The Role of Farmers' Participation in Improving On-Farm Water Resource Management

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ABSTRACT

Water resource management is one of the major challenges facing agriculture in Iran. Due to its arid and semi-arid climate, Iran is experiencing a severe water scarcity crisis. This crisis, compounded by climate change and increasing demand for food, has significantly impacted agricultural productivity. One of the effective solutions for better water management is the active participation of farmers in decision-making and implementation processes. This study examines the role of farmers' participation in water resource management at the farm level and investigates its effects on water efficiency, reduction of water loss, and improvement of water distribution. The results indicate that farmers' involvement in local organizations and management processes enhances water productivity and reduces excessive water use. Moreover, farmers' participation helps reduce social tensions among them and fosters mutual trust. The study also identified several obstacles to effective participation, including lack of training, legal issues, and inadequate infrastructure. To strengthen participation, the study proposes recommendations such as improving educational programs, establishing local organizations, and providing legal support.

Keywords: *Farmers' participation, water resource management, water productivity, sustainable agriculture.*

1. *INTRODUCTION*

Iran, located in the arid and semi-arid regions of the world, has always faced severe water resource limitations. In recent years, climate change, rising average annual temperatures, decreased effective precipitation, and unsustainable exploitation of surface and groundwater resources have exacerbated the water crisis across many parts of the country. Simultaneously, population growth and increasing demand for food have led to the expansion of agriculture as the largest consumer of water resources. Currently, over 90% of the country's water consumption is allocated to the agricultural sector. However, water use efficiency in this sector remains very low, with a significant portion of resources being wasted due to poor management, traditional irrigation methods, and the lack of precise control systems [1, 2, 22].

Under such conditions, revisiting traditional water resource management methods particularly at the farm level has become an unavoidable necessity. One of the most effective modern approaches in this context is emphasizing the participation of water users in the water management process. These users are, in practice, the primary stakeholders in water consumption, and any policymaking or planning effort that ignores their role and input is likely to fail. Farmers' participation refers to the voluntary and informed involvement of agricultural water users in decision-making, planning, distribution, and maintenance of water resources and irrigation networks. This type of participation can enhance responsibility, improve efficiency, promote more sustainable use of water resources, and even strengthen social capital among farmers [3, 4].

Successful experiences in various countries, including India, Spain, Turkey, and Mexico, have demonstrated that delegating certain water management responsibilities to local users through the

establishment of associations, cooperatives, or water user organizations not only ensures more equitable water distribution and better maintenance of infrastructure, but also significantly reduces local conflicts over water. In Iran, efforts have been made over the past two decades to strengthen farmer participation through irrigation cooperatives or water user groups. Nevertheless, these structures have yet to be fully institutionalized in executive policies and still face challenges such as insufficient legal support, weak training and empowerment of users, and poor coordination among responsible institutions [6, 21].

In this context, research on how to effectively involve users in farm-level water management becomes increasingly important. Studying the impacts of their participation on water efficiency, distribution regulation, reduction of social tensions, and improved maintenance of irrigation systems can pave the way for presenting localized models of participatory water management in Iran. This article aims to explain the concept of user participation, examine the benefits and challenges of this approach at the farm level, and propose strategies based on field evidence and comparative studies to enhance such participation toward improving water resource efficiency. It is hoped that this study will serve experts in the field of water management, policymakers, and the users themselves, contributing, however modestly, to the move toward sustainable water resource management in the country.

2. The Concept of Water Users' Participation in Water Resource Management

The participation of water users in water resource management is considered one of the key pillars in improving the efficiency and sustainability of irrigation systems at the farm level. In traditional water management systems, decision-making and program implementation were mainly carried out by governmental institutions, with little to no active involvement from the users. However, the experience of countries facing similar water crises has demonstrated that no program aimed at sustainable water use can succeed without the active involvement of farmers and the integration of their local knowledge. Users' participation means their direct engagement in various stages of planning, implementation, monitoring, and maintenance of irrigation systems, which results in enhanced ownership, improved efficiency, and reduced governmental costs [7, 22].

Firstly, the participation of users through the establishment of local water user organizations is one of the most effective operational structures for managing agricultural water. These organizations, which can be formed at various levels from individual farms to entire watersheds, provide a platform for better coordination, knowledge sharing, and fair distribution of water resources. Within such structures, members can collaboratively make decisions regarding irrigation scheduling, equipment maintenance, and water consumption management. Numerous studies in Iran and other countries like India and Turkey have shown that the establishment of these entities leads to increased participation, reduced conflicts among farmers, and significant improvements in water use efficiency [8].

Secondly, participatory decision-making by users at the farm level plays a critical role in the operational management of water resources. When farmers are directly involved in planning irrigation schedules, selecting crop types, determining irrigation timing, and even contributing to the design of modern irrigation systems, water is utilized more efficiently. Farmers' engagement in decision-making processes not only enhances productivity but also reduces dependence on top-down decisions and increases adaptability in the face of climate variability and water-related crises [9].

