

# Overcoming barriers to the adoption of water-saving technologies in Jordan: Policy pathways for transforming knowledge, attitudes and practices

## Key messages

- The adoption of water-saving technologies (WSTs)<sup>1</sup> in Jordan is hindered by financial constraints, limited extension services, technical gaps and unequal access to WSTs, especially for smallholders and marginalized communities.
- Lack of pre- and post-installation support from suppliers of WSTs and extension services limits the widespread and effective use of these technologies.
- Aligning farmers' knowledge, attitudes and practices (KAP) with water conservation goals is crucial for the successful adoption of WSTs. Researchers can design targeted studies, practitioners can tailor support and policymakers can create effective policies that drive adoption through education, financial mechanisms and incentives.
- Farmer-centric approaches drive adoption. A Market Systems Development (MSD) strategy, supported by peer learning and extension services, can enhance farmers' knowledge and confidence in WSTs.

<sup>1</sup> Water-saving technologies refer to technologies that lead to improving irrigation efficiency and uniformity.

## Introduction

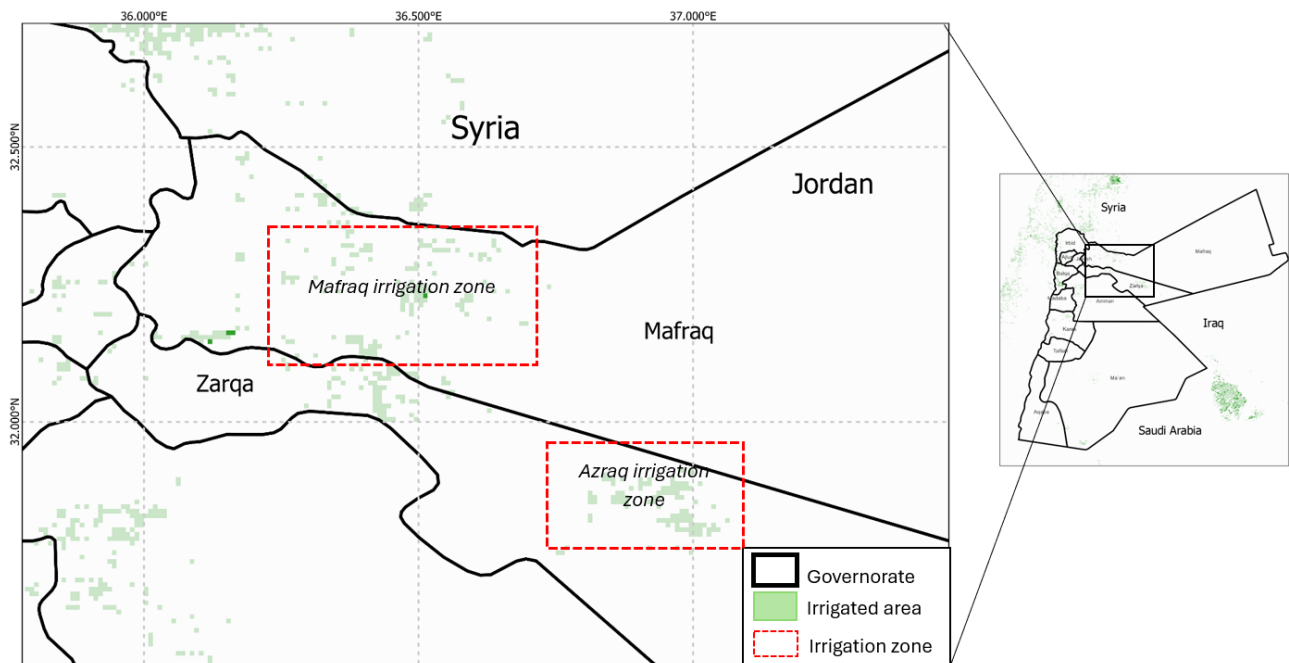
Jordan's severe water scarcity remains a critical challenge, exacerbated by a rapidly growing population, climate change and the overextraction of limited groundwater resources. With per capita water availability at just 61 m<sup>3</sup>/year as of 2021—far below the global water scarcity threshold of 500 m<sup>3</sup>/year—Jordan is one of the most water-scarce countries in the world (Ministry of Water and Irrigation 2023). This scarcity puts immense pressure on various sectors, particularly agriculture, which consumes 48% of the country's freshwater resources (Ministry of Water and Irrigation 2023). The agriculture sector is heavily reliant on inefficient irrigation practices, with water productivity in the highlands reaching JOD 0.36 per m<sup>3</sup>, far below the potential achievable through WSTs (FAO 2022).



A farm in Mafraq area (photo: Maha Al-Zu'bi, IWMI).

In the highlands region, especially Azraq and Mafraq areas (Figure 1), which are among Jordan's most productive agricultural areas, the situation is particularly dire. These areas rely heavily on groundwater, which has been extracted at unsustainable rates, leading to declining water tables and deteriorating water quality. The overextraction of groundwater in these regions not only threatens the long-term viability of agriculture but also exacerbates the broader issue of water scarcity, creating a vicious cycle where the available resources continue to dwindle. These areas urgently require transformative solutions to conserve water while ensuring that agricultural productivity is not compromised (Al-Bakri et al. 2023; Balasubramanya et al. 2019; Borghuis et al. 2022). Water-saving technologies (WSTs)

have the potential to significantly reduce water usage in Jordan's highland agriculture, easing pressure on the nation's strained water resources (Balasubramanya et al. 2019; Borghuis et al. 2022). However, their adoption remains limited due to systemic barriers such as financial constraints, technical challenges (Figure 2) and policy weaknesses. Addressing these barriers requires a comprehensive approach that considers farmers' knowledge, attitudes, and practices (KAP). Policymakers should prioritize water conservation by implementing supportive policies, including financial incentives, subsidies and technical support, to facilitate the transition to sustainable practices (Pronti et al. 2024; Campuzano et al. 2023).



