"STATE OF THE ART" REPORT FOR WASH THEMATIC PRIORITY WITHIN UFM WATER AGENDA

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الاتحاد من أجل المتوسط

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Water. Energy. Environment

Table of Contents

Table of Figures

List of Tables

Forward

Within the activities of the WASH thematic priority of the UfM Water Agenda supported by Union for the Mediterranean (UfM Secretariat) and Konrad Adenauer Stiftung, Regional Program Energy Security and Climate Change in Midle East and North Africa (KAS - REMENA). The WASH Task force recognized the need to set the stage and have some initial preparatory work in order to review the status and current efforts on WASH aspects across the countries of the Mediterranean. This is presented via this "State of the Art" Report (SoA Report) which identifies strengths and weaknesses, highlights priority areas for information and knowledge sharing about WASH services in the Mediterranean region. The SoA Report capitalize on existing data as well as collected additional data through a questionnaire for this study distributed among UfM member countries and WASH related stakeholders in the region.

The main objectives of the SoA report are to provide a brief overview of the current status of WASH services in the UfM region, also, it identifies strengths and weaknesses, priority areas for WASH sector in MENA region highlighted for information and knowledge sharing (i.e., technology, governance and economic aspects, best practices and case studies). Moreover, this report provides an assessment of sanitation conditions and aspects in UfM region. With elaboration of a policy chapter highlighting different approaches in dealing with policy, regulation and implementation of WASH. In addition, an overview on worldwide innovative solution in the WASH sector and those which can be applied in the region to support UfM WASH working group linking report outcomes with the UfM financial strategy objectives in the Mediterranean region.

Acknowledgement

This initiative was led by Union for Mediterranean (UfM) and Konrad Adenauer Stiftung (KAS) under the mandate of Regional Program Energy Security and Climate Change Middle East and North Africa (REMENA). Along the guidance of the WASH Task Force leaders from Malta and Egypt. The initiative has received the valuable inputs of members of the UfM Water Expert Group and WASH Task Force, who contributed to the report with case studies of their countries. The SoA report was drafted and prepared by WEE Pros.

List of Abbreviations

ACs	Affiliated Companies
AfD	Le groupe Agence française de développement
AFO	Acoustic Fiber Optic
AMI	Advanced Metering Infrastructure
AVF	Automatic Variable Filtration
AW	Aqaba Water
BAT	Bottleneck Analysis Tool
BOT	Build-Operate-Transfer
CBC	Cross Border Cooperation
CIP	Committee of Prices
CNTs	Carbon Nanotubes
COVID-19	Coronavirus Disease
DBO	Design-Build-Operate
DM	Dry Matter
DWD	Drinking Water Directive
ENI	European Neighbourhood Instrument
ENP	European Neighborhood Policy
EU	European Union
GIS	Geographic Information System
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GJU	German-Jordanian University
GLASS	Global Analysis and Assessment of Sanitation and Drinking Water
GPR	Ground Penetrating Radar
HCWW	Holding Company for Water and Wastewater

HTC	Hydrothermal Carbonization
ICRC	International Committee of the Red Cross
IWRM	Integrated Water Resources Management
JMP	Joint Monitoring Program
KAS	Konrad Adenauer Stiftung
LDPs	Leadership Development Programs
LMICs	Low- and Middle-Income Countries
MAGG	Ministry of General Affairs and Governance
MENA	Middle East and North Africa
MFC	Microbial Fuel Cell
MHUUC	Ministry of Housing, Utilities and Urban Communities
MF	Microflitration
MOEW	Ministry of Energy and Water
NRW	Non-Revenue Water
NTD	Neglected Tropical Disease
O&M	Operation and Maintenance
OECD	Organization for Economic Cooperation and Development
ONEE	National Office of Electricity and Water
PBCs	Performance Based Contracts
PCCP	Pre-stressed Concrete Cylinder Pipes
PFI	Private Financed Initiative
PFP	Private Financed Project
POI	Point of Interest
PPI	Private Participation in Infrastructure
PPP	Public Private Partnership
PSP	Private Sector Participation

PVC	Polyvinyl Chloride
PWA	Palestinian Water Authority
SAR	Synthetic Aperture Radar
SDGs	Sustainable Development Goals
SoA	State of the Art
SWOT	Strengths, Weaknesses, Opportunities, Threats
UfM	Union for Mediterranean
UF	Ultrafiltration
UNICEF	United Nations Children's Fund
UV	Ultra Violet
UWWTD	Urban Waste Water Treatment Directive
WAJ	Water Authority of Jordan
WASH	Water Supply, Sanitation and Hygiene
WEE Pros	Water, Energy and Environment Professionals
WEG	Water Expert Group
WFD	Water Framework Directive
WHO	World Health Organization
WSRC	Water Sector Regulatory Council
WSS	Water Supply and Sanitation Services
WUAs	Water Users Associations
YWC	Yarmouk Water Company
ZVI	Zero Valent Iron

1. Introduction

Access to drinking water and sanitation is a fundamental human right. Achieving universal, adequate, and equitable access to safely managed water and sanitation services is at the core of sustainable development. This is reflected in SDG 6 “Ensure access to water and sanitation for all”. The importance of good hygiene through handwashing and access to clean water has been further highlighted by the COVID-19 pandemic. Despite progress over the past few decades, billions of people worldwide still lack access to clean water and sanitation, with only 9 years left to achieve SDG 6.

Safe drinking-water, sanitation and hygiene are crucial to human health and well-being. Safe WASH is not only a prerequisite to health, but contributes to livelihoods, school attendance and dignity and helps to create resilient communities living in healthy environments. Drinking unsafe water impairs health through illnesses such as diarrhea, and untreated excreta contaminates groundwaters and surface waters used for drinking-water, irrigation, bathing and household purposes. Chemical and microbial contamination of water continue~~s~~ to pose a health burden, whether natural in origin such as arsenic and fluoride, or anthropogenic such as nitrate. Furthermore, the infectious material like bacteria, yeast, mold, fungi, virus, and prion It is a source of water pollution.

Safe and sufficient WASH plays a key role in preventing numerous Neglected Tropical Disease (NTDs) such as trachoma, soil-transmitted helminths and schistosomiasis. Evidence suggests that improving service levels towards safely managed drinking-water or sanitation such as regulated piped water or connections to sewers with wastewater treatment can dramatically improve health by reducing diarrheal disease deaths.

WASH services provide for water availability and quality, presence of sanitation facilities and availability of soap and water for handwashing. Adequate water, sanitation and hygiene are essential components of providing basic health services. The provision of WASH in health care facilities serves to prevent infections and spread of disease, protect staff and patients, and uphold the dignity of vulnerable populations including pregnant women and the disabled. Many health care facilities in low resource settings have no WASH services, severely

compromising the ability to provide safe and people-centered care and presenting serious health risks to both health care providers and those seeking treatment.

A recent UNICEF report highlighted that every day more than 700 children under the age of 5 years die of diarrheal diseases related the lack of water, sanitation and hygiene (WASH) services. UNICEF reported that the children at risk of dying from diarrheal disease 20 times more from the violence in conflict (UNICEF 2019).

The majority of Mediterranean countries have made sustained efforts to improve the sanitary and hygiene conditions of urban and rural agglomerations, to protect the environment and to improve life condition of citizens through major projects in the field of sanitation; many of these countries have developed national strategies and programs to improve and set up sanitation infrastructures since the 80s of last century.

UFM water agenda is an instrument to contribute to the Global development agenda and to achieve universal water and sanitation coverage for all and to consider the economic value and water economies in general terms toward achieving a sustainable services and stable utility modules in the region aiming to enable private sector engagement and development of investment opportunities and building capacities for development of bankable projects.

To achieve such equation innovation and invention is needed and thus new technologies is needed or to create a sustainable mechanism to speed up their transfer and implementation. Addressing this at regional level in the UFM will enable the member states to build capacities in this sector and exchange knowledge at policy and operational level by creating a sustainable platform among water utilities and water operators and integrate these elements on the national development Plans (UFM, 2020).

These efforts and strategies are implemented in line with SDG 6 and are currently directed towards general access to sanitation services, including rural areas, by sharing best and adapted practices from prior experiences. This includes the improvement of treated wastewater reuse as a nonconventional resource that can contribute to mitigating local water shortage.

North-South, but also South-South cooperation in the Mediterranean should be strengthened and structured. It is necessary to value the know- how of some countries in the region, but also learn from the failures. It would be interesting to further structure the cooperation, notably through the launch of a specific Euro-Mediterranean call for projects to target innovative projects (on the use of sewage sludge, for example), of a scientific and/or normative nature (adaptation, generalization or harmonization of standards in force between countries). Emphasis should be placed on strengthening the capacity of local authorities, particularly for the implementation of Integrated Water Resources Management (IWRM).

Another important element to consider is that North-South cooperation is two-way, since the knowledge base in the South will increasingly become important for the North in particular due to the onset of climate related changes which will bring the operational environment in the North closer to that currently experienced in the South (Roederer 1996, Andrade 2009).

As regards the tools by which to support regional cooperation between the MENA regions countries and European countries, by moving from a number of different and unrelated initiatives to a more centralized approach, and hence ensure that the learning factor is maintained throughout the different initiatives. One good example to mention here is the ENI CBC-Med where the importance of the alignment of this process with the UfM Water Agenda should be solicited.

The UfM Financial Strategy for Water promotes the financial sustainability of the Mediterranean water sector in order to secure the social, economic and environmental benefits to be gained from the implementation of the UfM Water Agenda. It identifies challenges that are shared by many countries in the region, while recognizing that not all countries face the same exact challenges or to the same degree. It sets a shared goal, common strategic objectives, and a menu of actions, but individual countries will implement different actions according to their individual circumstances, priorities, and capacities.

The UfM Financial Strategy Strategic Objectives

- Reform the water sector to enhance its financial sustainability.
- Integrate water financing considerations across water-related sectors.
- Use existing financial resources to fund water-related activities that provide the highest social, economic and environmental benefits.
- Improve the coordination of water-related investments.
- Increase value-for-money in the implementation of water-related projects and the delivery of water services.
- Increase efficiencies in water use and ensure adequate asset management to optimize the use of existing financial resources.
- Increase revenues internally generated in the water sector.
- Increase allocations of public budgetary resources to water-related activities.
- Mobilize more resources from domestic private actors.
- Use resources from international financial partners strategically to leverage other sources of finance.

The UfM will support the implementation of the Financial Strategy by making use of its convening power to provide a platform for policy dialogue, through the relevant work of the four thematic task forces mandated to support the implementation of the UfM Water agenda, and through targeted work to be carried out by a renewed Water Financing Task Force (UFM, 2020). On another hand, the WASH task force shall be working on the following activities to help implementing the UfM financial strategy:

- Reviewing legal and regulatory frameworks for water supply and sanitation services.
- Regional and local authorities/Water service providers shall use existing financial resources to fund water-related activities that provide the highest social, economic and environmental benefits.
- Organizing capacity development activities on increasing water use efficiency and asset management.

2. Overview

This section provides an overview of statistical data on SDG 6 'Clean water and sanitation' in the Mediterranean region via reviewing different platforms and monitoring data published online. provides a range of statistics and accounts about the state of the environment and the drivers, pressures and impacts of our societies on the environment. Environmental indicators are based on statistics and accounts. They allow comparisons over time, provide warning signals and help in making decisions. Eurostat provides environmental indicators related to water and sanitation, since the environment is a substantial parameter in several EU policies, related indicators are also included in different policy sets: Sustainable Development Goals (SDGs), circular economy, Europe 2020 and the resource efficiency scoreboard (Petersen,-Elbersen et al. 2014)

Eurostat also re-disseminates relevant data by the European Environmental Agency, the Joint Research Centre and other producers. Because the environment is global, Eurostat works together with United Nations, OECD and other international organizations to establish common solutions for global environmental statistics.

According to Eurostat records (ENP-East countries and ENP-South countries) section, in principle, the ENP-South region covers ten non-EU Mediterranean countries: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia. Currently Syria is not actively involved in data exchange or statistical cooperation activities. Here the indicator figures for the population connected to public water supply are presented in the Table 1 below listing southern Mediterranean and north Mediterranean countries:

Table 1: Population connected to public water supply

Country/Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Algeria	96%	96.5%	98%	98.	98%	98%	98%	98%	98%	
Egypt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Morocco	77.5%	79.5%	80.2%	NA	NA	NA	NA	NA	NA	NA
Tunisia	82.6%	82.8%	83%	83%	NA	NA	NA	NA	NA	NA
Israel	100 %	100%	100%	100%	100%	100%	100%	100%	100%	100%
Jordan	97.7%	NA	NA	96.7%	96.7%	96.7%	96.7%	98%	98%	NA
Palestine	94.2%	93.8%	96.6%	97.5%	NA	94.9%	NA	NA	NA	NA
Greece	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Spain	100%	100%	100%	100%	100%	100%	100%	NA	NA	NA
France	99%	99%	99%	99%	NA	NA	NA	NA	NA	NA
Croatia	83.5%	85.5%	87.5%	90.2%	91.6%	92.16%	93%	93%	93%	NA
Cyprus	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA
Malta	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA
Portugal	NA	NA	NA	NA	NA	NA	NA	92.6%	NA	NA
Serbia	77.7%	78.2%	80.1%	81.9%	83.7%	85%	85.9%	86.9%	87.9%	AN
Turkey	98.3%	NA	98.3%	NA	97.4%	NA	98.3%	NA	98.6%	NA
Bosnia and Herzegovina	NA	NA	55.2%	62%	64.2%	64.4%	66.2%	67.9%	69.6%	NA

Here the indicator figures for the population connected to wastewater collection and treatment systems for both south and north Mediterranean countries are presented in the table below:

Table 2 Population connected to wastewater collection and treatment systems

Country/ Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Algeria	86.0	87.0	90.0	90.0	90.0	90.0	90.0	91.0	91.0	NA
Egypt	62.1	NA	64.7	NA	NA	NA	NA	NA	NA	NA
Morocco	89.3	89.0	90.0	NA	NA	NA	NA	NA	NA	NA
Tunisia	57.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Israel	98.1	98.2	98.4	97.7	97.7	97.7	97.7	99.0	99.0	99.0
Jordan	65.0	67.0	59.7	59.7	61.0	61.0	NA	61.0	61.0	NA
Greece	87.3	88.1	92.0	92.8	92.8	93.4	93.4	NA	NA	NA
Spain	98	NA	90.1	NA	87.03	NA	89.37	NA	NA	NA
France	100	100	100	100	100	100	100	100	100	NA
Cyprus	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Malta	20.7	100	100	100	100	100	100	100	100	NA
Portugal	NA	NA	NA	NA	NA	NA	NA	85	NA	NA
Albania	NA	NA	NA	NA	20.9	19	16	17.45	52	NA
Serbia	NA	NA	9.89	10.42	11.25	12.11	13.86	13.85	14.12	NA
Turkey	52.1	NA	58.3	NA	64.01	69.91	70.7	74.24	74.44	NA
Bosnia and Herzegovina	32.34	31.79	30.4	29.63	29.61	29.59	36.59	36.9	36	NA

The joint WHO/UNICEF Joint Monitoring Program is affiliated to UN-Water and was established in 1990. It builds on earlier monitoring activities carried out by WHO since the 1960s. The Joint Monitoring Program's (JMP's) objectives are to provide regular global reports on drinking-water and sanitation coverage to facilitate sector planning and management, to support countries in their efforts to improve their monitoring systems, and to provide information for advocacy. JMP indicators for drinking water, sanitation and hygiene service levels (2017) are shown below Figure. It is shown from the figure that the drinking water

services have the largest percentage of coverage and reach to 60% in North Africa and, while the coverage percent in Europe and Northern America is more than 97%.

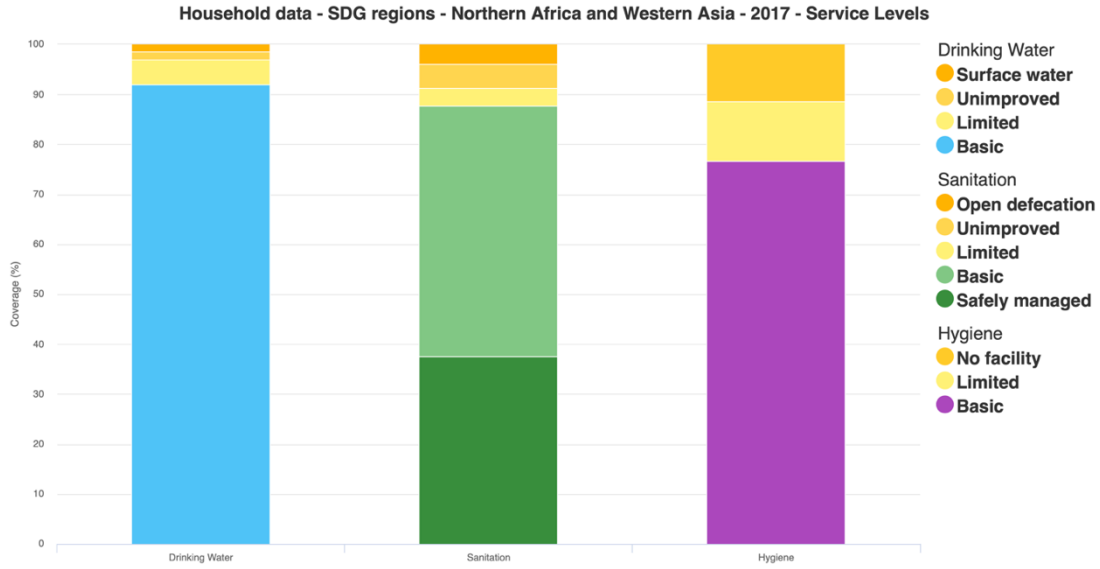


Figure 1 WASH Service Levels in Northern Africa and Western Asia-2017, Source: https://washdata.org

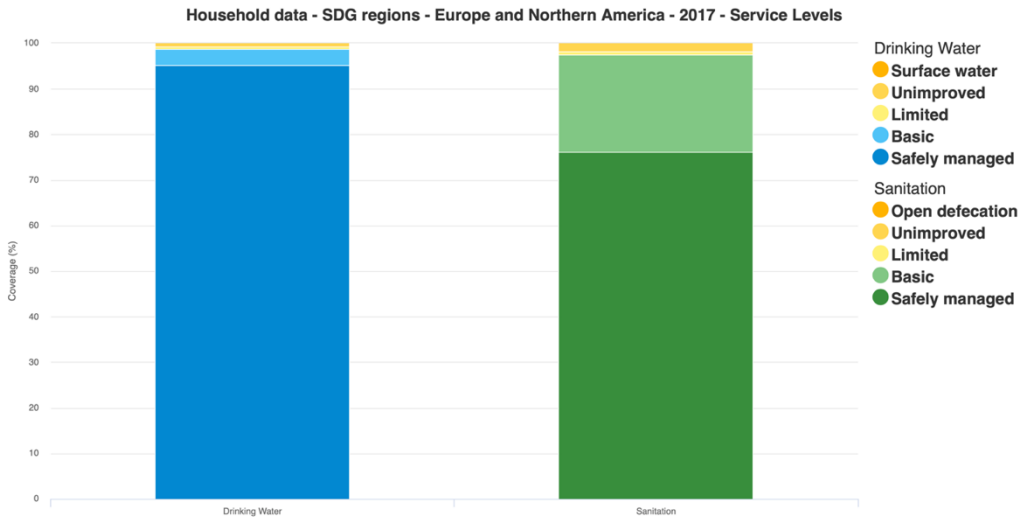
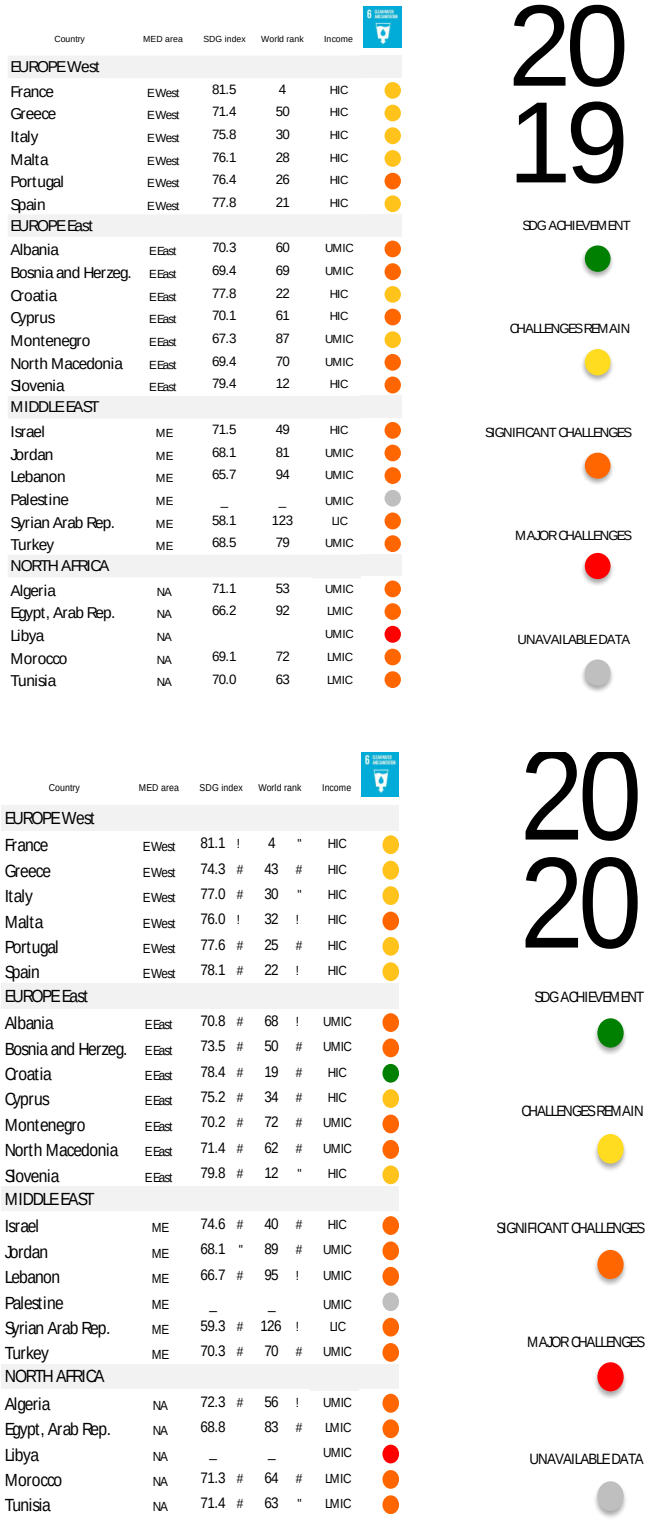


