The League of Arab States

Expanding water reuse in Arab countries of MENA

Draft report
to the High-Level Joint Water and Agriculture Technical Committee

KEY MESSAGES

- ✓ The region faces a severe water crisis. Efforts to resolve this crisis have been insufficient.
- ✓ Wastewater is part of the problem *and* part of the solution.
- ✓ Indirect use of untreated wastewater is a common reality in the region. The health risks need to be assessed and mitigated.
- ✓ Wastewater is only a waste if we decide to waste it. The potential for resource recovery from municipal wastewater in the region is still untapped.
- ✓ The region needs to accelerate to meet the UN's Sustainable Development Goal #6 which addresses the recovery and reuse of wastewater and to make reuse safer and more productive.
- ✓ The region needs to address the challenges that lock the potential. High costs and lack of cost recovery, cultural barriers and distrust, institutional fragmentation, improper regulations and lack of political will.
- ✓ The region needs to accelerate the replication of successful water reuse projects.
- ✓ The region needs to recover and reuse loss wastewater when feasible and make reuse, particularly indirect use, safer not only through the use of better treatment methods but also with better agricultural practices.

About ReWater MENA

In 2018, the International Water Management Institute (IWMI) and its partners embarked on a four-year project to expand the safe reuse of water in the Middle East and North Africa. The project addressed barriers to reuse in the region and promoted safe reuse practices that improve food safety, health and livelihoods. Drawing on experience with water reuse strategies already developed in the region, the project identified promising innovations and validated reuse models, with the aim of resolving past management bottlenecks. These include cultural barriers, institutional fragmentation, inappropriate regulations and lack of financial models for cost recovery. With a focus on Egypt, Jordan and Lebanon, the project facilitated inclusive and participatory engagement with stakeholders, to support the development and uptake of project results.

1. Executive summary

Arab countries in the Middle East and North Africa[1] (hereafter called "the region") generate around 21.5 billion cubic meters (BCM) of municipal wastewater each year. Many countries are substantially improving their wastewater treatment rate, however, about 40% of produced domestic wastewater and a substantial portion of industrial wastewater in the region are still left untreated.

Water reuse can help tackle the water scarcity problems of the region, which have been exacerbated by climate change. It also has the potential to play an important role in water resources management to lessen the present and long-term demand-supply imbalance. Addressing these challenges is particularly important when considering the increasing population and urbanization trends of the region, which will lead to an increase of domestic water use.

Many uncertainties remain regarding the reuse of water. It is strongly recommended that policies be pushed forward which holistically consider social, economic and environmental implications. This will also support Arab governments in developing national strategies on water reuse through an investigation of the existing situation, evaluation of policy options in different areas and offering appropriate recommendations.

The successful and efficient use of treated water in agriculture will depend on its reliability, in quantity and quality, as an alternative source of water for irrigation. It will also depend on factors such as setting adequate national standards for reuse; improving public awareness and attitudes towards treated wastewater utilization; and its effective utilization in existing agriculture to replace unrenewable water resources.

The region needs to overcome the factors that limit the materialization of the regional full water reuse potential, including cultural barriers and distrust; institutional fragmentation; inadequate regulatory frameworks; and the lack of appropriate tariffs, economic incentives and financial models that undermine cost recovery and the sustainability of reuse projects. Arab governments should provide concrete financial mechanisms to support upscaling of sustainable use of non-conventional water related technologies.

In order to remove these barriers and reduce the investments risks, water reuse projects must strengthen international and multi-stakeholder cooperation. Public-private partnerships are essential in attenuating the risks of investments and share the complementary human, financial and technical resources to implement long-term non-conventional water projects. A sound and adequate policy, as well as an adequate legal and institutional framework is essential to provide an enabling environment for public and private sector investments in the water reuse sector. Cost benefit and cost recovery should be integrated for sustainability of any water reuse project. Greater attention should be given to the role of women in water reuse projects. The lack of political will in some countries must be addressed. Finally, efforts should be made to incentivize the adoption of on-farm practices for safe water reuse.

[1] This brief includes these Arab countries in MENA: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen.

2. The findings: State of water reuse in the region

Per capita water availability reducing

In the past few decades the region has experienced the fastest global decline in available water resources in the world. The situation is forecast to dramatically worsen in the future in view of population and economic growth and climate change. The region's population grew from 119 million inhabitants in 1970 to an estimated 418 million in 2020 (Figure 1). That rapid population growth has also led to a corresponding drop in per capita water availability. In 1970, the region inhabitants had 1,752 cubic meters of water resources per capita. That fell to 530 by 2020 (Figure 2).

