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Water as Crosscutting Factor in the SDGs Under Review at the High-Level Panel Forum for Sustainable Development (HLPF) 2019 in the Arab States

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July 2019

Supported by:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

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Acknowledgements

This Regional Policy paper is part of the efforts of the UN-Water Expert Group on Agenda 2030 and spearheaded by the UNESCO World Water Assessment Programme (WWAP), Economic and Social Commission of Western Asia (ESCWA) and UNESCO Regional Bureau for Science in the Arab States (CAIRO) to maintain the relevance of the cross-cutting nature of water in the achievement of all the SDGs. It was prepared by Dr. Ali Karnib, Senior Water Expert and Professor of Engineering at the Lebanese University and UNESCO WWAP consultant. Mr. Akmal Abdurazakov, independent consultant, contributed analyses of data and graphs. Earlier versions of the document received review comments and inputs from the following organizations: UNESCO WWAP, ESCWA, UNESCO Regional Bureau for Sciences for the Arab States, UN-Water.

The preparation of this document is part of the activity “Facilitating an integrated implementation of the Agenda 2030 through water” that is supported by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany. The support to the UNESCO World Water Assessment Programme (WWAP) is gratefully acknowledged.

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Summary

The objective of this paper is to contribute to increasing the understanding of Arab policy-makers on the central role water plays in achieving the SDGs through facts and case studies of the Arab states[1] and to serve as a call for action to Arab decision-makers on the importance of water for the achievement of the Sustainable Development Goals (SDGs) under review in the 2019 High Level Political Forum (HLPF). The theme of the latter is set to be **'Empowering people and ensuring inclusiveness and equality'.** The Goals under consideration are: SDG 4 (quality education), SDG 8 (decent work and economic growth), SDG 10 (reduced inequalities), SDG 13 (climate action), SDG 16 (peace, justice and strong institutions), and SDG 17 (partnerships). Water has a centrality in achieving the 2030 Agenda, this is because of its importance to each of the four dimensions that cut across all SDGs (society, economy, environment and governance).

Profound interlinkages exist between all the aforementioned SDGs, with water being an important cross-cutting factor. Identifying and understanding these interconnections is of particular importance to set water high on the political agenda and to identify follow-up priority actions that may increase policy coherence and effectiveness in addressing these interlinked issues in a holistic approach at a regional and national scale.

The main objectives of this document are:

- To support that water aspects are considered at the HLPF 2019 preparatory meetings in the Arab states;
- To identify and recognize interlinkages that exist between the SDGs reviewed in HLPF 2019 and SDG 6 that may help in increasing policy coherence and effectiveness in addressing these interlinked issues in a holistic approach;
- To share concrete examples of how to better integrate SDG 6 and other SDGs reviewed in HLPF 2019 in policy and practice; and
- To identify key messages and policy recommendations to serve as a call for action to Arab decision-makers on the importance of water for the achievement of the aforementioned SDGs.

[1] Arab states and Arab region include the following countries: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen.

The **main findings and policy messages** described in the document are the following:

1- **SDG 4 and 6:**

Key Findings:

- The proportion of schools with access to improved drinking water services decreased between 2010 and 2016, where armed conflicts, fluxes of refugees, water scarcity and lack of financial resources are, among other, the reasons of this decrease.
- As shown in the submitted VNRs, an increasing trend in the Arab states to introduce Education for Sustainable Development into official school curricula.

Key policy recommendations:

- Improve access to WASH facilities in schools including Menstrual Hygiene especially in the Arab LDCs and in countries facing armed conflicts and fluxes of refugees.
- Improve cleaning and maintenance of WASH facilities in schools and to include regular maintenance funding as part of schools recurrent budgets.

2- **SDG 8 and 6:**

Key Findings:

- Information of water use in the economy is largely incomplete or lacking for the majority of Arab states.
- Low efficiency irrigation techniques are still predominant in the majority of Arab states while the agriculture sector accounts for 85% of the total water use.

Key policy recommendations:

- The United Nations System of Environmental-Economic Accounts for Water (SEEA) should be promoted as appropriate to local context in the Arab states as the basis for storing, sharing and improving environmental data, where the accounts of pollutants released to the environment should be integrated within the countries' water accounts.
- There is a need to improve water use efficiency in all productive sectors and particularly the agriculture sector. In addition, there is a need to improve access to water and economic related data and information to support policy and decision-making.
- Efforts should be made to provide valid and disaggregated information of water use and trends for the different socio-economic activities.

3- SDG 10 and 6:

Key Findings:

- Unemployment and agricultural job losses across the Arab region has worsened in recent years. This challenge remains critical in Arab LDCs and countries facing armed conflicts and fluxes of refugees (Iraq, Jordan, Lebanon, Libya, Palestine, Syria and Yemen).
- Moreover, information on women's employment in water related jobs are lacking for the majority of Arab states.

Key policy recommendations:

- There is a need to improve access to safely managed water supply and sanitation services to all, including disadvantaged groups such as the poor, slum dwellers, migrants, refugees, people with disabilities, etc.
- There is a need to use water efficient and high value crop production to increase rural incomes.
- Efforts should be made by the Arab states to promote gender mainstreaming in water governance.

4- SDG 13 and 6:

Key Findings:

- Climate change brings huge risks for Arab states societies, directly through changes in water availability and climate-related hazards, but also indirectly through risks for energy and food security.

Key policy recommendations:

- There is a need to further develop knowledge and methods to evaluate the risks of climate-related hazards and to facilitate data exchange and knowledge sharing for informing policy making.
- There is a need to increase water use efficiency to deal with increasing water scarcity due to climate change and to integrate climate change measures into national water policies and strategies.

5- SDG 16 and 6:

Key Findings:

- About 67% of renewable water resources in the Arab region crosses at least one international border.

- A process of discussions on a cooperation framework between Arab countries has been launched by the League of Arab States (LAS) to encourage the development of cooperation arrangements on transboundary water basins within the Arab region.
- The Arab Strategy for Water Security encourages the development of cooperation arrangements on shared water between Arab states.

Key policy recommendations:

- There is a need to improve cooperation on shared water resources management between Arab states.
- The SDG 6.5 framework can support the development of institutional capacity and participatory processes and provide tools for transboundary cooperation and conflict resolution.
- Effective water governance can enhance water supply and sanitation services, infrastructure and procurement services, and increased water utilities revenues.
- There is a need to address the needs of the refugees and displaced persons and of their host communities where appropriate in areas affected by conflict.

6- SDG 17 and 6:

Key Findings:

- Water and wastewater tariffs in most Arab states are among the lowest in the world, which leads to over abstraction and depletion of water resources and increases pressure on the operation and maintenance of water supply and sanitation systems.
- Adequate and innovative technological choices for desalination, wastewater treatment, irrigation and agricultural production are key response options for water scarcity challenges that characterize the Arab region.

Key policy recommendations:

- Water and sanitation utilities need to improve investment and operational efficiency.
- Subsidies and tariff structures need to be applied with the objectives of achieving equity, affordability and the appropriate level of service for each targeted group.
- There is a need to strengthen innovation and improve the use of available efficient technologies for desalination, wastewater treatment and reuse and for increasing agricultural water use productivity.
- Transparency and exchange of information and data need also to be improved.

Methodology and framework

This policy paper serves as resource base to inform policy and decision makers on the importance of water for the achievement of the SDGs under review in the HLPF 2019. The approach consists of the following conceptual elements:

i) Scanning a set of regional challenges related to SDGs for review by HLPF in 2019 and identifying the rationale of interlinkages with water;

ii) Assessment of the qualitative dependency levels on water using regional expert judgment-based in a formal consultation meeting;

iii) Mapping water related challenges and policy actions distilled from the regional Voluntary National Reviews (VNR);

iv) Providing national and regional examples and case studies of response options; and

v) Proposing potential policy recommendations.

The identification of challenges, interlinkages with water and potential policy recommendations are based on existing literature and author expertise judgment. The sources of information for all steps are:

- Regional and international reports (e.g. SDG 6 Synthesis Report on Water and Sanitation (UN, 2018)),
- Submitted VNRs and Sustainable Development Strategies (NSDS), and
- Consultation meetings and review comments.

Table 1 presents a list of Arab regional strategies reviewed in the assessment. Table 2 presents a list of outcome documents of preparatory meetings for the 2018 Arab Forum for Sustainable Development and High-Level Political Forum on Sustainable Development. Table 3 presents a list of the Arab states submitted VNRs.

Table 1. List of Arab regional strategies reviewed in the assessment

Arab Regional Strategies	Timeframe	Abbreviation	Reference
Arab Strategy for Disaster Risk Reduction	2020	ASDRR	LAS & UNISDR (2018)
Arab Strategy for Sustainable Agricultural Development	2025	ASSA	LAS & AOAD (2007)
Arab Strategy for Water Security	2030	ASWS	LAS (2013)
Action Plan for the Arab Strategy for Water Security	2020	AP-ASWS	LAS (2014)

Table 2. List of outcome documents of preparatory meetings for the 2018 Arab Forum for Sustainable Development

Arab Forum preparatory meetings	Date	Venue	Reference
Arab Forum for Sustainable Development "Natural resources, future generations and common good"	2018	UNH*, Beirut	UNESCWA (2018a)
Arab Preparatory Meeting on Energy-related Issues for the 2018 AFSD and the HLPF.	2018	UNH*, Beirut	UNESCWA (2018b)
Arab Preparatory Meeting on Water Issues for the 2018 AFSD and the HLPF.	2018	UNH*, Beirut	UNESCWA (2018c)
Arab Preparatory Meeting on Environmental and Natural Resources Issues for the 2018 AFSD and the HLPF.	2018	Cairo	UNESCWA (2018d)
Regional Meeting of Civil Society on Sustainable Development in the Arab Region.	2018	UNH*, Beirut	UNESCWA (2018e)

*UNH: United Nations House

Table 3. List of the Arab states submitted VNRs

Year of submission	Countries
2018	Bahrain, Egypt, Lebanon, State of Palestine, Qatar, Saudi Arabia, Sudan
2016/2017	Egypt, Jordan, Morocco, Qatar, United Arab Emirates

Assessment method of the qualitative dependency on water

The method adopted a qualitative approach that is evident in the SDG interlinkages literature (Weitz et al., 2014; Karnib, 2017; Nilsson, 2017; Le Blanc, 2015). Three possible qualitative levels of dependency on water to achieve SDG targets are considered as follows (Table 4):

Table 4. Proposed three possible levels of water dependency to achieve SDG targets

Score	symbols	Explanation
5		Strong water dependency level (i.e. the achievement of SDG targets is strongly dependent on water).
3		Moderate water dependency level (i.e. the achievement of SDG targets is moderately dependent on water).
1		Feeble water dependency level (i.e. water creates favorable conditions to the achievement of SDG targets)

The assessment of qualitative water dependency levels to achieve SDG targets is expert judgment-based, supported by experts' elicitations of 24 regional experts and stakeholders in a formal consultation meeting. The experts' elicitations were collected based on a questionnaire (Annex 1) and an introductory session to the questionnaire during the activities of the regional capacity building workshop on the Water, Energy and Food Nexus (19-20 February 2019 - UNESCO Regional Bureau for Sciences for the Arab states, Cairo, Egypt). Table 5 presents the number of participating experts from the different Arab states. Annex 2 presents the names and positions of the experts.

Table 5. Number of participating experts from the different Arab states

Arab states	No. of experts
Bahrain	1
Egypt	3
Iraq	2
Jordan	3
Lebanon (including the author)	2
Oman	3
Palestine	2
Sudan	4
Tunisia	3
UNESCO Office in Doha	1
Total	24

The overall score (may be referred also as average score) of the qualitative dependency level of each SDG challenge/target is evaluated using the following calculation:

Overall Score (OS) = 5*(% of no. of experts reported 5) + 3*(% of no. of experts reported 3) + 1*(% of no. of experts reported 1).

If $4 \leq OS \leq 5$ than the water dependency level is strong.

If $2 \leq OS < 4$ than the water dependency level is moderate.

If $1 \leq OS < 2$ than the water dependency level is feeble.

This assessment is primarily aimed at promoting discussion between the concerned stakeholders on the importance of water in implementing the SDGs. The proposed qualitative assessment should be evolved

towards quantitative assessment of the water needs for implementing the SDGs. It is important for water scarce countries as the Arab states to initiate quantitative assessment which permits to analyze and compare water needs with water availability to inform policy makers about the impacts of the SDGs on water scarcity.

Evaluation of the costs of making water and sanitation to achieve the implementation of the SDGs is not considered in this study. This may be considered when engaging in quantitative assessment of the water and sanitation services needed.

The square brackets are used throughout this paper to refer to SDG target numbers.

Chapter 1: Interlinkages between Quality Education (SDG 4)[2] and Clean Water and Sanitation (SDG 6)[3]

1.1 Key challenges and rationale of interlinkages with water

The Arab region achieved 93 % of primary school net enrolment rates in 2016 compared to 85 % in the 2000s, just above the global average of 91 % in 2016 (Figure 1.1).

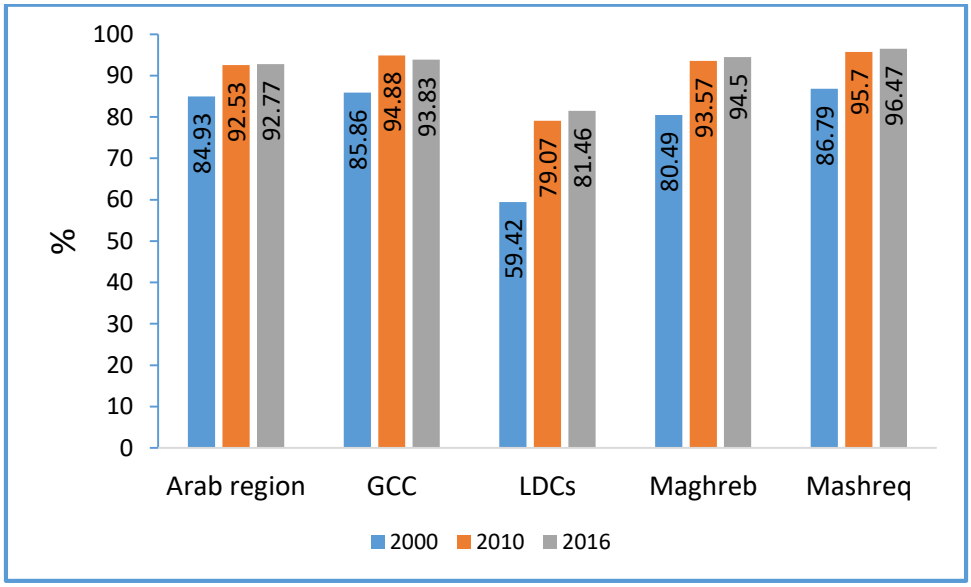

Figure 1.1 Net enrolment in primary education (%)[4]
Source: World Bank - World Development Indicators – Accessed March 2019

The most relevant interlinkages between Quality Education (SDG 4) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

1.1.1 Improving educational outcomes and ensuring inclusive access to education [4.1, 4.2, 4.3, 4.4, 4.5]

Rationale of interlinkages with water

Access to safe WASH services at domicile will help to ensure that children and adults, and particularly girls and women, are not spending their time collecting drinking water from a source outside the house. Carrying

[2] SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
[3] SDG 6: Ensure availability and sustainable management of water and sanitation for all.
[4] The Arab States considered in this figure are for: Gulf Cooperation Council (GCC) (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates); Mashreq (Egypt, Iraq, Jordan, Lebanon, Palestine and Syria); Maghreb (Morocco and Tunisia); Least Developed Countries (LDCs) (Mauritania, Sudan and Yemen).

water consumes time and valuable personal energy that can prevent (mainly) girls from attending schools. WHO & UNICEF (2017) study on the primarily responsibility for water collection across 61 countries shows that women and girls are responsible for water collection in 8 out of 10 households with water off premises; the study also shows that in most Arab LDCs (Somalia, Mauritania, Yemen and Djibouti), the burden of water collection falls mainly on women. Paths to water sources are long and in many cases are passing through remote areas which may put women and girls at risk of physical violence. This is especially prevalent in the Arab LDCs and in countries facing armed conflicts and fluxes of refugees. The results of field surveys targeting vulnerable communities that were conducted in the Arab LDCs namely in Sudan, Mauritania and Yemen in the framework of the MDG+ Initiative[5] (LAS et al. 2016) show that, in many locations, men, women, as well as boys and girls under 15 years age, are responsible for collecting water from the source and bringing it to the house one or more times each day. This time for water collection is in most cases at the account of the children education time. It is important to mention that, in addition to the water collection time, the time lost due to illness caused by poor water quality (e.g. water borne diseases) might also account for the children lost education time.

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of improving educational outcomes [4.1, 4.2, 4.3, 4.4] on water [6.1 & 6.2]. Figure 1.2 shows the qualitative dependency on water as suggested by the regional experts. The average qualitative dependency level on water SDG targets (SDG 6.1 & SDG 6.2) as suggested by the regional experts is moderate.

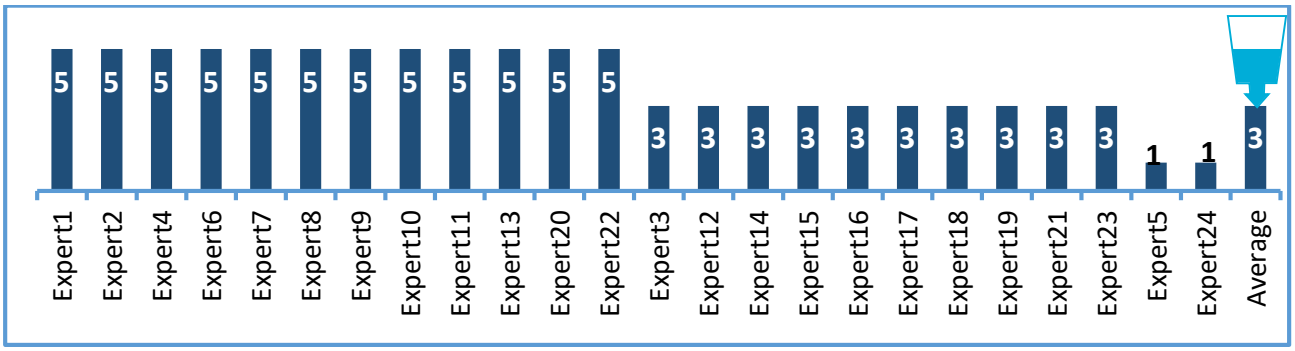

Figure 1.2 Educational outcomes improvements dependency on water, based on the regional experts' elicitations

[5] MDG+ Initiative: Regional Initiative for Establishing a Regional Mechanism for Improved Monitoring and Reporting on Access to Water Supply and Sanitation Services in the Arab Region.

These results show, from regional experts' point of view, the importance of improving the access to safely managed WASH services to improve educational outcomes.

1.1.2 Improving access to WASH facilities in schools [4.a.1]

One of the means of implementation targets, SDG 4 includes specific reference to water, in indicator [4.a.1]: "*Proportion of schools with access to: (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)*"

Rationale of interlinkages with water

"*Improving the access to WASH facilities in schools can improve the health, attendance and welfare of students and teachers, and can therefore contribute to better educational outcomes. WASH in schools is particularly important for girls and young women, as is providing privacy for menstrual hygiene management*" (Source: UN 2018a).