**Figure 1.** Map of Jordan showing the highlands region, Azraq and Mafraq areas, with a focused zoom view.



**Figure 2.** Farmers using drip irrigation and underground barrels to keep soil moisture in Azraq Area, Jordan (Source: Maha Al-Zu'bi, IWMI).

Farmers' KAP are crucial in adopting WSTs. While many are aware of these technologies, practical implementation is often hindered by insufficient technical knowledge on their use and maintenance (Pronti et al. 2024; Campuzano et al. 2023). Educating farmers through targeted extension services, hands-on training and awareness campaigns can bridge this gap and empower informed decision-making. Additionally, addressing skepticism about the effectiveness and costs of new technologies is essential. Local, regional and international success stories, peer influence and demonstrations of the long-term benefits of WSTs are key to shifting attitudes and fostering adoption (Borghuis et al. 2022; Kruse and Gardner 2022; Mercy Corps 2022).

This policy brief explores farmers' KAP towards the adoption of WSTs in the highlands region in Jordan. It focuses on examples from the Azraq and Mafraq areas. The brief draws on insights from a literature review, experts feedback, field observations and 91 semi-structured interviews conducted with farmers in these areas, as part of the *Water Innovation Technologies* project implemented by the International Water Management Institute (IWMI) and Mercy Corps during the period 2019–2022. Ultimately, aligning farmers' KAP with water conservation goals along with providing multi-sectoral support, is crucial for the long-term sustainability of Jordan's water resources and agriculture sector. These efforts are vital in addressing challenges such as water scarcity and food security, particularly in the face of climate change and population growth.

## Key challenges to the adoption of water-saving technologies in Jordan

The study revealed that the following challenges hinder farmers' adoption of WSTs in Azraq and Mafraq areas. It is only by overcoming these obstacles, among others, that Jordan can achieve widespread adoption of WSTs and enhance its agricultural water efficiency in the face of growing water scarcity.

- 1. Financial barriers:** One of the primary obstacles to the adoption of WSTs is the high cost associated with these systems (Balasubramanya et al. 2019; Mercy Corps 2022). WSTs require significant initial investment, which many farmers cannot afford. Smallholder farmers, in particular, face difficulties accessing affordable financing options, as they often lack the financial security or collateral required to obtain loans from formal financial institutions (Mercy Corps 2022). While there are some government subsidies available through Jordan's Agricultural Credit Cooperation (ACC) for the adoption of WSTs, these programs remain limited and are not evenly distributed, making it challenging for farmers in remote areas, such as Azraq and Mafraq, to benefit from them. Without inclusive financing mechanisms, the high upfront costs, limited access to credit and uncertain return on investment remain substantial barriers to the widespread adoption of WSTs.
- 2. Lack of a comprehensive policy framework:** Adoption of WSTs in Jordan faces challenges tied to policy implementation, which could benefit from greater consistency and broader application. Regulations promoting efficient irrigation systems or offering subsidies for WSTs, while present, require more systematic enforcement and alignment with broader goals (Ministry of Water and Irrigation 2023). Coordination among water, agriculture and energy sectors remains limited, hindering the development of integrated strategies for water efficiency (World Bank Group 2022). Enhanced collaboration between water resource managers and agricultural extension services could improve the dissemination and adoption of WSTs (Al-Bakri et al. 2023). Additionally, water pricing structures in agriculture, aimed at balancing social and economic needs, may inadvertently reduce the incentive for adopting efficiency measures. Irrigation water and pumping are incentivized, and the import tariff scheme encourages domestic production of crops that require significant water resources. Import tariffs and regulatory hurdles further constrain the accessibility of WST equipment (IWMI 2020a, 2020b). Strengthened and integrated policies can address these gaps, supporting sustainable water use in Jordan (IFAD 2020).
- 3. Absence of a robust Market Systems Development (MSD) framework for WSTs:** MSD focuses on developing and strengthening market systems that allow local actors, such as farmers, suppliers and service providers, to engage in mutually beneficial relationships, which can drive long-term development. Current policies fail to create a sustainable market that connects farmers with essential resources such as knowledge, tools and financial support. Without a strong MSD framework, farmers rely on subsidies or short-term solutions, fostering dependency instead of resilience. A lack of market incentives, such as affordable financing or accessible extension services, discourages large-scale adoption of WSTs. Furthermore, a weak MSD system limits local suppliers' ability to scale, hindering widespread adoption.
- 4. Inadequate extension services:** Agricultural extension services play a crucial role in educating farmers about modern farming techniques, including WSTs (Pronti et al. 2024; Campuzano et al. 2023). However, these services are often under-resourced and lack the specialization needed to effectively support the adoption and maintenance of WSTs. Existing extension programs lack irrigation support and fail to meet the specific needs of farmers, particularly in rural areas where water scarcity is most pressing (FAO 2022; IWMI 2020a, 2020b). There is a lack of comprehensive training programs that focus on the operation, maintenance and troubleshooting of WSTs, which leaves farmers without the technical support they need to ensure successful implementation. This gap in extension services prevents farmers from fully understanding the benefits of WSTs or learning how to operate them effectively, ultimately hindering adoption.