Figure 2 Water and Sanitation Service Levels in Europe and Northern America-2017, Source: https://washdata.org

The following figures show dashboard for comparison (benchmarking) for Mediterranean countries for SDG6 for the year 2019 and 2020 showing status of achievement for each country and status progress. Figures show some positive results for high income countries

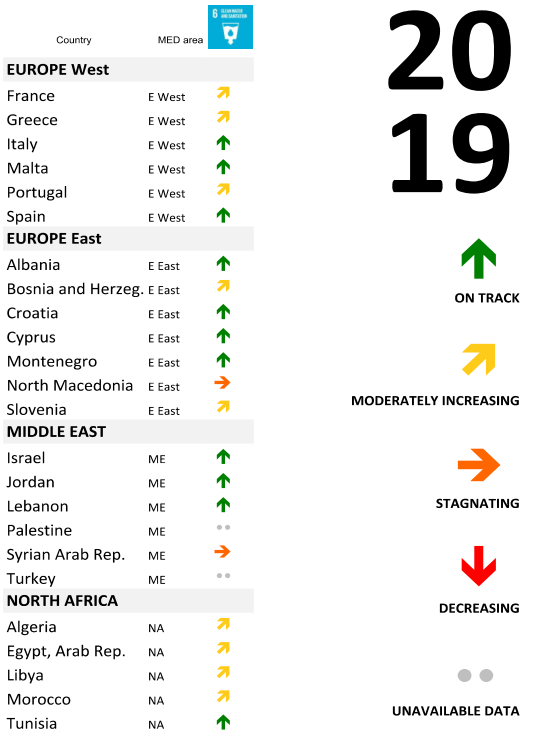
and contradicting gap results from low-income countries, which eventually raise the need for urgent need for collaboration to help them mind the gap in WASH service delivery.



Country	MED area	SDG index	World rank	Income
EUROPE West				
France	EWest	81.5	4	HIC
Greece	EWest	71.4	50	HIC
Italy	EWest	75.8	30	HIC
Malta	EWest	76.1	28	HIC
Portugal	EWest	76.4	26	HIC
Spain	EWest	77.8	21	HIC
EUROPE East				
Albania	EEast	70.3	60	UMIC
Bosnia and Herzeg.	EEast	69.4	69	UMIC
Croatia	EEast	77.8	22	HIC
Cyprus	EEast	70.1	61	HIC
Montenegro	EEast	67.3	87	UMIC
North Macedonia	EEast	69.4	70	UMIC
Slovenia	EEast	79.4	12	HIC
MIDDLE EAST				
Israel	ME	71.5	49	HIC
Jordan	ME	68.1	81	UMIC
Lebanon	ME	65.7	94	UMIC
Palestine	ME	_	_	UMIC
Syrian Arab Rep.	ME	58.1	123	LIC
Turkey	ME	68.5	79	UMIC
NORTH AFRICA				
Algeria	NA	71.1	53	UMIC
Egypt, Arab Rep.	NA	66.2	92	LMIC
Libya	NA			UMIC
Morocco	NA	69.1	72	LMIC
Tunisia	NA	70.0	63	LMIC

Country	MED area	SDG index	World rank	Income
EUROPE West				
France	EWest	81.1 !	4 "	HIC
Greece	EWest	74.3 #	43 #	HIC
Italy	EWest	77.0 #	30 "	HIC
Malta	EWest	76.0 !	32 !	HIC
Portugal	EWest	77.6 #	25 #	HIC
Spain	EWest	78.1 #	22 !	HIC
EUROPE East				
Albania	EEast	70.8 #	68 !	UMIC
Bosnia and Herzeg.	EEast	73.5 #	50 #	UMIC
Croatia	EEast	78.4 #	19 #	HIC
Cyprus	EEast	75.2 #	34 #	HIC
Montenegro	EEast	70.2 #	72 #	UMIC
North Macedonia	EEast	71.4 #	62 #	UMIC
Slovenia	EEast	79.8 #	12 "	HIC
MIDDLE EAST				
Israel	ME	74.6 #	40 #	HIC
Jordan	ME	68.1 "	89 #	UMIC
Lebanon	ME	66.7 #	95 !	UMIC
Palestine	ME	_	_	UMIC
Syrian Arab Rep.	ME	59.3 #	126 !	LIC
Turkey	ME	70.3 #	70 #	UMIC
NORTH AFRICA				
Algeria	NA	72.3 #	56 !	UMIC
Egypt, Arab Rep.	NA	68.8	83 #	LMIC
Libya	NA	_	_	UMIC
Morocco	NA	71.3 #	64 #	LMIC
Tunisia	NA	71.4 #	63 "	LMIC

Figure 3A: Compared 2019-2020 SDG6 Trend Dashboards for Mediterranean countries towards 2030, Source: https://washdata.org



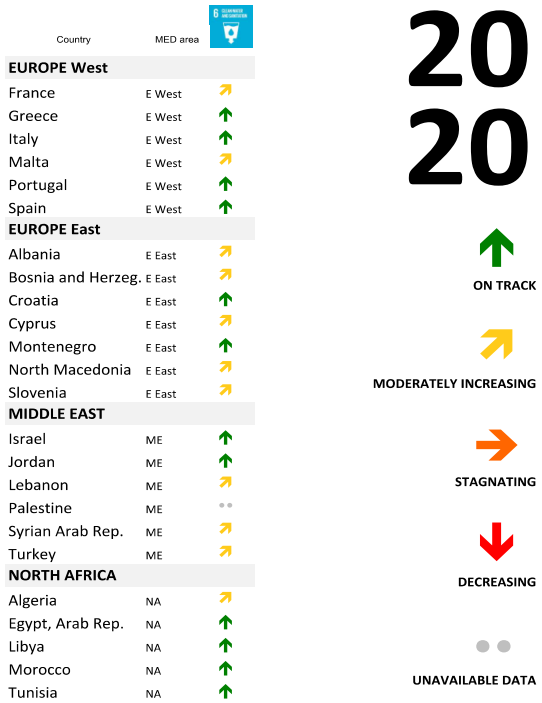


Figure 3B :Compared 2019-2020 SDG6 Trend Dashboards for Mediterranean countries towards 2030, Source: https://washdata.org

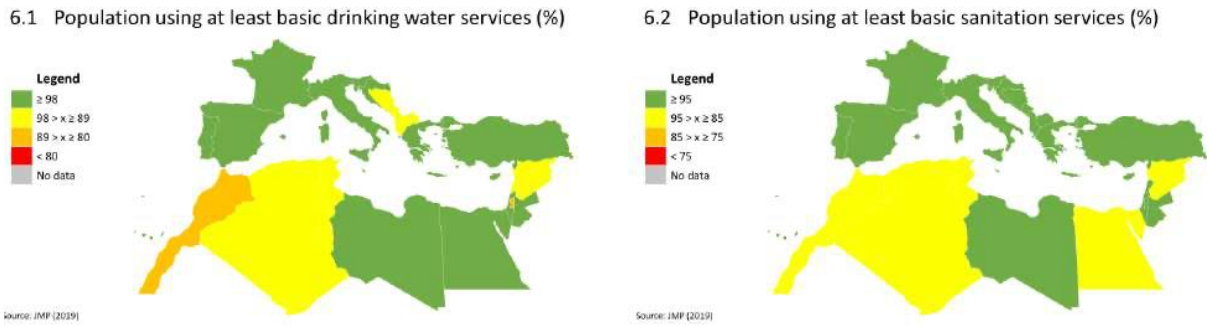


Figure 4 Representation of SDG 6.1 and 6.2 in Mediterranean Region in 2019, Source: https://washdata.org

As shown in Figure 4, North Africa is the Med area that mostly suffers from lack of access at basic drinking water services (8,8 million people) and lack of basic sanitation services (15,9 million people), but trends are positive compared to the 2019 (respectively -2 and -2,6 million people).

Figure 5 Representation of SDG 6.4 in Mediterranean Region in 2018, Source: https://washdata.org

Wastewater treatment is not a practice deployed enough as shown in the figure 6. Besides EW (78%), Middle East and North Africa (MENA) countries need consistent improvements (33% only). Some countries in particular in EE and MENA show unsatisfactory performances and call for investments in wastewater infrastructures and management.

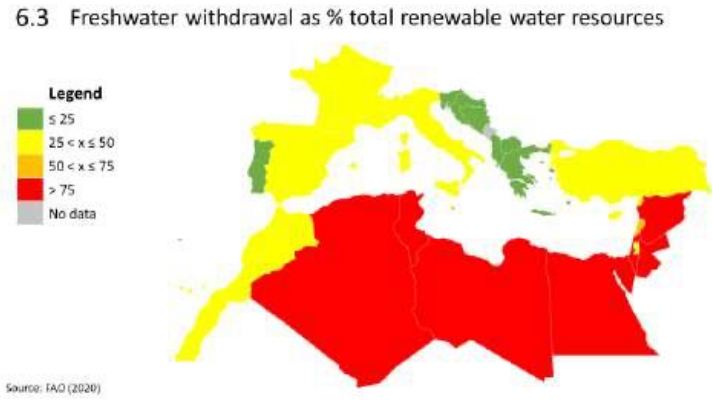


Figure 6 Representation of SDG 6.3 in Mediterranean Region in 2020, Source: https://washdata.org

Critical issues in the Mediterranean mainly related to the condition of water scarcity and negative trends due to the impacts of climate change. Over 40 million people in North Africa and Middle East are left out of basic services of drinking water and sanitation (UNICEF 2021). Water networks look well-structured in most of the Mediterranean area, including MENA countries, despite gaps in accessing basic drinking water and sanitation services mostly affecting rural areas (Health 2019).

The UfM financial strategy for water clearly lines out, that there is a significant funding gap for water management in the Mediterranean region to achieve the water-related SDGs, to upheld the human righ (Health 2019) ~~ts~~ to safe drinking water and sanitation, and – for EU member states to comply, as well, with the demands of EU legislation. UfM member states need to work both on improving the management of current water-related expenditures and on raising additional financial resources if the objectives of the UfM Water Agenda are to be achieved.

To close the funding gap, there is a need to adjust tariffs, taxes and transfers. There are different models for funding the water sector around the Mediterranean region, but all rely on a combination of the three ultimate sources of finance (the 3Ts): contributions from users ("service tariffs"), contributions from government budgets ("taxes"), and contributions from donor countries (directly or through multilateral instruments) and from local and international charities and foundations ("transfers"). Lenders (such as public domestic banks, public multilateral banks, and private banks) and investors (such as private companies or public pension funds) can provide finance in the form of loans, bonds and equity investments,

but they require remuneration in the form of interest and dividends. Ultimately, the money to pay for interests and dividends must come from a combination of the 3Ts.

3. COVID-19 Defense Line

The COVID-19 emergency has emphasized the critical role of water and sanitation utilities for our societies. As countries were hit hard and unexpectedly, water and sanitation operators have had the duty to show resilience to fulfil their mission as well as to adapt rapidly to ensure both the continuity of essential services for all and the safety and health of workers in the frontline and citizens. These efforts have required immediate organizational and operational measures: from the setup of crisis units and development of emergency strategies to adaptation to a permanently evolving, uncertain situation.

Most water and sanitation utilities worldwide were not prepared for a global pandemic. Water utilities had to rethink organizational structures and include and improve both risk management approaches and information collection procedures to be able to cope with the crisis.

The provision of safe water, sanitation and hygienic conditions is essential to protecting human health during all infectious disease outbreaks, including the COVID-19 outbreak. Ensuring good and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces, prisons and health care facilities will further help to prevent human-to-human transmission of the COVID-19 virus. The impacts of the COVID-19 reached a larger dimension than the sole emergency sanitary solutions: they question the viability and resilience of national and sub- regional systems of infrastructures and basic facilities supply.

Water and sanitation services are a cornerstone in efforts to manage the pandemic. Unfortunately, despite this, some measures taken to ensure that water and sanitation services are widely available are putting a financial burden on water utilities that may compromise their ability to deliver essential public services throughout the pandemic and beyond.

The growing liquidity crisis of public utilities under COVID-19 is caused by a twofold burden of (1) increasing costs and (2) decreasing revenues. Costs for service provision have increased due to mounting operational expenses, such as additional safety and hygiene measures to

protect the health of personnel. Moreover, given their critical role in maintaining public health, many utilities have expanded service provision to stall the spread of the virus by way of public handwashing facilities and standpipes, among other measures.

At the same time, revenue streams have fallen due to a pandemic induced economic slowdown that is seeing decreased demand from industrial actors and the inability of household customers to pay their bills on time. Many governments have mandated that utilities freeze payment compliance measures during the pandemic, e.g. not to disconnect households with water bills in arrears. This leaves water operators without enough cash flow to operate sustainably.

Having no or limited cash reserves, many utilities already struggle to maintain a service that provides safely managed water and sanitation for all. The economic downturn in low to middle-income countries, which is leading to increasingly high public debt levels, means that scarce public resources for water supply and sanitation may decline even further.

According to many reports and policy papers from international institutions and IFI's, COVID-19 has highlighted the needs to invest in wastewater facilities and adequate sanitation. The outbreak of pandemic is projected to slow down mainly in this sector. During the recovery period of the it is important to invest and manage the WASH services to mitigate the secondary effects on the livelihoods of the community. As such giving priority to disposal investments in sanitation and to adequate wastewater treatment must be a pre-requisite for an effective WASH strategy.

Utilities' key experiences, successes and challenges in terms of operational issues in responding to COVID-19

- Utilities had to adapt very quickly and intensely when the crisis struck as lock-down measures were put in place along very short timelines, often within days and in some cases in a matter of hours. Operators who had risk management methodologies in place adapted quicker.

- Staff management measures, such as employee well-being and work-from-home protocols, required new systems for internal coordination and rapid implementation. It also required rapid access to equipment such as PPE.
- IT infrastructure has quickly become an essential component for day-to-day management, for both internal and external coordination. Safety and security of IT systems are very important.
- Ensuring critical supplies has proven difficult, especially for those utilities who do not have financial flexibility or easy access to stocks.
- Water utilities will experience different situations in terms of water demand and other changes impacting on their operations. Solutions must be tailored accordingly.
- Technology is an enabler for internal workflows and collaboration, and critical in ensuring service continuity.
- Preparedness, moving from a 'just-in-time' to a 'just-in-case' approach, should be the new normal and many of the changes that are currently being experienced are here to stay. For example, a stock of essential supplies should be maintained.
- International and regional networks for exchange and learning are important as sources of knowledge and possible solutions.
- Ensure the proper operation of water points and sanitation facilities in to the rural areas.
- Ensure the safely mange of WASH services and applying the good hygiene practices of the operators.

Lessons learned from COVID-19 pandemic affecting WASH services (The New Normal):

- The crisis has been managed with two main objectives in mind: ensuring the continuity of service and keeping the staff safe.
- Teamwork and knowledge sharing have proven to be essential to address the COVID-19 crisis.
- The development and implementation of Contingency Plans and Recovery Plans is crucial to be prepared for future crises.
- Monitoring wastewater for SARS-CoV-2 is useful to follow the trends of the pandemic and for early warning. More research is needed in order to accurately determine the quantity of cases of COVID-19 that corresponds to a certain viral load in the

wastewater. The viral load to a given sewage or fecal sludge treatment process could itself be influenced by various physical, chemical and environmental factors as well as the characteristics of the sewer shed or fecal sludge conveyance processes.

- Global exchange between utilities and wastewater monitoring experts and researchers is important, especially as the topic is fast evolving, in order to share data, sampling and analytical protocols and good practices. This type of collaboration should be continued and deepened in order to scale up wastewater monitoring.
- To minimize the impact of reduced incomes, utilities may be able to reduce certain costs, such as unnecessary transport, the purchase of certain materials, or non-essential maintenance work. However, cost saving decisions should always be made in consultation with relevant departments and employees.
- Utility management must ensure risk management/business continuity plans are in place and well-integrated into day-to-day operations in order to support resilience and cost-effective responses to future crises.
- Effective digitalization, to facilitate the payment of bills, should be pursued to help minimize disruptions to cash flows.
- Utilities should invest in renewable energy to power facilities, thus reducing their dependence on a single energy source, as this is considered high-risk.
- Stakeholders should take advantage of the financial challenges raised by COVID-19 to engage in political dialogue and knowledge exchange on financial sustainability of water and sanitation operators.
- Income from non-residential customers as well as government subsidies should be considered in assessing the financial health of utilities.

4. WASH innovations

As indicated by the name, WASH covers three strongly linked, overlapping subsectors. For example, good sanitation and hygiene are difficult to achieve without adequate and clean water, and poor sanitation affects water quality. Often, challenges, actors, products and solutions act together across these subsectors, creating the rationale for grouping them under the umbrella term of WASH. Major development and humanitarian organizations implement large WASH programs specifically addressing the interconnectedness. Such programs often contain activities related to water supply, toilets and latrines, safe sanitation practices, waste management and disease vector control.

Technology often plays an important role by providing resource-efficient solutions to some of the challenges associated with WASH. This is emphasized in the targets for SDG 6, including support for technologies in areas such as water harvesting, desalination, efficient use, treatment and recycling. WASH innovation focuses mainly on water supply and sanitation, whereas hygiene is considered more a matter of behavioural change (Rush and Marshall, 2015).

Business-as-usual is no longer an option if we are to achieve the transformative progress needed to meet SDG 6. 'Future-proofing' the sector necessitates innovative approaches, partnerships, systems and technologies that will meet the challenges of tomorrow, including disease outbreaks, migration, urbanization, a changing climate and increasing pressure on natural resources. Reducing rather than exacerbating inequalities will require governments and service providers to respond with solutions that are practical, cost-effective and able to be developed.

Governments can encourage innovation and experimentation through supportive government policy and regulation, accompanied by rigorous monitoring and evaluation of systems and proposed solutions. Innovative practices and technologies can be leveraged, including those that support accelerating sanitation services for rural areas and marginalized communities. Governments can also support the sharing and dissemination of research and innovation. Partnerships between service providers and academic institutions have proven valuable and mutually beneficial.