The indicator [4.a.1]_represent a direct interaction with SDG 6 and particularly with indicators [6.1.1] and [6.2.1] as the sub-indicators of [4.a.1] specifically refers to proportion of schools with access to: (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (UN 2019).

Figures 1.3 presents the values of the above mentioned indicators for selected Arab states for the year 2017 (or 2016) (UIS 2019).

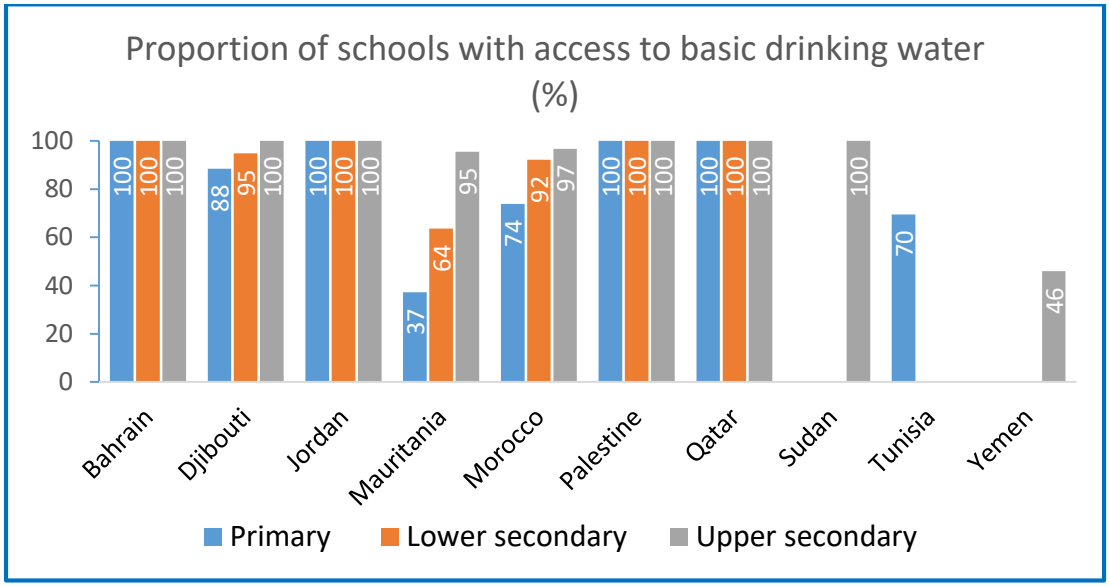

Figure 1.3 Proportion of schools with access to basic drinking water (%) (2017)
Source: UNESCO Institute for Statistics (UIS), 2019

Based on the available data at UNESCO Institute for Statistics (UIS), figure 1.3 shows that the different school levels of the Gulf countries, Jordan and Palestine have 100% coverage with basic drinking water services, followed by Morocco (with 74% and more coverage of schools). Yemen has the lowest coverage of upper secondary schools with basic drinking water that accounts for about 46%.

Figure 1.4 shows the proportion of schools that have access to water supply or have access to drinking water from an unimproved source in the Arab states.

Figure 1.5 shows the proportion of schools that have access to basic sanitation services in the Arab region.

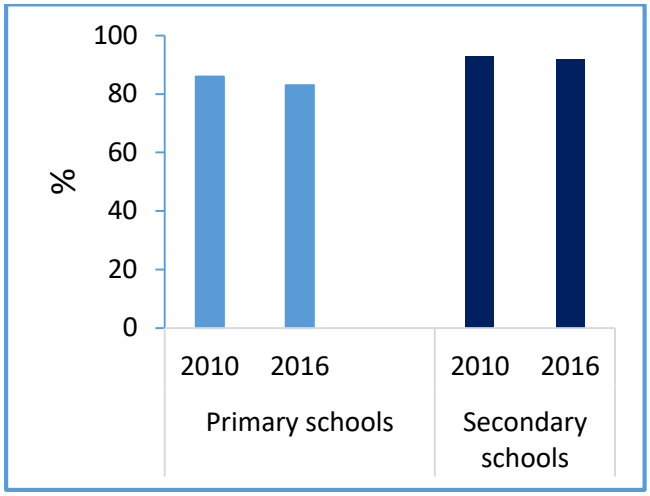

Figure 1.4 Share of schools that have access to water supply or have access to drinking water from an unimproved source in the Arab region (%)
Source: Washdata, 2019

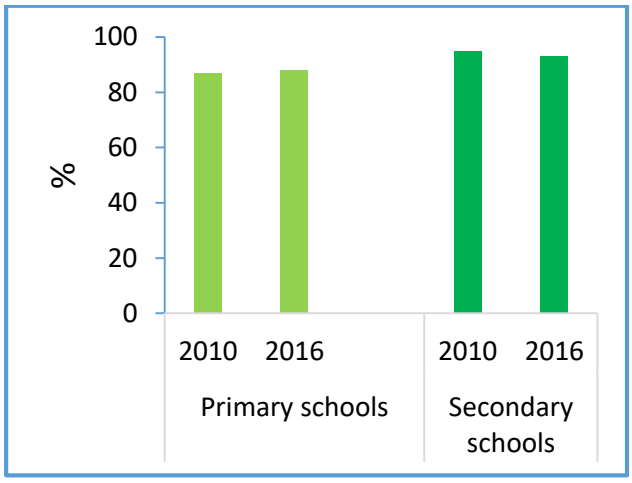

Figure 1.5 Share of schools that have access to improved sanitation services in the Arab region (%)
Source: Washdata, 2019

The following facts are revealed by analyzing trends related to the access to improved drinking water and sanitation services at the regional level (Washdata 2019):

The proportion of schools that have access to improved drinking water services in Arab states decreased from 86% to 83% for primary schools and from 93% to 92% for secondary schools over the period from 2010 through 2016, where armed conflicts, fluxes of refugees, water scarcity and lack of financial resources are, among other, the reasons of this decrease. For the same period of time, 34% more children (4.3 million in 2010 and 5.8 million in 2016) at primary school were exposed to schools without improved drinking water

services. As for children at secondary school, 22% more children (2.2 million in 2010 and 2.7 million in 2016). When it comes to sanitation, absence of improved sanitation services increased in secondary schools by 2% while coverage with improved sanitation has decreased in primary schools by 1%. In 2016, about 2.4 million children at secondary school age were exposed to schools without improved toilets (which is 700 thousand more students than in 2010).

The continuity of water supply is also an important concern in the Arab states. Many schools have access to WASH facilities, however, the intermittency of water supply may lead to inappropriate operation of these facilities and may lead to closure. The access of many schools in the Arab states to water supply through the piped system faces the problem of the intermittency of piped water supply system in several Arab states. The regularity and reliability of water supply, sanitation and hygiene services is a necessary component of understanding the access of schools to WASH facilities in a water scarce region such as the Arab states. Data on water supply intermittency can support integrated decision-making on water resources management and service provision. It can also inform policy formulation and regulations on water storage and water quality testing at the household level. Figure 1.7 shows that continuity of piped water supply is a critical problem in some Arab states, and is largely due to energy availability, water scarcity, or on-going conflicts which affect the water availability in schools connected to piped network system.

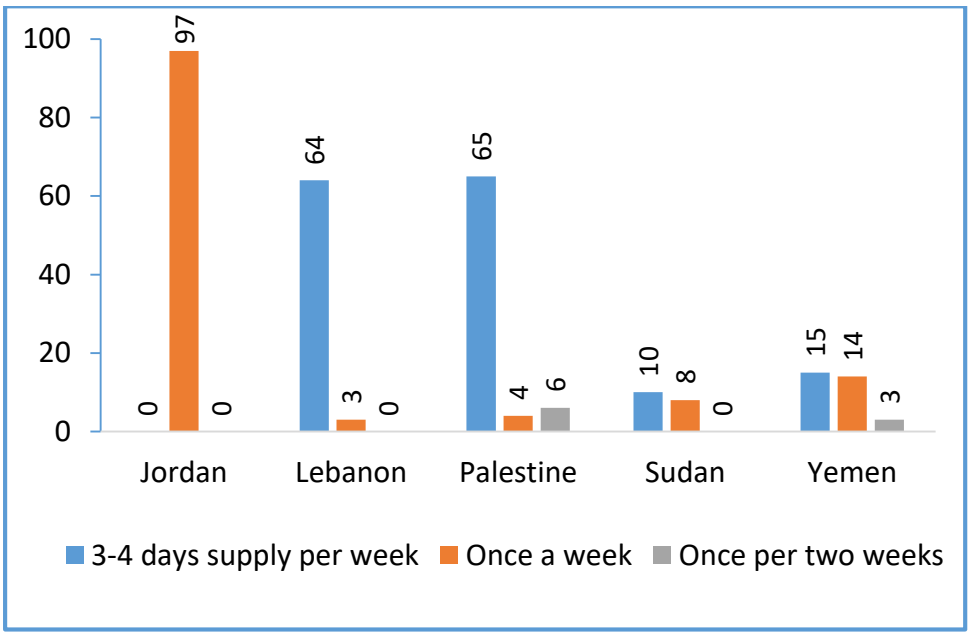

Figure 1.7 The proportion of the population receiving intermittent water supply (2013) (%)
Source: LAS, UNESCWA, ACWUA 2016

Building human capacity in the water and water-using sectors [6.a]

Education and training provide a vital basis for building much-needed human capacity in the water and water-using sectors. Note that far more than 50% of all jobs are heavily or moderately dependent on water security, particularly in agricultural based economies (WWAP, 2016). Education and vocational training programmes are viewed as conditions enabling the achievement of SDG 6.

1.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

Several challenges and policy actions can be distilled from the VNRs submitted by Arab States:

- Efforts have been exhorted in Bahrain to building human capacity in the water and water-using sectors (Bahrain VNR 2018).
- The Egyptian Government adopted a new strategy of redirecting its social spending programs for households with children, aiming at promoting capital accumulation by providing family income support while incentivizing poor households to invest in their children's education and nutrition by imposing conditions such as enrolment of children in schools (with a minimum of 80 percent attendance) and getting the necessary health check-ups, including child immunization and growth monitoring for children aged 0-5 years old (Egypt VNR 2018). These type of programs will call attention to the importance of household and schools WASH for the nutrition and health of young children, and will contribute, at the long term, in improvement of the WASH facilities in schools.
- The education policy in Jordan for the near future will integrate the concepts and principles of sustainable development in all stages of education (Jordan VNR 2017).
- A Royal Order was issued in Saudi Arabia to include the SDGs into education curricula. Work is in progress towards this end, led by the Ministry of Education, in partnership with public and private stakeholders (Saudi Arabia VNR 2018).

1.3 Successful case studies

Introducing Education for Sustainable Development (ESD) into Egyptian Schools "EDUCAMP" (Source: Egypt VNR 2016) (http://www.educamp.eu/index.php/about).

The RWTH Aachen University in Germany, in collaboration with the Center for Sustainable Development (CSD) in the American University in Cairo (AUC), have launched in 2010 the Education for Sustainable Development Beyond the Campus (*EduCamp-I*) initiative, which aimed to introduce sustainable development

concepts in Egyptian schools. Water has a centrality in achieving sustainable development because of its importance to each of the sustainable development dimensions (society, economy and environment). The project ended by establishing seven Centers of Excellence in seven Egyptian universities to promote the concept of ESD into education where sustainable water is an integral part. The project's success later leads to the launching of two more phases, *EduCamp-II* and *EduCamp-III*. The CSD, which runs the project, aims to implement the project on a larger scale by transforming the poor schools in Egypt into schools that meet the objectives of the Country's Sustainable Development Strategy "Egypt 2030" where water is a key integral sector. The project is planned over the span of 14 months and is to be implemented through various work packages.

1.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to take water better into account when implementing SDG 4:

- Improving safely managed access to water supply and sanitation services at domicile especially in the Arab LDCs and in countries facing armed conflicts and fluxes of refugees.
- Improving access to WASH facilities in schools including Menstrual Hygiene especially in the Arab LDCs and in countries facing armed conflicts and fluxes of refugees.
- Improving cleaning and maintenance of WASH facilities in schools and including regular maintenance funding as part of schools recurrent budgets.
- Introducing Education for Sustainable Development into Schools is viewed by most Arab states as a means for enabling the achievement of SDG 6 and other SDGs by providing a vital basis for building much-needed human capacity in the water and water-using sectors. As shown in the submitted VNRs, several Arab states introduced or willing to introduce Education for Sustainable Development into Schools Education.

1.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

Faidi D (2016) How might Education Policy in the United Arab Emirates (UAE) support Education for Sustainable Development programmes? University of Bath Department of Education Working Papers Series. No. 2016/5 December 2016. Bath, United Kingdom.

League of Arab States (LAS) (2018) Arab Regional Report for 8th World Water Forum - Pre-Forum report.

LAS, 2014. Action Plan of the Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

LAS, 2013. The Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

Luha J, Bartrama J (2016) Drinking water and sanitation: progress in 73 countries in relation to socioeconomic indicators, Bulletin of the World Health Organization 2016, 94:111–121. doi: http://dx.doi.org/10.2471/BLT.15.162974

United Nations Economic and Social Commission for Western Asia (UNESCWA), United Nations Environment Programme (UNEP) (2015) Arab Sustainable Development Report. Beirut.

United Nations Economic and Social Commission for Western Asia (UNESCWA) (2016) Doha Declaration on Implementation of the 2030 Agenda. United Nations Economic and Social Commission for Western Asia, Beirut.

United Nations (UN) (2018) Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation. New York.

United Nations Children's Fund (UNICEF), World Health Organization (WHO) (2018) Drinking water, sanitation and hygiene in schools: Global baseline report. New York.

Chapter 2: Interlinkages between Decent Work and Economic Growth (SDG 8)[6] and Clean Water and Sanitation (SDG 6)

2.1 Key challenges and rationale of interlinkages with water

The most relevant interlinkages between Decent Work and Economic Growth (SDG 8) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

2.1.1 Sustain economic growth [8.1, 8.2]

Rationale of interlinkages with water

Water is important for sustaining economic growth, it is embodied in agriculture, industry, energy production and all other economic activities. Within the Arab states, same as worldwide, economic growth is a priority for all countries, the interlinkages of water with economic growth in the region have particular importance due to water scarcity.

Figure 2.1 presents time trends of the GDP and GDP per capita over the period 1999-2017 in the Arab states. Although GDP growth has been relatively good, GDP growth per capita has been considerably weaker due to population growth. Given the different economic structure of each country, these indicators should be used carefully to evaluate the water inputs for sustaining economic growth, taking into account the water use efficiencies in country's sectorial activities and natural resource endowments.

[6] SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

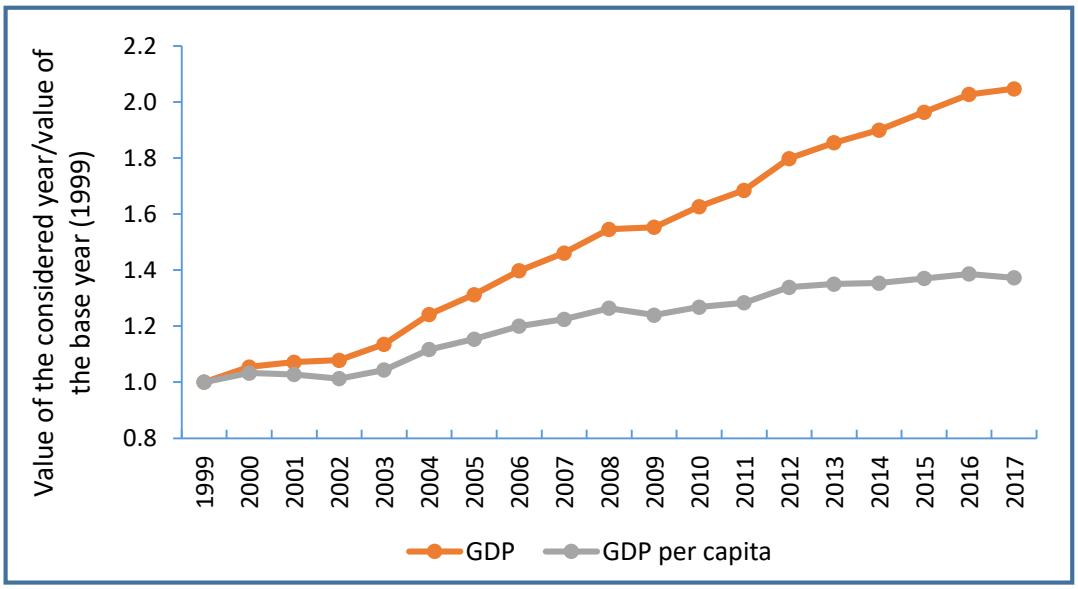

Figure 2.1 Trends of the GDP and GDP per capita in the Arab states, 1999-2017[7]
Source: Compiled by the author from World Bank data base (2019)

Figure 2.2 shows the relation between per capita total water withdrawals and per capita GDP for selected Arab states. As shown in the figure, with increasing prosperity, the total water withdrawals per capita will also increase for a certain per capita GDP level (this mainly due to changes in industrial and/or agricultural demands, lifestyle and consumption patterns changes). Once the per capita GDP reaches a certain high level, it is assumed that the per capita water consumption will decrease or remain constant (World Bank 2011). This may be explained by the possibility of substantial investments in water-saving technologies (making per capita total water withdrawals decrease), however, this decrease may be offset by the fact that people might use more water due to lifestyle changes (e.g. washing cars, swimming pools and watering gardens).