**5. Technical capacity gaps:** A critical challenge in Jordan is the lack of effective communication and technical support from suppliers of WSTs. Research conducted by IWMI highlighted that many suppliers fail to provide adequate pre- and post-installation support or training to farmers (IWMI 2020a, 2020b). This gap is particularly acute in remote areas, where access to technical expertise is scarce. Therefore, farmers often find the operation and maintenance of these systems complex and burdensome, especially in regions such as Mafraq and Azraq, where water quality is compromised by high salinity and sulfur content. This complexity, combined with limited supplier engagement, significantly hampers the adoption of WSTs. Without proper training or reliable technical support, farmers struggle to manage these systems effectively, leading to reduced functionality and performance. Such challenges diminish trust in the technology, further discouraging its adoption and undermining efforts to improve water management practices (IWMI 2020a).

**6. Equity issues:** Access to WSTs in Jordan is often inequitable, with larger and wealthier farms having a disproportionate share of resources and opportunities. Smallholder farmers, women and individuals with lower levels of education are particularly disadvantaged when it comes to accessing WSTs. These marginalized groups frequently lack the financial resources, education and networks needed to participate in WST programs or to secure the necessary technical and financial support (IWMI 2020a, 2020b). The uneven distribution of resources exacerbates existing inequalities, further entrenching disparities in agricultural productivity and water-use efficiency. As a result, the benefits of WSTs are not equally shared, and the adoption of these technologies remains skewed in favor of more affluent farming communities.

**7. Resistance to change:** Jordanian farmers resist adopting WSTs due to deep-rooted traditions, skepticism and uncertainty about economic and agronomic impacts. Many lack reliable cost-benefit analyses, leading them to prioritize financial stability and proven methods over innovations. Even common technologies such as drip irrigation are often misused, while advanced solutions face stronger resistance due to limited technical skills and distrust. Social norms further discourage deviation from traditional practices. Overcoming these barriers requires building trust, knowledge sharing and demonstrating the benefits of WSTs. Policymakers should focus on farmer-centered outreach, financial incentives and peer learning, supported by policies integrating financial access, technical aid and behavioral change strategies (Ma et al. 2023).

## Knowledge-Attitude-Practice conceptual framework

The Knowledge-Attitude-Practice (KAP) framework is a structured tool for analyzing behavior, particularly in the adoption of innovations and technologies (Liao et al. 2022). It explores how knowledge, attitudes and practices interact with social

and economic factors, such as peer influence and financial conditions, to shape decision-making. This adaptability makes it useful across various contexts. Since its introduction in the 1960s, the KAP framework has been widely applied in agricultural technology adoption research (Yahya et al. 2023). For example, Amsalu and de Graaff (2006) used this framework in Ethiopia to assess farmers' perceptions on soil conservation, revealing that external socioeconomic and cultural factors play a crucial role in adoption. Similarly, Raimondo et al. (2022) examined pesticide use in Argentina, finding that despite the awareness of risks, economic limitations and cultural norms heavily influenced farmers' decisions. While knowledge and attitudes shape behavior, real-world adoption of technologies is often driven by economic realities, social norms and resource availability. Research in Ethiopia and Argentina highlights how financial constraints and peer influences outweigh theoretical understanding in decision-making. Addressing these challenges requires context-specific solutions that go beyond abstract models to tackle structural barriers to adoption (Masoud et al. 2014).

## Supporting insights from recent research

Synthesis of recent studies from Asia and Africa highlights the following common key points that reinforce the relevance of the KAP framework to the adoption of WSTs (Preeti et al. 2024; Monteiro et al. 2024; Singh and Gandhi 2023; Levidow et al. 2014; Yazdanpanah et al. 2014; Zhong et al. 2019):

- **Behavioral influence:** Farmers' attitudes and behaviors are shaped by a combination of normative inclinations, perceived behavioral control and subjective norms. These factors influence not only intentions but also the actual adoption of WSTs and practices. Normative inclinations represent the social pressure to conform to community practices, while perceived behavioral control reflects farmers' confidence in their ability to implement the technologies. Subjective norms involve the individual's perception of others' expectations regarding technology use. Together, these elements not only guide intentions but also determine the likelihood of consistent adoption.
- **Barriers to adoption:** Across regions, farmers face significant barriers, including economic constraints, inadequate access to financial and physical resources, and lack of supportive infrastructure. In Zimbabwe, limited access to financial assets and agricultural inputs poses challenges for rural farmers in implementing adaptive practices. Similarly, in India, factors such as damage to irrigation systems caused by wild animals and ineffective subsidy mechanisms further hinder technology adoption. These systemic barriers underscore the need for structural support and targeted policy interventions.
- **Regional and subgroup variations:** Behavioral drivers differ across regions and among farmer subgroups, necessitating tailored interventions rather than one-size-fits-all solutions. For instance, geographic differences can influence resource

availability and cultural attitudes, while subgroup-specific challenges such as gender roles or land tenure systems can further shape adoption dynamics.

- **Role of education, social networks and digital tools:** Participation in cooperative societies and larger networks significantly boosts the impact of social interactions on the adoption of WSTs. Enhanced public awareness, neighborhood interactions and continuous knowledge exchange systems are essential for promoting sustainable practices. Additionally, the moderating role of internet use underscores the importance of digital connectivity in enhancing farmers' ability to acquire and act upon information. Participation in decision-making processes further strengthens the alignment of farmers' practices with broader water conservation goals.