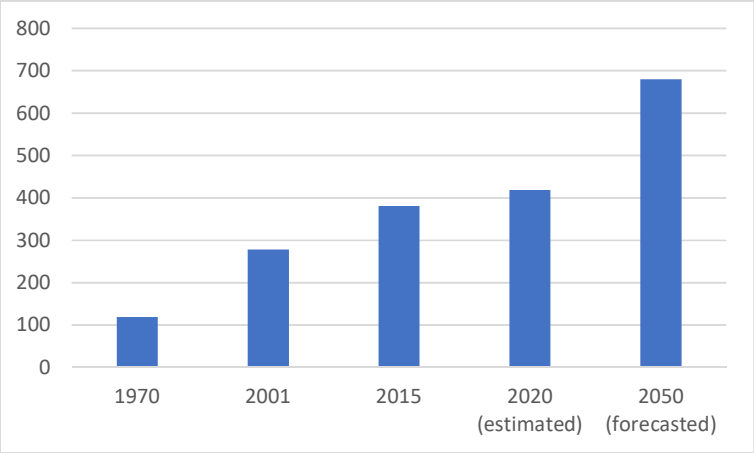


Figure 1. Population in the region (millions of inhabitants).

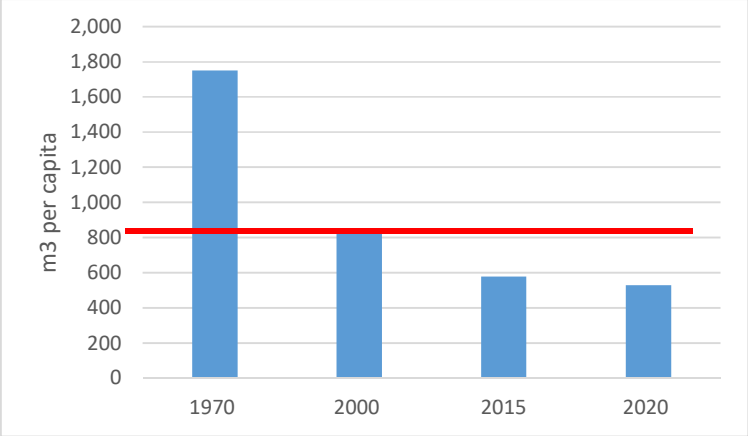


Figure 2. Water resources per capita in the region.

This increased water scarcity will have a profound impact on the economies of Arab countries and the livelihood of its people. For example, the water scarcity is forecast to reduce the average gross domestic product by 6 to 14% by 2050 and reduce labor demand by up to 12%.

Wastewater is part of the problem and part of the solution

Wastewater can be a problem. Wastewater production grows as population, urbanization and income per capita grow and in many Arab countries still there is a long way to go in wastewater treatment to catch up with wastewater production growth.

The 19 countries analyzed produce around 21.5 BCM of municipal wastewater every year. The most recent data shows that at least 40% of the domestic wastewater that is generated is not safely treated

and does not meet national standards for disposal. The situation varies in different countries (Figure 3). Income per capita is a good predictor for the level of treatment. High-income countries such as Bahrain, Qatar, United Emirates or Saudi Arabia treat most of the domestic wastewater generated. Lower middle-income countries such as Yemen, Sudan, Mauritania and Morocco are having more challenges.

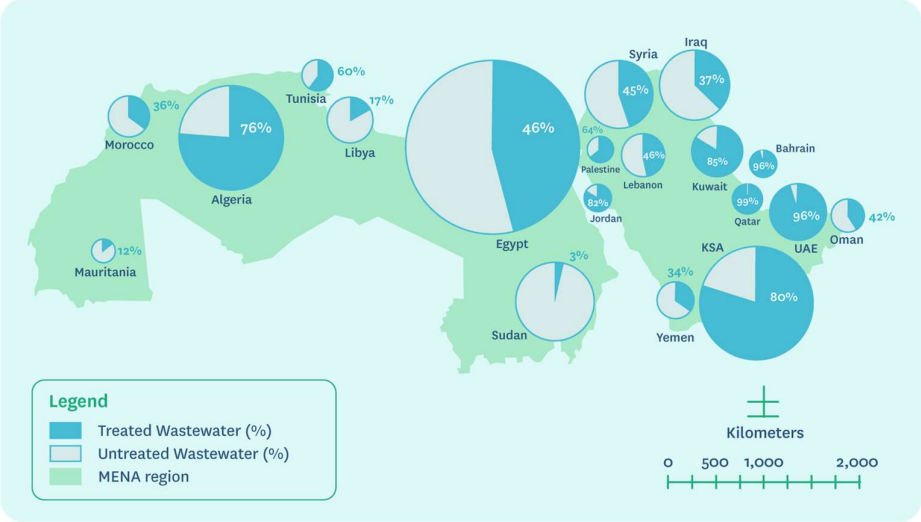


Figure 3. Proportion of domestic wastewater safely treated in 2020 as per WHO (2021).

In many countries, the growth of wastewater produced out paces the investment in treatment, which leads to increasing amounts of untreated wastewater contaminating freshwater supplies. This reduces the amount of water that is safe to use and aggravates water scarcity.