Urbanization and migration call for new ways of meeting the needs of high-density populations living in poverty, often in informal settlements. To date, most urban sanitation interventions have relied on the expansion of centralized sewer infrastructure that rarely reach low-income communities and are ill-suited to dense urban slums and unplanned settlements, where the majority of urbanization is happening. Recognizing the urban sanitation crisis, its disproportionate burden on the urban poor, and the limited progress of prevailing approaches, there is a need for a radical shift in approach.

The challenge of urbanization has already driven the development of successful and innovative programming approaches and sanitation systems. These approaches combine new ways of providing facilities and services with community mobilization and action to strengthen demand and collective action, along with building government and service provider capacity.

The challenges of climate change and mounting resource pressure call for innovative ways of delivering services that will be resilient and enable resource-recovery. Climate variability and change will increase the strain on sanitation systems, and therefore must be considered to ensure sanitation technologies and services are designed, operated and managed in a way that minimizes risks to human and environmental health. Well-designed sanitation services in turn increase community resilience to climate change through continuity of services that contain waste after extreme events. While human excreta are a globally significant source of greenhouse gas emissions, there is considerable potential to capture emissions and recover water, nutrients and energy from sludge and wastewater. Their safe use in energy generation, and as inputs to agricultural processes, help mitigate the effects of drought, reduce reliance on chemical fertilizers and strengthen food systems.

WASH is increasingly affected by climate change and needs climate-smart innovations and approaches. In an increasingly unstable and changing climate, risks to health systems are expected to increase, particularly in LMICs and populations. Climate change can overwhelm health systems, disrupt services and stress facility infrastructure, particularly the reliability and safety of WASH, health care waste and energy services, and thereby compromise a population's access to health care facilities. These risks continue to grow with increasing frequency and intensity of extreme weather events across the world, including heatwaves,

droughts, extreme rainfall and flooding, which in turn may cause mass displacement and/or disruption of livelihoods.

Governments must think beyond conventional sewage systems, which are costly and time-consuming to install, and consider other options, such as decentralized sanitation systems. Innovations in sanitation technologies and systems can mitigate and adapt to the risks posed by climate change, urbanization and resource scarcity. The selection of sanitation technologies and systems is context- specific and depends on local technical, economic and social factors.

Governments can enable innovation through sound regulation, and by setting sanitation technology performance criteria and standards that reduce risk but are not overly prescriptive. This includes O&M criteria and incremental standards, if appropriate for specific settings. By setting standards for and regulating safe use of wastewater and sludge, governments can reduce waste and recover resources for agriculture. For example, decentralized wastewater treatment systems offer an opportunity for local water reuse, such as for crop irrigation or fish production.

Innovation extends to the protection of the sanitation workforce. Innovative technology and approaches can help to limit workers' occupational exposure and provide a healthier workplace. Measures such as phasing out manual emptying, and replacing it with motorized systems, can improve worker health. Appropriate personal protective equipment, standard operating procedures and regular health checks can also improve worker health and safety, at the same time as supporting continuity of services.

It is important to highlight that there is no one solution to address all challenges – but a comprehensive/integrated application of different techniques at different levels is the best way to address WASH in the region.

Water Treatment Technology

Nanotechnology

Nanotechnology involves several approaches and processes of applying materials on the atomic or molecular scale. Nanotech-based water purification processes are considered to be modular, highly efficient and cost-effective when compared to conventional water purification methods (Kunduru, Konda Reddy et al.2017). The major applications of nanotechnology in water treatment processes include silver, copper and zero-valent iron (ZVI) nanoparticles, nanostructured photocatalysts, nano-membranes, and nanoadsorbents.

The large surface-to-volume ratio of nanoparticles enhances the adsorption of chemical and biological particles, while enabling the separation of contaminants at very low concentrations. Nano adsorbents feature specific physical and chemical properties for the removal of metallic pollutants from water.

Carbon nanotubes (CNTs) are considered to be one of the prominent nanomaterials used in water purification. CNT-based filtration systems can remove organic, inorganic and biological compounds from water.

Acoustic nanotube technology

The acoustic nanotube technology was invented by scientists at Nasa's Johnson Space Center. It employs acoustics in place of pressure to direct water through small-diameter carbon nanotubes. The technology is based on an acoustically driven molecular screen integrated with carbon nanotubes that allow the passage of water molecules while blocking any larger molecules and contaminants. It consumes less power than traditional filtration systems and drives water away from contaminants instead of removing pollutants from water. The process also eliminates the need for flushing the filter system (water technology, 2021).

The primary applications of acoustic nanotube technology are municipal water plants, medical facilities, laboratories, distilleries, desalination plants, industrial facilities, wastewater treatment plants, and consumer segment. The innovation is scalable with the integration of multiple filters, according to the filtration needs of users.

Photocatalytic water purification technology

Water treatment using photocatalysis has gained prominence in recent years due to its efficiency in treating contaminated water. The technology utilises photocatalyst and ultraviolet (UV) rays to remove toxic substances from water. Technology leading companies had developed a technology that binds the photocatalyst (titanium dioxide) to a commercial adsorbent and a catalyst called zeolite, ensuring effective separation and recovery of photocatalysts from the water for reuse. Titanium dioxide can mineralise a range of organic compounds into safe end products. The catalyst uses UV radiation either from sunlight or artificial light to separate substances.

Photocatalysis can break down a range of organic materials, estrogens, pesticides, dyes, crude oil, and microbes such as viruses and chlorine-resistant pathogens, as well as inorganic compounds such as nitrous oxides. Photocatalytic water treatment systems are suitable for use in water and wastewater treatment facilities and can treat industrial wastewater polluted with high loads of organic substances or metals.

Automatic Variable Filtration (AVF) Technology

Automated Variable Filtration (AVF) technology involves a simple process where upward flow of influent is cleaned by downward flow of filter media. It eliminates the need for any additional process or freshwater for filter media cleaning.

The AVF method employs continuously cleaned descending bed filters embedded in a variable array. The two-stage configuration of the system integrates two sets of media filters that can function either in serial or parallel mode. The process delivers water with quality equivalent to that of micro-filtration technology and at a fraction of the cost of low-pressure membranes. It features no moving parts and consumes less power, offerings savings on reduced operating and maintenance costs. AVF systems are suitable for municipal drinking water and wastewater treatment, wastewater recycling and reuse, pre-filtration for membrane processes and desalination applications.

Wastewater Treatment Technology

Membrane Bioreactors

Membrane bioreactors (MBR) for wastewater treatment is a combination of a suspended growth biological treatment method, usually activated sludge, with membrane filtration equipment, typically low-pressure microfiltration (MF) or ultrafiltration (UF) membranes. The membranes are used to perform the critical solid-liquid separation function. In activated sludge facilities, this is traditionally accomplished using secondary and tertiary clarifiers along with tertiary filtration. The two general types of MBR systems are vacuum (or gravity-driven) and pressure-driven systems. Vacuum or gravity systems are immersed and normally employ hollow fiber or flat sheet membranes installed in either the bioreactors or a subsequent membrane tank. Pressure driven systems are in-pipe cartridge systems located externally to the bioreactor.

Thermal Hydrolysis

Thermal hydrolysis technology is a successful method to make the sludge of the sewage more amenable to anaerobic digestion which is very important to produce the energy (Barber 2016). This technology involves the involves the heating at above autoclave temperature for a proper time before the anaerobic digestion. The heat is typically provided by live steam injection at design temperature. The range of the temperature requirements are between 160 to 165 C^{o}. However, the pressure should be in the range of 7 – 11 bars and with a well distribution (Pereboom, Luning et al. 2014). One of the main advantages of this technology are allows higher loading rates and resulting in smaller digestion plants and increase the rate of biogas production (Xue, Liu et al. 2015). There are two types of the thermal hydrolysis; Biothelys and Exelys. The major difference between the two processes is that batch process consists of a series of batch tanks while the Exelys utilizes the continuous plug flow reactor. The batch process is a more established technology with more than 25 treatment plants around the word, however the Exelys process is still new due to the high cost of development of this kind of plants (Abu-Orf and Goss 2012).

Microbial Fuel Cells

The wastewater is now considered as source of energy. The microbial fuel cells (MFC) are one of technologies that has been proved as a critical for bioconversion processes to generate the electricity (He, Du et al. 2017). The by-product of the bacteria's consumption of wastewater sludge is charged electrons that can be converted into electricity (Aelterman, Rabaey et al. 2006, He, Du et al. 2017). The main factors that affect the performance of MFC are the type of substrate and its concentration and the type of the membranes. Operating conditions such as pH, temperature and ionic strength of the mediums have a significant impact on electricity generation (Aghababaie, Farhadian et al. 2015).

Solar Photocatalytic Wastewater Treatment

The solar photocatalytic reactor using **Titanium dioxide** (TiO_2) nanoparticles to treat the organic compounds of the wastewater (Kositzi, Poulios et al. 2004). The advanced oxidation processing is widely used method in wastewater treatment to decompose organic pollutants that are difficult to decompose with conventional methods due to the high chemical stability of these compounds (Blanco-Galvez, Fernández-Ibáñez et al. 2007).

Natural Technologies for Wastewater/Urban Runoff Treatment

The storm water runoff from urban has become the source of a significant contribution of pollutants to the water bodies. The areas that contribute with the runoff include residential areas, commercial, industrial, parks and road (Aryal, Vigneswaran et al. 2010). One of the most proper technologies is the constructed wetland technology. Which is shallow, extensively vegetated water bodies with a high process stability and long retention time, fine filtration and biological treatment to remove the pollutants from the storm water.

Water Distribution Technology

Smart Water Network

Every day, a huge number of raw data generated from the water utilities as it reported in many literatures, about 60% of these raw data goes unused due to the lack of processing these data quickly (Cahn 2014, Yigitcanlar 2016, Colella, Bates et al. 2021).

The smart water network integrates the water processes into data and communication technology infrastructure, thus converting the real-time data into actionable information. This enables utilities to manage their assets and facilities more effectively (Cahn 2014).

The smart water network consists of different technologies includes; sensors, communication technology and software tools (Adedeji et al. 2019, Nwulu et al. 2019).

Smart Water Metering

The smart water metering is an integration of data into a business system and sharing these data with the customers (Mudumbe and Abu-Mahfouz 2015). Smart water meter uses the wireless communications to enable the connection with the local area network. The main objective of smart water management ~~the~~ system is to build a reliable relationship between the customer and the utility sector (Abu-Mahfouz, Hancke et al. 2012). It enables mesh networks between meter interface nodes within a radius of 100 metres. The gateway collects the data sent by the counter interface node and sends it to the server directly (Mudumbe and Abu-Mahfouz 2015). The system consists mainly of three components; the meter interface node, the gateway and the back-end system.

Leak Detection Systems

The main of the leak detection system is to monitor the flows of water through the pipes network. The concept of the leak detection systems depends on sensors and collection of specific data from data collectors that placed on the water networks. The most proper sensor for pipe network monitoring should be non-invasive to the pipe, low in energy consumption and easy to install. Furthermore, these sensors should be able to collect useful data without extensive data processing or high sampling rates (Sadeghioon, Metje et al. 2014).

Rainwater Harvesting

Rainwater harvesting is collection of runoffs to use it in a productive way (Critchley and Siegert 1991). There are many techniques for harvesting water that have been developed over the time. There are two common criteria to classify the water harvesting system. This is the applied water storage method, watershed type and size. The classification of water harvesting depending on the type of watershed is divided into the following groups; flood water harvesting, macro-catchment systems, microcatchment systems, and harvesting of water from courtyard or rooftop (Gebreyess and Amare 2019). Many of features should be consider for using water harvesting technology as they have a significant impact on the sustainable use of the technology. These features include; the type of technologies, the context in which the technology will be used, who it will be used for, and how it will be implemented in the site (Robinson 2008, Liu, Yang et al. 2017).

Water harvested with different technologies can be used in different forms by implementing different storage options. Each storage option can have its own advantage based on mechanical feasibility, socio-economic desirability and legal conditions (Gebreyess and Amare 2019). The main advantages of the water harvesting are; creating access to fresh and healthy water for households; providing water for livestock; in dry land areas increasing the availability of water and productivity of crops resulting in maximizing the food productivity (Fuentes-Galván, Ortiz Medel et al. 2018).

Desalination Technology

Desalination have been considered as an essential strategy to cover the shortfalls in water supply. The desalination plant includes various processes for obtaining fresh water, among which the desalination unit is the costliest component of energy (Curto, Franzitta et al. 2021). The desalination technologies are mainly classified according to the working principles and the main energy input (Alkaisi et al. 2017, Mossad et al. 2017). The following charts (figure 7 and 8) shows the classification of desalination technologies by working principle and the energy input.

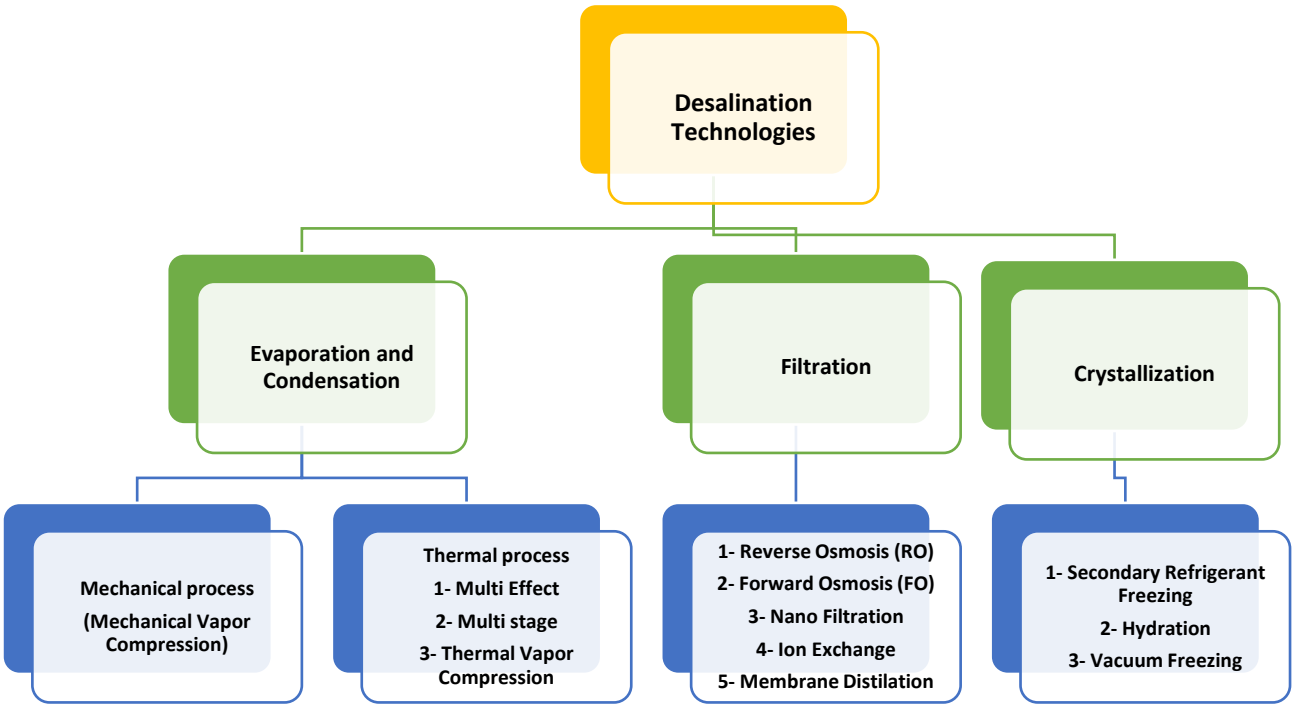


Figure 7: Classification of the desalination technologies according to the working principles

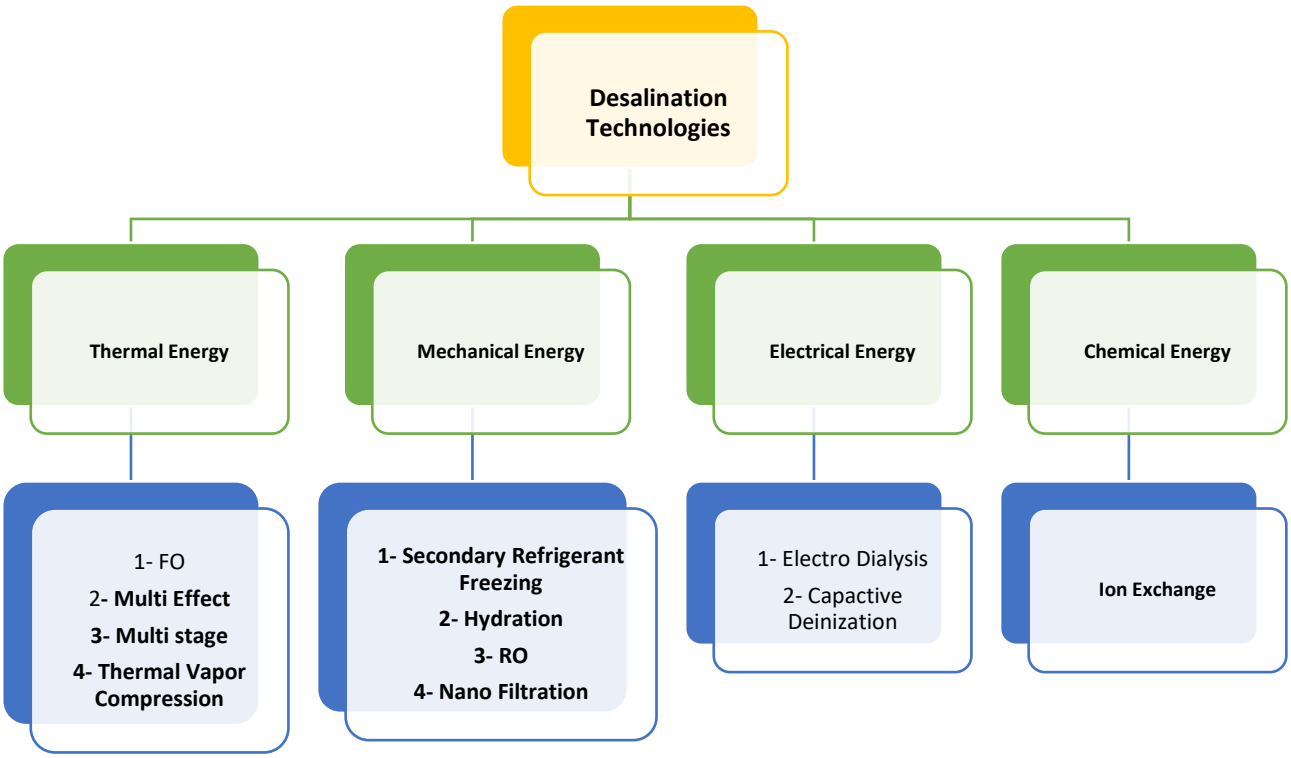


Figure 8: Classification of the desalination technologies according to the energy

Thermal Sludge Treatment

The sewage sludge mixture of solids and liquids resulting from the treatment of wastewater from various stages during the treatment. The different sludge types from various stages are collected and stored together. Usually the final destination of treated sewage sludge is land in the landfills (Schnell et al . 2020, Horst et al. 2020). The thermal sewage sludge treatment processes include:

1- Monoincineration,

2-Co-incineration

3- Alternative processes such as gasification and pyrolysis (Schnell, Horst et al. 2020).

The thermal treatment is expected to be the most important disposal way in the future and will become increasingly popular (Pająk 2013, Syed-Hassan, Wang et al. 2017). Thermal processes are mainly used before the anaerobic digestion of the sludge, as well as pre-treating sludge for dewatering (Werle and Wilk 2010).

Anaerobic digestion

Anaerobic digestion is a proven method for recovering methane from sludge. Biogas facilities are widely installed, according to Budzianowski (2016), but their operation requires large financial incentives. The use of co-digestion of sludge with other organic wastes as a feasible feedstock to overcome the barrier of insufficient digestion rate in field applications was advocated in this review. According to a review (Budzianowski, 2016), the transient response of pH and concentrations of inhibitory intermediates have a significant impact on the quantity and composition of biogas and biosolids, as well as the conversion of sulfur, phosphorus, and nitrogen during the anaerobic digestion process.

Education and Knowledge Sharing

WASH MSc Program

At German Jordanian University (GJU) in Amman, Jordan planning to start a master's program in Humanitarian Water, Sanitation, and Hygiene (WASH) and it is started in February, 2021. The main aim of this program to educate the WASH experts who wish to work in the

humanitarian field. It is the first master's program of its kind in the Middle East where conflict has often exacerbated already existing challenges in accessing water and sanitation.