[7] Assuming 1999 is the base year, the trend value is calculated for each year using the following formula: Trend value = value of the considered year ÷ the value of the base year

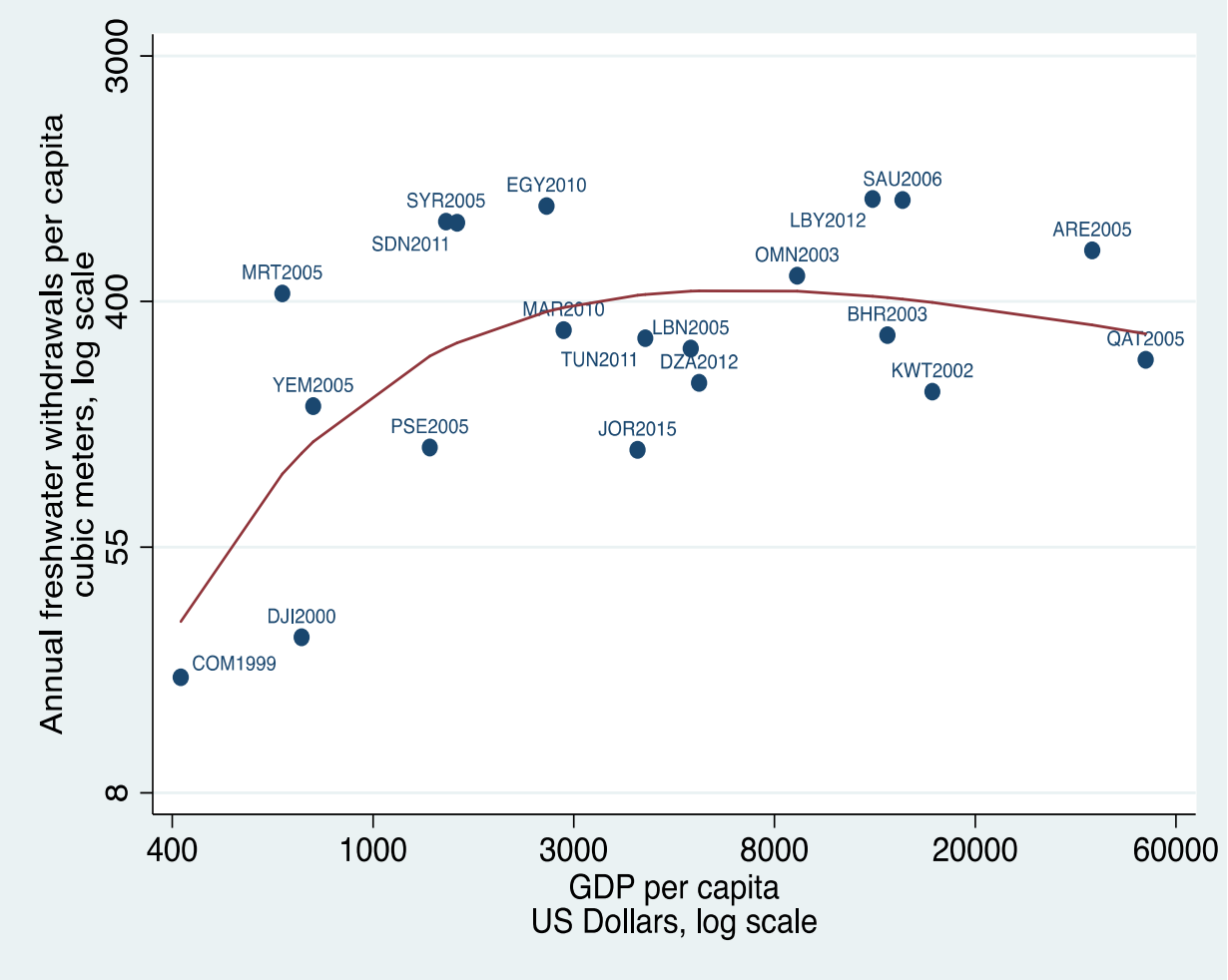

Figure 2.2 Relation between per capita total water withdrawals and per capita GDP for selected Arab states[8]
Source: World Bank - World Development Indicators & FAO Aquastat – accessed April 2019

Figure 2.3 and 2.4 show the economic structure of the Arab states with the percentual share of sectors in GDP (UNESCWA et al. 2015) and the proportion of water withdrawals for the main economic sectors (industry, agriculture and domestic water use) (FAO, 2018a), respectively. The oil, gas and mining comprise 41 % of GDP in the countries rich in oil and almost 10 % in the other countries. The service sector, a high employment sector, comprises a high and growing share of GDP. Manufacturing continues to be among the smaller parts of most Arab economies. Although agriculture represents a little share of GDP, it accounts for up to 84 % of total water withdrawals regionally. It is the central component of economic growth in many Arab states, it is an important livelihood source for many households in rural areas.

[8] ARE (United Arab Emirates), BHR (Bahrain), COM (Comoros), DJI (Djibouti), DZA (Algeria), EGY (Egypt), IRQ (Iraq), JOR (Jordan), KWT (Kuwait), LBN (Lebanon), LBY (Libya), MAR (Morocco), MRT (Mauritania), OMN (Oman), PSE (Palestine), QAT (Qatar), SAU (Saudi Arabia), SOM (Somalia), SDN (Sudan), SYR (Syria), TUN (Tunisia), YEM (Yemen).

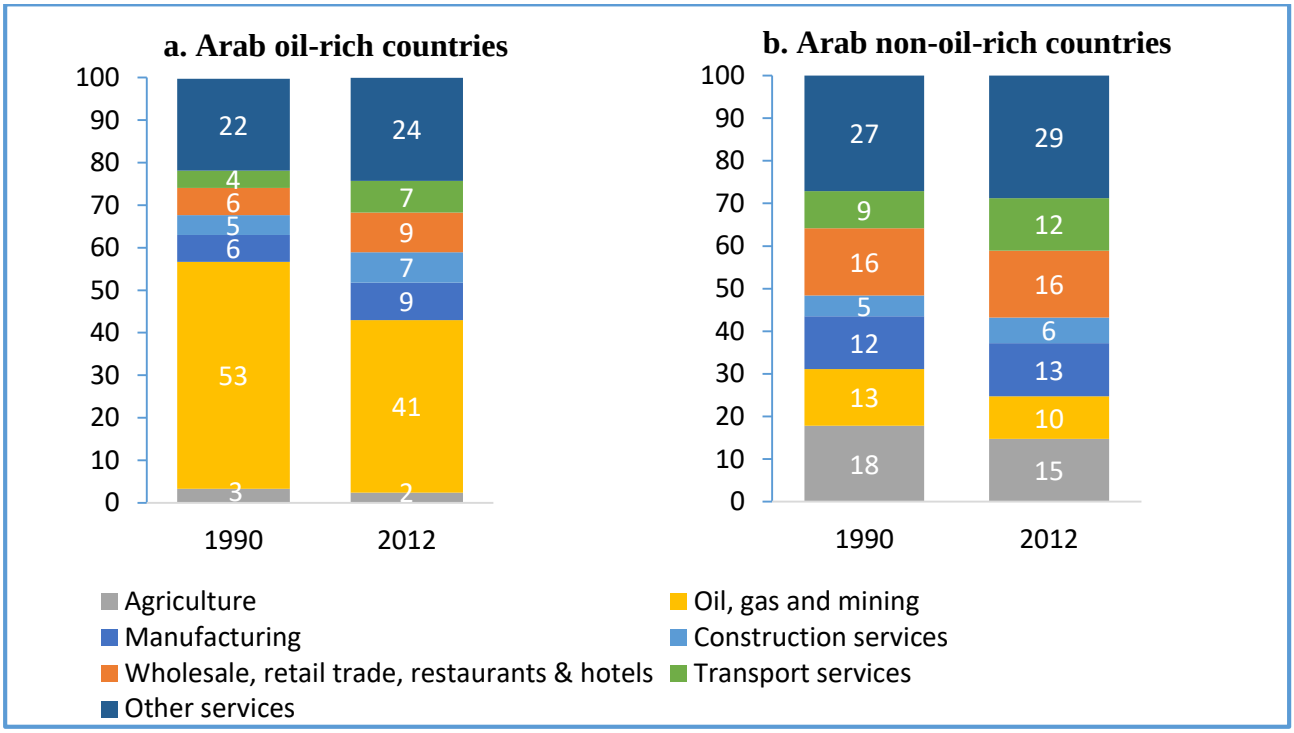

Figure 2.3 Economic structure of Arab states (percentage share of sector in GDP)
Source: UNESCWA et al. (2015)

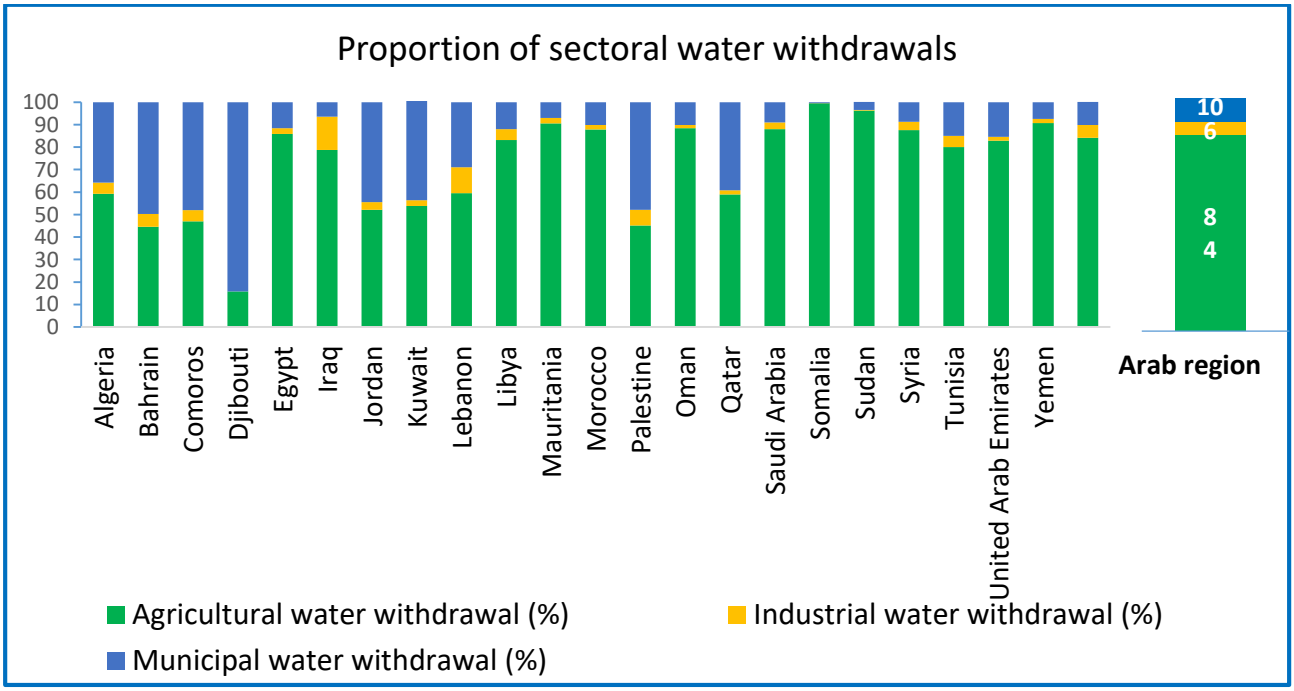

Figure 2.4 Proportion of sectoral water withdrawals (2014)
Source: compiled by the author using FAO data base

The water scarcity that characterizes the Arab region imposes the use of non-conventional water resources such as desalination and wastewater reuse, which enforces extra financial burden for availing water. The

high production cost of non-conventional water resources limits the ability of Arab states to make more water available for domestic, agricultural, industrial and environmental uses, which will require better management of water resources (partly by prioritizing) and more cross-sectoral planning and integration.

Information of water use in the economy is largely incomplete or lacking for the majority of Arab states. In general, efforts should be made by the Arab states to provide valid and homogeneously disaggregated information of water use and water use trends for the different socio-economic activities.

Water-economic-environmental accounting is an important tool that might be applied and used to inform IWRM analysis. The System of Environmental-Economic Accounts for Water (SEEA-Water) adopted in 2010 by the United Nations Statistical Commission (UNDESA 2012), provides the conceptual framework to ensure the coherence of water, environmental and economic statistics, hence facilitating and improving integrated analysis of the interrelations between these key sectors. SEEA-Water is based on, and coherent with, the System of National Accounts (SNA), which has become a widely accepted international standard for monitoring economic policies.

To effectively monitor progress towards achieving the SDG 8 and adopting better policy decisions, water experts, policy-makers, statisticians and economists, among others, need to work together in order to make this happen.

Water-economic-environmental accounting systems may, when coupled with input-output analysis framework, improve (lower) the quantification of the embodied water use for generating a dollar of Gross Domestic Product, the trade in virtual water, the efficiency of the water use in the different economic activities and the impacts of growth in population and economy on water quantity and quality.

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of sustaining economic growth [8.1, 8.2] on water [6.5.1]. Figure 2.5 shows the qualitative dependency level on water as suggested by the regional experts, 17 experts out of 23 suggested that sustaining economic growth is strongly dependent on water (SDG 6.5.1). The average qualitative dependency level on water as suggested by the regional experts is also strong.

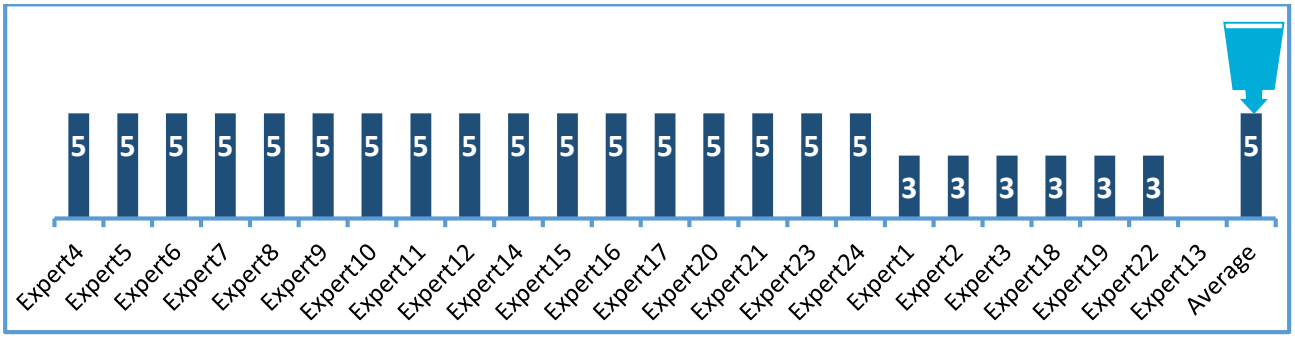

Figure 2.5 Qualitative dependency level of economic growth on water, based on the regional experts' elicitations

These results show, from regional experts' point of view, the importance of improving implementing integrated water resources management (SDG 6.5.1) to sustain economic growth.

2.1.2 Improve global resource efficiency in consumption and production [8.4]

Rationale of interlinkages with water

Improving water use efficiency in consumption and production allows reducing water stress by freeing up water for other uses. Regional efforts to improve water use efficiency therefore have to be part of the development of IWRM plans.

Given the high proportion of water used in the agricultural sector in the Arab states, the gains from improving water use efficiency are likely to be greatest in that sector. Figure 2.6 shows growth trends over the period 2002-2012 of agriculture productivity (US$/$m^3$), added agriculture value (US$) and agriculture water withdrawal (m^3) in selected Arab states. It can be observed that agriculture water withdrawal decreased in Jordan and Morocco in 2012 compared to 2002, while added agriculture value and agriculture productivity increased which highlights the important progress in water use efficiency in agriculture in these two countries.

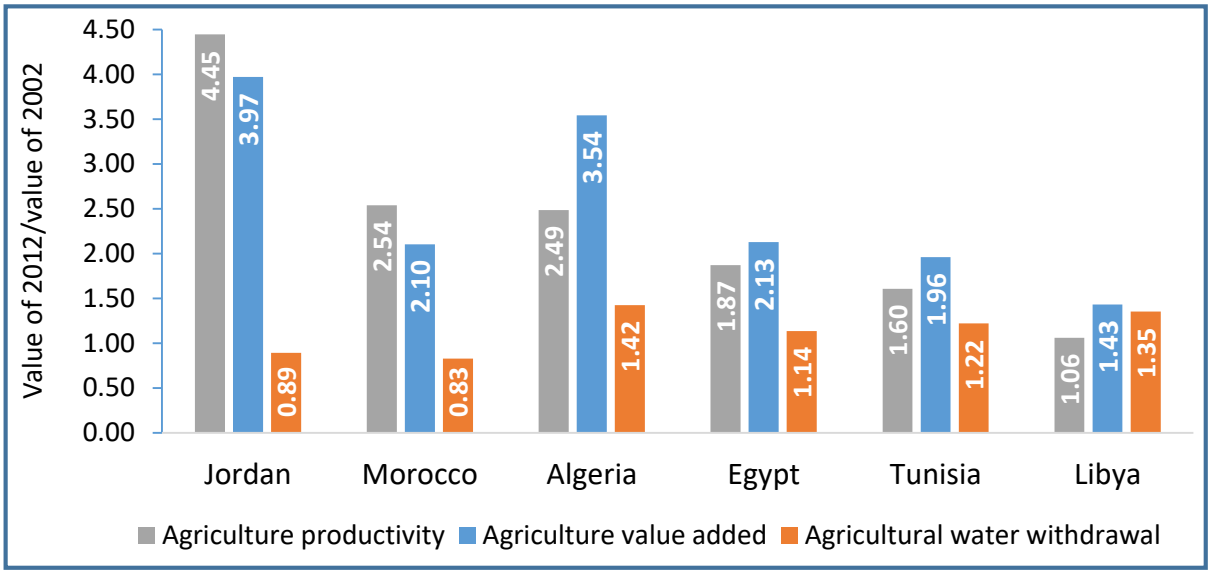

Figure 2.6 Growth trends of selected agriculture indicators over the period 2002-2012 in selected Arab states[9]
Source: compiled by the author using FAO data base

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of Improve global resource efficiency in consumption and production [8.4] on water [6.4.1 and 6.5.1]. Figure 2.7 shows the qualitative dependency level on water as suggested by the regional experts, 16 experts out of 23 suggested that improving global resource efficiency in consumption and production is strongly dependent on water (SDG 6.4.1 and 6.5.1). The average qualitative dependency level on water as suggested by the regional experts is also strong.

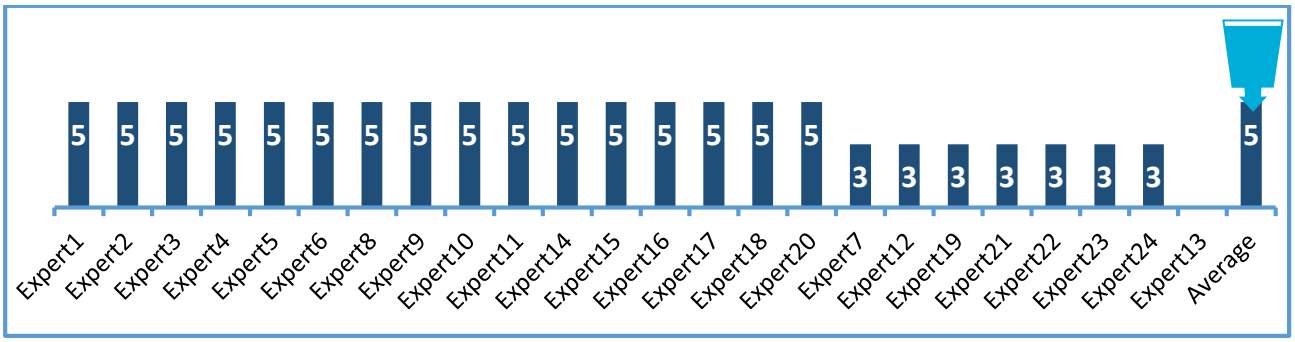

Figure 2.7 Qualitative dependency level of global resource consumption and production efficiency in water based on the regional experts' elicitations

[9] Assuming 2002 is the base year, the trend value is calculated for each year using the following formula: Trend value = value of the considered year ÷ value of the base year.

2.1.3 Decoupling economic growth from environmental degradation [8.4]

Rationale of interlinkages with water

Within the Arab states time trends of collected wastewater, removed water pollutants (COD) and GDP reveal the fact that some Arab states managed to reduce the volume of water pollutants substantially. For example, over the period 2010-2015, the wastewater collection in Qatar increased by 94 %, and while GDP had grown by 30%, the country managed to reduce the volume of water pollutants substantially (Figure 2.8).