Nevertheless, wastewater can be part of the solution to the water crisis. Wastewater is hardly 'waste' though. It contains valuable resources. Water is the most important and abundant asset in wastewater and can be used as a substitute for freshwater if appropriately treated. Nutrients such as nitrogen, phosphorus, potassium are valuable in agriculture and aquaculture. Organic carbon can be used as a soil conditioner or to generate energy.

The water and nutrients embedded in the municipal wastewater generated in the 19 analyzed countries, if fully recovered, can irrigate and fertilize more than 2.6 million hectares. The carbon embedded in the generated wastewater, if recovered in the form of methane, would have a caloric value to provide electricity to millions of households.

Part of the water and nutrients in wastewater are already being reused indirectly. This occurs when treated or untreated wastewater is discharged into freshwater streams where it becomes diluted and is subsequently used – mostly unintentionally – by downstream users (e.g., farmers, households or industries). But substantial amounts of wastewater are lost when it is discharged to the sea or evaporates on land or along rivers with no productive use.

Direct and indirect use of untreated wastewater is a common reality in the region

It is estimated that about 36% of the municipal wastewater is reused indirectly, typically without any treatment. Within this context, indirect water reuse is by far the most extensive type of reuse in the region (Velpuri et al. 2022). In areas where a large portion of the wastewater is still not safely treated (WHO 2021) the practice poses health risks to farmers and to consumers, particularly if such water is used to irrigate vegetables to be eaten raw.

The use of raw wastewater in agriculture has also been reported in some countries of the region, although the exact extent of the practice is unknown. For example, untreated wastewater is used on farms because it is cheaper than using groundwater from boreholes, for which farmers have no capacity to pay. In other cases, farmers use wastewater from malfunctioning treatment plants or sewers, taking advantage of the already collected resource. In other cases, wastewater is the only water flowing in irrigation canals in the dry season and at the tail-ends of irrigation schemes. In some extreme cases, farmers rupture or plug sewage lines to access the wastewater.

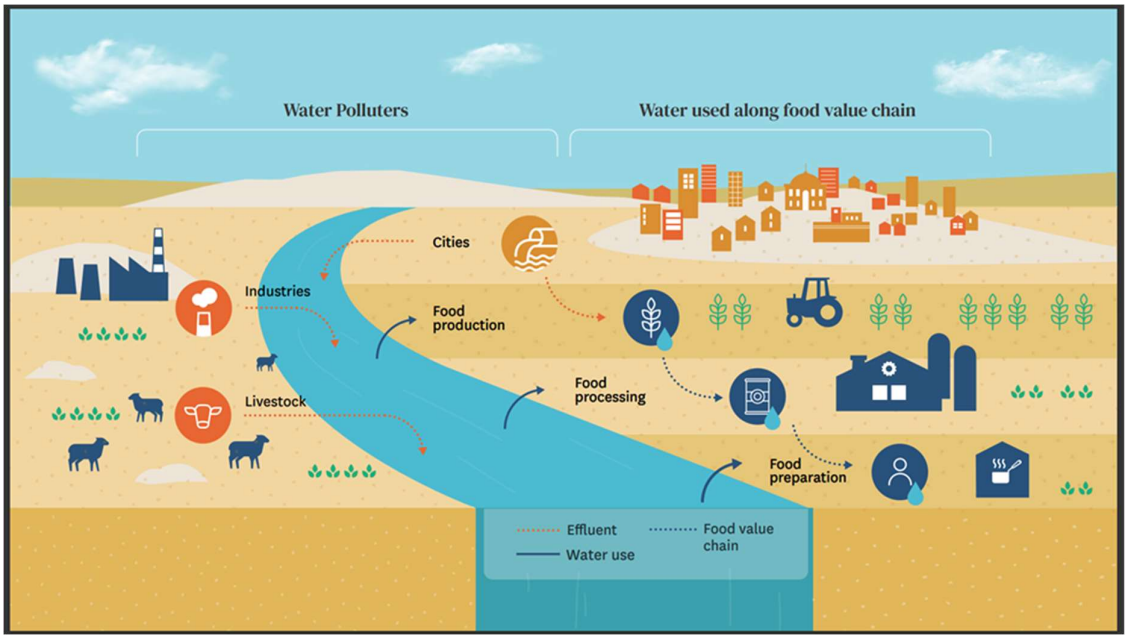


Figure 4. The fate of wastewater in MENA showing the sources of wastewater and its uses along the food value chain.

Wastewater is only a waste if we decide to waste it: the potential is still untapped

The number of reuse project in the region has doubled every decade since 1990, growing from 40 projects in 1990 to more than 400 in 2020 (Figure 6).