### Application of Knowledge-Attitude-Practice conceptual framework in Jordan

In the context of adopting WSTs in Jordanian agriculture, the KAP conceptual framework (Figure 3) was used to provide a detailed and holistic analysis of the various factors influencing farmers' decisions. The KAP framework offers a comprehensive approach to understanding how socioeconomic, policy and technical elements interact and impact the adoption of these technologies. This framework focuses on **three interconnected components**, each playing a critical role in shaping the decision-making process:

1. **Knowledge:** Defined as a synthesis of data, information, experience and expertise, knowledge forms the foundation for evaluating and incorporating new practices. It plays a critical role in the adoption of WSTs, as highlighted by Larson et al. (2016) and Singh et al. (2017). While knowledge is essential, scholars indicate that its transformation into actionable water-saving behaviors is often hindered by economic constraints and limited access to resources.
2. **Attitudes:** Attitudes encompass the feelings, perceptions and beliefs individuals hold about specific technologies or practices. They shape farmers' willingness to adopt WSTs and are influenced by their overall perceptions of the technology's benefits and risks (Ajzen 2011). Scholars also show that normative inclinations and the perception of risks are critical in shaping attitudes and influencing adoption.
3. **Practices:** Practices refer to habitual or customary actions performed in specific contexts. These range from temporary actions to long-term behavioral patterns (Rouse 2007). In the case of WSTs, practices reflect the actual behaviors and strategies farmers implement in their agricultural operations. However, displaced responsibilities and a lack of incentives often limit farmers' efforts toward more efficient practices.

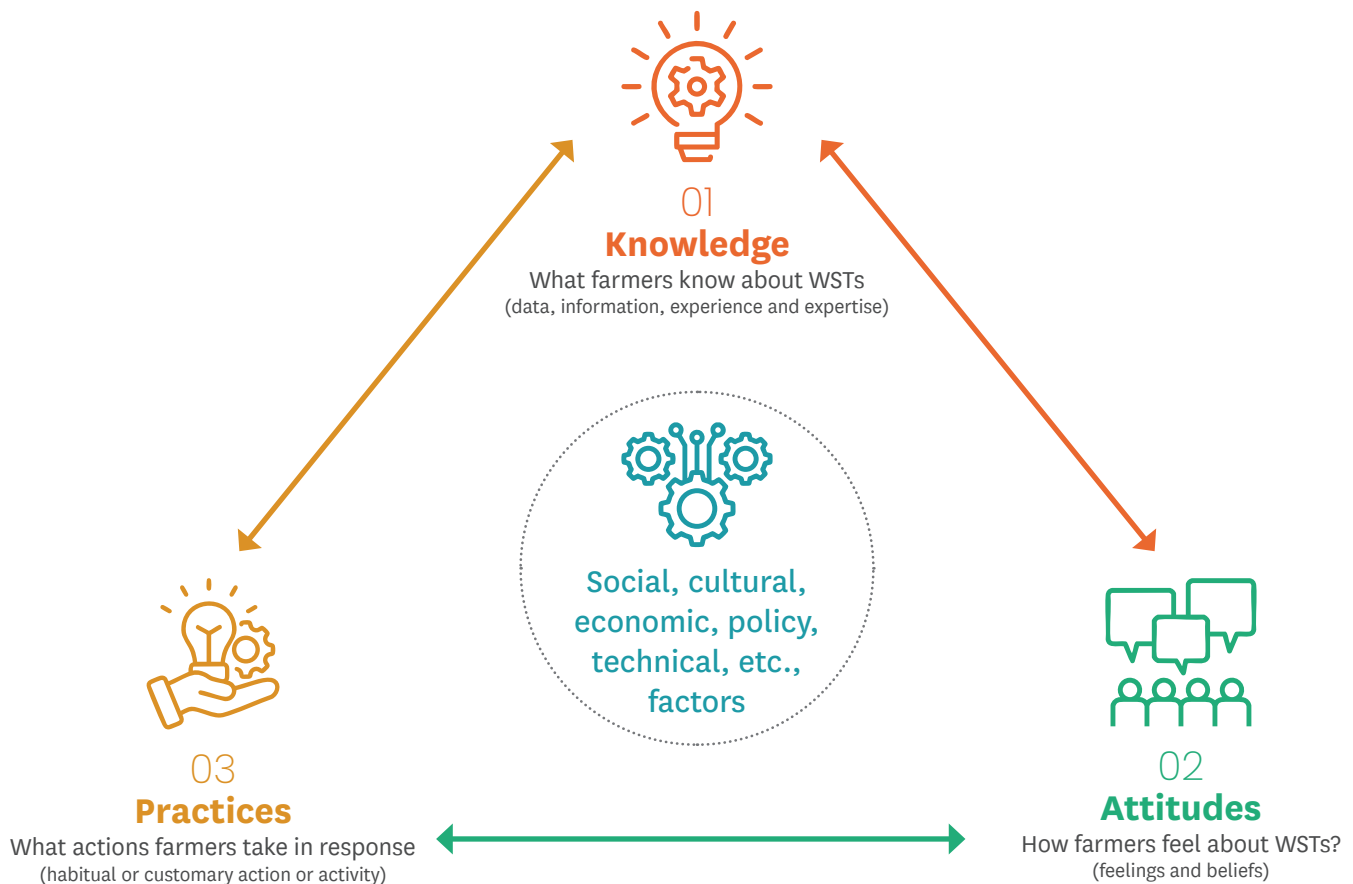


Figure 3. Knowledge, Attitudes and Practices (KAP) conceptual framework.