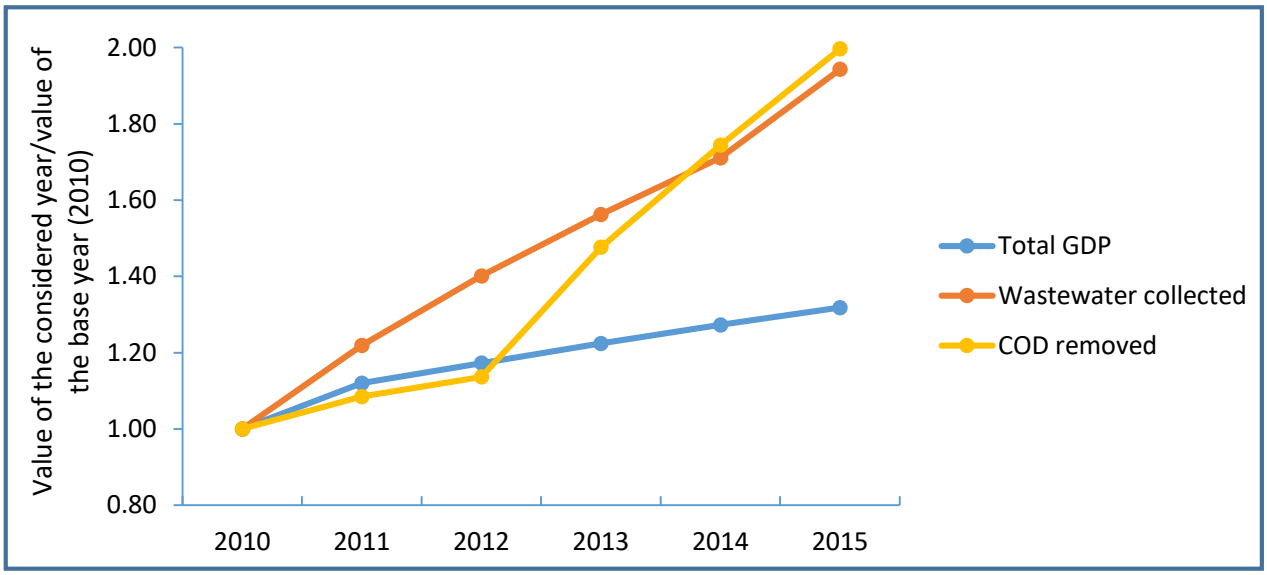

Figure 2.8 Trends of the GDP along with wastewater collected and COD removed in Qatar (2010-2015)[10]
Source: Compiled by the author from MDPS, 2015

Quantifying pollutants released to the environment is key input to properly inform on the extent of environmental risks (Karnib 2016). For example, although the proportion of population connected to piped wastewater network is 71.23 % in Beirut and Mount Lebanon, only 9.64 % of the pollutants are safely removed (Karnib 2016) before release into the environment. Information of pollutants released to the environment is largely incomplete or lacking for the majority of Arab states. In general, efforts should be made by the Arab states to provide valid information of pollutants released to the environment within their water accounts.

[10] Assuming 2010 is the base year, the trend value is calculated for each year using the following formula: Trend value = value of the considered year ÷ value of the base year.

The quantitative water-economic-environmental systems when coupled with input-output analysis framework will provide useful tools to increase water use efficiency and reduce environmental risks (Karnib 2017).

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of decoupling economic growth from environmental degradation [8.4] on water [6.5.1]. Figure 2.9 shows the qualitative dependency level on water as suggested by the regional experts, 13 experts out of 22 suggested that decoupling economic growth from environmental degradation is moderately dependent on water SDG 6.5.1. The average qualitative dependency level on water as suggested by the regional experts is also moderate.

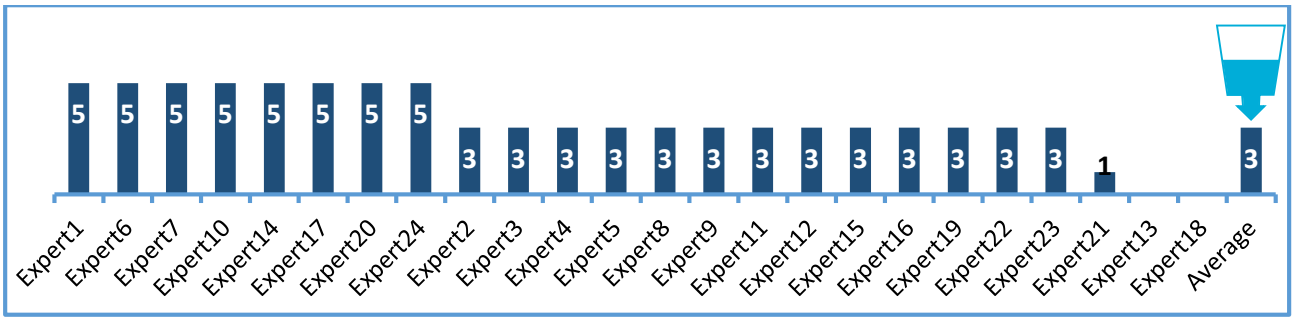

Figure 2.9 Qualitative dependency level on water of decoupling economic growth based on the regional experts' elicitations

These results show, from regional experts' point of view, the importance of improving implementing integrated water resources management (SDG 6.5.1) to reduce environmental degradation.

2.1.4 Achieve full and productive employment and decent work for all [8.5]

Rationale of interlinkages with water

Access to WASH in the workplace, including for persons with disabilities, is a component of productive employment and a secure working environment, with a strong positive impact on worker's health and thus their productivity. Moreover, sex-separated WASH facilities, including for Menstrual Hygiene Management (MHM), in workplace are also central to realize women's effective participation at all levels in economic life. Although, information on gaps between female and male employment in the Arab states are obtainable (Figure 2.10), information on women working in the agriculture sector and female access to sex-separated WASH facilities are not well outlined. In all cases, efforts should be made towards empowering women to have land rights and to be engaged more effectively in decision making in the water sector.

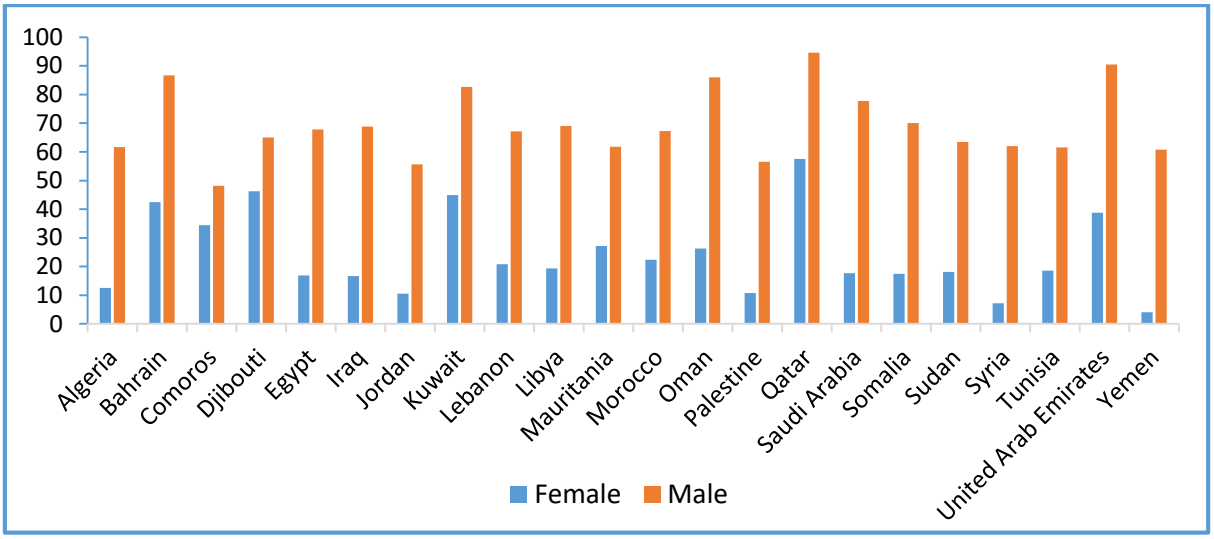

Figure 2.10 Female and male employment to population ratio (%) (2018) (ILO estimate)
Source: World Bank - World Development Indicators

Information on productivity losses due to illness caused by poor sanitation and hygiene is largely incomplete or lacking for the majority of Arab states. In general, efforts should be made by the public and private sector in the Arab states to provide valid and homogeneously disaggregated information of employee access to WASH.

2.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

Several challenges and policy actions can be distilled from the VNRs submitted by Arab states:

- The Egyptian Sustainable Development Forum (ESDF) works through economic groups on several sustainable development issues including: i) green economy & green jobs; ii) water & food security and sustainable agriculture systems; iii) sustainable production and consumption patterns; iv) energy; v) sustainable tourism; vi) technology transfer, and vii) green buildings (Egypt VNR 2016).
- In 2017, Jordan has adopted the Jordan Economic Growth Programme 2018-2022 to refocus efforts on the inclusive growth agenda. Some of these include, among other, key deliverables under main national sectoral strategies in water and green economy (Jordan VNR 2017).
- The Lebanese Ministry of Agriculture Strategy 2015-2019 aims to develop the agriculture sector by ensuring food security and food safety, reducing poverty and rural-urban migration, creating job opportunities, and increasing efficiency and sustainable use of natural resources including water (Lebanon VNR 2018).

- The confiscation of water and other natural resources, among other factors by Israeli unfair and unequal policies, has hampering Palestine's economic growth (Palestine VNR 2018).
- In January 2012, H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launched the green economy for sustainable development initiative (UAE VNR 2017). The initiative includes, among other, policies in agriculture sector which may involving the efficient use of water in irrigation.

2.3 Successful case studies

Water, Economic and Environment statistics in Qatar (Source: Environment statistics bulletin 2015 published by the Ministry of Development Planning and Statistics) (MDPS 2015).

The Ministry of Development Planning and Statistics in Qatar issued the "Environment statistics bulletin 2015" which includes quantitative water-economic-environmental interlinked data and indicators. This information is important to support sustainable national development strategies.

Figure 2.11 shows progress of water use by economic sector in million m^3/year for Qatar (including injection, losses, and discharged wastewater into lagoons). In 2005, the agriculture sector was the main user of water, while, starting from 2012, the water use by households became the main user of water. The figure shows also the increase of water use by the industry and the commercial activities.

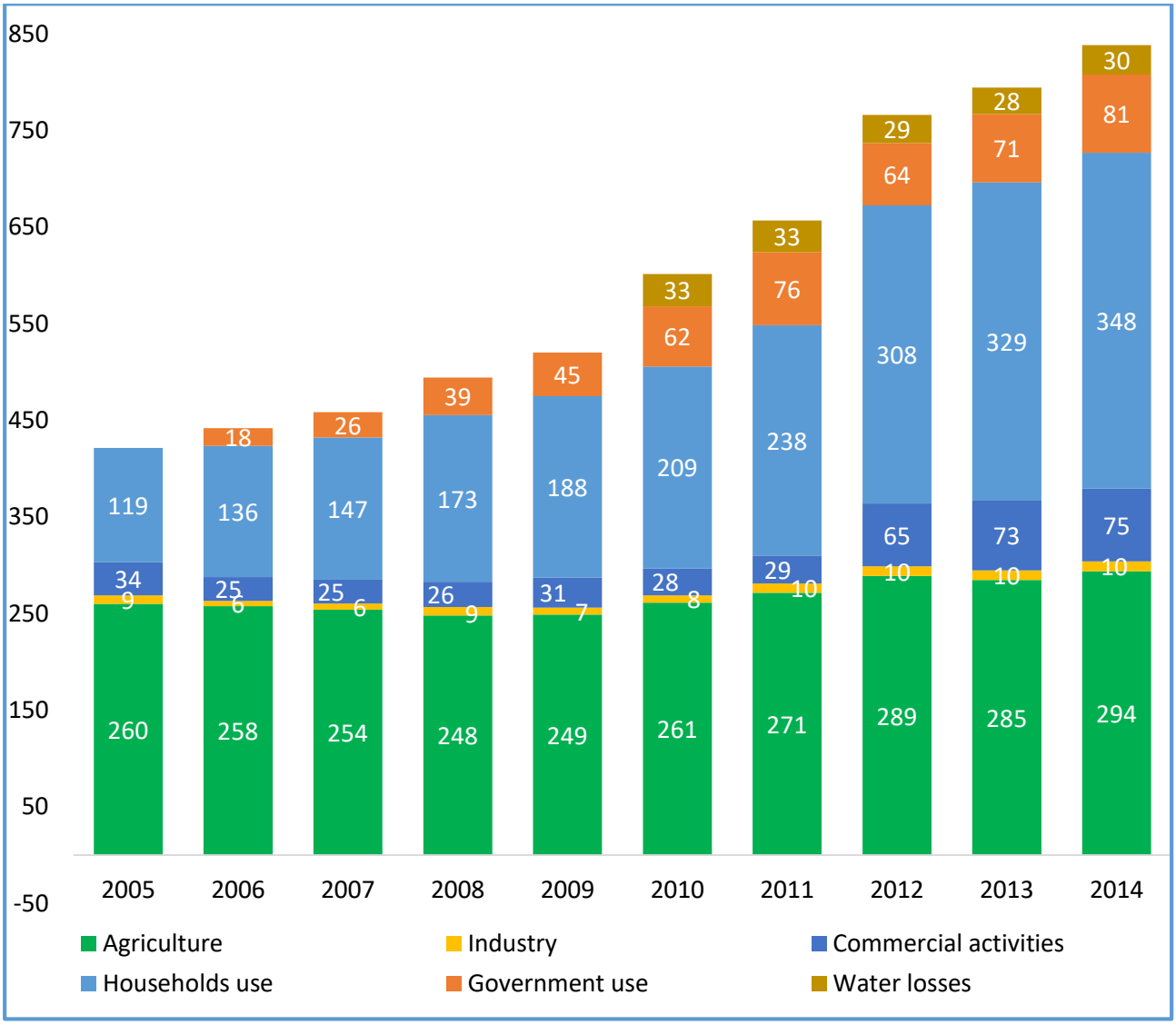

Figure 2.11 Water use by economic sector in million m^3/year for Qatar
Source: Compiled by the author using MDPS 2015 data

Figures 2.12, 2.13 and 2.14 show the trend lines of water use efficiency in the agricultural, industrial and commercial sectors in Qatar, respectively (US$/$m^3$) (2002-2014).

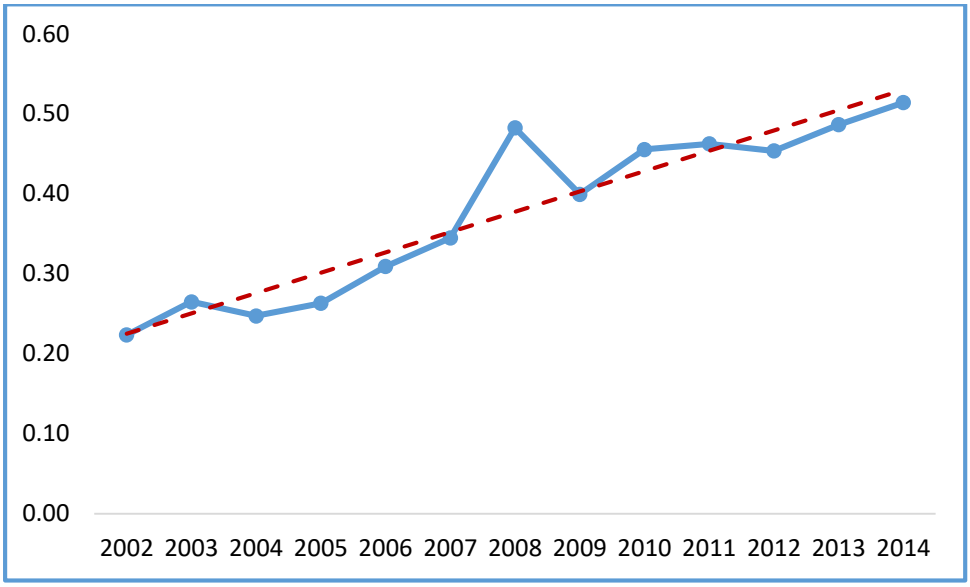

Figure 2.12 Trend line of the water use efficiency in the agricultural sector in Qatar (US$/m^3)
Source: Compiled by the author using MDPS (2015) data

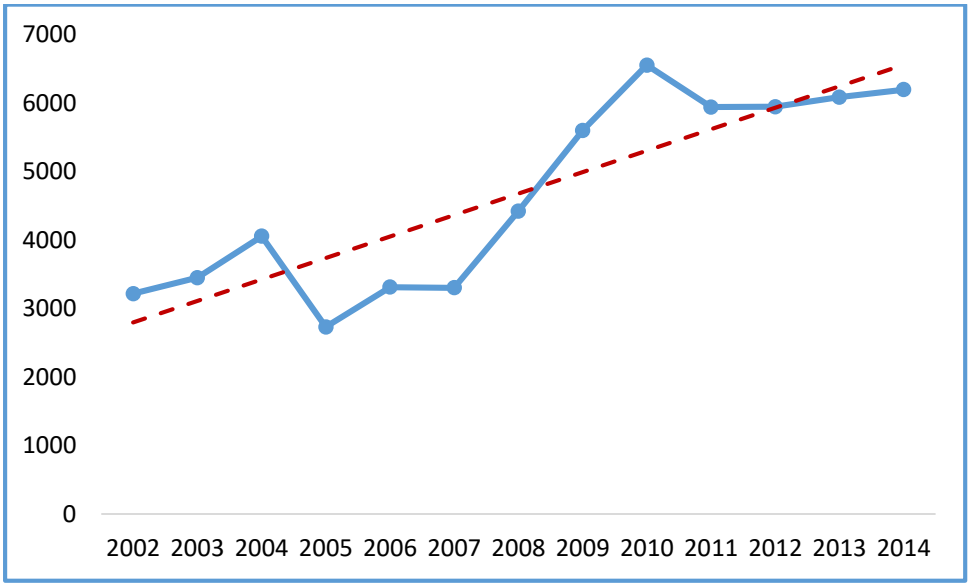

Figure 2.13 Trend line of the water use efficiency in the industrial sector in Qatar (US$/m^3)
Source: Compiled by the author using MDPS (2015) data

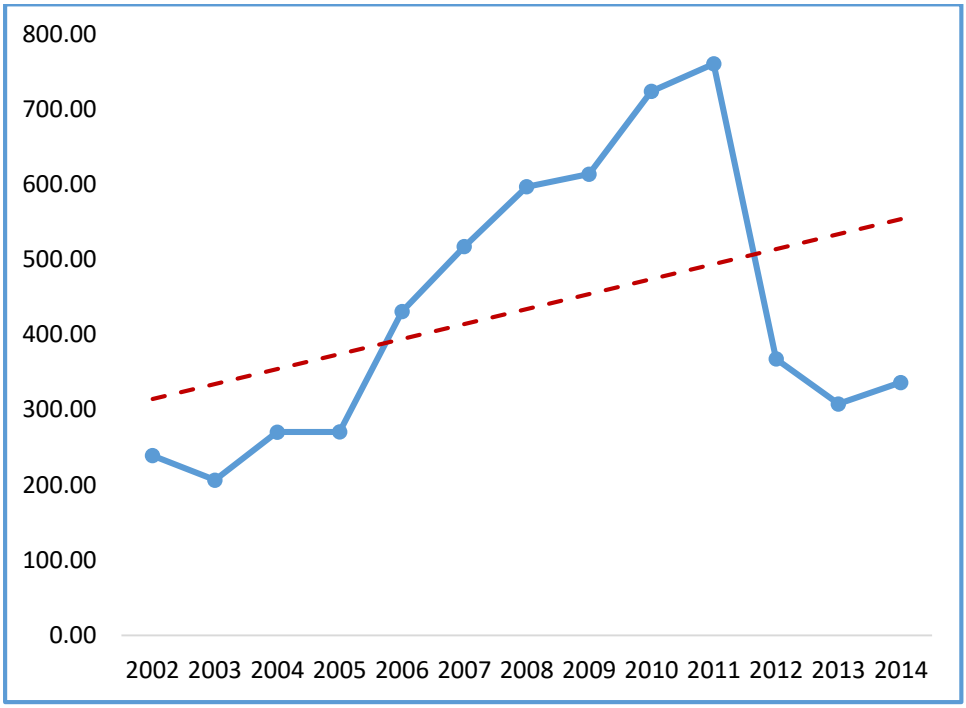

Figure 2.14 Trend line of the water use efficiency in the commercial sector in Qatar (US$/m^3)
Source: Compiled by the author using MDPS (2015) data

The trend lines of the water use efficiency in the agricultural and industrial sectors, show significant improvements between 2002 and 2014, while the water use efficiency in the commercial sector shows improvement between 2002 and 2011 and a significant decrease between 2011 and 2014.

