increase their implementation potential. Moreover, organizing special events dedicated to climate extremes attracted many farmers and stakeholders.

Finally, it is important to achieve substantial communication and cooperation with the local and/or regional authorities. External dissemination activities were organized in order to communicate the strategy in the local authorities, which can contribute to policy and governance aspects at a larger scale. Although there is communication between F.ORs and the local authorities, this communication is mainly limited to information provided by the F.OR regarding the actions and practices that took place, without continuous and bi-directional feedback. This is a fundamental problem of communication between the relevant authorities and the agricultural sector and vice versa, according to which the agricultural sector is not actively involved in the development of the management plans, despite the fact that it consumes 80% of the water that is used nationally. In any case, the communication of F.ORs with local and regional authorities could be more effective, and F.ORs should clearly define their potential contribution to water resource management targets in order to develop a robust cooperation with the relevant authorities. Carvalho et al. [24] analyzed the future development needs of the WFD across Europe, underscoring the challenges of achieving good water status and the need for more effective integration of agricultural policies to support water quality objectives. This work suggests the importance of engaging the agricultural sector in water management planning.

4. Conclusions

In the present paper, an integrated water governance scheme is proposed for agricultural water management. This integrated water governance scheme consists of the water management adaptation strategy that is formulated for each organization and the AWMS, which is a useful tool for ensuring the implementation of the strategy. Moreover, the distribution of roles and responsibilities within the organization and the establishment of some main governance actions are also crucial for the effective implementation of the strategy. The proposed methodology for agricultural water governance has been developed and implemented in three F.ORs, two in Crete, Greece, and one in Basilicata, Italy.

The proposed integrated water governance scheme is a valuable tool for F.ORs to carry out adaptation to climate change in terms of water efficiency. The AWMS uses a system approach, which is not restrained to satisfying baseline requirements. On the contrary, it requires that the organizations strive for continuous improvement, developing their goals, objectives, and targets via instructions that are customized to the real needs of each land parcel. In order to include policy making and goal setting, consultation, structures, roles, and responsibilities, each organization defines its own strategy towards its goals and thus develops its own AWMS.

The action plans highlighted the intricate links between water management and other resources. Although quantifying these relationships proved challenging due to their complex nature, the exercise emphasized the necessity of considering these interconnections in water management strategies to enhance resource efficiency and sustainability.

The development of emergency preparedness and response plans for dealing with natural and anthropogenic hazards demonstrated a proactive approach to risk management. Tailoring response plans to specific threats and providing actionable guidance for farmers ensures that the agricultural community is better equipped to handle emergencies, thereby mitigating potential impacts on water management and crop production.

While the initiative aimed to promote economic transparency through the reporting of sustainable water management investments, the absence of related investments during the study period highlights a potential area for further development. Enhancing mechanisms to track and report on such investments could strengthen the economic case for sustainable water management practices.

The implementation of a water management adaptation strategy is valuable for F.ORs wishing to incorporate responsible water resource management practices into their financial activities and to make these actions publicly available to their clients using specific certifications.

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