In addition to the three core components, the KAP framework also incorporates **external factors** such as economic conditions, cultural norms and policy environments (Figure 3). These external influences play a key role in shaping the relationship between knowledge, attitudes and practices, offering a more comprehensive understanding of the adoption dynamics. For example, farmers' behaviors are strongly influenced by factors such as access to social networks, the economic benefits associated with adopting new technologies and the opportunities for participatory decision-making. These external factors help mediate how knowledge and attitudes translate into actual practices, further highlighting the complexity of the adoption process. By employing the KAP framework in the study of WSTs in Jordan, this research aims to achieve the following:

- Identify key knowledge gaps that hinder the adoption of WSTs.
- Understand the attitudes shaping farmers' perceptions and willingness to adopt these technologies.
- Analyze current practices to determine barriers and facilitators of sustainable agricultural innovation.

The proposed KAP conceptual framework leverages both qualitative and quantitative methods, such as surveys, focus group discussions and case studies, to capture the multi-dimensional nature of behavior. The dynamic interplay between the three core components and external factors, supported by insights from recent research, will inform strategies for promoting sustainable agricultural practices and overcoming barriers to innovation.

## From theory to practice: Insights and learnings from employing the Knowledge-Attitude-Practice framework in Jordan

### 1. Knowledge: The foundation of adoption

Farmers in Azraq and Mafraq are generally aware of technologies such as drip irrigation, which are designed to conserve water by delivering it directly to plant roots, minimizing evaporation and runoff. However, many farmers lack a clear understanding of the technical requirements, including proper design, installation, operation and maintenance. Additionally, limited practical experience with WSTs prevents farmers from effectively utilizing these systems. Furthermore, their knowledge of the long-term benefits of WSTs, particularly in relation to the upfront investment costs, is often inadequate, leading to uncertainty and hesitation in adoption decisions. These challenges are compounded by the absence of pre- and post-installation support and guidance from suppliers of WSTs and extension services, further impeding the widespread and effective implementation of these technologies.

- **Awareness without depth of understanding:** While many farmers are aware of WSTs, their understanding of the design, operation and maintenance of the technologies is often limited.

For example, farmers may not know how to determine the correct number of emitters based on flow rates or how to select appropriate filtration systems to prevent clogging—challenges that are particularly acute in areas with poor water quality. Furthermore, they may not fully understand the advantages of WSTs over conventional drip irrigation systems. This knowledge gap stems from insufficient guidance and support from suppliers of WSTs and extension services, which often fail to address these critical details during promotion of the technology.

- **Inadequate technical support:** A pronounced lack of technical support further hampers the adoption and effective use of WSTs. Farmers frequently do not receive the necessary pre- and post-installation assistance from suppliers of WSTs, leaving them unprepared to manage the systems effectively. This is exacerbated by a lack of extension services, which are critical for providing hands-on training and technical guidance. Without these resources, farmers struggle to understand the functionality of WSTs and troubleshoot potential issues, increasing their reluctance to fully adopt the technologies.
- **Missed opportunities in decision-making:** The insufficient knowledge and technical support lead farmers to underestimate the long-term benefits of WSTs, such as water conservation and cost efficiency. This lack of clarity often results in hesitation or outright rejection of these technologies, hindering progress toward improved water-use efficiency and agricultural sustainability.

### 2. Attitudes: Perception of benefits of WSTs and barriers to adoption

In the case of adoption of WSTs, farmers in Azraq and Mafraq generally have a positive perception of these technologies. Yet, they face challenges to recognize the potential advantages of improving water-use efficiency, sustainable farming practices and crop productivity by optimizing irrigation, which is crucial in water-scarce areas such as Azraq and Mafraq, where groundwater depletion is a growing concern.

- **Concerns about cost:** Despite positive perceptions, farmers' attitudes are tempered by concerns about the high upfront costs associated with WSTs. WSTs can be expensive to install, and the lack of affordable financing options for farmers is a major deterrent. For smallholders with limited financial resources, these costs may be prohibitive, even if the technology promises long-term savings.
- **Technical challenges:** In addition to cost concerns, farmers express anxiety about the complexity of installing and maintaining WSTs. The perceived technical difficulty of managing advanced irrigation systems, particularly in the absence of adequate training or ongoing support, causes many farmers to remain hesitant about adopting these technologies.

- **Influence of social norms:** Farmers' attitudes are also influenced by social norms and peer experiences. Those who have seen success stories and demonstrations within their community are more likely to view WSTs favorably (Figure 4). Conversely, negative experiences or lack of community success stories can deter others from trying new technologies.

### 3. Practices: The gap between knowledge and action

Despite farmers' general knowledge of WSTs and their positive attitudes towards the potential benefits of these technologies, actual adoption rates in Azraq and Mafrq remain low. This gap between knowledge and practice reflects the systemic barriers that inhibit farmers from putting their knowledge and positive attitudes into action.

- **Financial constraints:** High initial costs are a major barrier to the adoption of WSTs. Due to limited financial resources, farmers are often forced to purchase cheaper, less effective drip irrigation systems, even if they are aware of the benefits of WSTs. The lack of financial support, such as affordable credit or loans, further exacerbates this issue, especially for smallholder farmers who do not have the collateral to secure loans.