The third dimension of user participation involves joint monitoring and maintenance of water distribution systems. In many regions, irrigation networks deteriorate rapidly due to poor maintenance and a lack of shared responsibility, resulting in increased water losses. When farmers are involved in continuous monitoring, reporting system failures, contributing to repairs, and providing necessary financial resources, the sustainability of these networks is significantly improved, and maintenance costs are greatly reduced. Furthermore, when users play an active role in preserving infrastructure, they are more likely to prevent misuse or overuse by others, helping to cultivate a culture of collective responsibility in water consumption.

In summary, water users' participation in water management is not only a social and economic necessity but also a prerequisite for sustainable agricultural development under water-scarce conditions. Strengthening participatory infrastructure and leveraging local capacities can be a major step toward alleviating the water crisis and enhancing the efficiency of existing water resources [9, 10].

3. Effects of Water Users' Participation on On-Farm Water Management

The participation of water users in on-farm water resource management has several positive impacts, including improved water use efficiency, reduced water consumption, and enhanced equity in water distribution. The first major effect is the promotion of fairness in water allocation. When users collectively engage in decision-making processes regarding the distribution of water resources, allocation is made based on actual needs and soil conditions. This leads to more equitable access to water for farmers and a fairer distribution of pressure on water resources. For instance, in areas where water user organizations are active, disputes and dissatisfaction regarding water division have significantly decreased [11, 12].

The second impact is water conservation and reduction in water losses. When users participate in water management, their awareness of crop water requirements and efficient usage practices increases, which significantly improves water use. This participation often encourages the adoption of modern irrigation techniques such as drip irrigation or the use of soil moisture sensors, directly contributing to reduced water wastage and enhanced efficiency [13, 14].

Improved operation and maintenance of irrigation networks is another key result of user participation. In irrigation systems where users play an active role, collective responsibility leads to better upkeep and timely repairs. This ensures that faults and malfunctions in the system are identified and addressed more quickly, minimizing water losses. In regions where farmers collaborate, reports show that damage due to poor maintenance or misuse is reduced, as users see themselves as responsible for the proper functioning of the systems [12, 14].

Another notable benefit of participation is the reduction of social tensions among farmers. In many agricultural areas, conflicts over water allocation are common. However, when users are involved in the decision-making process regarding resource distribution and management, these conflicts tend to decrease significantly. This is mainly due to increased transparency and cooperation at the local level, which fosters greater social cohesion and reduces interpersonal conflicts. In such systems, farmers are more likely to trust one another and work collectively toward the sustainable management of water resources.

In conclusion, the participation of water users in on-farm water management contributes to increased efficiency, reduced water waste, improved equity in water distribution, better infrastructure maintenance, and lower social tensions. Ultimately, these outcomes lead to enhanced agricultural performance and long-term sustainability of water resources [15].

4. Barriers and Challenges to Water Users' Participation

Barriers and challenges to water users' participation in water resource management have consistently been among the main obstacles to improving on-farm water efficiency. These challenges can be analyzed from social, technical, and legal perspectives. On the social side, a lack of education and awareness among farmers often results in limited understanding of the importance of participation and the need for efficient water management. Furthermore, the absence of appropriate infrastructure and clear legal frameworks regarding users' rights and responsibilities creates significant gaps in the implementation of participatory approaches. Additionally, social issues such as mistrust among farmers, weak local governance, and poor community engagement hinder effective cooperation and solidarity among water users [15, 16].

One of the primary obstacles is socio-cultural resistance. In many regions, farmers are reluctant to engage actively in collective decision-making due to a lack of trust in management systems or in one another. This distrust often stems from past negative experiences or perceived inequalities in water allocation. In such conditions, even well-designed participatory policies may fail to yield desired outcomes unless mutual trust and coordination among water users are first established. Therefore, building a supportive environment in which farmers can trust each other and collaborate over shared water resources is essential [15, 17].

From a technical standpoint, the lack of specialized training and access to appropriate tools is a critical barrier. Many farmers, particularly those in rural and remote areas, lack sufficient knowledge about modern irrigation methods, water resource management practices, and new technologies. This knowledge gap often leads to inefficient water use and wastage. Moreover, the high initial costs associated with purchasing and installing advanced irrigation equipment deter many farmers from adopting such innovations. In this regard, organizing training workshops and offering financial incentives or subsidies for the adoption of smart irrigation systems could be an effective solution.

Legal and institutional challenges also significantly hinder user participation. In many areas, existing laws and regulations regarding water management are not structured in a way that empowers users or encourages their involvement in decision-making processes. Weak enforcement and inadequate local oversight

further prevent farmers from fully exercising their rights. For instance, in some regions, water allocation is not conducted based on scientific or socially just principles, which leads to fears among users about losing their share of the resource. Legal reform, enhanced monitoring, and the establishment of transparent regulatory frameworks are necessary to support user participation [18, 22].