WASH Bottleneck Analysis Tool (BAT)

The Water, Sanitation and Hygiene (WASH) Bottleneck Analysis Tool (BAT) by UNICEF "WASH BAT"[1] is an online tool to support the WASH sector to reach its sustainable development goal (SDG) targets by identifying the bottlenecks to sector progress, and enabling costed and prioritized sector plans to achieve the SDG targets on WASH.

The tool aims to assess the enabling environment for WASH service delivery by identifying and tracking the barriers to delivering sustainable and efficient services at national, regional, service provider and community levels. The performance of key factors in the enabling environment are scored, bottlenecks are identified, and activities for the removal of bottlenecks agreed, sequenced and prioritized. Costs are estimated, funding sources assessed, and additional funds are allocated to the activities according to their priority level (UNICEF 2019).

OCTOPUS platform

OCTOPIS is the first collaborative online platform on emergency faecal sludge disposal and treatment. Faecal sludge disposal and treatment is a significant problem in rapid onset emergencies. Low consideration is given to this issue when deploying emergency responses, and while general guidance and resources exist, improper decisions are often made. This generates health and environmental risks. To address this issue, the Solidarités International NGO has created the first collaborative platform called OCTOPUS. Intended for sanitation practitioners, OCTOPUS aims to provide them with a space for knowledge sharing, and to guide them in the development of their projects and decision-making (Chen, Zheng et al. 2021).

1- https://www.unicef.org/documents/review-wash-bottleneck-analysis-tool-bat-improving-wash-bat-tool-planning-and-partnering

5. Policies & Regulatory Frameworks

The policies and regulation regarding to the WASH sector that every country has pay attention to it refers to the laws, regulations, enforcement mechanisms, incentives, and processes that are employed by governments to ensure that essential services such as water supply and sanitation services (WSS) are available to the population at reasonable prices. The governance of the WASH sector involves making the proper decisions for the sector, and ensure that the implantation will be effectively (Mumssen and Triche 2017).

Regulation is necessary because WSS are natural monopolies and there is no competition in the market. As a result, there is little pressure on service providers to maintain service quality, operate efficiently to keep prices down, and serve marginal and less portable areas. This is true whether service providers are public or private, but the formal regulation of WSS became a topic of international interest in the late 1980s when the rising cost of infrastructure needed to serve expanding populations and protect the environment led policy makers to seek private investment.

Although institutional arrangements and approaches may vary from one country to another, regulation of WSS typically includes the specification of rules, standards, and procedures, and enforcement of rules and standards and decisions about market structure.

Rule-making includes the specification of regulations governing matters, such as:

- Principles, rules, and formulas governing tariff levels and tariff structure
- Procedures and conditions governing formal tariff reviews and automatic tariff adjustments (for example, to consider price inflation or movements in exchange rates)
- Service access and service quality standards and targets
- Technical and efficiency performance standards and targets
- Consequences (rewards or penalties) for achieving or not achieving standards or targets
- Requirements for operators to submit reports and publish information on service quality and performance, and for independent audits of such information
- Customer rights and obligations

- Requirements governing customer contracts, customer relations, and resolution of complaints
- Market structure and rules governing the tendering of operational contracts.

The EU Water Framework Directive (WFD)

Regarding to the economic activities, the population growth is increasing pressures on freshwater within Europe. In 2000, the EU Water Framework Directive (WFD) was adopted. The main task to take a pioneering approach to protect the water resources depending on the natural geographical formations which includes river basins.

The WFD is complemented by other, more specific, EU laws are:

- The Environmental Quality Standards Directive (2008)
- The Marine Strategy Framework Directive (2008)
- The Floods Directive (2007)
- The Groundwater Directive (2006)
- The Bathing Water Directive (2006)
- The Drinking Water Directive (1998)
- The Urban Wastewater Directive (1991)
- The Nitrates Directive (1991)

The Drinking Water Directive

The Drinking Water Directive (Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption) concerns the quality of water intended for human consumption. Its objective is to protect human health from adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean (Weinthal, Parag et al. 2005).

The Urban Waste Water Treatment Directive

The Council Directive 91/271/EEC concerning urban waste-water treatment was adopted on 21 May 1991. Its main objective is to protect the environment from the negative impacts of urban wastewater that discharges from the industrial sectors, and concerns the collection,

treatment and discharge of the wastewater from the residential and from the industrial areas in addition to the mixture of both of domestic wastewater and the industrial wastewater (Heathwaite, Dils et al. 2005).

This is illustrated in the figure9 below shows the articles for urban wastewater treatment directive covering the above-mentioned sectors.

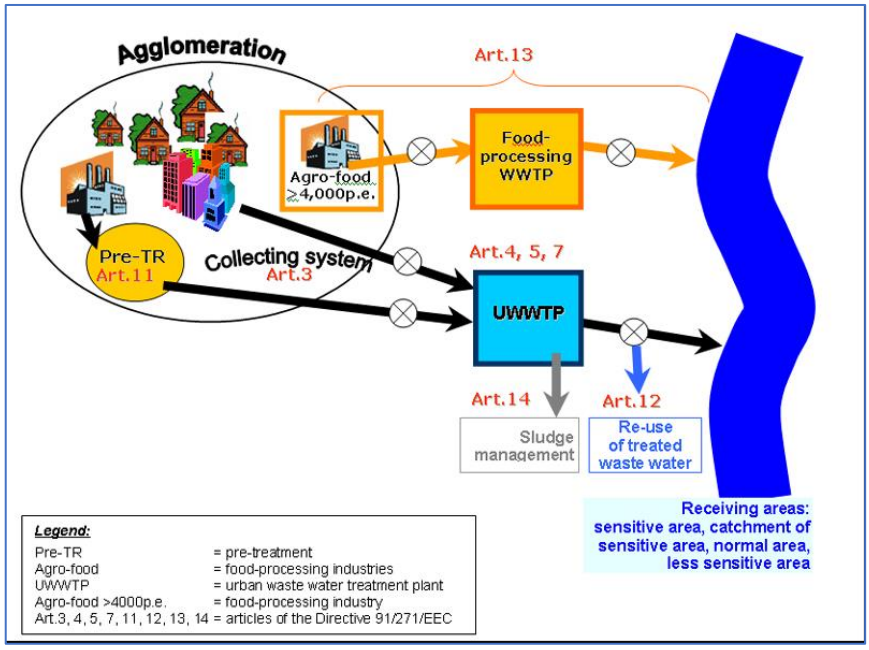


Figure 9: Illustration of Urban Waste Water Treatment Directive, source: European Commission

Four main principles are laid down in the Directive (Planning/Regulation/Monitoring/Information and reporting), where the requires of the Directive is to collect and treatment of the wastewater, secondary treatment of all discharges from agglomerations, pre-authorization of all discharges of urban wastewater, performance monitoring of the treatment plant and controls of sewage sludge disposal and the options to reuse it.

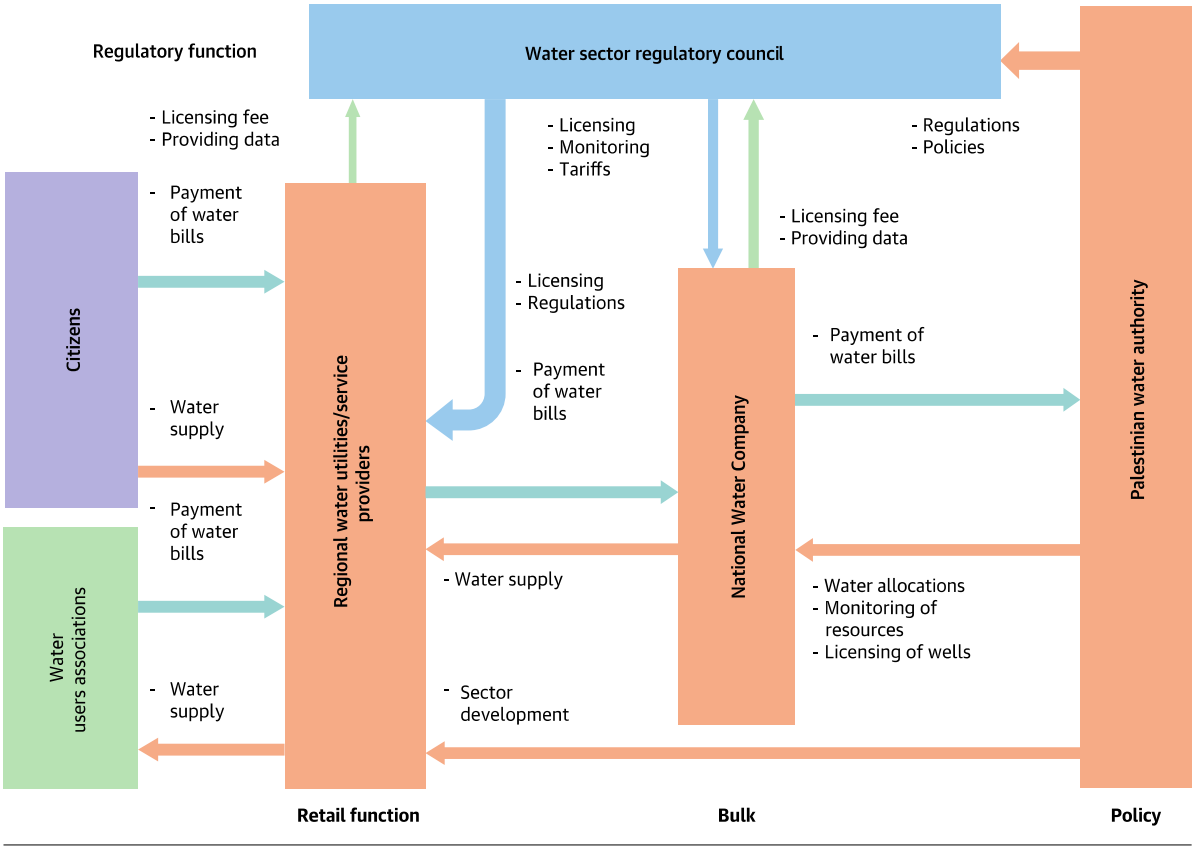
The European environment agency developed an interactive urban waste water map. The map reflects the most recent available information at the EU-level on implementation of the Urban Waste Water Treatment Directive (UWWTD) in EU 28 plus Iceland based on data reported by the Member States (for reference year 2018) in 2020.

The European Commission has evaluated the Urban Waste Water Treatment Directive to see whether the existing rules have reached their objectives, and whether they still serve their purpose. The assessment confirms that the Directive has proved very effective overall when fully implemented. The reduction of organic matter and other pollution in treated waste water has improved water quality throughout the European Union. Though implementing the Directive has been expensive, benefits clearly outweigh costs. Moreover, implementing the Directive remains crucial to meeting the objectives of other EU legislation, such as the Water Framework Directive and the Marine Strategy Framework Directive.

It worth mentioning that the implementation of the Drinking Water and Urban Waste Water Directives highlighting instances of non-compliance, indicating that also in Northern Mediterranean countries, there is a need for investment in WASH infrastructure. In fact, the EU Cohesion Fund aims to support specific Member States in improving water and wastewater treatment infrastructure towards compliance with the requirements of these two Directives. The European Environment Agency monitor and publish most recent available information at the EU-level on implementation of the Urban Waste Water Treatment Directive (UWWTD) highlighting the level of compliance in EU 28 plus Iceland based on data reported by the Member States (for reference year 2018) in 2020.

Water Sector Regulation in Palestine

West Bank and Gaza face~~s~~ enormous challenges related to water and sanitation access and services. Resource and implementation issues are exacerbated by the political challenges and related constraints facing the Palestinian people. As shown in Figure 10, yet despite or maybe because of these challenges, the Palestinian government has embarked upon what some may view as the most ambitious program of regulatory and institutional reform for the water sector in the Middle East and North Africa region. However, the reforms are at an early stage, and it may take up to 15 years putting the new structure in place. A key challenge is the delay in the transfer of regulatory functions from the Palestine Water Authority (PWA) to the Water Sector Regulatory Council (WSRC) which have left a governance gap as a result. Nonetheless, the series of staged reforms are attempting to provide more accountable service delivery in a sustainable manner.



Source: World Bank.

Figure 10 Functional Structure of the Water Sector Entities as Envisioned by the New Water Law of 2014 in Palestine, Source: World Bank

Water Sector Regulation in Egypt

Egypt is one of the few countries in the MENA that has established a specific water sector regulator dedicated to monitoring service provision. However, institutional challenges remain, including some overlapping responsibilities and the need to clarify and strengthen the role of the regulator. Since 2015, the government has made positive efforts to set up the necessary institutional arrangements that would improve overall sector performance, including the establishment of a dedicated management team within the Ministry of Housing, Utilities and Urban Communities (MHUUC), as well as efforts at tariff reforms designed to enhance financial sustainability figure 11 explain the institutional Framework of Egypt's Water Supply and Sanitation Sector. Moreover, a new Water Law providing clearer mandates and strengthening the regulator and the regulatory framework has reportedly been reviewed by a Council of Ministers and will be reviewed by Parliament. A capacity-building program for the regulator is under way.

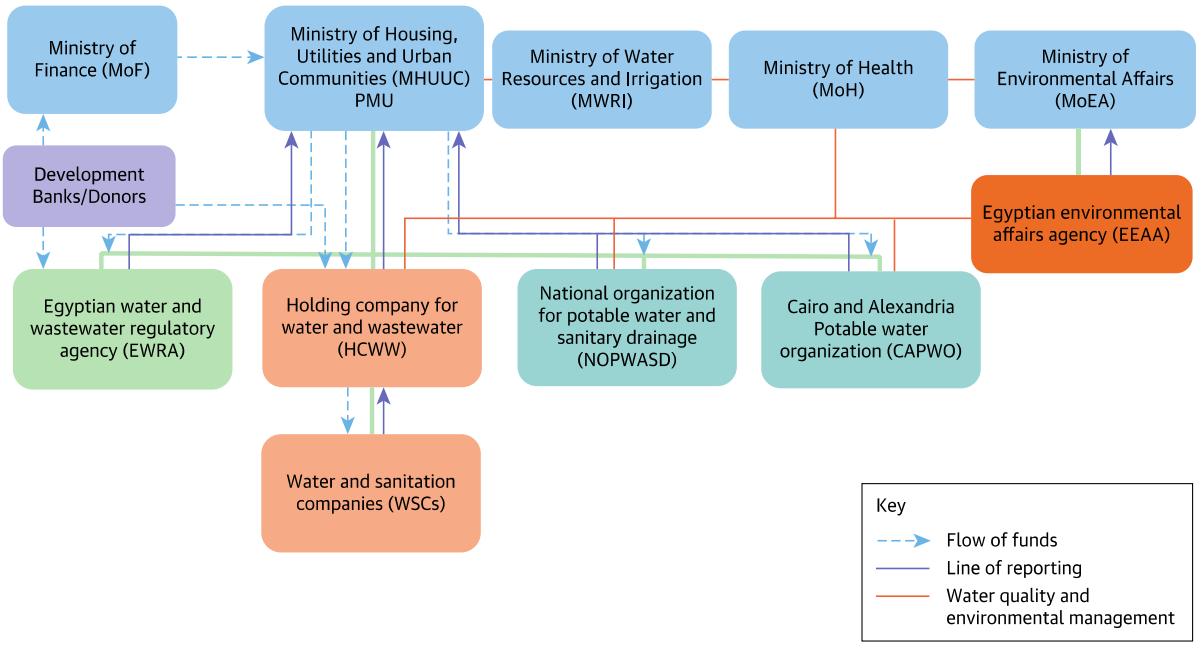
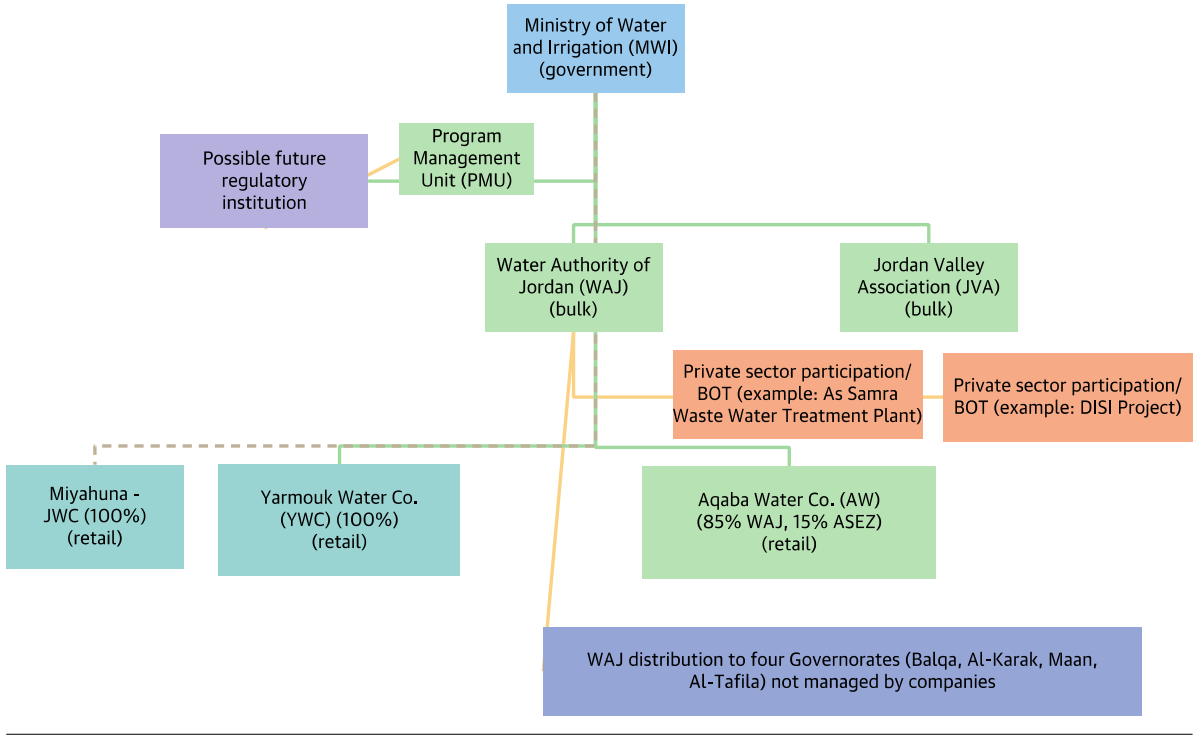


Figure 11: Institutional Framework of Egypt's Water Supply and Sanitation Sector, Source: World Bank

Water Sector Regulation in Jordan

Jordan is one of the world's most water scarce countries. Options for increasing water resources are limited and highly political. Further complicating matters, Jordan is host to a very large population of displaced persons. The Jordanian government recognizes the importance of sustainable water use, is taking steps to increase efficiency and awareness of this vital resource, and is working with partners and varied stakeholders, including the private sector, to increase the options available. The Jordanian water sector has historically been highly centralized and nationally integrated figure 12 explains the institutional framework of Jordan's water supply and sanitaion sector. The government is now moving toward disaggregation and devolution of responsibilities through the creation of ring-fenced service providers and the engagement of the private sector in key projects (Mumssen and Triche 2017).

A new Water Law is being drafted to reflect the objectives set out in the strategy documents. The new water law will define the structure and functions of the institutions governing and managing the water sector and clarify the responsibilities of the different ministries involved in the water sector. It will also clarify legal issues related to water.



Source: World Bank.
Note: ASEZ = Aqaba Special Economic Zone; BOT=build-operate-transfer; JWC = Jordan Water Company.