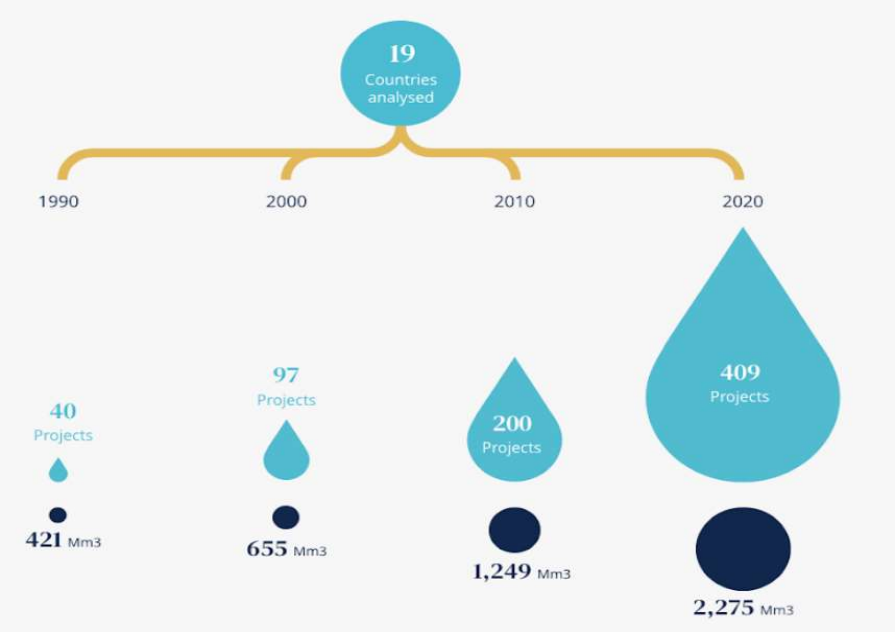


Figure 6. The number of reuse projects in the region has doubled every decade since 1990.

Despite the rapid growth of water reuse projects across the region, the amount of municipal wastewater that is treated and directly reused for beneficial purposes is still very limited in the region. The main exceptions are in the GCC with Qatar, UAE, Kuwait, Oman and Bahrain. There is nevertheless a good portion of the (treated or untreated) wastewater that is discharged into the environment that evaporates or ends up in the sea with no productive use (Figure 5).

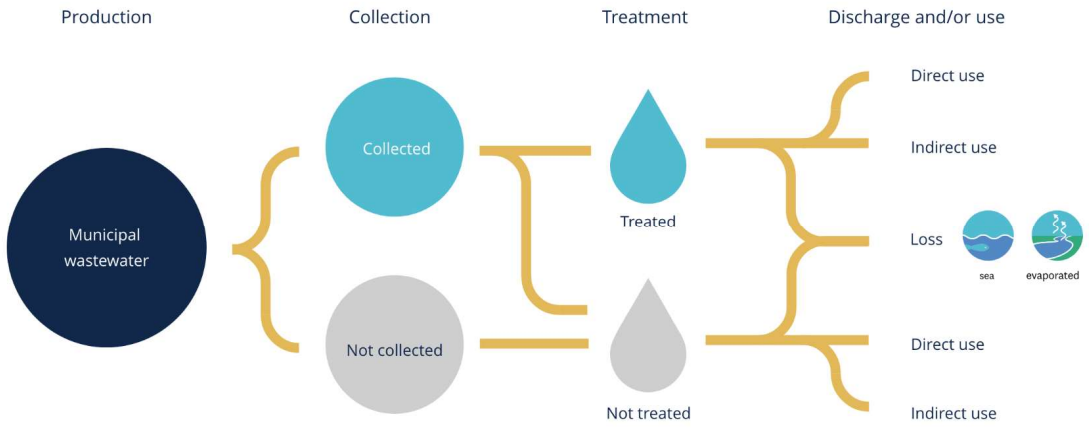


Figure 5. The fate of municipal wastewater.

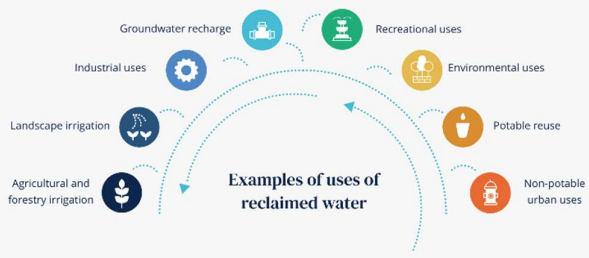
Some nutrients end up in non-productive sinks, such as weeds or algal blooms. Recent estimates from Velpuri et al. (2022) suggest that the wastewater evaporated or lost in the sea can be as high as 54% of the total wastewater produced in the region, while the rest is reused directly or indirectly.