- **Limited access to trusted technical support:** While farmers may be willing to invest in WSTs, the absence of reliable technical support and training hinders effective implementation. Farmers often rely on peer-to-peer networks for guidance, as they find these sources more trustworthy. However, professional and accessible technical support is scarce, making it difficult for farmers to maintain and operate systems such as drip irrigation, which require specialized knowledge and expertise.
- **Cultural and practical barriers:** In some cases, local farming practices and traditional irrigation methods are deeply embedded in the farming culture. Transitioning to WSTs may require significant behavioral change and adaptation, which can be challenging, especially for older farmers who may be more accustomed to conventional techniques.
- **Smallholder exclusion:** Smallholders are disproportionately affected by barriers to adoption. Larger farms, which often have more resources and access to credit, are better positioned to adopt WSTs. This unequal distribution of resources limits the adoption of WSTs in regions most in need of these technologies.



**Figure 4.** Farmers using nets to protect trees from heat and dust storms in Azraq area, Jordan (Source: Maha Al-Zu'bi, IWMI).

## Conclusions and policy recommendations for the adoption of water-saving technologies in Jordanian Agriculture

The sustainable management of Jordan's water resources is closely tied to the adoption of WSTs in agriculture, a sector that consumes nearly half of the country's freshwater resources. In areas such as Azraq and Mafrq, where there is a heavy reliance on groundwater, optimizing irrigation practices is critical. While WSTs offer potential solutions to conserve water, improve food security and support rural economies, there are significant barriers to the widespread adoption of these technologies, including financial constraints, limited technical capacity and inadequate institutional support.

To overcome these challenges, Jordan needs a Market Systems Development (MSD) approach that engages all stakeholders—farmers, suppliers and institutions. This approach focuses on addressing market failures by creating sustainable, scalable solutions that help farmers thrive within existing economic and social systems. Bridging the knowledge-attitude-practice (KAP) gap requires a comprehensive strategy to build farmers' skills, not only in operating WSTs but also in making informed financial decisions. Strengthening extension services and promoting peer-to-peer learning will further support knowledge transfer and long-term sustainability.

The high upfront costs of WSTs remain a barrier for smallholders, necessitating innovative financial mechanisms such as low-interest loans, tax incentives and public-private partnerships (PPPs) to reduce initial costs. Providing demonstration sites where farmers can test technologies and gain trust in their effectiveness will further encourage adoption. Strengthening service delivery is also essential, ensuring farmers have access to essential installation, troubleshooting and maintenance support from local technical hubs.

Institutional support and policy alignment are crucial in fostering an enabling environment for the adoption of WSTs. Policies should prioritize water needs in agriculture, allocate resources equitably and promote site-specific strategies, such as addressing salinity issues in Azraq, to improve water-use efficiency and crop productivity. Empowering farmers through education on salt-tolerant crops can further enhance resilience and productivity.

Farmers in Jordan generally have a positive attitude toward WSTs, especially when they witness the success stories of peers. By leveraging these positive attitudes through participatory programs and community-driven solutions, the MSD approach can create a positive feedback loop that accelerates adoption and scaling of WSTs.

By embracing an MSD strategy, Jordan can unlock the full potential of WSTs to conserve water, boost agricultural productivity and strengthen rural livelihoods. This inclusive, farmer-centric approach ensures that all farmers, regardless of economic status, benefit from WSTs, contributing to a resilient and sustainable agriculture sector. Ultimately, aligning stakeholders and creating synergies

across governments, businesses, service providers and farmers will help secure Jordan's water resources and pave the way for a more resilient and equitable future for its rural communities.

The following short-term and long-term recommendations can accelerate the adoption of WSTs in Jordan, leading to more sustainable and water-efficient agricultural practices, while also supporting economic resilience in water-scarce regions.

### Short-term recommendations

- 1. Enhance education and awareness programs:** Develop targeted educational campaigns for farmers, farm managers and workers to bridge knowledge gaps on WSTs, including market policies, system design, installation, maintenance and cost-effectiveness. This will ensure farmers are equipped with the necessary skills to operate and maintain WSTs effectively. Expanding outreach to farm workers, who play a critical role in the daily operation and maintenance of WSTs, will ensure their involvement in training efforts for long-term success.
- 2. Promote peer-to-peer learning and from success stories:** Leverage the existing 'word of mouth' communication among farmers by encouraging successful adopters to share their experiences with peers (Figure 5). Facilitate farmer-to-farmer networks in areas such as Mafrq to spread knowledge about the benefits and practicalities of the adoption of WSTs.
- 3. Strengthen supplier support and visibility:** Encourage suppliers to play a more active role in promoting WSTs by increasing their visibility and collaborating with community-based organizations or local champions. Suppliers should also offer free or low-cost pre- and post-sale services to help farmers overcome financial barriers and ensure the proper implementation of WSTs.
- 4. Strengthen extension services role:** The Ministry of Agriculture should invest in training and capacity building programs for extension officers to promote the adoption of WSTs. This includes, for example, raising awareness on drip irrigation, moisture sensors and rainwater harvesting. Extension officers should regularly share the best practices through field visits, workshops and digital platforms, ensuring farmers have the support needed for sustainable water management and enhanced agricultural productivity.
- 5. Provide financial support:** Introduce a bundle of solutions by offering farmers small, free demonstration samples of WSTs to test for a season. This approach allows farmers to assess the effectiveness of the technology first before making decisions to adopt. To support this, suppliers should be encouraged to provide free samples as part of the initiative. After the trial phase, low-interest loans can be introduced to help farmers scale up their use of the technologies, ensuring the transition to broader adoption is financially viable and sustainable.