Figure 12 Institutional Framework of Jordan's Water Supply and Sanitation Sector, Source: World Bank

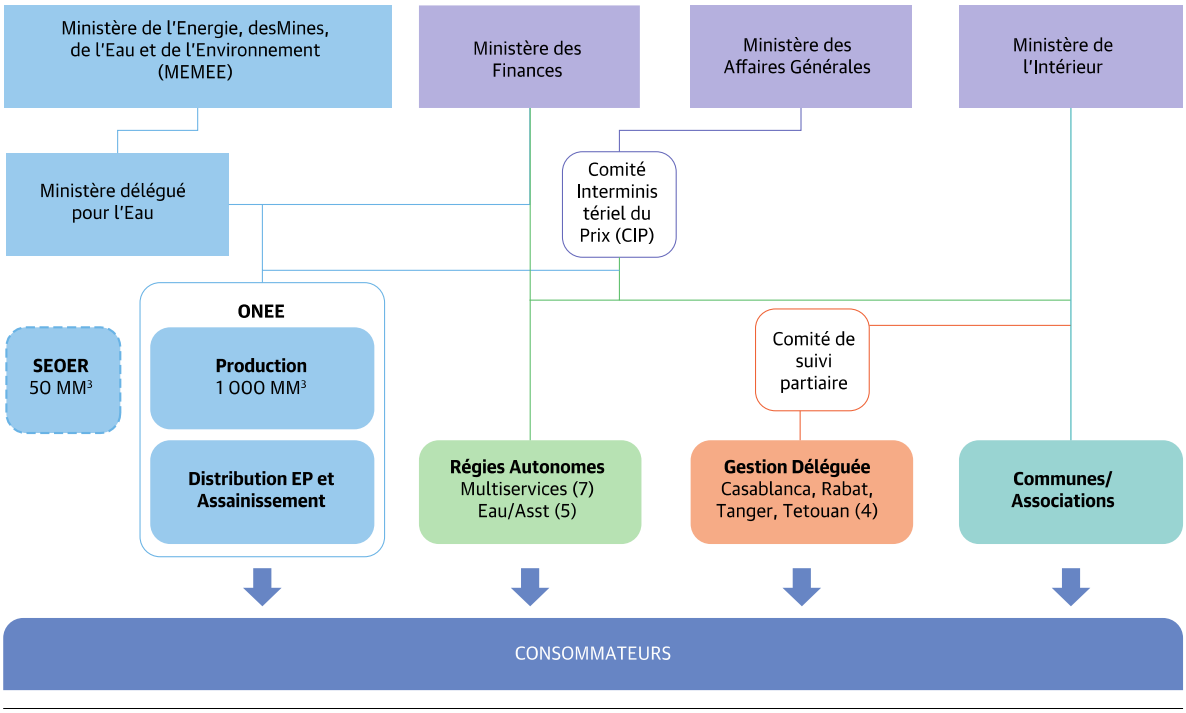
Water Sector Regulation in Morocco

Morocco has faced a number of challenges in managing water resources. Therefore, the government is focusing on increasing demand for drinking water in addition to providing sufficient water for agriculture sector to meet the nutritional needs of the population. The following Figure illustrate the statues of water and sanitation sector in Morocco. Many ministries are involved in managing this sector. The main ministry is Ministry of Equipment and Water. The Intermenstrual Price Committee (CIP) of the Ministry of Public Affairs and Governance plays an important role in setting tariffs.

A new law has been proposed and approved by Parliament Law number (36-15). The law aims to address some of Morocco's current and most significant environmental and water challenges. This law is likely to lay the foundation for many activities, investments and regulations in this sector in the future.

The government is exploring several options on how best to address the challenges in the water and sanitation sector, such as desalination projects. Integrated Urban Water

Management (IUWM) will be considered to help bring many disparate stakeholders together to examine more efficient, holistic and sustainable options (Mumssen and Triche 2017).



Source: World Bank compilations.

Figure 13 Institutional Framework of Morocco's Water Supply and Sanitation Sector Ministry of Equipment and Water., Source: World Bank compilation

Water Sector Regulation in Lebanon

The water sector in Lebanon is governed by law 221 of May 29, 2000 and its amendments, which is based on IWRM). The Law mandated the consolidation of all water agencies, committees, and projects into four water establishments, through which authorities have been defined for each as mandated in the Law 221 above. There are also exist several by-laws and regulations that also govern those public water establishments (Mumssen and Triche 2017).

Law 228 was issued in 2001, to induce private sector participation and to regulate and organize privatization activities through defining terms and scope. This law coordinates efforts of the economic sector when partnering with the public sector through defining

delegation rules, and monitoring privatization projects through independent regulatory bodies established under this law for those purposes.

The objectives of those laws were to distinctly separate between the overall general level and the lower detailed level of management of the sector, and to promote decentralization policies through giving more autonomy to the water establishments for their daily management of services. Law 228 encourages the water establishments to adopt commercial principles in their management, to qualify for future partnerships with the private sector. The extent of private sector participation is defined based on actual needs for providing the best services, taking into consideration the social and economic conditions (Mumssen and Triche 2017).

From a regulatory perspective, the Ministry of Energy and Water (MOEW) is mandated with those types of responsibilities in addition to its main role of managing water resources figure 14 explain the intuitional framework of Lebanon's water supply and sanitation sector. In this context, the MOEW is mandated to technically monitor the four water establishments, including provisions for pollution prevention, setting standards, and ensuring compliance with pertinent legislations. Moreover, the Ministry performs financial monitoring in liaison with the Ministry of Finance. However, such monitoring and control responsibilities of the MOEW are greatly hindered by weak or limited enforcement capacity due to the absence of needed statutory and regulatory instruments.

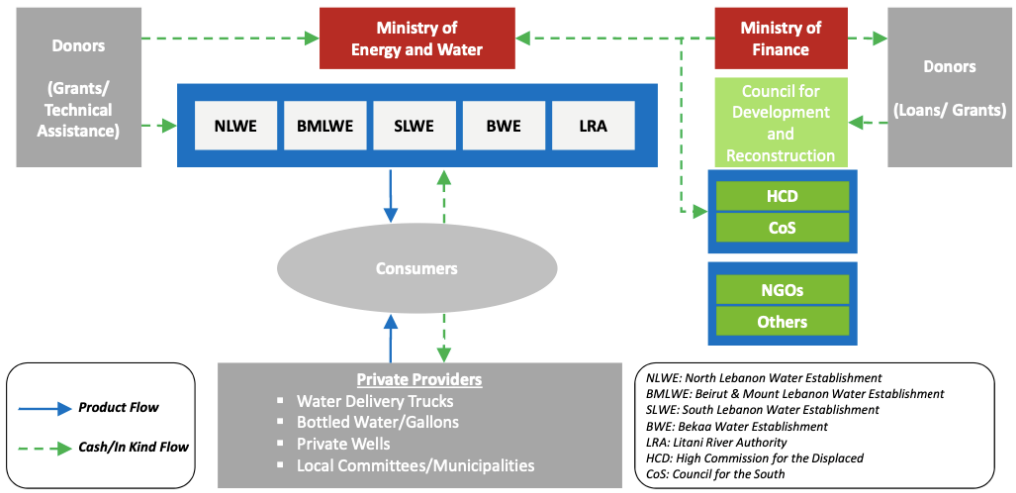


Figure 14 Institutional Framework of Lebanon's Water Supply and Sanitation Sector, Source: World Bank compilation

6. Financial Sustainability

The sustainability of the financial in the WASH sector mainly focuses on how governments, donors, and the private sector responsible for the services in WASH sector to ensure revenue streams to cover operating and maintenance costs and infrastructure renewal (UNICEF 2011). Financing WASH Services sustainably – in the sense of securing service delivery after implementation has proven to be a challenge. Providing sustainable WASH services requires sound strategic financial planning to ensure that existing and prospective resources are appropriate for investment needs and costs of operating and maintaining services. Accounting for the capital maintenance, direct and indirect support costs in the life-cycle of services is often "forgotten" and the mechanisms and institutional changes catering for them left unaddressed (Mumssen and Triche 2017).

Considerable effort has been done towards scaling-up coverage of WASH services in recent years. Sustaining these services in the long-term is crucial. Supplying water as well as providing sanitation and hygiene services incur financial cost not only with regards to initial capital investments, but also during operation and maintenance, rehabilitation, upgrading and expansion phases. Financial sustainability focuses on how the governments, donors, civil society and private sector that are responsible for WASH services can ensure revenue streams to cover all costs (AGUASAN 2012).

The most important aspect in financial sustainability is the planning process. With initial capital expenditure the service level raises. However, if maintenance and service security is not planned in terms of costs and responsibilities, the service level drops in the long-run and leads to disappointment (Uandela et al.2010)). Therefore, cost and finance planning must be an integral part of ensuring sustainability, and the elements of the following Financial Sustainability Framework have to be considered for sustainable finance planning (AGUASAN 2012).

UfM Financial Strategy for Water promotes the financial sustainability of the Mediterranean water sector in order to secure the social, economic and environmental benefits to be gained from the implementation of the UfM Water Agenda. Its main message is that UfM member states need to approach water financing in strategic way, and combine making the best use of existing financial resources with mobilizing additional domestic and international financial resources. The Financial Strategy for Water sets ten common strategic objectives and a menu of actions that individual countries are expected to prioritize and implement according to their individual circumstances, priorities, and capacities (UFM, 2020).

The UfM with the EU Delegation in Egypt and support of the League of Arab States, have implemented a regional event titled "EU-UfM Water Governance & Business Forum – Cairo, October 2019". The forum listed a result of actions implemented and recommendations towards financial sustainability of WASH services in the Mediterranean region (UFM, 2020):

- There is an urgent need for attention and action by all stakeholders to mainstream and coordinate efforts towards meeting the Sustainable Development Goals and Targets, in particular SDG 6 on Water.
- Action has been taken and there are several ongoing initiatives on climate in the Mediterranean region; their implementation faces tremendous financial challenges. External and international climate finance is an important instrument for bridging the financial gap.
- Key issues: Public-private partnerships and the WASH sector. Having a roadmap for regional action, guiding the financing and investment in the water sector would be a valuable asset and the EU-UfM Water Governance & Business Forum aims to assist with this.
- Having a roadmap for regional action, guiding the financing and investment in the water sector would be a valuable asset and the EU-UfM Water Governance & Business Forum aims to assist with this.
- While yet very little public-private partnerships (PPPs) or other similar schemes are successful in Egypt, it is important to address Egypt's transitional phase with several structural reforms and a clear interest for private sector participation. Such endeavours require a strategic and direct discussion with the private sector, investors, and

international financing institutions to discuss the required means to cover the financial gap, key challenges in financial, legal, and institutional terms, means to support public-private partnerships in the water sector, and the required actions to create an enabling environment to foster local and international partnerships.

We need to pay attention to when we want to promote sustainable development in water, sanitation and hygiene. We need to take into account financial, institutional, environmental, technological and social aspects of sustainability (Uandela, Batchelor et al. 2010).

7. WASH partnerships

Usually, the WASH partnerships work on long-term prevention to improve health and improve the social and economic development. The public-private partnership (PPP), between an agency of the government and the private sector for a long-term nature that can be used to finance, build, and operate the WASH projects. PPP can be a mechanism that help the governments fund much needed investment that can improve the financial sustainability and the performance the WASH sector. PPP models vary widely, it is challenging to generalize the responsibilities and tasks of each actor (e Silva, Cools et al. 2020).

The water sector in most developing countries is chronically underfunded and ineffective. This problem translates into a shortage of clean drinking water, adequate sanitation and wastewater treatment, which has significant implications for people's health (United Nations Report, 2020). In the water and sanitation sector, many types of PPP can be used. For example, a public-private partnership for bulk water supply, operation and maintenance (O&M) purposes, service management, refurbishment of existing networks, increased treatment capacities, and improved performance of existing facilities (e Silva, Cools et al. 2020). The successful PPP can be described as a PPP that improved the water and sanitation service for residents and creating win-wins for both public and private actors.

The private sector involving is very useful to counterbalance the limited efficiency of government institutions in addition to their limited financial resources, technological know-how and relevant personnel (Ayee and Crook 2003). The types of public-private partnership are generally categorized on the basis of the different levels of participation of private actors. Although there are many potential models for public-private partnerships. An important component for private actors considering engaging in a public-private partnership is risk mitigation. However, one thing must realize that reducing and mitigating risks are closely related concepts (Rafaat, Osman et al . 2020).

In large parts of the MENA region, due to strained public finances, private investment is required to accommodate for the rising infrastructure needs (OECD 2015).

Build-Operate-Transfer (BOT) and Design-Build-Operate (DBO)

Particularly in desalination and wastewater treatment plants, have become a solid business line in many emerging countries with good competition from a large and growing number of international players as well as regional players from developing countries. This is an area where private financing can be raised, often with the help of risk mitigation tools such as guarantees. These projects do not usually involve the challenges of the private sector managing an existing public workforce or an interface with household customers, but they bring the benefits of private investment, expertise and technology and sustainable operations. Usually, it's a new build in nature and do not carry the risks of existing assets.

Performance-Based Contracts (PBCs)

For activities ranging from reduction of non-revenue water, leakage management to increasing connectivity have proved to be useful tools in increasing efficiency and expanding connectivity (for instance Ho Chi Minh City in Vietnam where a PBC leakage contract resulted in almost half the pre-project amount of leakage, with the amount of saved water equivalent to what would be needed to serve an additional 500,000 people and saved power (23,000 kwh/d)). These projects focus on results, with payments conditional on the achievement of outputs. Often these projects do not involve the private sector taking over the management of the overall utility, so the public sector is still running the day-to-day operations but benefiting from private sector expertise in key areas. A substantial element of these contracts is typically knowledge transfer and capacity building of the utility workforce.

Performance/ output on based management contracts

Significant number of performance/ output-based management contracts have been implemented in the MENA (Algeria, Saudi Arabia, Oman), Latin America (Tegucigalpa in Honduras, Colon in Panama) and Africa (Congo DRC), some with regional private operators (such as SDE in Senegal which won the Congo DRC contract). Some of these involve the management of the utility being outsourced to a private operator, whilst others bring systems and expertise to work alongside existing management;

Small scale private operators are becoming more and more commonplace in developing countries, with many donor-sponsored water or sanitation PPP projects for rural and peri-urban areas having been successfully implemented and scaled up, with new local operators emerging.

Example of PPP from Southern Mediterranean Countries

Egypt: The affiliated companies under the HCWW in Egypt operate wastewater treatment plants in a total capacity of 6,493,000 m^3/day. Whilst other private companies operate wastewater treatment plants in a total capacity of 3,107,000 m3/day. Similarly, while the affiliated companies operate desalination plants in a total capacity of 115,900 m^3/day, other private companies operate desalination plants in a total capacity of 50,100 m^3/day.

The affiliated companies also operate surface water treatment plants in a total capacity of 24.39 MCM/day. Whilst other private companies operate surface water treatment plants in a total capacity of 610,880 m^3/day. For the first time, and through a PPP setup, a private wastewater treatment company in New Cairo is utilized to perform tertiary treatments in a total capacity of 250,000 m^3/day.

In regard to the PPPs in Egypt, many researches have studied the risk of PPPs in Egypt (Hannoura and Director 2011). The results of the research enable the development of an effective risk distribution framework for public-private partnerships in the water sector in Egypt in the early stages of project development. Egypt has adopted an ambitious program of economic reform and structural adjustment to increase private sector participation in public infrastructure services, and more political work is still needed to enhance and implement the long-term PPP program (OECD 2015). The PPPs procurement in Egypt follows the "Private Financing Initiative (Hannoura and Director 2011).

Jordan**:** The role of the private sector is being expanded with management contracts, concessions and other forms of private sector participation in water utilities being considered and adopted as appropriate. The concepts of BOT/ Build-own-operate (BOO) are also implemented. The private sector role in irrigated agriculture is also encouraged and expanded through Water Users Associations (WUAs). Furthermore, and since MWI (Ministry of Water

and Irrigation) started to promote PSP and PPP approaches in the water sector, Water Authority of Jordan (WAJ) established the three limited liability companies (Miyahuna, AW and YWC, 2017) (van den Berg et al. 2017) that provide services to six of the 12 governorates in Jordan, and provides the remaining six with services itself with initiatives of functional outsourcing in three of them. AW and YWC were given title to the assets in the Assignment Agreements, but Miyahuna was provided only with the right to use the assets.

WAJ has also been responsible for all wastewater treatment and disposal throughout the kingdom, but handed over responsibility for this function to the corporatized companies in their respective Assignment Agreements. The major As-Samra wastewater treatment plant is a BOT project serving both Amman and Zarqa governorates, and managed by WAJ. The remaining parts of Jordan are served by WAJ administrative units (Mistarihi, Al Refai et al. 2012).

PSP also has been applied through outsourcing services and the involvement of the private sector in different functions/business processes in operation and maintenance of water supply and water disposal, whereas service contracts on billing and revenue collection and network operation & NRW (Non-Revenue Water), have been put into application. Such contracts have been developed to be contracted out implementing the performance-based compensation. Another example for private sector involvement is the Improvement of Energy Efficiency Program supported by German International Development Agency (GIZ) where the MWI and WAJ developed an approach for performance-based energy service contracting in the water sector (Humpal et al. 2012).

Lebanon**:** Several forms of partnering with the private sector were applied in Lebanon, such as services contracts, management contracts and others. Previously, there were no laws or regulations in place that supported establishing partnerships with the private sector for the management of the water sector on a larger scale. Currently, the need is to develop on laws that would enable BOT contracts, in an effort to finance large scale projects. In terms of partnerships with the private sector, the North Lebanon Water Establishment worked on such a partnership through a service and management contract for the city of Tripoli with the support of the French Agency for Development (AFD).

PPPs can be crucial way for Lebanon to rehabilitate its infrastructure and solve sectoral bottlenecks thus paving the way for job creation and inclusive growth. Nonetheless, a revision of the fiscal motivation of engaging in such initiatives is needed.

8. Case Studies

	**Morocco**
WASH Service Framework in Morocco	In Morocco, drinkable water access in cities is about 100%, in rural areas is near to 97%. in the other hand, sanitation is pretty much generalized in cities but it was noted that a slow process to generalize sanitation in rural areas which still about 15% of rural population.
COVID-19 impact on WASH in Morocco	WASH sector has been reacted well to COVID-19, especially in Provision and Distribution. But we note some problems in paying bills by some consumers.
Priorities and/or actions related to the WASH sector in Morocco	Nowadays, Morocco work on a national plan of water access in the purpose to generalize the access of water in all territory. But the actions need to be taken in sanitation sector.
WASH innovative solution(s) in Morocco	Morocco work with a strategy, the important points of this strategy are: construction of dams, water reuse, and desalination of seas water.
Lessons learnt from WASH policies and regulatory frameworks in Morocco	The problem is concentrated in rural areas, we must provide a sustainable resource for population
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Morocco	Supporting the investments in rural areas
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Morocco	No Answer
Successful WASH service delivery partnerships in Morocco	There is some examples of PSP and PPP in Morocco, but still insufficient, the PSP and the PPP need to be expanded.
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Morocco	Desalinization of seas water is a new technic that need innovative solutions because of the high price of the meter cube of drinkable water in output.

Future prospective towards achieving a sustainable WASH service in Morocco	To achieve a sustainable WACH service, Morocco will invest in more Dams, reuse water, Desalinization and water use economy.

Here are the latest figures for water and sanitation service levels for Morocco from JMP database in year 2017.