Table 1. Wastewater production, treatment and reuse in 19 countries within the region in 2020 (or latest available year)				
Countries	Total municipal wastewater generated (BCM)	Municipal wastewater treated and directly reused (BCM)	Directly reused from municipal wastewater (%)	Number of projects where municipal wastewater is treated and directly reused
Algeria	2.649	0.100	3.8	22
Bahrain	0.186	0.045	24	4
Egypt	7.196	0.341	4.7	77
Iraq	1.232	NA	NA	NA
Jordan	0.187	0.071	37.9	25
Kuwait	0.666	0.271	40.7	6
Lebanon	0.481	0.002	0.4	4
Libya	0.514	0.040	7.8	1
Mauritania	0.138	NA	NA	NA
Morocco	0.415	0.076	18.3	22
Oman	0.275	0.079	28.6	30
Palestine	0.180	0.007	3.7	24
Qatar	0.225	0.165	73.6	17
Saudi Arabia	3.144	0.431*	13.7	40
Sudan	1.533	0.029	1.9	3
Syria	1.147	NA	NA	NA
Tunisia	0.254	0.034	13.4	63
UAE	0.801	0.549	68.6	64
Yemen	0.326	0.036*	11.1	7
The region	**21.549**	**2.275**	**10.5**	**409**

If all wastewater that is lost was recovered, the region can unlock new opportunities whilst enhancing the region's ability to adapt to changes in climate and enhance food security. The 10.7 BCM of municipal wastewater estimated to be lost, if fully recovered, could additionally irrigate and fertilize about 1.3 million hectares with a relatively high application rate of 8,000 m^3/ha/year (Steduto 2012). If no wastewater were lost and 70% of the COD was recovered in the form of methane, the energy produced could provide electricity to around 4 million households, or to all wastewater treatment plants in the region and an additional surplus for hundreds of thousands of households.

BOX 1. Examples of uses of reclaimed water.

The dominant uses of reclaimed water are for forestry, agriculture and landscaping, including irrigation of parks and gardens. Forestry and agriculture are the dominant users of reclaimed water for example in Egypt, Tunisia and Jordan while landscaping is the preferred option in countries like Morocco, United Emirates, Oman and other GCC countries.



BOX 2. A brief history of water reuse policies and development of guidelines in the region.

Country-specific findings

Policymakers and other stakeholders have discussed country-specific priority challenges and approaches for water reuse in the region. The key approaches identified for seven MENA countries are below.

- **Egypt** – The approach in Egypt stems from a top-down governance structure that focuses on implementing national water reuse projects to secure water for irrigation (i.e., supply-driven management).
- **Jordan** – The country has adopted a semi-decentralized approach that involves the private sector through Design-Build-Operate concession contracts.
- **Lebanon** – The involvement of end-users, municipalities and private sector in implementation, monitoring and evaluation is necessary due to the country's political and financial instability.
- **Bahrain** – The country approaches water reuse by setting practical scientific-based water reuse standards according to the intended use of treated water.
- **Syria** – Although the country's plans for water reuse have been disrupted due to the ongoing conflict, there was a shift towards decentralized water treatment and reuse solutions for villages and cities with populations less than 25,000 inhabitants.

- **Morocco** – The private sector (particularly golf courses owners) are key beneficiaries of water reuse. On the other hand, water reuse in agriculture is not approved in Morocco.
- **Saudi Arabia** – Saudi Arabia follows a holistic approach in water reuse for different purposes on the national level. This includes consideration of water reuse as essential measure in the national water strategy for achieving water security according to Saudi 2030 Vision, and utilizing sound governance frameworks including organizational, institutional and legal aspects to succeed in implementing water reuse with bankable projects and active participation of private sector.

3. Challenges for more and safer water reuse in the region

For the region, treated wastewater constitutes a constant and perennial resource. Most of national water strategies and plans in the region are relying on wastewater treatment as a key component in the national water resources plan. However, before any water reuse plan can become a reality, several challenges need to be surpassed.

Challenges for more water reuse

Water reuse has low social acceptance

Water reuse can trigger rejection, especially when resulting in a possible direct exposure, like where reclaimed water is replenishing surface or groundwater for potable reuse or used within the household.

Both farmers and the public perceive the potential presence of these pollutants as environmental, health or agronomic risks. Even in cases where the risks are negligible or non-existent, the public perception of risk increases depending on the appearance, color and odor of reclaimed water, but can even more be steered by gossip, fear, and misinformation.

Challenges of safer water reuse

Unclear regulations and ineffective implementation

Water regulations are sometimes overly stringent. This is an internal barrier to productivity as sometimes recycled water is forbidden for many cash crops. At the same time meeting the standards requires prohibitive investments in wastewater treatment. There is an issue of effectiveness and enforcement: stringent standards do not necessarily prevent informal direct and indirect use of wastewater. The enforcement of water quality standards is often ineffective with farmers who have poor incentives or support to find alternative practices. Regulations are only applied to planned reuse projects while informal reuse remains poorly located and risks left unmitigated. Some countries, such as Lebanon, do not have yet any regulations on water reuse and as a result there is no legal security for investments.