These results demonstrate the efforts exerted by Qatar to improve the water use efficiency in the main productive sectors to combat water scarcity.

2.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to better take water into account when implementing SDG 8:

- The improvement of governance and the application of Integrated Water Resource Management (SDG 6.5) are positively associated to: sustaining economic growth (SDG 8.1, 8.2), improving global resource efficiency in consumption and production (SDG 8.4) and decoupling economic growth from environmental degradation (SDG 8.4).
- The achievement or progress in the achievement of SDG 6 may lead to improvements in the well-being of the population through positive spill-over effects to the other SDGs.

- The United Nations System of Environmental-Economic Accounts for Water (SEEA) should be promoted as appropriate to local context in the Arab states as the basis for storing, sharing and improving environmental data, where the accounts of pollutants released to the environment should be integrated within the countries' water accounts.
- There is a need to improve water use efficiency in all productive sectors and particularly the agriculture sector.
- Improving access to water and economic data to support policy and decision-making.
- Efforts should be made towards empowering women to have land rights and to be engaged more effectively in decision making in the water sector.
- Encourage the public and private sector in the Arab states to collect and provide valid and homogeneous disaggregated information of employee access to WASH at the work place.

2.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

League of Arab States (LAS) (2018) Regional Report for 8th World Water Forum - Pre-Forum report.

LAS, 2014. Action Plan of the Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

LAS, 2013. The Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

United Nations Economic and Social Commission for Western Asia (UNESCWA) (2016) Doha Declaration on Implementation of the 2030 Agenda. United Nations Economic and Social Commission for Western Asia, Beirut.

UNESCWA (2009) Framework for environmental economic accounting in the UNESCWA region. Beirut.

United Nations Economic and Social Commission for Western Asia (UNESCWA), United Nations Environment Programme (UNEP) (2015) Arab Sustainable Development Report. Beirut.

United Nations - Department of Economic and Social Affairs (UNDESA) - Statistics Division (2012) System of Environmental-Economic Accounting for Water. New York.

Chapter 3: Interlinkages between Reduced Inequalities (SDG 10)[11] and Clean Water and Sanitation (SDG 6)

3.1 Key challenges and rationale of interlinkages with water

The most relevant interlinkages between Reduced Inequalities (SDG 10) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

3.1.1 Sustain income growth [10.1]

Rationale of interlinkages with water

The influence of demographic economic variables can be investigated by applying water-economy accounting methods to analyze interlinkages between water use and household income and expenditure (Lenzen & Foran 2001). The water use and water use per capita could be evaluated as function of households expenditure/income, therefore, the influence of the progress on per-capita expenditure/income could be quantified.

As it was mentioned in chapter 2, information of water use in the economy is largely incomplete or lacking for the majority of Arab states. In general, efforts should be made by the Arab states to provide valid and homogeneous disaggregated information of water use and water use trends in the difference socio-economic activities.

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of sustaining income growth [10.1] on water [6.5.1]. Figure 3.1 shows the qualitative dependency level on water as suggested by the regional experts, 17 experts out of 23 suggested that sustaining income growth is strongly dependent on water.

[11] SDG 10: Reduce inequality within and among countries.

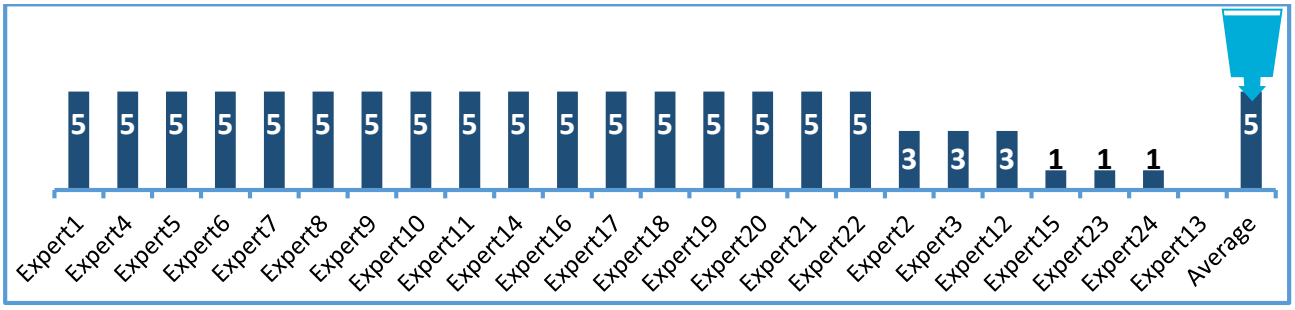

Figure 3.1 Qualitative dependency level of sustaining income growth on water based on the regional experts' elicitations

These results show, from regional experts' point of view, the importance of improving implementing integrated water resources management (SDG 6.5.1) to sustain income growth.

3.1.2 Empower and promote the social, economic and political inclusion of all [10.2]

Rationale of interlinkages with water

Unemployment across the Arab States region has worsened in recent years as rural incomes have fallen due to droughts, land degradation and groundwater depletion, resulting in low agricultural productivity. Inadequate and unreliable water supply has contributed to agricultural job losses. This challenge remains critical in Arab LDCs and countries facing armed conflicts and fluxes of refugees (Jordan, Iraq, Lebanon, Libya, Palestine, Syria and Yemen).

Moreover, information on women's employment in water related jobs are lacking for the majority of Arab states. In general, efforts should be made by the Arab states to promote gender mainstreaming in water governance.

3.1.3 Reduced Inequalities in providing access to safely managed WASH facilities

Rationale of interlinkages with water

The Arab states is facing the challenge of inequalities in access to safely managed WASH facilities among and within countries. Rural communities in many Arab states lag behind the urban areas in access to at least basic drinking water services (Figure 3.2) (Washdata, 201916). Moreover, water and sanitation inequalities are not just rural/urban issues; slums, refugees and internally displaced people are among the most vulnerable and disadvantaged groups in several countries in the Arab states, often faced with barriers to access basic water

supply and sanitation services. Disaggregated data on access of the vulnerable groups to safely managed WASH facilities are lacking.

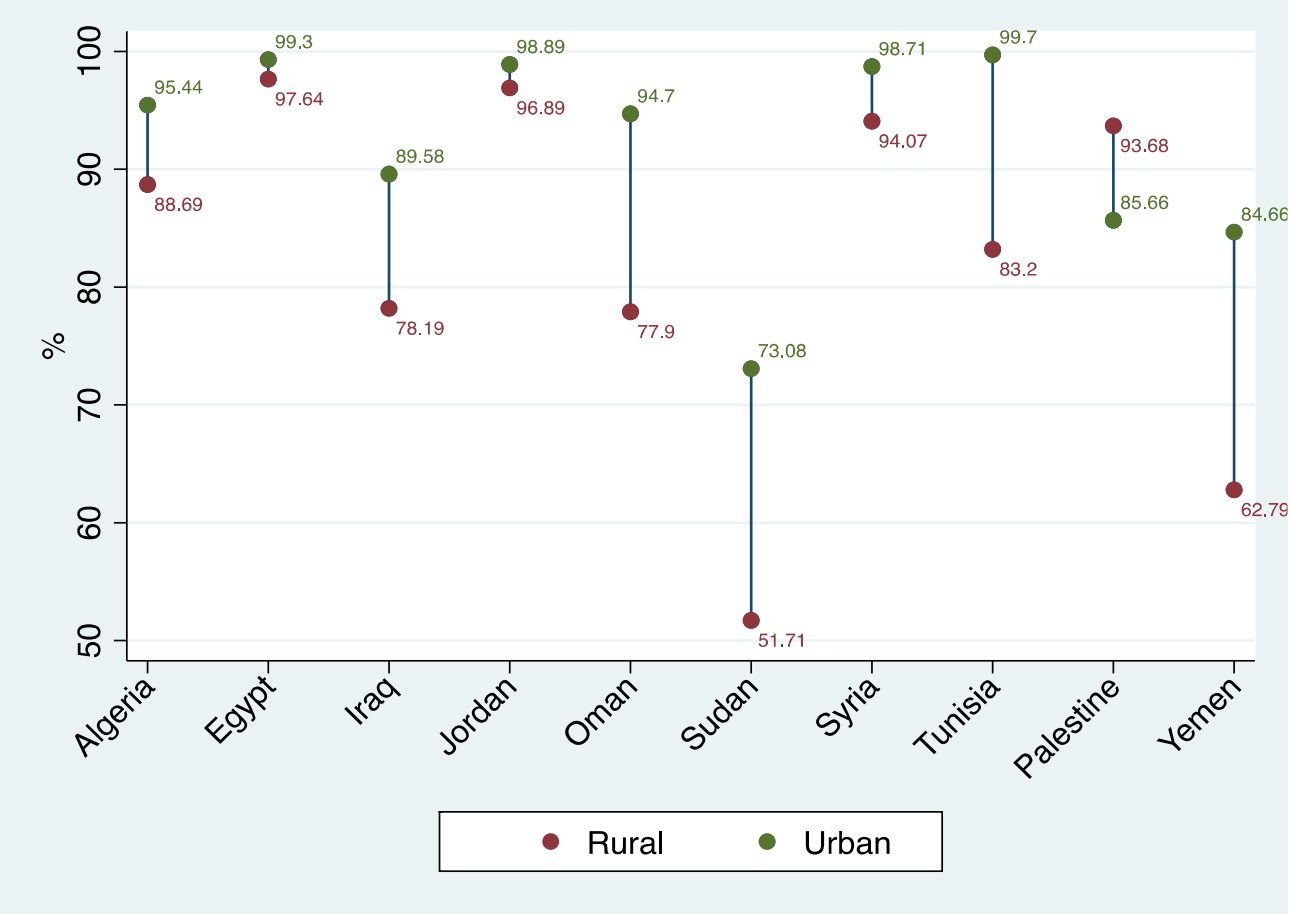

Figure 3.2 Rural and urban sector inequalities in providing access to at least basic drinking water services (Source: Washdata, 2019)

Figure 3.3 shows the water consumption in rural and urban areas in selected Arab states (LAS, UNESCWA & ACWUA 2016).

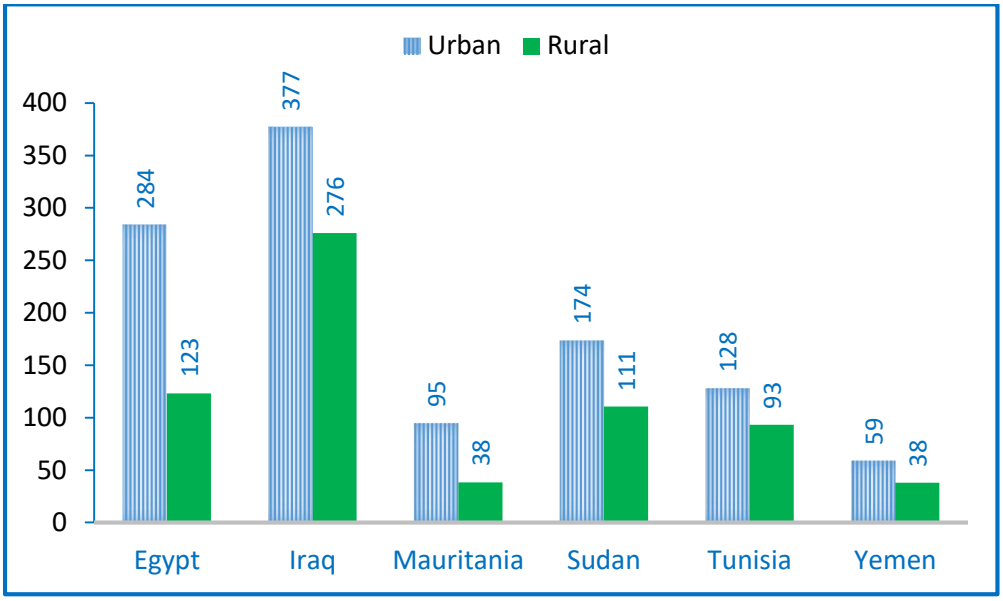

Figure 3.3 Water consumption in rural and urban areas in selected Arab states (liters/capita/day) (Source: LAS, UNESCWA & ACWUA 2016)

As shown in Figure 3.3, over the Arab states, the volume of water consumed from piped water networks greatly varies between rural and urban areas within the same country.

3.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

- The expansion of the community-based schools models equipped with adequate WASH facilities and targeting girls in rural and vulnerable areas in Egypt have been successful in encouraging girls' enrolment in basic education (Egypt VNR 2016).
- The ability to access services extremely differs between the rural and urban areas in Palestine, and between the West Bank and Gaza. Access to services provided by the government is hampered by Israeli restrictions and the ability of Palestinians to pay for better quality services. (Palestine VNR 2018).
- The Palestinian government will continue to develop educational facilities equipped with adequate WASH facilities adapted to the needs of persons with disabilities (Palestine VNR 2018).

3.3 Successful case studies

Socio-economic aspects of irrigation in the SASS BASIN - A Better Water Valorization for Sustainable Management of the Basin (Source: OSS 2014 & 2015).

The North-Western Sahara Aquifer System (NWSAS) extends over a total area of more than one million km^2. This transboundary aquifer system is shared by Algeria (700,000 km^2), Libya (250,000 km^2) and Tunisia

(80,000 km^2). The basin's water reserves are estimated at 60,000 billion m^3. According to Sahara and Sahel Observatory (OSS) estimations, the annual recharge of the aquifer amounts to one billion m^3 and estimated water withdrawals have increased from 0.6 billion m^3/year in the early 1970s to 2.7 billion m^3/year in 2012.

The NWSAS basin is highly important at the socio-economic and environmental levels in the three above mentioned countries. It represents the unique resource of water to support the economic and social development in the Saharan regions.

To sustain income growth [10.1], the study conducted by OSS shows that the farmers tend to adopt more profitable agricultural systems, i.e. systems that help to improve water productivity.

3.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to take water better into account when implementing SDG 10:

- Promote gender mainstreaming in water governance.
- Promote using efficient and high value crop production to increase rural incomes.
- Improving access to water supply and sanitation services to all, including disadvantaged groups such as the poor, slum dwellers, migrants, refugees, people with disabilities, etc. The challenge remains critical in Arab LDCs and countries facing armed conflicts and fluxes of refugees.
- Disaggregated data play a vital role in supporting the reducing inequalities efforts, to enable policymakers to identify disadvantaged groups and to tailor support to their specific needs and priorities.

3.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

Abu Ismail K, Al Jondi SG (2011) Poverty and Decent Work in the Arab Region: Where Do We Stand? Background Paper. Doha Forum on Decent Work and Poverty Reduction 25-26 October 2011 Doha, Qatar.

League of Arab States (LAS) (2018) Arab Regional Report for 8th World Water Forum - Pre-Forum report.

LAS, 2014. Action Plan of the Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

LAS, 2013. The Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

Sahara and Sahel Observatory (OSS) (2014) Socio-economic aspects of irrigation in the SASS basin - A Better Water Valorization for Sustainable Management of the Basin. Tunisia.

UN Habitat (2016) UN-Habitat launches the World Cities Report 2016, Urbanization and Development: Emerging Futures. Nairobi, Kenya.

Chapter 4: Interlinkages between Climate Action (SDG 13)[12] and Clean Water and Sanitation (SDG 6)

4.1 Key challenges and rationale of interlinkages with water

The most relevant interlinkages between Climate Action (SDG 13) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

4.1.1 Take urgent action to combat climate change and its impacts [13.1, 13.2, 13.3, 13.b]

Rationale of interlinkages with water: SDG 6 targets can provide an important effect on resilience and adaptive capacity to combat climate change impacts [13.1, 13.2, 13.3, 13.b]. The progress on access to safely managed WASH systems [6.1, 6.2] will increase the adaptive capacity and decrease the sensitivity which will ensure greater resilience in terms of water availability for drinking and health consequences in front of climate change-related risks. Moreover, advances in freshwater quality and water use efficiency [6.3, 6.4] will also increase the adaptive capacity as well as ensure greater resilience in terms of water availability in front of climate change-related risks, which can additionally be relieved through the natural protection offered by water ecosystems [6.6]. Moreover, IWRM [6.5] offers effective instruments to reduce climate change vulnerability and negative impacts.

Numerous potential impacts of climate change on water related issues and the potential adaptive measures for the Arab states are presented and discussed in the training manuals that have been produced by UNESCWA on developing the capacities of Arab states for climate change adaptation by applying IWRM tools (UNESCWA 2017b, UNESCWA & ACWUA 2017, UNESCWA & WHO 2017, UNESCWA & UNEP 2017, UNESCWA et al. 2017d, UNESCWA et al. 2017e). The developed manuals provide a set of regionally appropriate IWRM tools for supporting climate change adaptation in five key sectors, namely agriculture, economic development, environment, health and human settlements. In addition, the WMO & UNEP (2008) Technical Paper that addresses the impacts of climate change on freshwater related issues is taken into account.

The vulnerability is defined by the Intergovernmental Panel on Climate Change (IPCC) as "*the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate*

[12] SDG 13: Take urgent action to combat climate change and its impacts.

variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system" (IPCC, 2007).

Progress towards achieving the SDG 6 targets in the Arab states is critical in determining key regional and sectoral vulnerabilities. Therefore, region-specific integrated vulnerability assessments which include the SDG 6 targets and indicators within the sensitivity and adaptive capacity analysis can be drawn upon to inform action on climate change resilience.