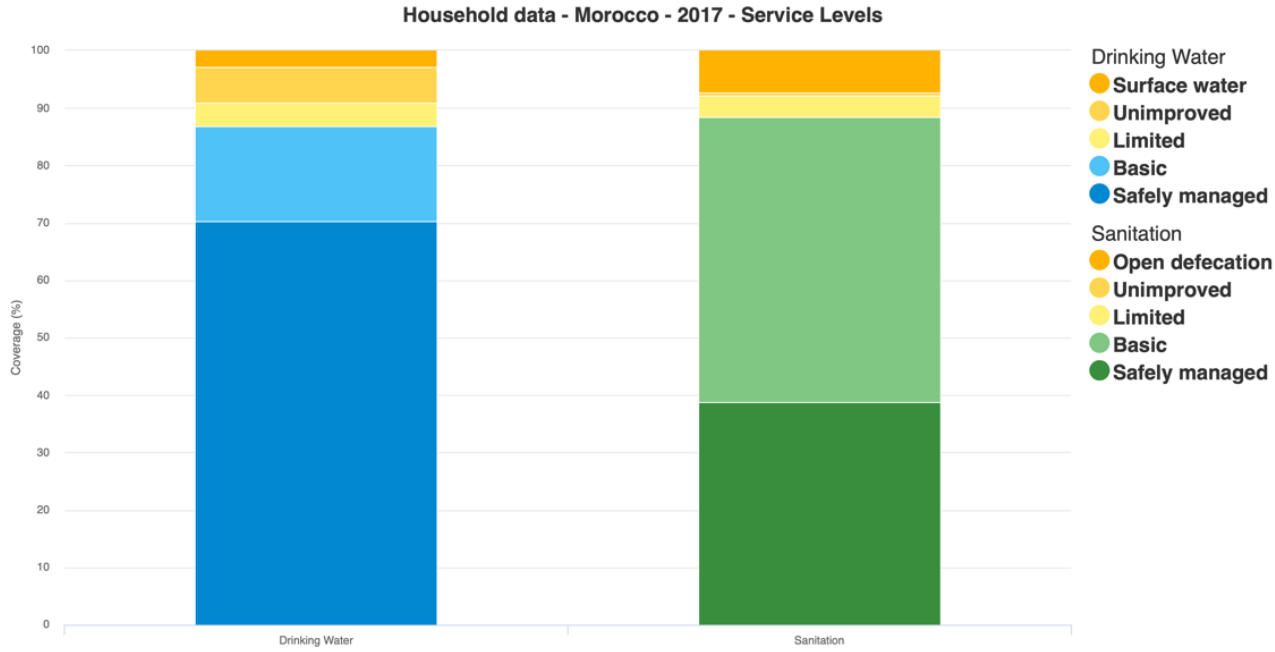


Figure 15 Water and Sanitation Service Levels in Morocco-2017, Source: World Bank

Malta

WASH Service Framework in Malta	The Water Services Corporation (WSC) provides comprehensive WASH services in the Maltese islands. Water intended for human consumption is a mix of groundwater and desalinated sea-water (at a 40:60 ratio). The water supply is disinfected and meets all the mandatory quality parameters of the EU Drinking Water Directive. The water supply network is spread over the whole islands, where a connectivity rate of 100% has been achieved. The mean consumption of urban water stands at 110 liters per capita per day. All wastewater is collected in the sewerage system (100% connection rate) and conveyed to three Urban Wastewater Treatment Plants, where it is treated to the requirements of the EU Urban Wastewater Treatment

	Directive prior to its discharge to coastal waters. The wastewater treatment plants include a further tertiary treatment phase, which produces a high-quality effluent which is then used for agricultural irrigation. Discharges to the wastewater network are regulated, in order to protect the resource value of sewage in view of its reuse potential.
COVID-19 impact on WASH in Malta	The COVID-19 pandemic has resulted in significant changes on the water consumption patterns, with relevance to demand shifts between areas. This was mainly a result of increased "work from home" conditions which shifted daily water demand from office/commercial areas to residential zones, an increased emphasis on personal hygiene which resulted in an increased per capita demand and a reduced number of visiting tourists which limited water demand from tourism areas. These changes in the water supply characteristics required increased planning to adapt water supply strategies to the new reality. From a qualitative aspect, increased attention was paid to disinfection of water intended for human consumption to ensure acceptable disinfection levels throughout the whole network. The water utility also increased security measures to protect key technical employees involved in ensuring water and wastewater services. Key technical procedures were also upgraded to ensure remote connectivity should cases of COVID-infections arise within water or wastewater installations. The Water Services Corporation is also participating in studies on the monitoring of COVID-19 in wastewater as an indirect indicator of the presence of the virus in the population.
Priorities and/or actions related to the WASH sector in Malta	• Continued improvement of the specific energy consumption of the desalination plants • Improving the taste of urban water, through better management of disinfection • Upgrades to the wastewater collection network, to reduce sea-water infiltration • Increase in wastewater treatment capacity (to meet projected increase in wastewater flows due to increased water demands) • Overall improvement in the energy required for the transferring of water and wastewater through the associated networks • Maintaining low values for leakages from the urban water distribution network
WASH innovative solution(s) in Malta	• Energy efficient desalination of sea-water

	• Leakage Management and Control (step=testing methodologies) • Reclamation of wastewater for irrigation and landscaping purposes
Lessons learnt from WASH policies and regulatory frameworks in Malta	Following widespread water shortages in the 1980s, Malta invested in the desalination of sea-water to meet the growing water demand. By the mid-1990's, five desalination plants were commissioned vastly increasing the water production capacity but still water demand was not met. The situation was not sustainable, and therefore a decision was taken to initiate a leakage identification and control program. At the time, leakage rates accounted to around 60% of the total water production. The leakage management program was a success, ensuring that national water demand was reliably met. It also led to a reduction in the production need for water which by the year 2000 was reduced by 40%, effectively meaning that two of the desalination plants could be decommissioned, and the remaining three operated at half-capacity. This clearly shows that water supply augmentation measures need to be implemented in parallel with water demand management measures, and that desalination of sea-water needs to be complemented by distribution network upgrades. Furthermore, Malta has also invested significantly in the optimization of energy use for sea-water desalination through the installation of energy recovery technology. The application of this technology has reduced the specific energy requirements of the desalination plants from a high of 7kWh/m^3 to less than 4kWh/m^3 today. Leakage management and energy optimization has significantly reduced the energy needs for WASH services provision, making such services increasingly sustainable.
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Malta	• WASH Service Provision is a priority funding element under the EU Cohesion Funds • Water supply tariffs ensure a high level of cost-recovery for WASH services provision
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Malta	

Successful WASH service delivery partnerships in Malta	BOT operational models have been used in the development of sea-water desalination plants and wastewater treatment plants.
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Malta	• Innovative wastewater treatment technologies, including but not limited to energy recovery processes • Energy efficiency in the provision of desalination services • Optimization of urban water disinfection services with a view of optimize the taste of water supplied to the population
Future prospective towards achieving a sustainable WASH service in Malta	Increased operational efficiency to ensure better service sustainability

Here are the latest figures for water and sanitation service levels for Malta from JMP database in year 2017.

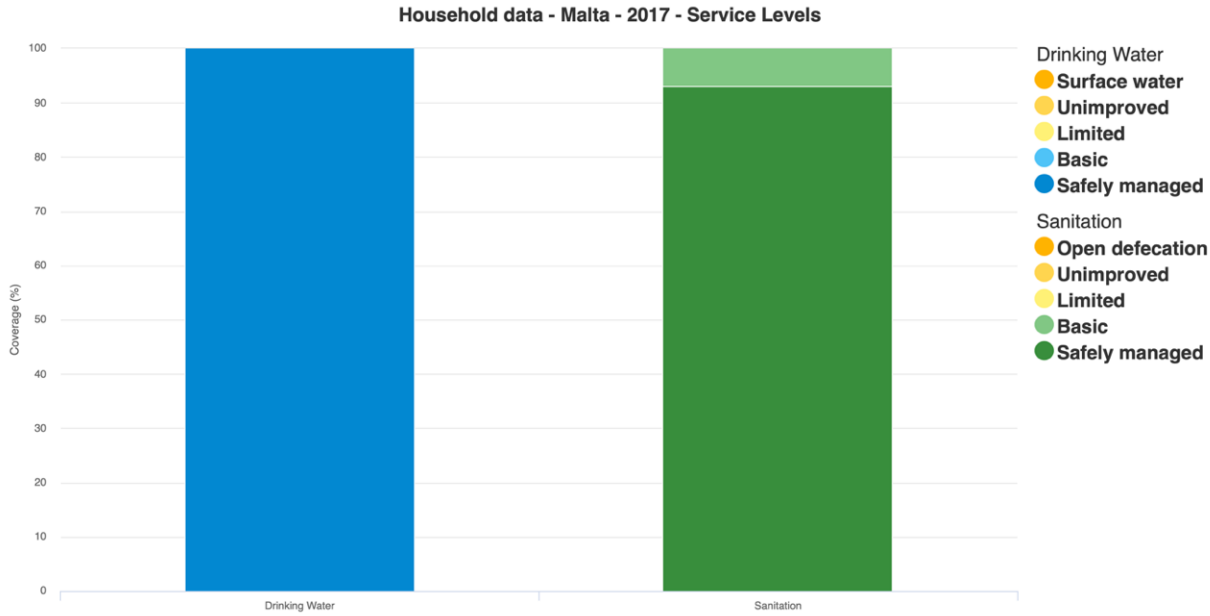


Figure 16 Water and Sanitation Service Levels in Malta-2017

	Turkey
WASH Service Framework in the Republic of Turkey	In Turkey, in order to protect human health, many regulations including laws, by-laws and communiques have come in force to create an organized ground for drinking water management and sanitation services. Many institutions are involved in the drinking water management sector in order to evaluate drinking water management strategies from various aspects such as Ministry of Health, Ministry of Agriculture and Forestry, Ministry of Environment and Urbanization, Metropolitan Municipalities, Local Administrations (Municipalities, Special Provincial Administrations and Villages) are tasked with providing water and sewerage infrastructure services. A serious number of regulations were adopted in line with the EU legal framework, relating to discharges of dangerous substances into water, quality of surface water intended for the abstraction of drinking water and protection of water against nitrate pollution from agriculture. The legal framework on monitoring surface and groundwater entered into force in 2014. Besides, the infrastructural investments are ongoing in an inclusive manner to meet the needs of increasing population. By doing so, 87 % of the Turkey's population has an access to waste water and sanitation services. There is no lack of legislation on the supply of drinking water in Turkey, and the whole population has an access to safe drinking water services.
COVID-19 impact on WASH in the Republic of Turkey	• Safe water supply, sanitation and hygiene conditions are essential to protect human and whole living beings' health, as well. This affirmation is even more true during a global pandemic particularly in response to Covid-19. • Taking necessary precautions to avoid any malfunction in the operation of drinking water treatment plants and wastewater treatment plants to disinfect the effluent before discharge "Water, Sanitation, Hygiene and Health (WASH)" document published by the World Health Organization (WHO) on March 3, 2020 has been translated into Turkish. For the purpose of informing, an official notification dated 17.03.2020 was sent to 81 Provincial Governorships. It is stated in the document for effective central disinfection, the contact time should be at least 30 minutes at pH <8.0 (less than 8) and should be delivered to the end consumer with a free chlorine concentration around 0.5 mg / L. • "Assessment of Sars-Cov-2 virus transmission from wastewater through reuse of used water" report was prepared and sent to the 81 Provincial Governorships with an official notification dated 10.04.2020 in order to be sent to relevant institutions and organizations to the

	accordingly. With the scope of the report necessary precautions should be taken to avoid irrigation especially the vegetables eaten raw with undisinfected wastewater • "Nationwide SARS-CoV-2 Surveillance Study of Turkey for Monitoring of Covid-19 Spread" project has been initiated by Ministry of Agriculture and Forestry of Turkey in April 2020 with the start of the pandemic. The project has been coordinated by of Turkish water Institute (SUEN) with support of State Hydraulic Works, General Directory of Food and Control and General Directory of Water Management which are the divisions of the Ministry. Marmara University Environmental Engineering Department is the principal investigator and scientific advisor of the project. University of Health Sciences take part in the Project as scientific advisor of molecular analyses.
Priorities and/or actions related to the WASH sector in the Republic of Turkey	• Establishing an integrated water resource management model • Developing a national basin-based classification system in a way that allows for the conservation and sustainable use of water resources • Identifying and monitoring the quantity and quality of water bodies (both the groundwater and surface water) as well as the protection and improvement of water resources, the prevention and control of water pollution • Securing the water supply system from source to tap for the entire urban and rural population, improve the water distribution networks to prevent water losses/leaks. • Ensuring financial sustainability in the provision of drinking water and sanitation investment and services • Mainstreaming water treatment facilities and operate them in line with the standards based on the required environmental protection level and classification of water basins • Promoting the reuse of treated wastewater • Water savings in the basins by assessing the effects of climate change and all activities on water quality and quantity in basins.
WASH innovative solution(s) in the Republic of Turkey	Turkey is one of the world leaders in the transfer of irrigation schemes to water users' organizations. The transfer of almost all large surface irrigations schemes (half of the total irrigated area) developed by the state to water users, associations has been completed. Importance given to water Turkey focuses on effective and efficient use of water. Thanks to the legal regulations, the municipalities and water administrations must reduce the rate of water loss averaging 25% by 2023. In this context, the necessary institutional activities are being carried out in

	accordance with the provisions of the Communiqué on Technical Procedures to be issued pursuant to this Regulation and the Regulation on Drinking and Potable Water Supply and Distribution Systems. "Regulation on the Control of Water Use and Reduction of Water Losses in the Irrigation Systems" was published in 2017 to control water use and mitigation of water losses in the irrigation systems. The National Water Plan aims to stipulates the boost in irrigational efficiency to 55% by 2024. Thanks to the "Evaluation of Reuse Alternatives of Used Water Resources Project" Pre-feasibility Reports are being prepared in order to reuse of used water resources across 25 river basins in Turkey. In this sense we aim to increase the rate of reuse of used waters from 2% to 5% by 2023.
Lessons learnt from WASH policies and regulatory frameworks in the Republic of Turkey	The predicted effects of growing water demand, driven by drought, urbanization, industrialization, and climate change, are likely to aggravate water scarcity even further in Turkey. Sustainable management of water policies through the long-term protection of water resources and the development of alternative sources of freshwater is critical to address the growing water scarcity problem as a big challenge for the WASH Sector.
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in the Republic of Turkey	There is need to evolve options for leveraging public and development finance, notably with blended finance, and to improve focus on the project development process and strategic investment pathways, to inform the sequencing and design of investments.
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in the Republic of Turkey	In Turkey, water resources, which are already under pressure, becomes much more vulnerable due to the impacts of climate change. Failure to meet the eligibility requirements of the relevant international financing institution in terms of protection measures can be a challenge for financing projects.
Successful WASH service delivery partnerships in the Republic of Turkey	Water and sanitation infrastructure projects are carried out by local administrations with the contribution of central government across Turkey. Under the Water and Sewer Infrastructure Project (SUKAP) launched in 2011, investments by local administrations are supported with the funds transferred from the central budget. ILBANK is implementing the Program with technical and financial support from the World Bank (WB) and European Union (EU). The program aims to help municipalities: (i) respond to current and increasing demands for urban services;

	(ii) plan for future infrastructure service needs in a sustainable manner; (iii) mobilize financing to fund priority investments; and (iv) adhere to new spatial planning mandates and infrastructure service requirements as prescribed by the amended Metropolitan Municipality Law No 6360 in December 2012. The main goal of the Program is to improve the planning capacity of and access to targeted municipal services in participating municipalities and utilities. The Program was designed as a series of projects (SOP). The SOP instrument is suitable as it allows for the provision of financing to a single borrower, ILBANK, for subnational lending to a gradually increasing number of municipalities or utilities that are interested in a sustainable cities approach to municipal development.
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in the Republic of Turkey	It is important to increase the banking capacity of Ilbank in accordance with the international governance principles of investment and development banks, and the technical capacity to implement EU Directives; to increase the capacity of consultancy services to be provided to municipalities; to increase the capacity in the development of appropriate methods for small and medium municipal wastewater treatment in Turkey.
Future prospective towards achieving a sustainable WASH service in the Republic of Turkey	Capacity building, exchange of know-how, sharing best practices and experience, mobilization of resources and enhanced infrastructural investment in water-energy-food nexus and WASH services as well, are essential to a sustainable and resilient recovery and integrated water resources management.

Here are the latest figures for water and sanitation service levels for Turkey from JMP database in year 2017.

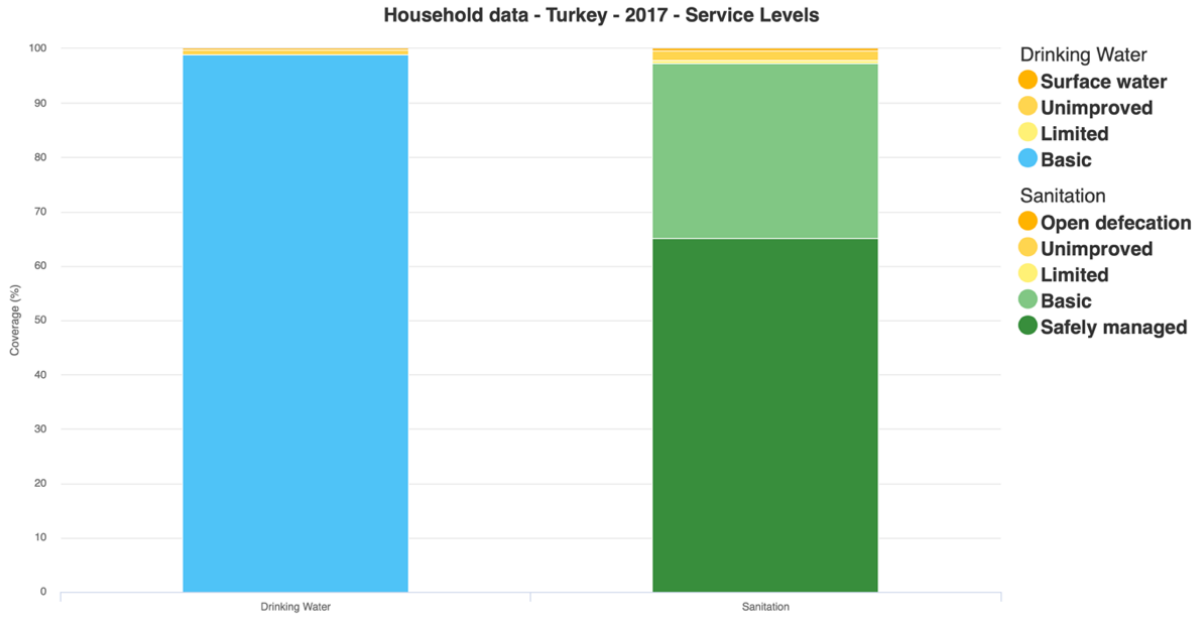


Figure 17 Water and sanitation service levels in Turkey-2017

	**Egypt**
WASH Service Framework in Egypt	Drinking water supply and sanitation sector in Egypt is characterized by both achievements and challenges. Despite the rapid population growth: (i) The current coverage of safely managed drinking water sources in Egypt is about 98.7% (100% for urban areas, and 97.4% for rural areas); (ii) The current safely managed sanitation is about 65% (96% for the urban areas, and 37.5% for rural areas), it was about 50% in 2014. Increasing access to safe drinking water, adequate sanitation services and improving water resources management are central to the basic right of every human being. Egypt has set an ambitious water agenda in that regard. In addition, Egypt has also taken several measures to meet the Sustainable Development Goals targets for drinking water and sanitation. The government has made the water and sanitation sector more equitable and sustainable according to the following facts & figures: (i)Complete 1131 projects for drinking water and sanitation in cities and rural areas with a total capacity of 10.8 million cubic meters per day for drinking water, serving 50.6 million people, and 6.7 million cubic meters per day for sanitation in order to serve more than 45 million people; the total cost for those projects was about EGP 124 billion. (ii) Implementing 5.8 thousand rehabilitation projects, with a total amount of about EGP 9 billion; (iii) Implementing 176.4 thousand household connections with a total amount of about EGP 600 million. (iv) 200 projects including projects to increase the capacity of different projects covering all the governorates at the national level with an amount of about EGP 455 million pounds. (v) In addition to EGP 40 billion to improve the water and sanitation projects in the new cities. (vi) To sum up, the total investment in the water and sanitation sector is about EGP 174 billion during this period. In addition, the government aims to achieve four main objectives: Reducing water physical and commercial losses, improving water pressures, rehabilitation of networks, in addition to improving the efficiency of the service provided to citizens.
COVID-19 impact on WASH in Egypt	Since the availability and access to water, sanitation and hygiene is fundamental to fight the virus and preserving the health and well-being of millions. COVID-19 will not be defeated without access to safe water for people, especially those who are vulnerable. Low access, reliability, and the quality of water, sanitation, and hygiene (WASH) present risks in developing countries. Large cities also face risks stemming from population density and informal settlements. Identifying pandemic “hotspots” pointed to

	the cramped living conditions of cities and inadequate public services, especially inadequate waste management and sanitation, as significant sources of risk for contagions in large developing market cities. Some actions have been taken in Egypt such as (but are not limited to): • Addressing historical gaps in the water supply through emergency facilities such as water trucks. • Has set up water supply points across the country for hand washing. • A clear awareness lesson from the crisis is water and sanitation systems to underserved areas must be expanded and improved. • Accelerate "Water and sanitation projects" implementation schedule and adapting their construction plans. • Rapid Assessment: personal hygiene item needs such as soap (for personal hygiene and laundry), water collection and storage containers
Priorities and/or actions related to the WASH sector in Egypt	• Use Public funds in a more targeted & cost-effective manner • Use appropriate technologies for Water & Sanitation • Capacity Building in WASH Sector • More attention to Research & Development (R & D) • Technologies transfer & adopting in WASH sector in coordination with WASH-member countries
WASH innovative solution(s) in Egypt	Water Supply: To meet the increasing water demand and to provide safe drinking water in Egypt, the Holding Company for water and Wastewater (HCWW) and its affiliated companies have started a program to develop riverbank filtration (RBF) sites in all Egyptian governorates for sustainable drinking water supply in upper Egypt Governorates. Sanitation: Egypt adopted a wastewater technology (Bioblock technology) for rural sanitation with the following advantages: small surface footprint, Low environmental impact (No odors, noise, aerosols), High quality of water in the treated effluent, short completion time, Minimization of on-site works, Low energy demand, Minimum maintenance demand, Safety –performance control & Low sludge production Reuse by 2030 the following: • Treat and (indirectly/directly) reuse 1.83 BCM/y of mixed agriculture drainage and wastewater from

	Bahr El Baqr drain for 153,300 Hectare of agriculture in North Sinai • Treat and (indirectly/directly) reuse 0.365 BCM/y of mixed agriculture drainage and wastewater from Mahsama • Drain for 73,000 Feddan of agriculture in North Sinai • Treat and reuse 2.19 BCM/y of mixed agricultural drainage and wastewater from Alhamam plant to supplement groundwater in irrigating 1,500,000 Feddan of agriculture land in the New Delta project including Mustaqbal Masr project. Non-Renewable Groundwater with Direct Treated Wastewater Reuse (by 2030): • Swap 0.9 BCM/y of allocated nonrenewable groundwater with direct treated wastewater for 180,000 Feddan of agriculture lands within the 1.5 million Feddan project and save fresh groundwater for drinking purposes • Swap 0.7 BCM/y of allocated nonrenewable fresh groundwater with direct treated wastewater for 140,000 Feddan of agriculture lands in West Menya & West West Menia within the 1.5 million Feddan project • Swap 0.10 BCM/y of allocated nonrenewable fresh groundwater with direct treated wastewater for 20,000 Feddan of agriculture lands in El-Marashda, Qena within the 1.5 million Feddan project • Swap 0.060 BCM/y of allocated nonrenewable fresh groundwater with direct treated wastewater for 12,000 Feddan of agriculture lands in West Kom Ombo, Aswan within the 1.5 million Feddan project
Lessons learnt from WASH policies and regulatory frameworks in Egypt	Current economic realities in Egypt is affecting the success of the development of WASH model, lack of local institutional capacity and lack of economic growth has led to a severe lack of internal resources to sustain development. But more important in the long run, the sources of external assistance, both financial and technical, are insufficient to fully address the needs WASH Policies. Therefore, Egypt must build its capacity to plan, finance, and implement their own programs. For most this means that governments and local communities must take up part of the burden, and that in turn means that individual citizens are going to have to grow and change. The WASH model is based on this reality.