**Figure 5.** A farmer in Mafraq area explaining Irrigation automation to peers (Source: Seersa Abaza, IWMI)

**6. Leverage farmers' behavioral insights for targeted adoption of WSTs:** Understanding farmers' decision-making processes helps design effective incentives that address economic, social and knowledge barriers, ensuring the successful adoption of WSTs.

**7. Use KAP analysis to inform policy and interventions:** KAP analysis helps decision-makers identify gaps, tailor interventions and promote sustainable water conservation by aligning policies with farmers' knowledge, attitudes and practices.

## Long-term recommendations

- 1. Strengthen institutional collaboration:** Foster stronger collaboration between the Ministry of Agriculture and the Ministry of Water and Irrigation to align policies and ensure coordinated efforts for sustainable water management in agriculture. This partnership should focus on ensuring the scalability and sustainability of water-saving initiatives.
- 2. Develop comprehensive market outreach programs:** Create more comprehensive outreach programs that not only focus on educating farmers about available WSTs but also provide information on the broader agricultural market, including

suppliers, financing options and regulatory frameworks. This holistic approach will empower farmers to make more informed decisions.

- 3. Support the integration of site-specific farm management strategies:** Promote integrated farm management strategies tailored to local conditions, such as water salinity levels, which are especially relevant in areas such as Azraq. This should include educating farmers on growing salt-tolerant crops and managing soil and water resources effectively.
- 4. Reduce taxes and offer long-term incentives:** Work toward long-term policy reforms that reduce taxes on WSTs and provide governmental incentives that make these technologies more affordable for farmers. This should include creating a long-term financial support structure for farmers who are adopting water-saving practices.
- 5. Monitor and evaluate impact:** Establish systems for tracking the financial and environmental impacts of adopting WSTs. This will provide valuable data to assess the cost-effectiveness and improvements in productivity resulting from the adoption of WSTs, and help refine policies and support mechanisms accordingly.

## References

- Ajzen, I. 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health* 26(9): 1113–1127. <https://doi.org/10.1080/08870446.2011.613995>
- Al-Bakri, J.T.; D’Urso, G.; Calera, A.; Abdalhaq, E.; Altarawneh, M.; Margane, A. 2023. Remote sensing for agricultural water management in Jordan. *Remote Sensing* 15(1): 235. <https://doi.org/10.3390/rs15010235>
- Amsalu, A.; de Graaff, J. 2006. Farmers’ views of soil erosion problems and their conservation knowledge at Beressa Watershed, Central Highlands of Ethiopia. *Agriculture and Human Values* 23: 99–108. <https://doi.org/10.1007/s10460-005-5872-4>
- Balasubramanya, S.; Kafle, K.; Stifel, D. 2019. *Increasing irrigation efficiency in Jordan: demand and supply side constraints and opportunities*. Report prepared by the International Water Management Institute for Mercy Corps’ “Water Innovation Technologies” project. Colombo, Sri Lanka: International Water Management Institute (IWMI). 58p. <https://hdl.handle.net/10568/107112>
- Borghuis, G.; Christoforidou, M.; Hellegers, P.; Seijger, C.; Van Halsema, G. 2022. *The role of water productivity in water and agricultural policies in Jordan*. *WaterPIP project report series*. Delft, Netherlands: IHE Delft Institute for Water Education.
- Campuzano, L.R.; Llanos, G.A.H.; Sossa, J.W.Z.; Mendoza, G.L.O.; Palacio, J.C.; Herrera, M. 2023. Barriers to the adoption of innovations for sustainable development in the agricultural sector—Systematic literature review (SLR). *Sustainability* 15(5): 4374. <https://doi.org/10.3390/su15054374>
- FAO (Food and Agriculture Organization of the United Nations). 2022. *Water productivity baseline assessment in Jordan*. Available at <https://openknowledge.fao.org/server/api/core/bitstreams/fe4e1637-1025-4628-b67a-5cc7fbff4060/content> (accessed on March 12, 2025).
- IFAD (International Fund for Agricultural Development). 2020. *Rural economic growth and employment project supervision report-Jordan*. Available at <https://www.ifad.org/documents/48415603/49455874/Jordan+1100001740+REGEP+Supervision+Report+December+2020.pdf/ddfcf65b-15ef-9eae-25fe-c91210c3121b> (accessed on March 12, 2025).
- IWMI (International Water Management Institute). 2020a. *Agriculture water saving technologies market trends reports*. Project report. *Jordan Development KaMP*. Unpublished project report.
- IWMI (International Water Management Institute). 2020b. *What happens to water saved at WIT farms*. Project Report. *Jordan Development KaMP*. Unpublished project report.
- Kruse, S.; Gardner, T. 2022. *Economics of water savings under the Jordan Water Innovation Technologies Project*. Final report. Available at <https://dldocs.mercycorps.org/USAID2017JordanWaterInnovationsTechEconWaterSavings.pdf> (accessed on March 14, 2025).
- Larson, N.; Sekhri, S.; Sidhu, R.S. 2016. Adoption of water-saving technology in agriculture: The case of laser levelers. *Water Resources and Economics* 14: 44–64. <https://doi.org/10.1016/j.wre.2015.11.001>
- Levidow, L.; Zaccaria, D.; Maia, R.; Vivas, E.; Todorovic, M.; Scardigno, A. 2014. Improving water-efficient irrigation: Prospects and difficulties of innovative practices. *Agricultural Water Management* 146: 84–94. <https://doi.org/10.1016/j.agwat.2014.07.012>
- Liao, X.; Nguyen, T.; Sasaki, N. 2022. Use of the knowledge, attitude, and practice (KAP) model to examine sustainable agriculture in Thailand. *Regional Sustainability* 3(1): 41–52. <https://doi.org/10.1016/j.regsus.2022.03.005>
- Ma, W.; Marini, M.A.; Rahut, D.B. 2023. Farmers’ organizations and sustainable development: An introduction. *Annals of Public and Cooperative Economics* 94(3): 683–700. <https://doi.org/10.1111/apce.12449>
- Masoud, Y.; Hayati, D.; Hochrainer-Stigler, S.; Zamani, G.H. 2014. Understanding farmers’ intention and behavior regarding water conservation in the Middle East and North Africa: A case study in Iran. *Journal of Environmental Management* 135: 63–72. <https://doi.org/10.1016/j.jenvman.2014.01.016>
- Mercy Corps. 2022. *Economics of water savings under the Jordan Water Innovation Technologies Project*. Project Report.
- Ministry of Water and Irrigation. 2023. *Water strategy for Jordan: 2021–2040*. Amman, Jordan: Ministry of Water and Irrigation.
- Monteiro, M.A.; Bahta, Y.T.; Jordaan, H. 2024. A systematic review on drivers of water-use behavior among agricultural water users. *Water* 16(13): 1899. <https://doi.org/10.3390/w16131899>
- Preeti, S.; Rani, E.; Bedi, P. 2024. A critical review of farmers’ perspectives on organic farming. *International Journal of Agriculture Extension and Social Development* 7(7): 48–51. <https://doi.org/10.33545/26180723.2024.v7.i7Sa.796>