Cross cutting challenges

Fragmented and partial planning and governance

Many sectors have a stake in water reuse including agricultural, water, health and environmental sectors at national and local levels. Regulating, planning and managing agricultural water reuse require harmonizing a multiplicity of decision-making processes and activities performed by stakeholders with different and often conflicting jobs, goals and interests (Figure 7).

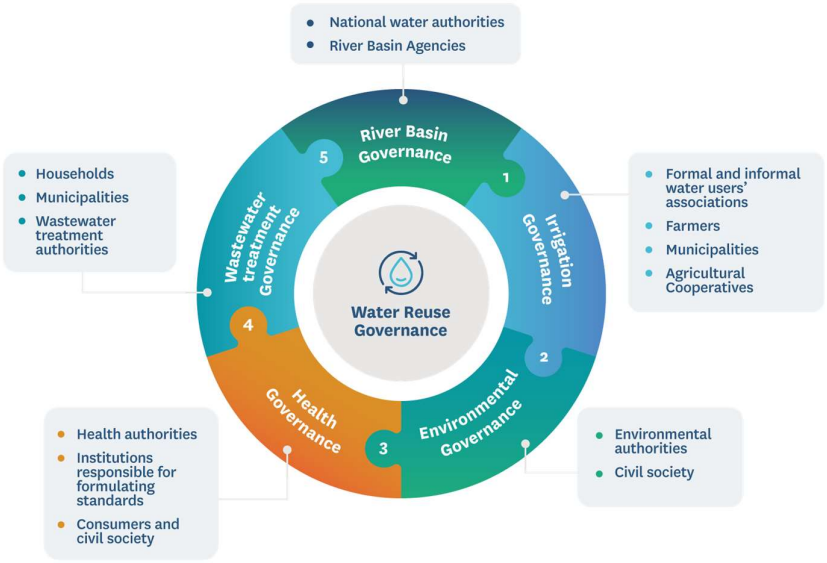


Figure 7. The large array of stakeholders involved in the governance of agricultural water reuse systems.

Water reuse projects can only work if socially accepted, technically reliable and profitable for farmers. This requires strong links between central administrations (and their donor partners) and local stakeholders to analyze local practices, develop appropriate infrastructure and negotiate adaptive management arrangements.

Operational challenges of the municipal wastewater sector in some countries are limited by infrastructure and capacity to keep up with hydraulic and pollution loadings.

Incomplete economic analysis and limited financial sustainability of wastewater treatment and reuse options

Water reuse projects are developing at a slow pace in part due to an incomplete economic analysis of wastewater treatment and reuse options, which can provide a sound justification to invest. There is a lack of economic incentives (or the removal of economic barriers) to invest once such investment has been economically justified. There is also a tendency to keep investing in conventional wastewater treatment technologies that are nevertheless not cost-effective and have large operation and maintenance costs, which are hard to recover and limits financial sustainability

Additionally, the development and implementation of water reuse strategies across the region is challenged by factors such as a lack of water reuse cost recovery mechanisms, low pricing of irrigation water, need for creating financial incentives for safe water reuse and lack of understanding among the public about the perceived environmental benefits of wastewater treatment and reuse (Otoo and Dreschel 2018; World Bank 2011).

Gender biases

The wastewater and sanitation services are missing out on including a large sector of society. Women face considerable barriers in the recruitment process for employment in water and sanitation utilities. The World Bank (2019) Utility Survey over a 12-month period showed that only 20% of new hires were females. Some of the reasons for fewer women being recruited include biases in the recruitment process since certain roles are socially perceived as male or female. The retention of women in water and sanitation utilities is affected by a lack of gender-sensitive policies and a discriminatory work environment.

4. Recommendations: The way forward

Currently, the region has a serious imbalance between available water resources and agricultural needs to grow food for its population, while its groundwater is experiencing major depletion and deterioration. The reuse of this non-conventional water can significantly improve the situation. Additionally, it can provide nutrients, especially nitrogen and phosphorus, to the mostly nutrient-deficient soils in the region, and thus may reduce the total requirement of commercial fertilizers, which will increase the total economic return to farmers.

Recommendations for greater water reuse

Gain wider social acceptance

Good practices and adequate technical capacity are not enough to guarantee the success of water reuse interventions. Understanding the issues and concerns around perceptions and acceptance and addressing these with timely, effective communications and stakeholder engagement can significantly help to build trust and improve and support of reclaimed water use initiatives. This chapter provides a greater understanding of the issues that hinder acceptance of water reuse across the region, and tools and strategies to overcome them.

Public involvement begins with early contact with potential users, and can involve the forming of an advisory committee, and public workshops on reasons, benefits and risks of reuse. The exchange of information between authorities and public representatives should ensure that concerns from perceived health or environmental impacts to lower property values have been shared and addressed (Crook et al. 1992; Helmer and Hespanhol 1997).