	It is worth to highlight neither individual projects nor the sector as a whole is sustainable if they depend solely on donors for long-term financial support. One of the lessons learnt is making operation and maintenance plans before facilities are constructed helps to ensure that sustainable technologies are selected. Operation and maintenance problems are widely considered to be the biggest issue facing the water supply and sanitation sector. But poor operation and maintenance is only the manifestation of the failure to consider a wide range of social, financial, institutional, and technological factors at the project design and implementation stages. If such an "integrated" decision-making process involving all these factors is used, it is more likely that the best-i.e., the most appropriate--water pumping system or type of latrine or wastewater collection system will be used and well maintained. For a technology to be suitable for use in a particular location, it should pass several socioeconomic tests. First, use of the technology should be conceptually and physically within the capabilities of the persons responsible for the operation and repair of the system. Hand pumps can often be repaired by bicycle mechanics after a relatively short training period. Water treatment plants, on the other hand, generally require a cadre of skilled staff
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Egypt	WASH is identified in Egypt annual budgeting process. The data available in Egypt on national budgets and expenditure, though limited, indicate that government allocation and spending for drinking-water and sanitation is increasing and thus suggest that WASH prioritization has improved. One alternative source is blended finance, which is the strategic use of public taxes, development grants and concessional loans to mobilize private capital flows to emerging and frontier markets, and it offers opportunities to increase the role of commercial financing for the WASH sector. Blended finance measures can come in many forms, but include grants, concessional loans, and credit enhancements such as guarantees to help “crowd in” private investment. For example, grants can be offered to provide technical assistance or to support capacity building activities. Concessional loans can be combined with commercial finance to soften lending agreements and to provide liquidity to lenders. Public finance can also be used to provide partial guarantees to commercial lenders. However, several initiatives have been undertaken by a wide range of actors, including EU, the World Bank, EBRD, GIZ and others, to improve tracking of financial flows in the WASH sector. These initiatives have greatly improved our current understanding of financial flows to the sector.

Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Egypt	• Speed up cooperation with development partners to attract more funds and investment that will enable the government to expand the establishment of water project across Egypt. • Allocation budgetary resources to sustainable water management is generally insufficient to address the current and future needs. • The user/beneficiary pays principle and the polluter pays principle are not applied consistently across Egypt.
Successful WASH service delivery partnerships in Egypt	Riverbank filtration for sustainable water supply in Egypt: Facing the challenges To meet the increasing water demand and to provide safe drinking water in Egypt, the Holding Company for water and Wastewater (HCWW) and its affiliated companies have started a Program to develop riverbank filtration (RBF) sites in all Egyptian governorates for sustainable drinking water supply in Upper Egypt Governorates. More than 120 projects have been implemented to secure drinking water supply to rural villages. Riverbank Filtration (RBF) is a low-cost and efficient alternative water treatment for drinking water supply. It is low cost and low waste technique. It minimizes the need for chemicals (disinfectants and coagulants) and decreasing costs to the community without increased risk to human health. The cost for an RBF unit that has a capacity of 30 liters per second ranges between 50,000 $ while a conventional water treatment plant with the exact capacity would probably cost more than 600,000 $
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Egypt	Effective capacity building in WASH: • Technologies transfer/innovative in water & sanitation • Knowledge transfer, • Skill development in water & sanitation, • Case studies on capacity building in the water, sanitation and hygiene sectors
Future prospective towards achieving a sustainable WASH service in Egypt	One of the main barriers to sustainability of interventions is the high fragmentation of the water sector. The sustainable provision of WASH services depends on an effective inter-organizational coordination between institutions and organizations, including external support agencies, at different levels. Programming for sustainability in WASH needs to build on a systems-based approach. This entails that sector wide partnerships for sustainability must be established, and that spaces for coordination and

	interaction among stakeholders should be established and maintained. For a WASH intervention to continue to deliver services indefinitely, it must be designed in such a way that it is resilient to different external risks such as social, environmental, and economic changes. The delivery of WASH results can be affected by factors such as climate change and variability, natural hazards, conflicts, urbanization, demographic trends, agriculture growth and industrialization as well as rising service level expectations and variable consumption patterns. To secure a sustainable WASH service, Egypt established a sound strategic financial planning to ensure that existing and prospective resources are appropriate for investment needs and costs of operating and maintaining services.

Here are the latest figures for water and sanitation service levels for Egypt from JMP database in year 2017.

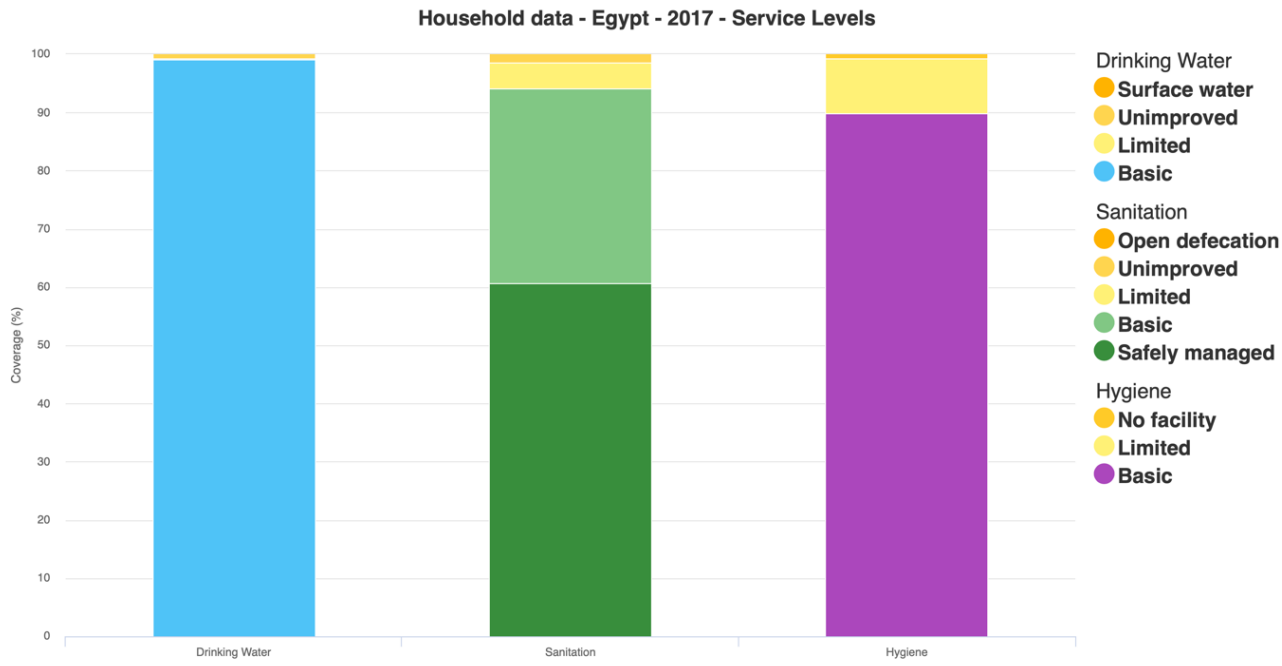


Figure 18 WASH service levels in Egypt-2017

	**Israel**
WASH Service Framework in Israel	Legislation, Regulation, Governmental Decisions, Development Plans on National, Regional and Municipal Levels, tariff system to support the cost recovery principle.
COVID-19 impact on WASH in Israel	There negative impact on the WASH sector not detected.
Priorities and/or actions related to the WASH sector in Israel	Israel has fully implemented the Integrated water recourses management approach. the challenge today are very specific areas and projects on municipal level to cope with housing development.
WASH innovative solution(s) in Israel	Israel has fully implemented the Integrated water recourses management approach. All the above is widely embedded in our policy and master plan.
Lessons learnt from WASH policies and regulatory frameworks in Israel	Holistic approach and stable regulatory system are the key to implement the projects.
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Israel	Israel water sector is a closed market sector based on cost recovery principle. There are some budget allocations to support water reuse plants and WWTPs in certain areas.
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Israel	NA
Successful WASH service delivery partnerships in Israel	PPP in desalination plants - BOT projects
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Israel	WASH sector is almost fully implemented. Very specific local solutions are needed in certain areas.

Here are the latest figures for water and sanitation service levels for Israel from JMP database in year 2017.

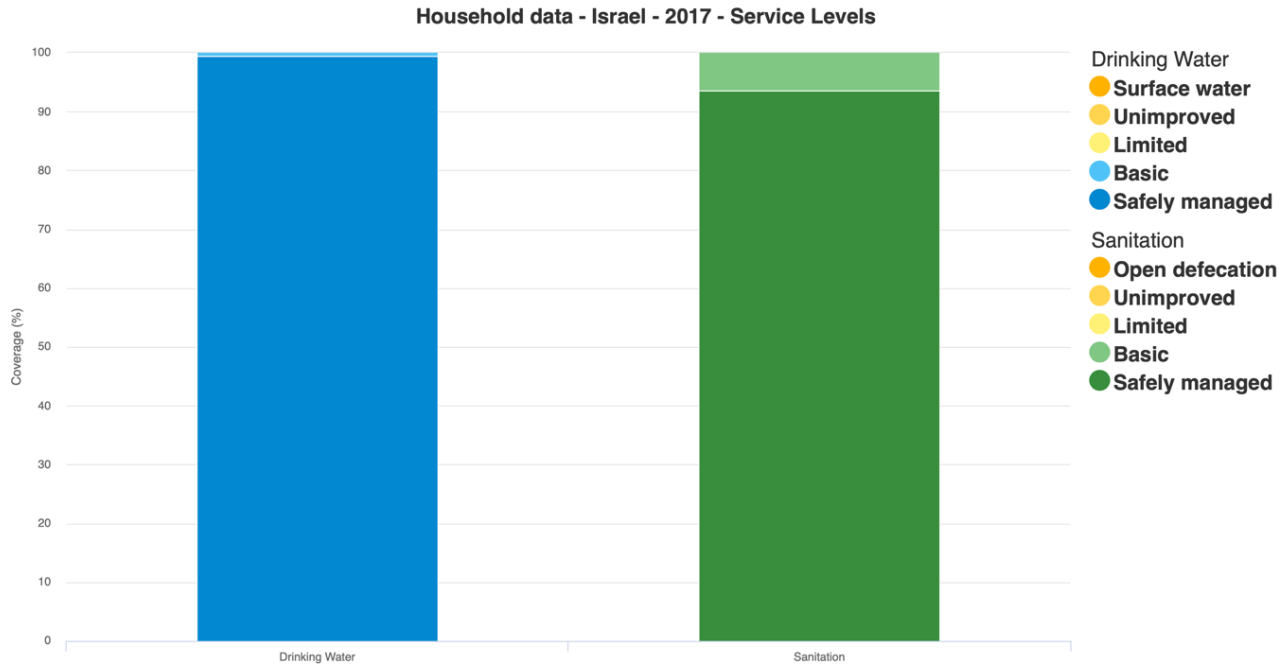


Figure 19Water and sanitation service levels in Israel-2017

	**Palestine**
WASH Service Framework in Palestine	The following main interventions/projects for the whole services in Palestine: • Water Resources: ○ Drilling new wells ○ Wells and springs rehabilitation ○ Equipping Wells ○ Construction of desalination plants ○ Water harvesting projects ○ Treated wastewater reuse projects ○ Increasing water amounts bought from the Israeli water company (Mekorot) • Water Supply: ○ Establishment of new water supply systems ○ Rehabilitation and expansion of existing water supply systems ○ Construction of new and rehabilitation of existing pumping stations and distribution systems ○ Construction of new water tanks ○ Rehabilitation of existing water tanks ○ Projects for connecting the resources using main lines ○ Wastewater: ▪ Construction of new WWTP ▪ Rehabilitation of existing WWTP ▪ Construction of sewage networks
COVID-19 impact on WASH in Palestine	Since the declaration of the state of emergency to confront the Corona virus in Palestine and the instructions issued by the Prime Minister and in line with the prevailing national situation, the PWA has taken several measures to ensure the sustainability of water and wastewater services efficiently and high effectively. The PWA also implement a precautionary emergency plan at the level of bulk water systems and the level of water and sanitation service providers in all governorates, in response to the government's strategic plan and goals to control the disease and limit its transmission, and provide basic needs for citizens. The Water Authority is intensifying its current efforts in the context of the existing challenges facing the water sector, which also doubled with the spread of the COVID-19, as on the one hand, the water sector in normal situation suffers from a decrease in the available water quantities as a result of Israeli policies while on the other hand, the continuous increase in demand in response to the increase in

	population. Groundwater is the main source of water supply in the West Bank and Gaza Strip, with the rate of extraction in the West Bank for Palestinian use averaging 120-125 MCM annually. To fill the deficit and provide additional quantities of water for the different uses of Palestinian communities in the West Bank and Gaza Strip, the Water Authority purchases an average of 83 million cubic meters annually from the Israeli Water Company (Mekorot). As for Wastewater services, more than 68% of the West Bank population and more than 28% of the Gaza Strip are still without adequate and safe sanitation services. The population still relies on cesspits to get rid of wastewater to this day. In addition, the majority challenges facing the service providers result from weak institutional capacity, inadequate infrastructure and high losses. In addition to other challenges facing the water sector in Gaza in particular in terms of water scarcity and lack of conformity with the quality standards for drinking water due to the Israeli blockade, and the lack of water supplies and Wastewater services .
Priorities and/or actions related to the WASH sector in Palestine	Since the declaration of the state of emergency to confront the situation of the COVID-19 virus in Palestine by H.E. President Mahmoud Abbas and instructions issued by the Prime Minister on dealing with the virus and in line with the prevailing national situation, the Water Authority has taken several measures and proactive steps that will ensure the provision of efficient water and sanitation services for the citizen through ○ Forming an emergency committee to deal with the state of emergency at the national level ○ Intensifying sterilization of water utilities at the wholesale level and raising the level of safety therein, by taking precautionary measures, including preventing entry or exit for those who are not authorized to ensure the sustainability of the water sources and their safety. ○ Issuing several urgent circulars to service providers at the beginning of the emergency phase, with a view to ensuring the commitment of service providers to: - Maintain and protect water resources and pumping stations, and ensure safe drinking water - Details of the approved sterilization mechanisms and the periodicity of performing the necessary tests for drinking water

	- Protection related to wastewater facilities, including sterilization operations and treated water quality - Safe supply of drinking water tanks - Safe disposal of wastewater with septic tanks - Take the necessary measures to protect the work crews - Emphasizing the necessity of preparing and following up the implementation of a special precautionary work plan by each service provider - The importance of communication and awareness campaigns by service providers, each within his work area, to raise citizen awareness of many issues ○ Pursuing a careful monitoring of the sterilization of water facilities in the isolated areas due to the appearance of cases there (such as the city of Bethlehem and the village of Bedou). ○ Training the local authorities on the approved sterilization mechanisms for administrative facilities, pumping stations and wells (the biggening was in the village of Bedou). ○ Identify the emergency needs of the West Bank Water Department, including equipment, machinery and materials required to deal with the emergency period. ○ Assessing the status of water service providers in the West Bank and Gaza Strip, to determine urgent needs through a questionnaire that was sent to all service providers, with a view to taking appropriate measures and providing the necessary support for the service providers to carry out their tasks during this period. ○ Follow up with the security forces to ensure that the water distribution tanks comply with the approved water resources and general safety conditions ○ Identify alternative water resources to be used as alternative / additional supply points covering Palestinian communities in the north and south of the West Bank, and to determine the requirements for undertaking the necessary linkage process for these communities. ○ Work on preparing an emergency plan and starting work on its implementation
WASH innovative solution(s) in Palestine	○ Ensuring the continuity of the resources' supply on the bulk level of wells and water connections purchased from the Israeli side, and enhancing the production of desalination plants in Gaza.

- Enhancing the work of desalination plants of limited quantity in the Gaza Strip
- Identifying alternative / additional water sources suitable for human usage by either connecting them to the existing water distribution systems or by providing filling points in areas that suffer from a shortage of water or facing an increase in water demand, focusing on marginalized areas that are far from the main distribution networks, or those lacking supply networks. These backup sources can be used in the case of any malfunction of the water supply sources.
- Determining the needs of temporary, established and proposed quarantine centers for water and sanitation services.
- Sterilizing the main water resources, alternative resources and distribution facilities.
    - Sterilizing of wells, stations, reservoirs and pumps at water bulk level
    - Training local authorities to sterilize their water facilities
    - Monitoring and following up with local authorities regarding the drinking water sterilization process
- Regular monitoring of water quality by examining samples from resources, where the water authority monitors water resources twice annually. The frequency of monitoring increases based on field data, especially regarding the wells of drinking water and focusing on the sterilization of water.
- Following-up on water tanks from the approved supply points and determine their commitments to the instructions and sterilization of tanks.
- Issuing special circulars with approved filling points, tanks authorized for transporting water and sterilization guidelines.
- Following-up with the security forces on the need for the tanks to comply with the approved water sources and safety and public health conditions
    - Following-up laboratory periodic checks of filling points in accordance with the protocols adopted in particular
    - Contacting private water production and distribution companies in the Gaza Strip to follow these procedures.