An integrated vulnerability assessment (VA) within the framework of Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) has been developed by UNESCWA et al. (2017b). The different conceptual components of the developed integrated vulnerability assessment are presented in Figure 4.1.

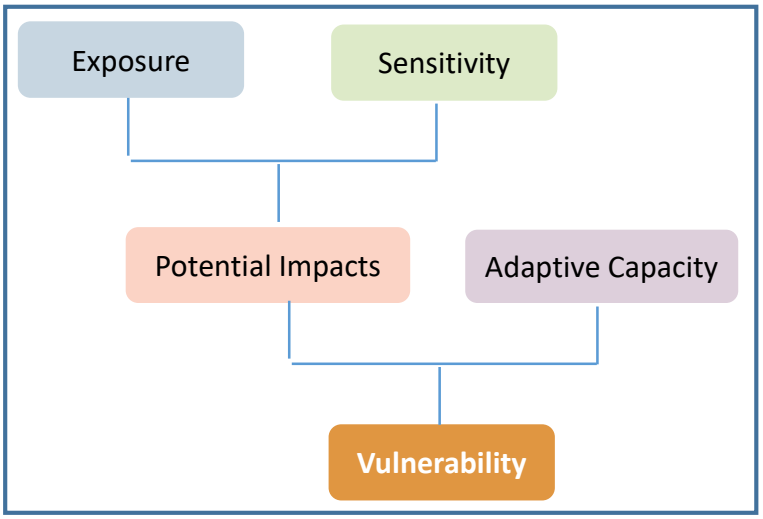

Figure 4.1 Components of an integrated vulnerability assessment within the RICCAR framework in the Arab states (Source: UNESCWA et al. 2017b)

Figure 4.2 presents example of RICCAR results for vulnerability of water availability in the Arab states for mid-century (RCP 4.5) scenario (UNESCWA et al. 2017a). Areas of high vulnerability include the south-western Arabian Peninsula, the upper Nile Valley and the northern Horn of Africa. Lower Nile Valley (including the Nile Delta) and Tigris–Euphrates basin areas suggest moderate vulnerability.

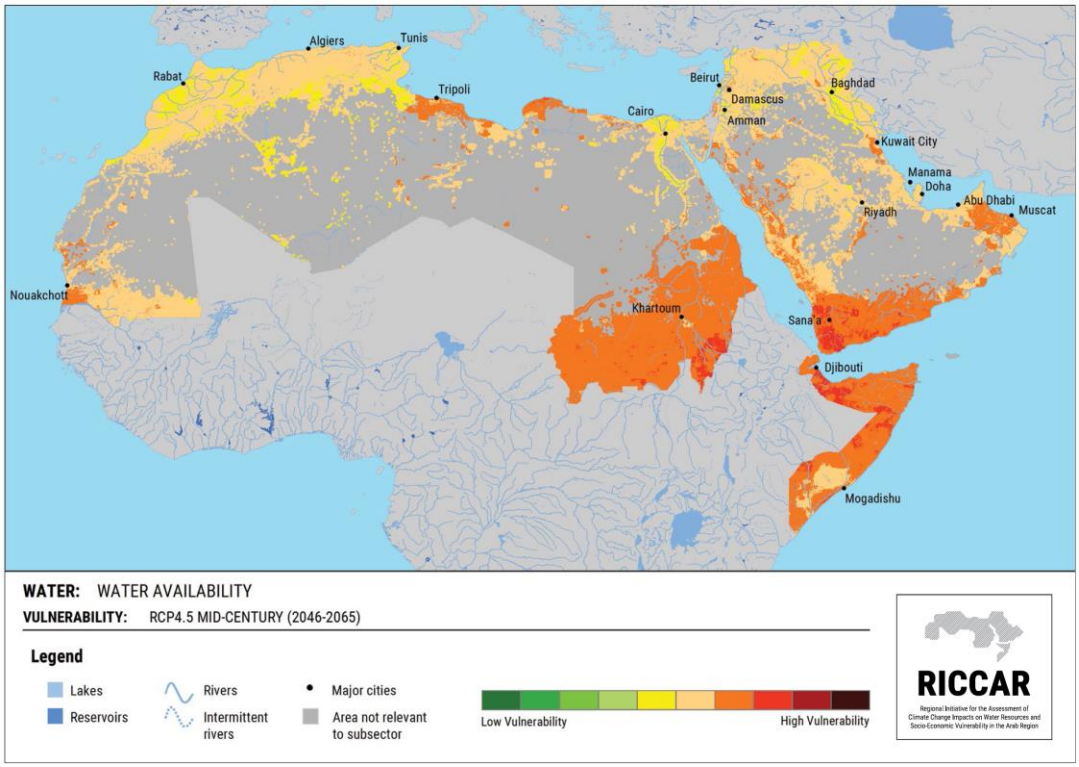

Figure 4.2 Vulnerability of water availability in the Arab states for mid-century (RCP 4.5) scenario (Source: UNESCWA et al. 2017a)

Table 6 present examples of selected water related indicators considered in the vulnerability assessment components from different sectors.

Table 6. Examples of selected water related indicators considered in the integrated vulnerability assessment (Source: UNESCWA et al. 2017b)

VA components	VA indicators
Sensitivity	Percentage of wastewater treated
	Total available renewable water resources per capita
	Water consumption per capita
	Share of water withdrawal in agriculture
	Share of agriculture in GDP
Adaptive Capacity	Access to improved water
	Access to improved sanitation
	Desalination capacity

In line with the approach mentioned above, the SDG 6 indicators could be included in a vulnerability assessment which may be part of the sensitivity and adaptive capacity components as shown in Table 7.

Table 7. Proposed inclusion of SDG 6 indicators in the vulnerability assessment components

VA components	SDG6 indicators
Sensitivity	[6.3.1], [6.3.2], [6.4.2], [6.6.1], [6.b.1]
Adaptive Capacity	[6.1.1], [6.2.1], [6.4.1], [6.5.1], [6.5.2], [6.a.1]

Theoretically, through the vulnerability assessment, the vulnerability to the various components considered may decrease when the progress towards the achievement of the SDG 6 targets increases, which may reduce the number of people affected by climate change impacts.

Moreover, IWRM [6.5] can support cross-sectoral cooperation and integration of climate change measures into national policies, strategies and planning [13.1, 13.2, 13.3, 13.b]. It represents a key science-based tool that should be used to integrate the climate change adaptive capacity into water policies.

Preliminary assessment of the qualitative dependency level on water

The regional experts were asked to give their opinions on the qualitative dependency of climate change action and its impacts on water (SDG 6). Figure 4.3 shows the qualitative dependency level of climate change action and its impacts on water as suggested by the regional experts, 16 experts out of 22 suggested that taking urgent action to combat climate change and its impacts is strongly dependent on water.

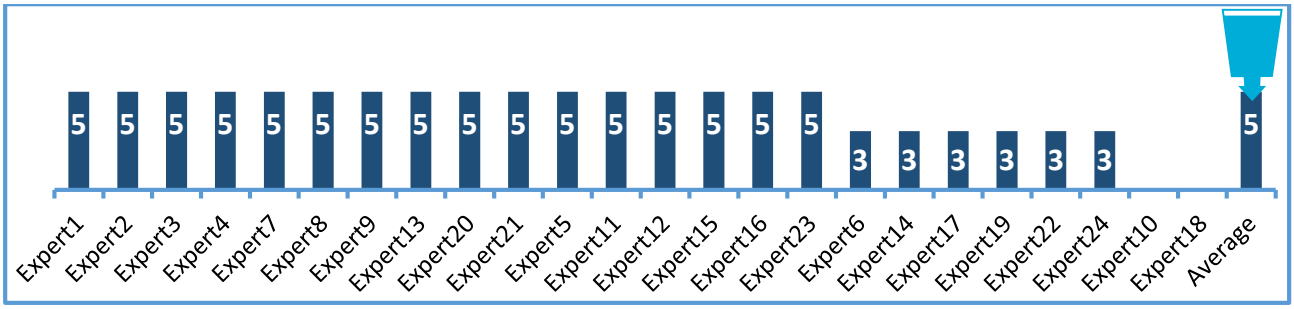

Figure 4.3 Qualitative dependency level of climate change action and its impacts on water, based on the regional experts' elicitations

These results show, from the regional experts' point of view, the importance of water to adapt to climate change impacts.

Finally, there is a need to further develop relevant national knowledge to evaluate the risks and the economic costs of climate-related hazards coupled with effective public awareness initiatives.

4.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

Several challenges and policy actions can be distilled from the VNRs submitted by Arab states:

- Lebanon, as part of its climate change Paris Agreement commitments, has set municipal wastewater treatment targets of 51 percent (unconditional) and 70 (conditional) of municipal wastewater treatment by 2030 [6.2.1 & 6.3.1] (Lebanon VNR 2018).
- Ensuring the availability and sustainable management of water and sanitation for all is an essential need for the resilience of Palestinian communities in the face of water confiscation and intensifying climate change. The Palestinian Government has also adopted the National Plan for Adaptation to Climate Change to help taking action to improve the climate change resilience in Palestine. (Palestine VNR 2018).
- Within the context of its efforts for adaptation and alleviation of climate change impacts, Saudi Arabia is implementing several water related measures which include: water and wastewater management, protection of marine ecosystems, coastal areas integrated management plans, desertification control and early warning systems (Saudi Arabia VNR 2018).
- The National Adaptation Program that was launched in September 2017 at the Annual Meeting of the UAE Government aims to develop awareness and adaptive measures for key sectors such as health, infrastructure, energy and water. The UAE Council of Climate Change and Environment will oversee the implementation of the plan moving forward (UAE VNR 2018).

4.3 Successful case studies

Vulnerability & Adaptation of the Water Sector in Jordan (Source: Ministry of Environment & United Nations Development Programme 2014)

The National Climate Change Policy (Ministry of Environment 2013) has identified water resources scarcity as one of the major barriers facing sustainable development in Jordan; a situation that will be magnified by climate change. The vulnerability assessment of the water sector in Jordan shows high and very high vulnerability to climate change hazards. The impacts of increased evaporation and decreased rainfall will result in less water recharge and therefore less replenishment of surface water and groundwater reserves. In the long term, this impact will extend to cause serious soil degradation that could lead to desertification, exacerbating future conditions and worsening the situation of the agricultural sector due to the lack of sufficient water. In this regard, a set of national adaptation strategies and measures concerning the water sector were identified which include: i) rainwater harvesting, ii) wastewater treatment and reuse, iii)

desalination using renewable energy such as solar and wind, iv) increasing efficiency of irrigation technologies, v) grey water reuse (used water from bathing and washing), vi) public educating regarding water issues, and vii) maintenance of the water distribution network to reduce the losses.

4.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to better take water into account when implementing SDG 13:

- Considering SDG 6 as essential component of climate change adaptation and natural disaster risk reduction.
- Strengthening IWRM is an effective measure to cope with climate change risks to improve resilience.
- Facilitating data exchange and knowledge sharing through existing and new knowledge hubs dedicated to water and climate change (LAS 2018).
- Integrating climate change measures into national water policies and strategies including the IWRM.
- Increasing water use efficiency is effective to deal with increasing water scarcity due to climate change.
- Studying the hydro-climatic changes under different scenarios to estimate future groundwater and surface water courses.
- Filling current knowledge and methodological gaps to evaluate the risks of climate-related hazards.

4.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

League of Arab States (LAS) (2018) Arab Regional Report for 8th World Water Forum - Pre-Forum report.

LAS, 2014. Action Plan of the Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

LAS, 2013. The Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

UNESCWA, LAS, ACWUA (2016) Regional Initiative for Establishing a Regional Mechanism for Improved Monitoring and Reporting on Access to Water Supply and Sanitation Services in the Arab Region (MDG+ Initiative) - An indicator framework to inform water related SDGs in the Arab Region. E/UNESCWA/SDPD/2016/Booklet, Beirut.

UNESCWA (2017b) Climate Change Adaptation in Economic Development Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULE.5. Beirut.

UNESCWA et al. (2017a) Arab Climate Change Assessment Report - Main Report, E/UNESCWA/SDPD/2017/RICCAR/Report. Beirut.

UNESCWA et al. (2017b) Integrated Vulnerability Assessment: Arab Regional Application. RICCAR Technical Note, E/UNESCWA/SDPD/2017/RICCAR/TechnicalNote.2. Beirut.

UNESCWA et al. (2017c) Training Manual on the Integrated Vulnerability Assessment Methodology. In Adaptation to Climate Change in the Water Sector in the MENA Region (ACCWaM) Programme. RICCAR Training Manual, E/UNESCWA/SDPD/2017/RICCAR/Manual. Beirut.

UNESCWA et al. (2017d) Developing the Capacities of the Arab Countries for Climate Change Adaptation Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULES/INTRO. Beirut.

UNESCWA et al. (2017e) Climate Change Adaptation in Agriculture, Forestry and Fisheries Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULE.2. Beirut.

UNESCWA & UNEP (2017) Climate Change Adaptation and Ecosystem-Based Management Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2016/MODULE.1. Beirut.

UNESCWA & ACWUA (2017) Climate Change Adaptation in Human Settlements Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2015/Module.4, Beirut.

UNESCWA & WHO (2017) Climate Change Adaptation in the Health Sector Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2016/MODULE.3. Beirut.

United Nations Development Programme (UNDP) (2018) Climate Change Adaptation in the Arab States - Best practices and lessons learned. Thailand.

Chapter 5: Interlinkages between Peace, Justice and Strong Institutions (SDG 16)[13] and Clean Water and Sanitation (SDG 6)

5.1 Key challenges and rationale of interlinkages with water

The most relevant interlinkages between Peace, Justice and Strong Institutions (SDG 16) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

5.1.1 Reduce all forms of violence [16.1]

Rationale of interlinkages with water

Water scarcity can be a source of conflict or cooperation within and across countries and regions. Improved and science-based IWRM (SDG 6.5.1) can inform and support socio-economic development and bring peace and security to countries and across countries that share freshwater resources, particularly those under water scarcity threat. The IWRM framework can support the development of institutional capacity and participatory processes and provide tools for transboundary cooperation and conflict resolution such as quantifying and optimizing benefits which may unlock stagnating cooperation processes.

Moreover, transboundary water basins cooperation arrangements concluded between co-riparian countries have a key role to ensure long-term and sustainable cooperation. A process of discussions on a cooperation framework between Arab states has been launched by the League of Arab States to encourage the development of cooperation arrangements on transboundary water basins within the Arab region. The Arab Strategy for Water Security encourages also the development of cooperation arrangements on shared water between Arab states (LAS 2013).

Figure 5.1 shows the water dependency ratio[14] indicator for selected Arab states, more than half of total renewable water resources in Kuwait, Egypt, Bahrain, Mauritania, Sudan, Syrian Arab Republic, Iraq and Somalia originate from outside the countries.

[13] SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
[14] Expressing the percent of total renewable water resources originating from outside the country (FAO 2018).

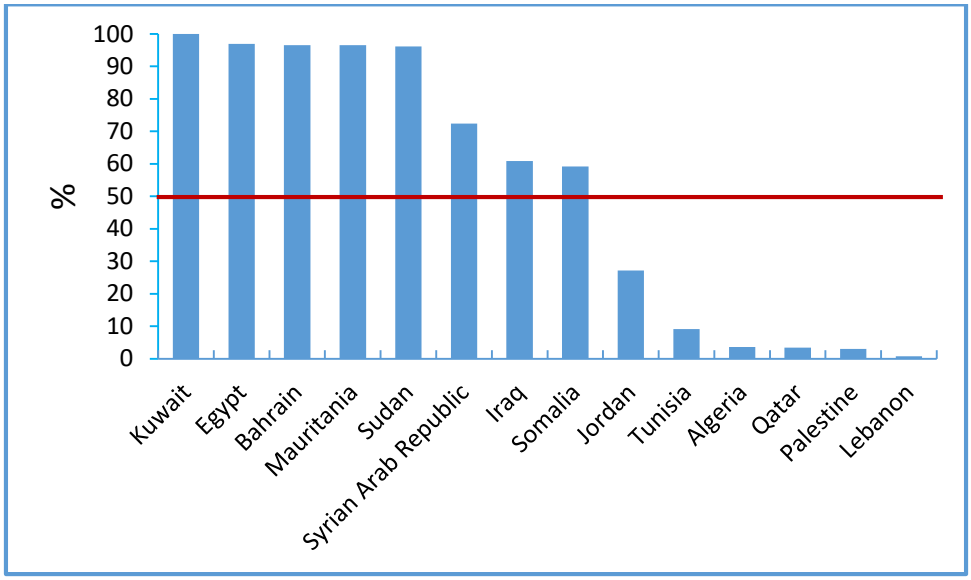

Figure 5.1. Water dependency ratio indicator for selected Arab states (%)
Source: FAO Aquastat data base

About 210 billion cubic meters a year of renewable water resources in the Arab states (total renewable water resources is estimated about 315 billion cubic meters) crosses at least one international border. Moreover, the Arab region is not only the region facing scarcity the most, it also remains the only region worldwide that receives more than 66% of its renewable water from upstream countries (LAS 2018). Therefore, effective management of transboundary basin areas through the implementation (or maintenance) of operational arrangement for water cooperation between Arab states and between Arab and non-Arab states is a critical need to inform political negotiations related to the management of transboundary water resources.

Preliminary assessment of the qualitative dependency level on water

Figure 5.2 shows the qualitative dependency level on water as suggested by the regional experts, 5 experts out of 22 suggested that water (SDG 6.5) create favorable conditions to reduce all forms of violence. The average qualitative dependency level on water as suggested by the regional experts is moderate.

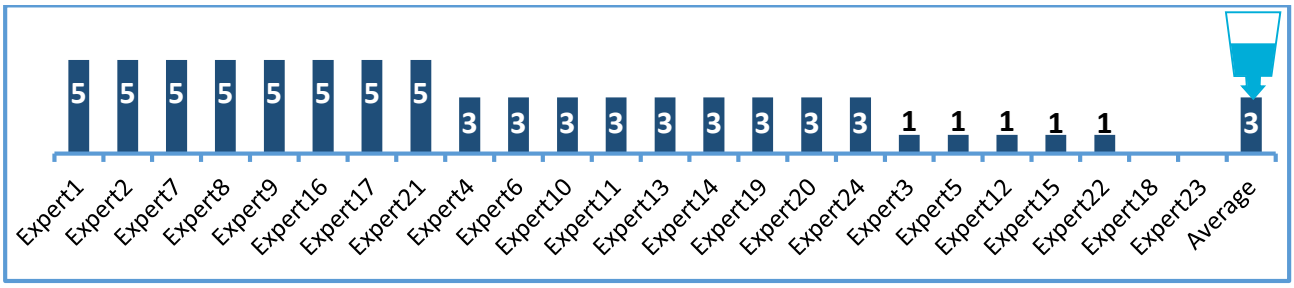

Figure 5.2 Qualitative dependency level of violence reduction on water based on the regional experts' elicitations

5.1.2 Reduce corruption [16.5]

Rationale of interlinkages with water

Reduction of corruption and conducting effective water governance can enhance water supply and sanitation services, infrastructure and procurement services, and increased water utilities revenues. The turn towards IWRM offers an opportunity to support Arab states' governments to further integrate principles of equity, transparency, efficiency, participation and accountability in their administration.