When these challenges converge, they substantially reduce the effectiveness of participatory water management. Therefore, to achieve meaningful outcomes, these obstacles must be addressed through appropriate policymaking, farmer education, and the development of supportive legal and social structures.

5. Strategies to Strengthen Water Users' Participation

To enhance the participation of water users in on-farm water resource management, a comprehensive and coordinated implementation of supportive and operational strategies is essential. One of the most critical steps in this process is education and outreach. Farmers must be continuously informed about modern water management practices, innovative irrigation technologies, and the benefits of participatory approaches. Organizing training workshops, seminars, and developing accessible and comprehensible educational materials can play a key role in changing farmers' behavior and fostering a stronger sense of responsibility. Moreover, using local media and incorporating the insights and experiences of successful farmers can further amplify the effectiveness of outreach initiatives [19, 21, 23].

The second key strategy involves legal and institutional support. One of the main obstacles to effective participation is the lack of robust legal frameworks and insufficient backing from governmental institutions. Governments must establish legal provisions that facilitate farmer participation, for instance, by enacting supportive legislation for user associations, simplifying the process of forming such organizations, and creating legal mechanisms for joint water management. Additionally, local executive bodies, such as the Ministry of Agriculture, regional water authorities, and community councils, should actively support these organizations and implement participatory programs effectively [20, 21].

A third strategy is to incentivize participation through financial support and accessible credit. Farmers may be reluctant to engage due to financial burdens or distrust of participatory systems. To address this, providing financial incentives such as subsidies for purchasing modern irrigation equipment, tax reductions, or low-interest loans for active participants can serve as strong motivators. Furthermore, the allocation of financial resources through agricultural banks or support funds can empower farmers to play a more effective role in optimizing water use and participating in water governance initiatives [22].

In conclusion, implementing these strategies can foster broader and more effective farmer participation in water resource management. This, in turn, contributes not only to improved water efficiency but also to the long-term sustainability of agriculture and the preservation of natural resources.

6. Results and Discussion

This study examined the impact of farmers' participation in on-farm water resource management and found that such involvement can significantly enhance water use efficiency. Comparative and empirical evidence from Iran and other countries indicates that engaging farmers in decision-making, planning, and managing water resources can lead to more optimal water usage and reduced wastage. Farmers who are actively involved in water management tend to consume less water and achieve higher productivity, particularly in arid and semi-arid regions where water scarcity is critical.

Beyond improving efficiency, farmers' participation contributes to fairer water distribution and reduced social tensions among agricultural communities. Through the formation of local water user associations and their involvement in collective decision-making, water is allocated more equitably, and conflicts over water distribution are minimized. Additionally, this participatory approach fosters a sense of responsibility among farmers, leading to better maintenance of irrigation infrastructure and prevention of system deterioration.

However, to fully harness the benefits of participation, several barriers must be addressed. These include a lack of awareness, legal challenges, and insufficient technical and educational infrastructure. Many farmers are unable to manage water efficiently due to limited training and lack of access to modern technologies. Moreover, inadequate legal support can hinder effective farmer engagement. To overcome these issues, it is essential for policymakers and relevant institutions to implement educational, promotional, and supportive programs, and to create the necessary infrastructure that encourages and facilitates participation.

These efforts can significantly enhance water use efficiency, mitigate the water crisis, and improve the sustainability of agricultural water management.

7. *Conclusion*

This study demonstrated that farmers' participation in the management of water resources at the farm level can substantially improve water productivity and irrigation performance. Given that water scarcity is one of the most pressing challenges in agriculture, involving farmers in decision-making processes not only contributes to efficient water management but also strengthens social bonds and trust between farmers and water management institutions. Research findings show that farmers who participate in water governance tend to consume less water and achieve greater efficiency compared to non-participating farmers. Nonetheless, to realize the full potential of such participation, existing barriers including lack of awareness, legal constraints, and inadequate technical and educational infrastructure must be removed. These obstacles can hinder farmers' effective involvement, particularly in small-scale and underserved agricultural regions that lack adequate support programs.

8. *SUGGESTIONS*

To strengthen farmers' participation in water resource management, it is recommended that government bodies particularly the Ministry of Agriculture develop and implement educational and extension programs at the farm level. These programs should focus on raising awareness about modern irrigation techniques, the benefits of participatory water management, and efficient water use under varying conditions. Furthermore, developing and empowering local water user associations can enhance farmers' sense of ownership and accountability. These associations can provide effective platforms for supervision, information exchange, and coordination among farmers, thereby contributing to reduced water loss and improved irrigation system efficiency.
Finally, policymakers and water management authorities should draw on successful international experiences to establish legal and operational frameworks that support farmer participation. This includes creating legal infrastructure for supporting user associations, offering financial and technical assistance to active participants in water management, and introducing incentives for farmers who implement efficient irrigation systems. These measures can play a pivotal role in enhancing water productivity and ensuring the long-term sustainability of water resources in agriculture.

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