For a water reuse initiative to succeed, community attitudes need to be understood and addressed. It is necessary to consider instinctive and emotional responses that people have toward 'human excreta' and 'sewage'. Many people trust hearsay or their own impressions of water quality more than they trust medical and scientific evidence or advice. Once water has been in contact with contaminants, it can be psychologically very difficult for people to accept that it has been purified. There is also an association between religious beliefs and respondents' willingness to use treated wastewater.

Farmers and traders want to know if the use of reclaimed water is financially viable, from their perspective. In the case of use of recycled water for irrigation, for example, crop acceptance by the consumer (buyer) remains the most crucial criterion.

To improve acceptance of water reuse, project designers can:

- Encourage public participation and discourse
- Engage proactively in early and continuous communication to build trust
- Select messaging with the right terminology
- Communicate the benefits of water reuse and how risks are mitigated
- Address possible religious concerns
- Facilitate behavior change

Develop bankable water reuse models

Wastewater reuse projects, if adequately planned and properly implemented, can provide opportunities for sound investments and financial rewards (Figure 8). Studies on developing bankable wastewater reuse models, and studies focusing on the potential of implementing wastewater reuse models, must first identify and set priorities in terms of the target area. This priority setting is

essential to identify potential wastewater reuse models that have high relevance and a likelihood of success for the local context. To develop a bankable wastewater reuse model, project designers should follow a stepwise approach consisting of five main phases:

- Step 1: Identify potential wastewater reuse options.
- Step 2: Develop a business model for wastewater reuse option.
- Step 3: Identify innovative partnership and financing options.
- Step 4: Identify risks and opportunities.
- Step 5: Develop implementation plan.

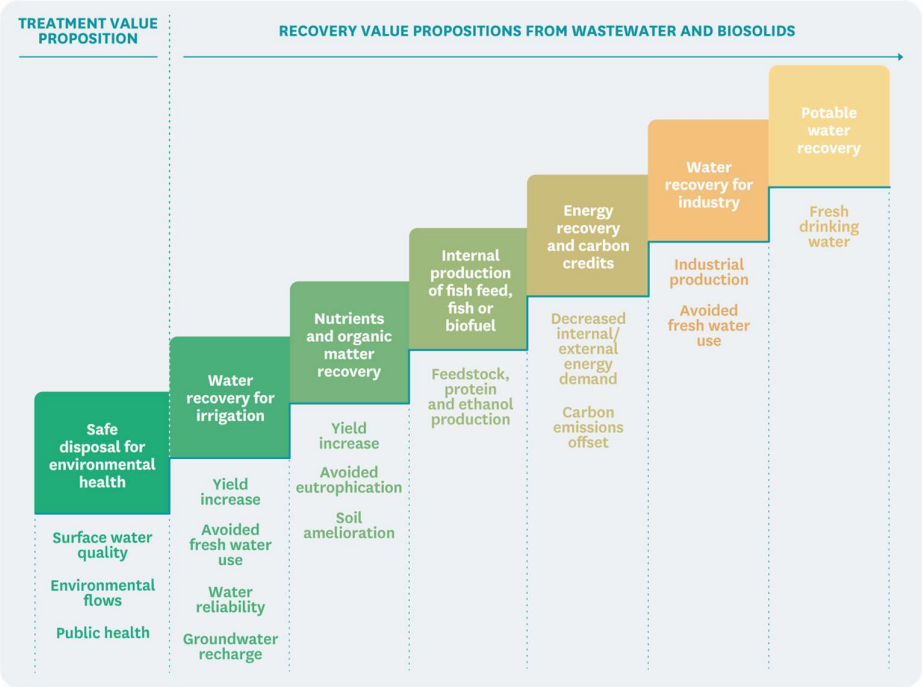


Figure 8. Ladder of increasing value propositions related to water reuse based on increasing investments in water quality and/or the value chain (Drechsel et al. 2015)

Recommendations for safer water reuse

Assess health risks in informal and indirect water reuse

Water scarcity and pollution are driving thousands of farmers in the region to use raw or diluted (untreated) wastewater to irrigate, posing potential health, agronomic and environmental risks. These risks need to be assessed and mitigated.

Incentivize the adoption of on-farm practices for safe water reuse

At the technical level, project designers must address the challenge in monitoring the operation and maintenance processes to maintain water reuse quality at acceptable level. This calls for incentivizing the adoption of on-farm practices for safe water reuse. This means that water must be made safer not only by using better treatment methods but also with better agricultural practices which will provide an additional safety net if treatment proves insufficient.

Accelerate wastewater treatment to cope with wastewater production growth

Wastewater treatment must keep pace with the increasing wastewater production. The ReWater MENA project developed case studies for nine successful wastewater treatment projects. Future treatment endeavors should draw on these model projects which have proved to be successful.