SIWI (2017) compiled 52 water integrity case studies from Lebanon, Palestine, Jordan, Tunisia and Morocco. The reported case studies include: water audits in the agricultural sector, setting water conservation plans, increasing transparency and saving water with real-time water metering systems, combat illegal groundwater wells, building decision-making capacity of female farmers, following up on citizens' complaints about favoritism in water allocation, identifying and addressing corruption risks in the Water Authority, preventing illegal access to water supply networks and combat non-revenue water.

Preliminary assessment of the qualitative dependency level on water

The average qualitative dependency level of corruption reduction on water, as suggested by the regional experts is moderate.

5.1.3 Effective, accountable and transparent institutions [16.6]

Rationale of interlinkages with water

The IWRM framework can support the development of institutional capacity and participatory processes and provide tools for effective, accountable and transparent institutions.

Several Arab states have national water plans or strategies that incorporate many IWRM elements to improve accountability and transparency. However, attaining the required effects through shifting in behaviors and attitudes necessitates additional time and effort (UNDP 2013).

Preliminary assessment of the qualitative dependency level on water

The average qualitative dependency level of effective, accountable and transparent institutions on water as suggested by the regional experts is moderate.

5.1.4 Responsive, inclusive, participatory and representative decision-making [16.7]

Rationale of interlinkages with water

IWRM promotes the participation of different stakeholders and interests, further showing the existence of synergies with efforts to ensure responsive, inclusive participatory and representative decision-making.

Several Arab states have national water policies that incorporate many IWRM elements to improve stakeholder involvement in water decisions. But these efforts are not yet reaching their intended goals (UNDP 2013).

Preliminary assessment of the qualitative dependency level on water

The average qualitative dependency level of responsive, inclusive, participatory and representative decision-making on water as suggested by the regional experts is moderate.

5.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

Several challenges and policy actions can be distilled from the VNRs submitted by Arab states:

- In 2014, Egypt adopted the four-year National Anti-Corruption Strategy developed by the National Coordinating Committee for Combating Corruption (NCCCC). The process of developing the strategy involved more than 80 government authorities, ministries and Governorates, and since its implementation, the Administrative Control Authority, Egypt's anti-corruption watchdog, and other law enforcement agencies, have been successful in uncovering an unprecedented number of major corruption cases (Egypt VNR 2018).
- In Lebanon, a national committee established to oversee the roll-out and implementation of the SDGs was formed in 2017 and is chaired by the prime minister. In addition to the Director Generals of concerned ministries, this committee includes representatives from civil society and the private sector to ensure the agenda is widely owned (Lebanon VNR 2018).

5.3 Successful case studies

Agreement for the management and utilization of the groundwater in the Disi Aquifer between Jordan and Saudi Arabia in 2015 (Source: Alatrash 2017).

The Disi Aquifer System, shared by Jordan and Saudi Arabia, contains considerable water reserves which are, however, mostly non-renewable. Both countries began exploiting the Aquifer in the 1980s soon after its discovery. The two countries sharing the Disi Aquifer have had to tackle the depletion risks together by finding a way to manage the basin in a collective manner. In 2015, an agreement for the management and utilization of the ground water in the Disi Aquifer was established. The agreement is concise with four main articles that include i) terms and definitions; ii) main norms for managing the aquifer; iii) creation and responsibilities of a Joint Saudi/Jordanian Technical Committee and iv) administrative provisions related to the implementation of the Agreement. Based on the agreement, a Joint Water Committee (JWC) was created as a permanent institution charged with implementing the agreement and addressing additional water challenges that might arise.

5.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to better take water into account when implementing SDG 16:

- Stimulating political transitions towards improving integrity, stakeholder involvement and transparency in the water sector.
- Designing and implementing sound water policies that incorporate IWRM elements to improve information provision on water budgets, legislations and policy-making.
- Encouraging transparency and stakeholder participation to create an equitable and transparent water sector.
- Developing holistic, integrated and sustainable resources management of shared water resources.
- Improving cooperation on shared water resources management between Arab states (LAS 2018, UNESCWA 2018c).
- Fostering cooperation, integration, fund mobilization and data sharing in transboundary waters (LAS 2018).
- Developing the capacity of Arab negotiators on the management of shared water resources issues.
- Where appropriate in conflict areas: address the needs of the refugees and displaced persons and of their host environments, and cooperate to prepare for rehabilitation and reconstruction based on sustainable water supply and sanitation systems.

5.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

UNESCWA (2013) Inventory of Shared Water Resources in Western Asia. E/ESCWA/SDPD/2013/Inventory. Beirut.

UNESCWA (2018) Overview of Shared Water Resources Management in the Arab Region for Informing Progress on SDG 6.5. E/ESCWA/SDPD/2017/Technical Paper.13. Beirut.

World Bank (2009) Water in the Arab World - Management Perspectives and Innovations. Washington.

World Bank (2011) Middle-East and Northern Africa Water Outlook. Future Water. The Netherlands.

Chapter 6: Interlinkages between Partnerships for the Goals (SDG 17)[15] and Clean Water and Sanitation (SDG 6)

6.1 Key challenges and rationale of interlinkages with water

SDG 17 defines seven means of implementation (MOI) building blocks: i) finance [17.1-17.5], ii) technology [17.6-17.8], iii) capacity-building [17.9], iv) trade [17.10-17.12], and v) governance, partnerships, data, monitoring and accountability [17.13-17.19].

The most relevant interlinkages between Partnerships for the Goals (SDG 17) targets and Clean Water and Sanitation (SDG 6) will be discussed in sequence in the following subsections:

6.1.1 Finance [17.1-17.5]

Rationale of interlinkages with water

One of the IWRM measures is applying water supply and wastewater tariffs, which would help improving the capacity for revenue collection while improving the service level for all members of society. The effective water and wastewater sector development policies recognize the need for the water and sanitation utilities to achieve financial independence by improving investment and operational efficiency, as well as by increasing tariffs and reducing subsidies (World Bank 2017). Water and wastewater tariffs in most Arab states are among the lowest in the world (Figure 6.1), which often cover only a small share of the cost of water supply and sanitation services. In several Arab states, wastewater tariffs are charged as a fixed percentage of the water bill and remain very low. Consequentially, this imposes increasing pressure to operate and maintain the water supply and sanitation systems and to build more improved systems to meet the growing demand. Moreover, it leads up to the way for over abstraction and depletion of water resources.

[15] SDG 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

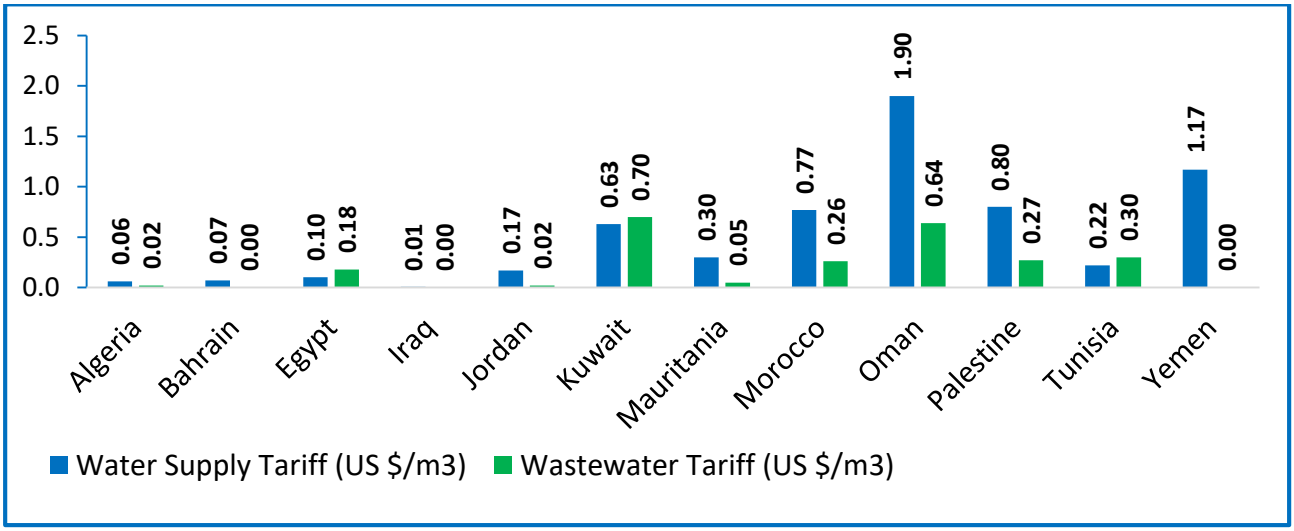

Figure 6.1 Average water and wastewater tariffs in selected Arab states (US$/m^3)
Source: UNESCWA et al., 2016

For example, Egypt's water and wastewater tariffs are among the lowest in the world, at US$ 0.08/m3, and cover only an estimated 25 % of the cost of water supply service and 10 % of the costs of providing sewerage service. Wastewater tariffs are charged as a fixed percentage of the water bill and remain very low at (35 % in most governorates). Consequentially, per capita water consumption is quite high, increasing pressure to build more water and wastewater systems to meet the high demand (World Bank 2017).

It is important to mention that subsidies and tariff structures should to be applied with the aims of achieving an appropriate level of service within the principles of equity and affordability.

The different domestic water supply tariff structures in the Arab states are shown in Figure 6.2 (UNESCWA 2016), these tariff structures vary between volumetric tariff structure, flat tariff structure (single yearly fixed charge) and no tariffs (free service). Information on agriculture and industries water tariff are largely unavailable for the majority of Arab states.

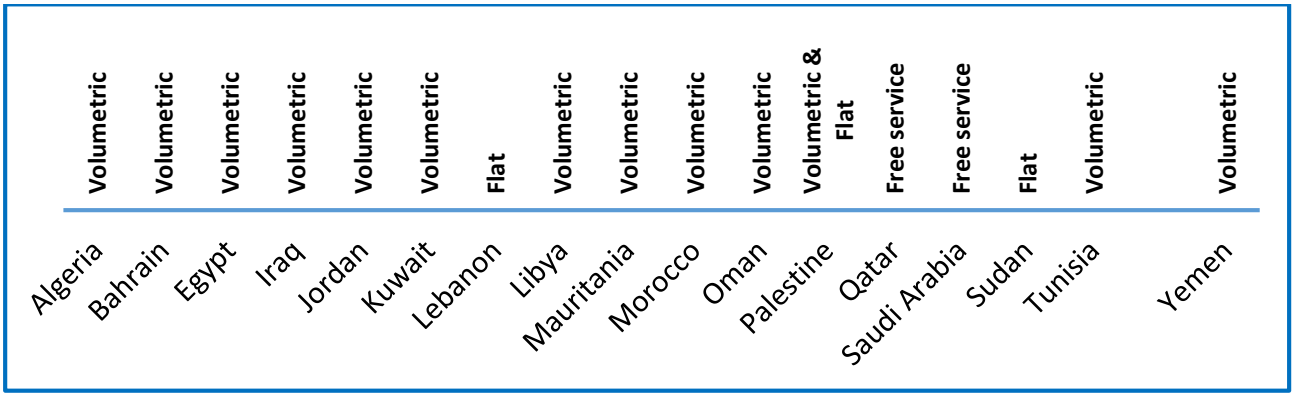

Figure 6.2 The different domestic water supply tariff structures in the Arab states
Source: UNESCWA et al., 2016

Preliminary assessment of the qualitative dependency level on water

The average qualitative dependency level of the finance MOI [17.1-17.5] on water as suggested by the regional experts is moderate.

6.1.2 Technology [17.6-17.8]

Rationale of interlinkages with water

SDG targets 17.6, 17.7 and 17.8 call for enhancing regional and international cooperation on access to science, knowledge and technology and implementing effective capacity building to support national plans to implement all the SDGs.

Desalination capacity has expanded in many Arab states to meet growing demand for water. As shown in Figure 6.3, the GCC countries, as well as Algeria, Egypt and Libya are the largest users of desalination in the region.

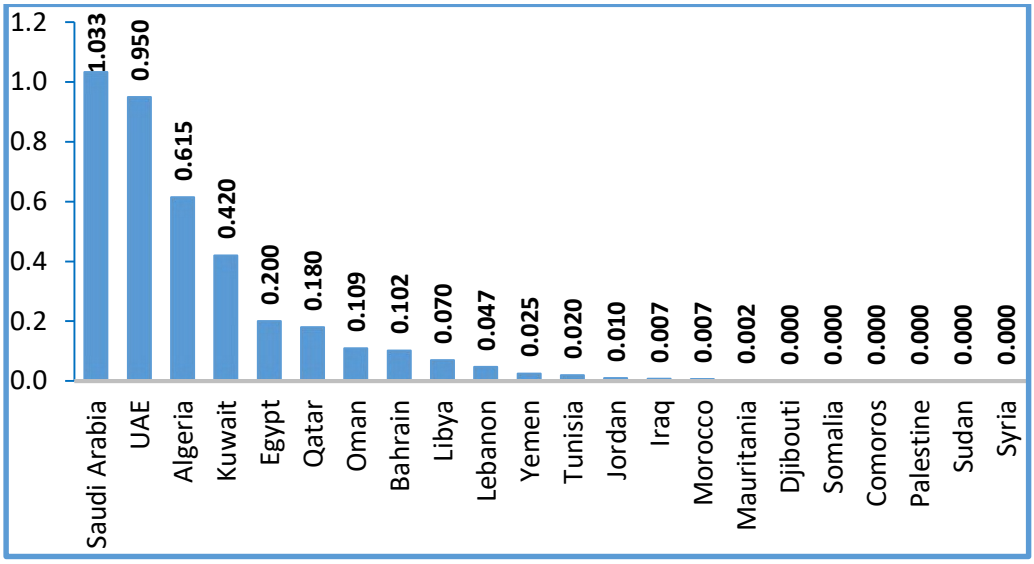

Figure 6.3. Desalination water produced in Arab states (Billion Cubic Meter/year) (2014)
Source: Compiled by the author from FAO Aquastat data, Accessed April 2019

The development of new desalination technologies powered by solar energy holds great promise for desalination and needs more attention from Arab states. In addition, the use of safely treated wastewater has become a mean for increasing water availability in several Arab states and has been included as a core component of water resources management plans at the national and regional level. The anaerobic wastewater treatment technology option fits better the hot climate condition that characterize the region, which should be considered when appraising aerobic and anaerobic wastewater treatment options.

Moreover, as shown in Figure 6.4, surface irrigation method, which is the inefficient water application method, still dominates the irrigated agriculture of several Arab states.

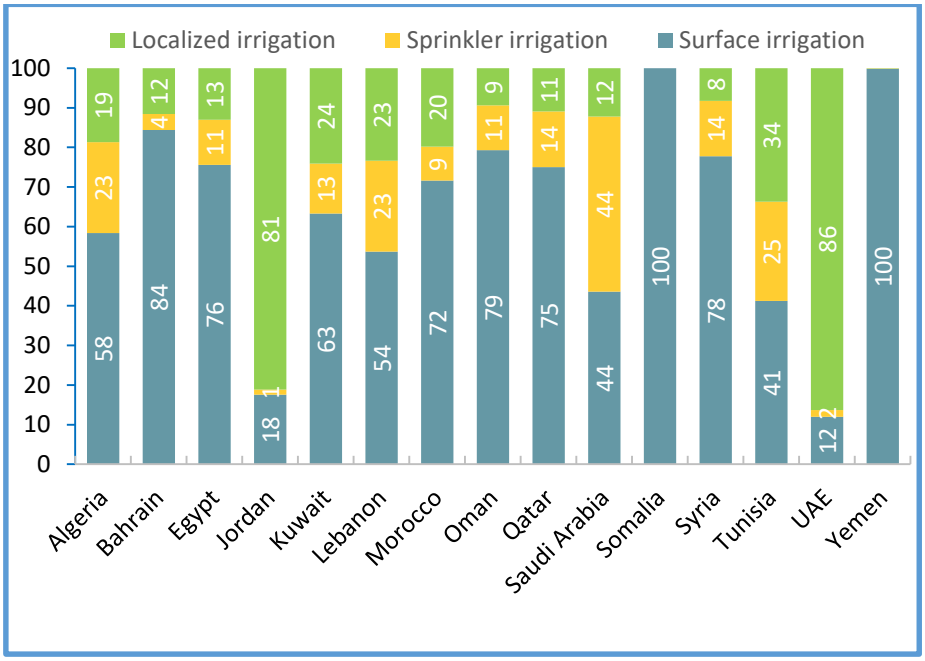

Figure 6.4. Irrigation methods used in selected Arab states (%) (2014)
Source: Compiled by the author from FAO Aquastat data, Accessed April 2019

Developing local capacity to adopt state-of-the-art technologies for desalination, wastewater treatment, irrigation and agricultural production should be on the agenda of the Arab policy makers as key response options for water scarcity challenges that characterize the region.

6.1.3 Improve the multilateral trading system [17.10-17.12]

Rationale of interlinkages with water

Customs duties on merchandise imports are levied either on an ad valorem basis (percentage of value) or on a specific basis. Customs duties can be used to create a price advantage for similar locally-produced goods and for raising government revenues. Reducing customs duties on food and agricultural merchandise imports will encourage virtual water trade, which is one of the IWRM measures that seek to find the best and sustainable balance of the water allocation between all use sectors based on available water quantities. This policy option should be analyzed as part of a comprehensive integrated approach that includes socio-economic dimension and the employment in the agricultural sector.

Preliminary assessment of the qualitative dependency level on water

The average qualitative dependency level of trade MOI [17.10-17.12] on water as suggested by the regional experts is moderate.

6.1.4 Governance, partnerships, data, monitoring and accountability [17.14-17.19]

Rationale of interlinkages with water

The interlinkages between SDGs 17.14-17.19 and SDG 6 address the important issues related to enhancing policy coherence, enhancing multi-stakeholder partnerships including public, public-private and civil society partnerships as well as enhancing capacity-building support, data, monitoring and accountability. In this regard, addressing the water scarcity challenges in the Arab region will depend largely on the Means of Implementation by endorsing pertinent policies, innovative frameworks of inclusive governance including effective institutions with adequate capacities as well as sustainable partnerships and innovative financing mechanisms. Moreover, necessary funds are needed for Arab non-oil rich countries to implement water infrastructure and to respond to water related challenges. Furthermore, public-private partnerships in the Arab region will enhance the performance of public water supply and wastewater utilities, increase and improve water services coverage, provide alternative mechanisms to finance water infrastructure investment and reduce the burden on government budgets (UNDP 2013).

6.2 Selected challenges and policy actions distilled from the regional Voluntary National Reviews

Several challenges and policy actions can be distilled from the VNRs submitted by Arab States:

- The scarcity of water, and the associated regional challenges, is a major driver for the Government of Egypt to actively implement projects that ensure efficient use of water resources, increased availability of fresh water resources, and improved quality of water. Moreover, in order to increase the percentage of households with access to safe drinking water to 100 percent by 2030, the Government of Egypt is expanding drinking water projects; it is currently implementing 236 projects, while a further 155 projects are under development, to cover 498 villages (Egypt VNR 2018).
- In Jordan, the portion of water resources allocated to agriculture has dropped from about 70% a couple of decades ago, to 51% at the end of 2013. Agriculture sector in Jordan will, therefore, have to optimize the productivity of water, in terms of its efficiency of use, value added, job opportunities provided by this sector, and develop mechanisms that better reflect the value of water in agricultural production. In response to the challenges of food security and agriculture, the Government of Jordan has developed the National Strategy for Agricultural Development in addition to the National Water Strategy in line with the "Jordan 2025". Policies have been developed that will increase growth in agricultural production (Jordan VNR 2018).