- Pronti, A.; Auci, S.; Berbel, J. 2024. Water conservation and saving technologies for irrigation. A structured literature review of econometric studies on the determinants of adoption. *Agricultural Water Management* 299: 108838. <https://doi.org/10.1016/j.agwat.2024.108838>
- Raimondo, E.E.; Costa Gutierrez, S.B.; Cabrera, S.E.; Benimelo, C.S. 2022. Knowledge, attitudes, and practices on pesticide application among farmworkers from communities in western Catamarca Province, Argentina. *Nova Scientia* 14(28): 1–34. Available at <https://www.scielo.org.mx/pdf/ns/v14n28/2007-0705-ns-14-28-00207.pdf> (accessed on March 14, 2025).
- Rouse, J. 2007. Practice theory. In: Turner, S.P.; Risjord, M.W. (eds.), *Handbook of the philosophy of science: Philosophy of anthropology and sociology*. North-Holland. pp. 639–681. <https://doi.org/10.1016/B978-044451542-1/50020-9>
- Singh, D.; Kaur, P.; Kaur, T. 2017. Level of knowledge and adoption of water saving technologies by farmers in Sri Muktsar Sahib District of Punjab. *International Journal of Bio-resource and Stress Management* 8(3): 488–495. <https://doi.org/10.23910/IJBSM/2017.8.3.1810a>
- Singh, G.; Gandhi, V. 2023. Enhancing the adoption of water saving technologies in India's agriculture: The determinants across four states of India. *SSRN*. <https://ssrn.com/abstract=4604984>
- World Bank Group. 2022. *Jordan country climate and development report*. CCDR Series. Washington, DC: World Bank. <https://hdl.handle.net/10986/38283>
- Yahya, A.S.; Haris, N.B.M.; Shah, J.A.; Zaki, N.A. 2023. Knowledge, attitude and practice towards the adoption of urban farming: A concept paper. *International Journal of Academic Research in Business and Social Sciences* 13(17): 312–320. <https://doi.org/10.6007/IJARBS/v13-i17/19838>
- Yazdanpanah, M.; Hayati, D.; Hochrainer-Stigler, S.; Zamani, G.H. 2014. Understanding farmers' intention and behavior regarding water conservation in the Middle-East and North Africa: A case study in Iran. *Journal of Environmental Management* 135: 63–72. <https://doi.org/10.1016/j.jenvman.2014.01.016>
- Zhong, F.; Li, L.; Guo, A.; Song, X.; Cheng, Q.; Zhang, Y.; Ding, X. 2019. Quantifying the influence path of water conservation awareness on water-saving irrigation behavior based on the theory of planned behavior and structural equation modeling: A case study from Northwest China. *Sustainability* 11(18): 4967. <https://doi.org/10.3390/su11184967>

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## Project

The Water Innovation Technologies (WIT) project was a five-year (2017-2022) initiative designed to conserve water in Jordan by adopting proven water-saving technologies and techniques. The WIT project used a market-based approach in Jordan to improve water-use efficiency and water conservation in the agriculture sector, in communities and households.

<https://www.mercycorps.org/research-resources/water-innovations-technologies-lessons-jordan>

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This publication has been prepared as an output of the Water Innovation Technologies (WIT) in Jordan project and has not been independently peer-reviewed. Responsibility for opinions expressed and any possible errors lies with the authors and not the institutions involved. The boundaries and names shown and the designations used on maps do not imply official endorsement or acceptance by IWMI, CGIAR, our partner institutions, or donors.

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