Cross cutting recommendations

Improve planning and governance

Governance problems are often rooted in deeper socio-political structures that cannot simply be changed by implementing participatory processes and social engineering tools. Some key recommendations within this context include:

- Ensure buy-in by the key national players around clear goals
- Establish multi-stakeholder platforms and welcome epistemic communities to facilitate
- Conduct a stakeholder mapping exercise
- Understand roles and responsibilities, gaps and overlaps
- Analyze stakeholders' influence and interest
- Clarify roles and responsibilities along six areas of prerogatives
- Establish central coordination and regulatory institutions
- Allow for flexibility in operation and cost-recovery mechanisms
- Empower stakeholders with existing know how and political leverage
- Understand and re-negotiate local water rights
- Ensure access to information and data sharing between stakeholders
- Create a climate of trust and collaboration
- Develop the capacity of public utilities and local institutions
- Promote clear institutional framework to enable the involvement of the private sector in water reuse implementation.

Expand implementation of water quality standards

While water reuse offers multiple benefits, it also comes with concerns on its potential impact on health, crops and ecosystems. To manage these hazards, governments typically issue water quality 'standards' usually promulgated through regulations centered around several water quality parameters and thresholds, monitoring protocols and best practice. Some key recommendations in this space include:

- Every country should adapt the guidelines based on local conditions and derive corresponding national standards.
- Environmental agencies should license, and banks should fund control measures that allow for stepwise improvement in water quality, even though standards are not immediately achieved.
- Control technologies should reflect countries' financial conditions. The use of appropriate technology should always be pursued.
- Standards should be enforceable and enforced. Standard values should be achievable and allow for enforcement, based on existing and affordable control measures. Environmental agencies should be institutionally well developed to enforce standards.
- The objective of pollution control is the preservation of the quality of water bodies. Discharge standards should be based on practical and justifiable reasons, assuming a certain dilution or assimilation capacity of the water bodies.
- The list of parameters should reflect the desired protection of the intended water uses and local laboratory and financial capacities, without excess or limitation.
- Efficient implementation of standards requires adequate infrastructure and institutional capacity to license, guide, monitor and control polluting activities and enforce standards.
- Decision makers and the population at large should be well informed about the benefits and costs associated with keeping good water quality, as specified by the standards.

Incorporate gender transformative approaches

Water reuse projects should incorporate gender transformative approaches (GTAs), which aim to address the root causes of gender inequality. A heightened level of awareness of gender issues will help project managers and implementers understand the complexities surrounding water reuse for agriculture, on the basis of which they can design targeted activities that meet the needs of the society as a whole – including men and women and facilitate acceptability and use of this important water re-source. Women who are well informed can be a force to address current social acceptance barriers towards water reuse.

Some key recommendations within this context include:

- Disaggregation of all data by sex, and whenever possible by age, economic status, ethnicity and other core social differentiating factors to account for differences in challenges and opportunities among different social groups.
- Women must not only be consulted, but they need to be represented at different levels of the service providers tiers and contribute to decision-making.
- Women should be provided with adequate and timely access to essential information, including procedures and protocols for reuse in order to give them an opportunity to be part of the process of identifying and deciding on appropriate reuse options and be in full compliance with the rules thereby protecting themselves, their household and the environment from harm.
- The intersectionality of the different dimensions (culture and religion) and sources of inequality (sex, race and ethnicity) that can exasperate existing inequalities and put certain groups of the society at a more disadvantaged position must be addressed.

Address lack of political will

The policy drive in the region is largely a top-down approach. Strong political will is one of the key factors to enable water reuse expansion and will need to be fostered if progress is to be made.

5. Conclusion

Arab countries in the MENA region need to recover and reuse loss wastewater when feasible and make indirect reuse safer. These countries are committed to achieve full sanitation coverage by 2030 as indicated by Goal 6 of the United Nations Sustainable Development Goals (SDGs), which strives for clean water and sanitation for all.

To achieve that Arab countries need to address the challenges that lock the potential of untapping water reuse opportunities. That means first addressing the institutional fragmentation and ensuring that the responsibilities and jurisdictions among national and local authorities and stakeholders are clear. The over-stringent regulations and prohibitive costs for treatment will need to be addressed.

Ultimately, the factors that will contribute positively to the inclusive scaling and replication of water reuse projects are: participatory stakeholder processes and effective communication that improves acceptability; economic and finance models that improve cost recovery and sustainability; effective and harmonic policies that address institutional fragmentation; and gender mainstreaming in water reuse projects and policies that ensures equitable participation and benefit sharing.

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For more information about the ReWaterMENA project, visit: https://rewater-mena.iwmi.org/ or contact: Javier Mateo-Sagasta, ReWaterMENA project leader (J.Mateo-Sagasta@cgiar.org)

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