	○ Responding to water scarcity in marginalized areas ○ Coordinating with partners to ensure the delivery of clean water to the most marginalized areas and the use of tanks approved by local authorities ○ ii. Issuing circulars of approved filling points and authorized tanks ○ iii. Water transfer and sterilization instructions. ○ iv. Follow-up with the security forces on the need for the tanks to comply with the approved water sources and safety and public health conditions • Follow-up laboratory periodic checks of filling points in accordance with the protocols adopted.
Lessons learnt from WASH policies and regulatory frameworks in Palestine	In addition to the public health and humanitarian implications of the COVID-19 pandemic, the crisis has delivered a negative shock to Palestinian socioeconomic development, putting at risk public welfare, employment and livelihoods, poverty and food security, social cohesion, financial and fiscal stability, and institutions. There is little doubt that the COVID-19 emergency threatens progress on the Sustainable Development Goals and on the 2030 Agenda in the Occupied Palestinian Territory and is exacerbating and deepening pre-existing inequalities, discrimination, and inequities.
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Palestine	We always present our priorities which comes from our sector strategic plans through the main platform of water sector working group, and bilateral relations with partner to get the financing the large-scale crucial infrastructure projects, and this not easy which takes time and efforts. Supporting a long-term CAPEX strategy for the operators Implementing dedicated financial mechanisms and incentives Developing knowledge sharing and capacity building, based on peer learning
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Palestine	○ Amount of fund are not sufficient ○ Long procedures when applying for urgent fund ○ President condition from donors to achieve the fund sometimes are difficult to approach. ○ Political situation for Palestine put some challenges for donors
Successful WASH service delivery partnerships in Palestine	UNECIF support for the marginalized areas Some UNGO's (GVC, Act for Hunger, UN Agency's they support human cases like filling points, small networks, chlorine pumps, pipes, and tankers

Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Palestine	○ Training for Services provider and for local staff ○ knowledge exchange ○ communication ○ providing experts
Future prospective towards achieving a sustainable WASH service in Palestine	○ "Towards an Organized Water and Wastewater Sector, which contributes in building up the Palestinian Sovereignty and ensures the sustainability of water resources according to robust health, environmental, social and economic structures capable of achieving the essential and developmental requirements of the Palestinian people" ○ Through: Reinforcing the Palestinian Authority's approach to sustainable water resources management by ensuring that all arms of government work together in the pursuit of shared water resources management goals; and ○ Establishing a framework for the coordinated development, regulation and financial sustainability of water supply and wastewater services to ensure concerted efforts towards improved water systems management, rehabilitation and maintenance.

Here are the latest figures for water and sanitation service levels for Palestine (West Bank and Gaza) from JMP database in year 2017.

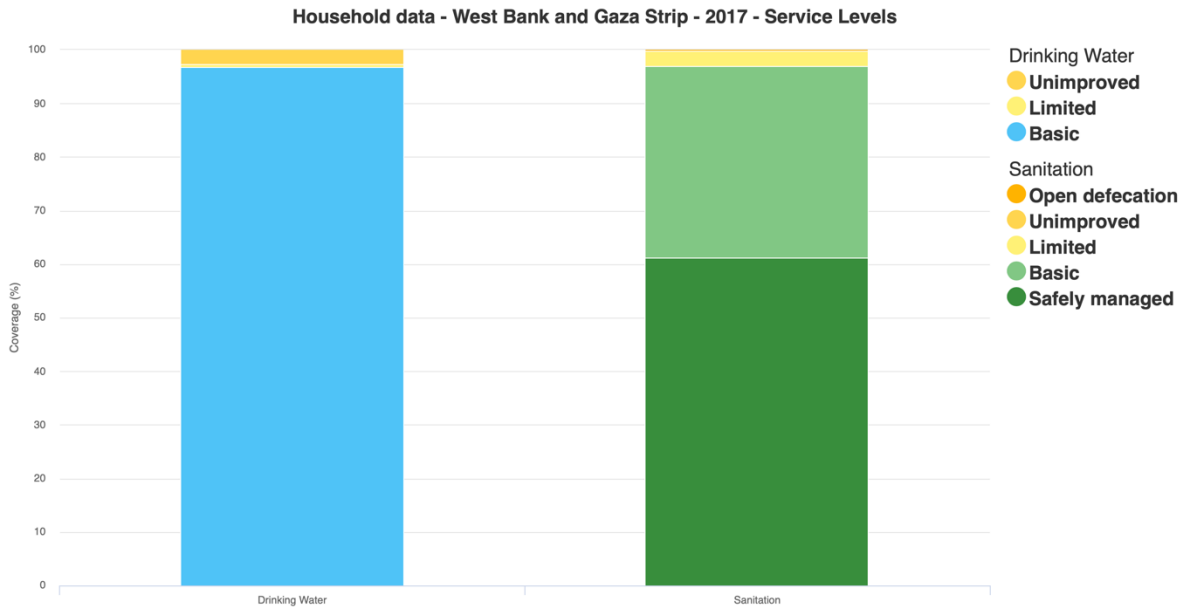


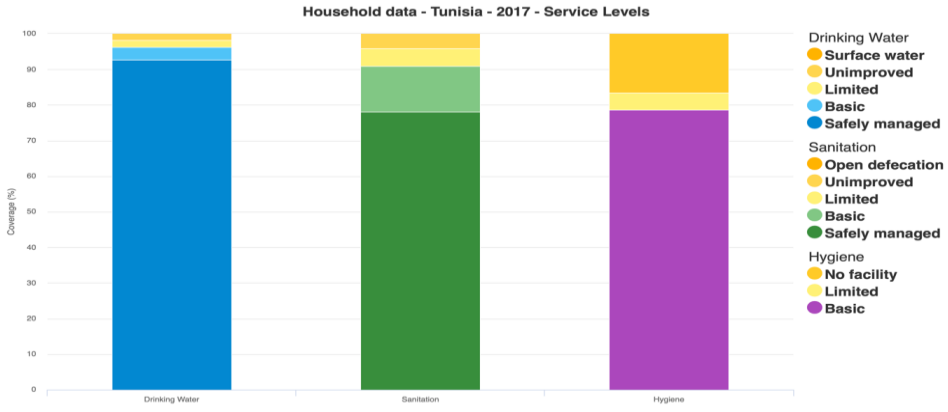
Figure 20 Water and sanitation service levels in Palestine-2017

	**Tunisia**
WASH Service Framework in Tunisia	In Tunisia, the number of beneficiaries supplied with drinking water reached 11.503 million inhabitants in 2019 against 7.5 million in 1994, which contributed to the improvement of the service rate successively from 84.7% to 98.2%. These rates are 100% in urban areas and 94.5% in rural areas.
COVID-19 impact on WASH in Tunisia	The COVID-19 A pandemic has impacted WASH services, especially in terms of the pace of implementation and progress of drinking water supply and sanitation projects For the management of the COVID-19 crisis, the government has taken decisions to ensure and guarantee WASH services during the period of confinement: in particular the postponement of bills payments whether for drinking water or sanitation,
Priorities and/or actions related to the WASH sector in Tunisia	• Completion and implementation of the treated wastewater reuse strategy: under strategy number: REUSE 2050 • Acceleration of the program to secure the supply of drinking water to deficit areas through capacity building for northern water transfer systems
WASH innovative solution(s) in Tunisia	Efforts have been made to promote new solutions to ensure the supply of drinking water to the entire population through program and projects: Strengthening and modernization of the capacity to transfer northern waters, National water saving program, Desalination of brackish water and sea water, promotion of the Nexus approach "Water / Energy": for the control of energy consumption for pumping and transfer Use of new technologies: SMART Water, smart meter,
Lessons learnt from WASH policies and regulatory frameworks in Tunisia	Successes: overall drinking water supply rate of 98%, Failures/problems: low network efficiencies, low cost recovery rates, management problems especially in rural areas, quality problems (nitrate salinity, etc.)
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Tunisia	The contribution of donors in the drinking water sector is very significant for Tunisia, via bilateral agreements (KFW/JICA for infrastructure: Rehabilitation of networks, desalination, transfer, ...) or multilateral (BM: institutional support and technical assistance, promotion of community management, ...)

Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Tunisia	No significant obstacles
Successful WASH service delivery partnerships in Tunisia	- SONEDE (public company): drinking water supply in urban and semi-urban areas - DGGREE (Central Administration): drinking water supply in rural areas - ONAS (public company): Sanitation (Establishment, management and operation of sewerage networks and treatment plants)
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Tunisia	New technology: intelligent system and equipment, real-time management and control of performance indicators for drinking water and sanitation facilities (equipment and structures) drinking water supply and sanitation,
Future prospective towards achieving a sustainable WASH service in Tunisia	Tunisia is considered among the countries that suffer from chronic scarcity and severe water stress (with a quota of less than 400 m^3/year/inhabitant). This difficult context will be exacerbated with the effects of climate change, this to prevent a more difficult future for Tunisia especially for the supply of drinking water.

Here are the latest figures for water and sanitation service levels for Tunisia from JMP database in year 2017.

Figure 21 WASH service levels in Tunisia-2017



	**Libya**
WASH Service Framework in Libya	In order to protect the environment and reduce the negative effects of contaminated water on public health and natural resources, the implementation of the national program to complete the water and sanitation infrastructure in various regions of Libya has been approved, starting with a comprehensive survey of water and sanitation in various urban communities in Libya for: Protecting the environment and reducing the negative effects of contaminated water on public health and natural resources by following modern techniques for treating such water. Providing a water resource that can be used to support traditional resources, as it is an unconventional renewable water resource and an additional source of irrigation that reduces groundwater depletion in agriculture. Ensuring that useable water is provided.
COVID-19 impact on WASH in Libya	• Spread health awareness among people about the seriousness of the pandemic. • Increasing cooperation between the Ministry of Health and the Ministry of Water Resources by establishing teams to oversee hygiene • Ensure the provision of clean, usable water. • Protect the environment and reduce polluting impacts.
Priorities and/or actions related to the WASH sector in Libya	These priorities are summarized in the following points • Spreading awareness among people and realizing the magnitude of responsibility • Implementation of city development plans • Infrastructure of sewage drainage systems • Sewage pumping stations • Sewage treatment plants • Reuse of treated water in agriculture and parks • Implementation of laws and legislation on environmental protection • Supporting SMEs in the environment sector
WASH innovative solution(s) in Libya	The total rainfall in all regions of Libya is about 80 billion cubic meters, the highest rainfall in the mountainous regions without any benefit, especially in the southern regions of the mountain, which have a high percentage of evaporation. the aim of the WASH projects within Libya is to collection and use of water and the formation of green spaces that have a positive impact on climate change in the Libya.

	Rainwater Harvesting: collection and storage of rain and flood water to provide water needs for agricultural crops and provide drinking water for humans and animals. More details of the project: - Water saving for various uses. - Strengthening groundwater levels. - Increasing quantities of crops in rainfed areas. - Water storage to reduce evaporation.
Lessons learnt from WASH policies and regulatory frameworks in Libya	The first wastewater treatment plants were established in 1963 in Tobruk, and during the period 1970-1980, interest increased, particularly as thousands of kilometers of sewage drainage systems, hundreds of sewages pumping stations and about 40 treatment plants were established. Sewage and on the latest roads have a total design capacity of about 590,000 m^3/day }215 m^3/year {however, part of the existing treatment plants faced many problems, which caused a significant decrease in the proportion of water being treated A national policy must be developed through national integration planning with the participation of all water-consuming sectors. From the reality of living in Libya, it is necessary to implement the urban plans and connect the sewage systems of each house.
Specific measures/instruments to mobilize funding from financial partners to sustain WASH sector in Libya	Building a national water and sanitation information system and networks. To implement mechanisms and financial incentives dedicated to the development of water and drainage system infrastructure, the private sector will be instrumental in this area. Most of the experiences between the countries, especially those bordering Libya with the same climatic conditions was not successful.
Key challenges/constraints/barriers to attract funding from international financial institutions and other financial partners to support WASH sector in Libya	• One of the main barriers faced by the state is the political and security instability of the state. • Facilitating Libya's frozen funds through international channels because this will do harm to the Libyan state as well as at the global level. • The financial procedures followed by the competent financial authorities are complex and these procedures are required to be facilitated, especially with international organizations that contribute to water and sanitation service programs. • Opening more channels of communication with intergovernmental and non-governmental organizations related to the environment sector.
Successful WASH service delivery partnerships in Libya	The Water and Wastewater Company is a government company affiliated with the Ministry of Water Resources

	and the cleaning company affiliated with the Ministry of Utilities. There are many private cleaning companies that do cleaning work that not have an agreement with the water and wastewater companies.
Specific areas of capacity building and innovative solutions (know-how) needed to improve and sustain the WASH sector in Libya	• Adopting programs to raise public water awareness. • Localization of modern technologies • Conveying the experiences and experiences of countries similar to the situation in Libya in line with international standards. • Supporting the private sector and activating its role by opening centers to train young people in recycling industrial waste. • Supporting SMEs in this area.
Future prospective towards achieving a sustainable WASH service in Libya	• The expansion of geography of Libya and the nature of its topography and climate and the distribution of the population and it's spread in clusters it is difficult to implement all plans to connect water and sanitation systems, so it is necessary to benefit the plans of modern and new cities with good ingredients and facilitate excellent service. • Activating and supporting sustainable management of Libya's water and sanitation sector. • Completion of sewage systems networks and repair of the existing network, and current water supply systems for cities should be updated and repairs needed to be fully operational.

Here are the latest figures for water and sanitation service levels for Libya from JMP database in year 2017.

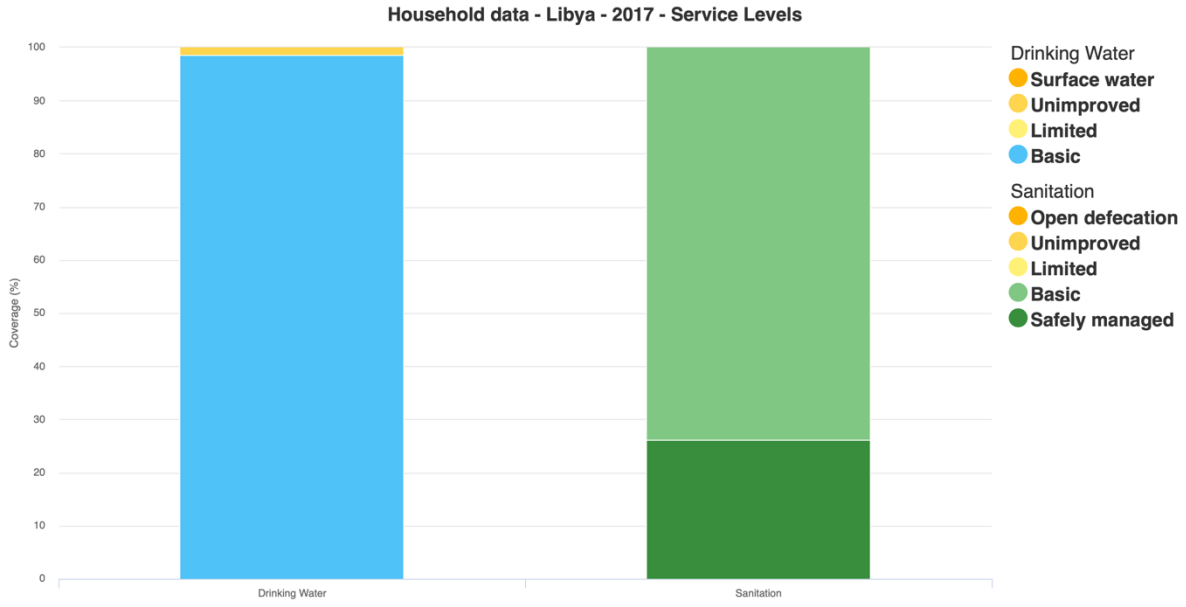


Figure 22 Water and sanitation service levels in Libya-2017

9. Recommendations

This report provided a comprehensive overview for WASH status at the Mediterranean countries, with recent update on the stats and figures in related to SDG 6 achievement. In addition to an overview of the recent technologies in WASH sector which some can be implemented in the Mediterranean region. Several case studies and examples about regulatory and institutional frameworks were shared by different countries, where it shows the importance of regional cooperation and knowledge sharing to help overcome similar challenges facing WASH sector in Mediterranean region. Water management is a crucial issue, also depending on the relevant effects of climate change in the Mediterranean area. Especially MENA countries, poor in water, risk to further compromise the access to basic drinking water and sanitation services, besides the risks for agriculture practices being farmers major users of water resources.

The Mediterranean Sustainable Development Report for 2020 indicated that North Africa is the Med area that mostly suffers from lack of access at basic drinking water services (8,8 million people) and lack of basic sanitation services (15,9 million people), but trends are positive compared to the 2019 (respectively -2 and -2,6 million people). Where wastewater treatment is not a practice deployed enough. Besides EW (78%), MENA countries need consistent improvements (33% only). Some countries in particular in EE and MENA show unsatisfactory performances and call for investments in wastewater infrastructures and management.

Regarding water quality, basic services of wastewater treatment are performed in Europe West at 78%, in Middle East at 36%, in North Africa at 31% and in Eastern Europe only at 29%. This has also impacted on seawater quality, highlighted as a critical issue in the Mediterranean basin that needs to enlarge and enforce environmental protection in marine and maritime areas.

Frequent and proper handwashing is the most basic frontline defense against the spread of COVID-19. The pandemic has heightened awareness of both the extent and consequences of WASH access gap, and it could slow down progress in meeting the SDG 6 development goal as revenue losses by water utilities affect their ability to make critical capital investments.

With a few exceptions, the outbreak of COVID-19 is projected to slow down investments in the water sector worldwide. It has also increased the importance of operational reliability due to the cost of disruption. These operational needs derive from shifts in demand patterns, supply disruptions, and the various emergency measures employed by governments to cope with the pandemic. Companies with good systems to remotely control and operate networks and treatment plants usually perform better during the crisis. Similarly, automated protocols for responding to occurrences (such as pipe bursts) will allow for efficient response, with a lower degree of physical interaction among staff.

Lasting lessons on crisis preparedness and resiliency of staff, systems, and equipment could lead to increased investments in digital solutions. The pandemic may help to boost the application of automation and remote-control processes as they become ever more crucial at times like these. Automated customer interfaces today may allow for a change in culture going forward. COVID-19 social distancing measures will push companies and customers to avoid contact in physical utility services centers and prioritize the use of other channels of engagement. More customer-utility interactions may be conducted via phone, apps, or the internet, which are often already available.

Regional cooperation, information exchange and policy coherence are fundamental in the water sector and critical for the achievement of SDG 6 on water and sanitation. This even more for the countries of the Mediterranean Sea as they have similar water resource problems and are exposed to similar drivers and pressures such as climate change, increasing water scarcity, population dynamics and migration. Due to the strong interdependencies of all SDGs, and particularly the strong linkages between SDG 6 and many other goals and targets, actions towards achieving SDG 6 will also enable progress towards other goals of the 2030 Agenda.

North-South, but also South-South cooperation in the Mediterranean should be strengthened and structured. It is important to value the know-how of some countries in the region, but also learn from the failures. It would be interesting to further structure the cooperation, notably through the launch of a specific Euro-Mediterranean call for projects to target innovative projects in WASH sector (i.e., adaptation, generalization or harmonization of

standards in force between countries). Emphasis should be placed on strengthening the capacity of local authorities, particularly for the implementation of IWRM.

The WASH task force within UfM Water Expert Group (WEG) shall conduct SWOT analysis with proposed possibilities from each country to move forward and to build regional cooperation to fill the gaps in WASH service delivery at country level. However, for the limited scope of this report, it recommends also that WASH task forces shall focus on implementing the following activities in order to meet the aimed objective towards promoting an integrated approach for achieving water and sanitation SDGs, catalyze an action for its mainstreaming, financing and implementation in UfM Member States, at the national, local and regional levels:

- Provide tools for introducing reforms needed in WASH sector governance systems
- Coordinate, leverage and facilitate financing for WASH interventions
- Capacity building on WASH policies, technologies, vocational jobs and stakeholder engagement
- Generate and disseminate knowledge on Innovations and inventions in WASH sector
- Design and implement pilot interventions with replication potential at local level

Such initiative can be materialized via establishing (virtual) center of excellence (hub) to institutionalize and follow the outcomes of the SoA report under the joint leadership of Egypt and Malta, with their capacity of leading WASH task force with UfM WEG. WASH hub activities shall focus on knowledge sharing and exchange, twinning, study tours, technical exchange, capacity development and training covering the following topics and not limited to (UFM, 2020):

- WASH projects strategic planning
- Risk management and shock resilient plans
- Strategic financial planning
- Desalination technology optimization
- IWRM and water governance principles

- Rural & urban water supply and sanitation
- Technology adaptation & localization
- Planning and management of PPP initiatives
- Energy efficiency and recovery in water and wastewater operations
- Knowledge management & data monitoring
- Automation of utility operations
- Asset management and project life cycle
- Sludge management and safe disposal
- Water loss reduction and NRW management plans
- Wastewater reclamation and reuse
- Cost recovery and commercialization

The fundamental issues such as capacity building, improved governance, knowledge sharing and innovation development, are substantial axis for ensuring the promotion of WASH in the region. In particular, it is necessary to address fragmentation witnessed in the past, and move towards the development of a comprehensive action for the region, which shall outline the future work of WASH thematic priority topic within the UfM Water Agenda (UFM, 2020).

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