- In Lebanon, the national water sector strategy aims to develop the infrastructure for surface water storage and recharging groundwater, and resolve transmission and distribution problems. The water sector strategy intends to increase coverage of the wastewater collection network and treatment capacity. The Capital Investment Programme (CIP) supports this with plans to complete ongoing projects, upgrade the coastal treatment plants for secondary treatment and expand existing plants (Lebanon VNR 2018).
- There is an expansion in building new wastewater treatment plants in Qatar. Moreover, Qatar has achieved a reduction in losses of desalinated water to 10% in 2016 compared to losses of 30% in 2011 (Qatar VNR 2018).

6.3 Successful case studies

Quantifying the Embedded Water and Energy in Food Production: A Case Study of Lebanon (Source: Karnib & Haidar 2019)

It is important to evaluate embedded water in irrigated crop production to examine cross-sectoral policy priorities when pursuing integrated water resources management (IWRM). This information can provide a baseline for informing cross-sectoral policy making. The quantitative Water-Energy-Food Nexus Framework offers potential for evaluating the direct and indirect embedded water in food production to capture the complex series of direct and indirect interlinkages between WEF systems (practical and theoretical concepts of the direct and indirect effects between WEF systems are described in Karnib (2018 & 2017c)). By using the WEF nexus tool (Q-Nexus Model) (Karnib & Haidar 2019), the preliminary quantification of useable water (UW)[16] embedded in Lebanon's agricultural production is assessed. Table 8 presents the selected irrigated crops with their quantities produced for the year 2014 in Lebanon, the values are estimated by the author based on data available at FAO AQUASTAT and FAOSTAT (FAO 2018 a, b). The Q-Nexus Model (WEF nexus tool) is used to evaluate the direct and indirect UW embedded in the irrigated crops mentioned above, the results are presented in Table 8.

[16] Useable water is related to exploitable surface water, groundwater, desalination water and/or recycled water sources.

Table 8. Irrigated crop quantities and the embedded direct and indirect UW for the year 2014 – Lebanon (Source: Karnib & Haidar 2019)

	Produced quantities (kt) (Irrigated)	Embedded UW (MCM)		
		Direct	Indirect	Total
Wheat	55.82	42.538	0.024	42.562
Barley	12.12	9.232	0.005	9.237
Maize	10.47	7.978	0.004	7.982
Other cereals	101.25	77.153	0.043	77.196
Vegetables	151.8	57.835	0.032	57.867
Potatoes	483.65	73.708	0.059	73.767
Other roots and tubers	104.77	15.967	0.013	15.980
Leguminous crops	54.36	103.556	0.056	103.612
Bananas	84.54	21.473	0.006	21.479
Citrus	394.12	100.106	0.028	100.134
Other fruits	732.02	185.933	0.052	185.985
Olives	18.75	7.144	0.004	7.148
Total	-	**702.623**	**0.326**	**702.949**

As shown in Table 8, the total embedded UW (direct and indirect) are 702.949 MCM. The evaluated embedded UW can be used for supporting policy making and informing about the trade-off between water and food security and food trade.

6.4 Key messages and policy recommendations

The following are selected key messages and policy recommendations to better take water into account when implementing SDG 17:

- Affirming the need for the water and sanitation utilities to achieve financial independence by improving investment and operational efficiency. Subsidies and tariff structures need to be applied with the objectives of achieving equity, affordability and the appropriate level of service for each targeted group.
- Enhancing regional cooperation to develop and access efficient technologies for desalination, treatment and reuse of wastewater and for increasing agricultural productivity.

- Strengthen the Innovation and Research investments in water sector at country and regional levels to help develop and test new technologies for desalination, wastewater treatment, irrigation and agricultural production.
- Improving the information about embodied water and energy in the food sector and making appropriate use of food trade as part of a comprehensive integrated approach that includes socio-economic dimension and the employment in the agricultural sector when relevant.
- Improving the transparency and exchange of information and data.

6.5 List of relevant literature

The following are selected references for further readings that may be of interest for the topics discussed in this chapter:

United Nations (UN) (2018a) Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation. New York.

World Bank (2009) Water in the Arab World - Management Perspectives and Innovations. Washington.

World Bank (2011) Middle-East and Northern Africa Water Outlook. Future Water. The Netherlands.

World Bank (2017) Status of Water Sector Regulation in the Middle East and North Africa.

REFERENCES

Alatrash M (2017) Jordan - Saudi Arabia, 2015 Agreement for the management and Utilization of the Ground Water in the Disi- Saq Aquifer, Ministry of water, Jordan. Presentation available from: https://www.unece.org/fileadmin/DAM/env/documents/2017/WAT/07July_4_Workshop_on_recent_progress_on_transboundary_water_cooperation/3_final_Disi.pdf. Accessed May 2019.

Alvarado R, Toledo E (2017) Environmental degradation and economic growth: evidence for a developing country. Environment Development and Sustainability. DOI: 10.1007/s10668-016-9790-y.

Food and Agriculture Organization of the United Nations (FAO) (2018a) Aquastat Main Database. FAO. http://www.fao.org/nr/water/aquastat/main/index.stm. Website accessed on January 2019.

FAO (2018b) FAOSTAT Database, Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/faostat/en/#data/. Website accessed on December 2018.

Karnib A, Haidar H (2019) Water-Energy-Food Nexus Framework for Quantifying the Embedded Water and Energy in Food Production: A Case Study of Lebanon. 11th World Congress of EWRA on Water Resources and Environment, 25-29 June 2019, Madrid, Spain.

Karnib A (2018) Bridging Science and Policy in Water-Energy-Food Nexus: Using the Q-Nexus Model for Informing Policy Making. Water Resources Management Journal 32(15): 4895-4909.

Karnib A (2017a) A Quantitative Nexus Approach to Analyze the Interlinkages across the Sustainable Development Goals. Journal of Sustainable Development 10(5): 173-180.

Karnib A (2017b) Mapping the direct and indirect interlinkages across the sustainable development goals A qualitative nexus approach. International Journal of Development and Sustainability 6 (9): 1150-1158.

Karnib A (2017c) Quantitative Assessment Framework for Water, Energy and Food Nexus. Computational Water, Energy, and Environmental Engineering Journal 6: 11-23.

Karnib A (2016) Assessing population coverage of safely managed wastewater systems: Case study of Lebanon, Journal of Water Sanitation and Hygiene for Development, 2: 313-319.

League of Arab States (LAS) (2018) Arab Regional Report for 8th World Water Forum - Pre-Forum report.

League of Arab States (LAS), Arab Organization for Agricultural Development (AOAD) (2007) Arab Strategy for Sustainable Agricultural Development.

LAS, UNISDR (2018) Arab Strategy for Disaster Risk Reduction 2030.

LAS, UNESCWA, ACWUA (2016) MDG+ Initiative Second Report. Amman, Jordan. ACWUA Web, http://www.acwua.org/sites/default/files/mdg_first_report-final-final.pdf. Accessed 12 September 2018.

LAS (2014) Action Plan of the Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

LAS (2013) The Arab Strategy for Water Security in the Arab Region, to meet the Future Challenges and Requirements for Sustainable Development (2010-2030). League of Arab States (LAS), Cairo.

Le Blanc D (2015) Towards integration at last? The Sustainable Development Goals as a network of targets, Sustainable Development, 23 (3): 176-87.

Lenzen M, Foran B (2001) An input-output analysis of Australian water usage. Water Policy 3: 321-340.

Ministry of Development Planning and Statistics (MDPS) (2015), Environment statistics bulletin 2015, Doha.

Ministry of Environment (2013) The National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020. Jordan.

Ministry of Environment, United Nations Development Programme (2014) Jordan's Third National Communication on Climate Change. Jordan.

Nilsson M (2017) Important interactions among the Sustainable Development Goals under review at the High-Level Political Forum 2017, working paper, Stockholm Environment Institute, Stockholm.

Sahara and Sahel Observatory (OSS) (2014) Socio-economic aspects of irrigation in the SASS BASIN - A Better Water Valorization for Sustainable Management of the Basin. ISBN: 978-9973-856-85-2. Tunisia.

OSS (2015) For a Better Valorization of Irrigation Water in the SASS Basin - Diagnosis and Recommendations. ISBN: 978-9973-856-87-6. Tunisia.

Stockholm International Water Institute (SIWI) (2017) Water integrity voices from the Middle East and North Africa: Compilation of 52 capacity building case studies from Lebanon, Palestine, Jordan, Tunisia and Morocco. SIWI-UNDP Water Governance Facility, Stockholm.

Tang X, Benjamin C, McLellan BC, Snowden S, Zhang B, Höök M (2015) Dilemmas for China: Energy, Economy and Environment. Sustainability. 7, 5508-5520. doi:10.3390/su7055508.

Thakur BK (2010) Impact of environmental degradation on Human development. In book: Human Development in India: Challenges and Policies, Edition: 2010, Chapter: 19, Publisher: New Century Publications, Editors: Himanshu Sekhar Rout and S. Bhyrava Murthy, pp.305-319.

United Nations Economic and Social Commission for Western Asia (UNESCWA), United Nations Environment Programme (UNEP) (2015) Arab Sustainable Development Report. Beirut.

UNESCWA (2016) Doha Declaration on Implementation of the 2030 Agenda. United Nations Economic and Social Commission for Western Asia, Beirut.

LAS, UNESCWA, ACWUA (2016) Regional Initiative for Establishing a Regional Mechanism for Improved Monitoring and Reporting on Access to Water Supply and Sanitation Services in the Arab Region (MDG+ Initiative) - An indicator framework to inform water related SDGs in the Arab Region. E/UNESCWA/SDPD/2016/Booklet, Beirut.

UNESCWA (2017) Climate Change Adaptation in Economic Development Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULE.5. Beirut.

UNESCWA et al. (2017a) Arab Climate Change Assessment Report - Main Report, E/UNESCWA/SDPD/2017/RICCAR/Report. Beirut.

UNESCWA et al. (2017b) Integrated Vulnerability Assessment: Arab Regional Application. RICCAR Technical Note, E/UNESCWA/SDPD/2017/RICCAR/TechnicalNote.2. Beirut.

UNESCWA et al. (2017c) Training Manual on the Integrated Vulnerability Assessment Methodology. In Adaptation to Climate Change in the Water Sector in the MENA Region (ACCWaM) Programme. RICCAR Training Manual, E/UNESCWA/SDPD/2017/RICCAR/Manual. Beirut.

UNESCWA et al. (2017d) Developing the Capacities of the Arab Countries for Climate Change Adaptation Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULES/INTRO. Beirut.

UNESCWA et al. (2017e) Climate Change Adaptation in Agriculture, Forestry and Fisheries Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2017/MODULE.2. Beirut.

UNESCWA & UNEP (2017) Climate Change Adaptation and Ecosystem-Based Management Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2016/MODULE.1. Beirut.

UNESCWA & ACWUA (2017) Climate Change Adaptation in Human Settlements Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2015/Module.4, Beirut.

UNESCWA & WHO (2017) Climate Change Adaptation in the Health Sector Using Integrated Water Resources Management Tools, E/UNESCWA/SDPD/2016/MODULE.3. Beirut.

UNESCWA (2018a) Arab Forum for Sustainable Development “Natural resources, future generations and common good”, United Nations House, Beirut.

UNESCWA (2018b) The Arab Preparatory Meeting on Energy-related Issued for the 2018 AFSD and the HLPF. United Nations House, Beirut.

UNESCWA (2018c) The Arab Preparatory Meeting on Water Issues for the 2018 AFSD and the HLPF. United Nations House, Beirut.

UNESCWA (2018d) The Arab Preparatory Meeting on Environmental and Natural Resources Issues for the 2018 AFSD and the HLPF. Cairo.

UNESCWA (2018e) The Regional Meeting of Civil Society on Sustainable Development in the Arab Region. United Nations House, Beirut.

UNESCO Institute for Statistics (UIS) (2019) http://data.uis.unesco.org/. accessed 28 January 2019.

United Nations (UN) (2018) Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation. New York.

UN (2019) Department of Economic and Social Affairs - Statistics Division, Sustainable Development Goal indicators website. https://unstats.un.org/sdgs/. Accessed February 2019.

United Nations - Department of Economic and Social Affairs (UNDESA) - Statistics Division (2012) System of Environmental-Economic Accounting for Water. New York.

United Nations Development Program (UNDP) (2013) Water Governance in the Arab Region: Managing Scarcity and Securing the Future. UNDP, New York.

Weitz N, Huber-Lee A, Nilsson M, Davis M and Hoff H (2014) Cross-sectoral integration in the Sustainable Development Goals: a nexus approach, discussion brief, Stockholm Environment Institute, Stockholm.

World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2017) Safely Managed Drinking Water. Geneva. Available from https://washdata.org/sites/default/files/documents/reports/2017-07/JMP-2017-tr-smdw.pdf.

WMO & UNEP (2008) Climate change and water. IPCC Technical Paper VI. Intergovernmental Panel on Climate Change. ISBN: 978-92-9169-123-4. Geneva.

World Bank (2011) Middle-East and Northern Africa Water Outlook. Future Water. The Netherlands.

World Bank (2017) Status of Water Sector Regulation in the Middle East and North Africa.

Annex 1

Interview Script (Prepared by Ali Karnib)

Background

This Interview Script will be used in a study to explore how SDG 6 (Clean water and sanitation) qualitatively connects to implementing the SDG 4 (Quality education), SDG 8 (Decent work and economic growth), SDG 10 (Reduced inequalities), SDG 13 (Climate action), SDG 16 (Peace, justice and strong institutions) and SDG 17 (Partnerships for the Goals).

Three possible qualitative levels of dependency on water to achieve SDG targets are as follows:

Score	Explanation
5	The achievement of SDG targets is strongly dependent on water targets.
3	The achievement of SDG targets is moderately dependent on water targets.
1	Water targets create favorable conditions to the achievement of SDG targets

The interview has the following six parts:

1. Interlinkages between Quality Education (SDG 4) and Clean Water and Sanitation (SDG 6)
2. Interlinkages between Decent Work and Economic Growth (SDG8) and Clean Water and Sanitation (SDG6)
3. Interlinkages between Reduced Inequalities (SDG10) and Clean Water and Sanitation (SDG6)
4. Interlinkages between Climate Action (SDG13) and Clean Water and Sanitation (SDG6)
5. Interlinkages between Peace, Justice and Strong Institutions (SDG16) and Clean Water and Sanitation (SDG6)
6. Interlinkages between Partnerships for the Goals (SDG17) and Clean Water and Sanitation (SDG6)

Disclaimer: Any information submitted will be used for the Study Purposes only and will not be passed on to third parties.

1- Interlinkages between Quality Education (SDG 4) and Clean Water and Sanitation (SDG 6)

Please consider the following SDG 4 related challenges. What are, in your opinion, the water dependency levels/scores to meet these challenges?

(The square brackets are used to refer to the sustainable development goal and target numbers).

SDG 4 challenges	Related water targets/ indicators	Water dependency level/score
Improving educational outcomes [4.1, 4.2, 4.3, 4.4]	[6.1 and 6.2]	
Improving access to WASH facilities in schools [4.a.1]	[6.1 and 6.2]	
Other (specify)		

2- Interlinkages between Decent Work and Economic Growth (SDG8) and Clean Water and Sanitation (SDG6)

Please consider the following SDG 8 related challenges. What are, in your opinion, the water dependency levels/scores to meet the challenges?

(The square brackets are used to refer to goal and target numbers).

SDG 8 challenges	Related water targets/ indicators	Water dependency level
Sustaining economic growth [8.1, 8.2]	[6.5.1]	
Improving global resource efficiency in consumption and production [8.4]	[6.4.1 and 6.5.1]	
Decoupling economic growth from environmental degradation [8.4]	[6.5.1]	
Other (specify)		

3- Interlinkages between Reduced Inequalities (SDG10) and Clean Water and Sanitation (SDG6)

Please consider the following SDG 10 related challenges. What are, in your opinion, the water dependency levels/scores to meet the challenges?

(The square brackets are used to refer to goal and target numbers).

SDG 10 challenges	Related water targets/ indicators	Water dependency level/score
Sustaining income growth [10.1]	[6.5.1]	
Other (specify)		

4- Interlinkages between Climate Action (SDG13) and Clean Water and Sanitation (SDG6)

Please consider the following SDG 13 related challenges. What are, in your opinion, the water dependency levels/scores to meet the challenges?

(The square brackets are used to refer to goal and target numbers).

SDG 13 challenges	Related water targets/ indicators	Water dependency level/score
Take urgent action to combat climate change and its impacts [13.1, 13.2, 13.3, 13.b]	All SDG6 targets	
Other (specify)		

5- Interlinkages between Peace, Justice and Strong Institutions (SDG16) and Clean Water and Sanitation (SDG6)

Please consider the following SDG 16 related challenges. What are, in your opinion, the water dependency levels/scores to meet the challenges?

(The square brackets are used to refer to goal and target numbers).

SDG 16 challenges	Related water targets/ indicators	Water dependency level/score
Reduce all forms of violence [16.1]	[6.5]	
Reduce corruption [16.5]	[6.5.1]	
Effective, accountable and transparent institutions [16.6]	[6.5.1]	
Responsive, inclusive, participatory and representative decision-making [16.7]	[6.5.1]	
Other (specify)		

6- Interlinkages between Partnerships for the Goals (SDG17) and Clean Water and Sanitation (SDG6)

Please consider the following SDG 17 related challenges. What are, in your opinion, the water dependency levels/scores to meet the challenges?

(The square brackets are used to refer to goal and target numbers).

SDG 17 challenges	Related water targets/ indicators	Water dependency level/score
Finance means of implementation (MOI) [17.1-17.5]	[6.5.1]	

SDG 17 challenges	Related water targets/ indicators	Water dependency level/score
Level of trade MOI [17.10-17.12]	[6.5.1]	
Other (specify)		

Name:	
Date:	

Thank you very much for participating in the interview!

Annex 2

Names and positions of the interviewed experts

Bahrain

Mr. Hasan Ali Al Thawadi
Chief Water and Land Development and Protection

Egypt

Ms. Hala Mohamed Ramdan
Business Developer
Ministry of Electricity and Renewable Energy

Ms. Eman Mohamed Mahfouz
Senior Engineer at testing lab

Mr. Reda Khaled Ali Darwesh
Senior Researcher
Soil, Water and Environment Institute
Agriculture Research Center

Ms. Abeer Mohamed Saad
Senior Engineer
Ministry of Electricity and Renewable Energy

Mr. Amre Gaber El Kady
Head of Central Directorate for planning and follow up

Ms. Doaa Mohamed Mahmoud
Regional Center for Training and Water Studies
Ministry of Water Resources and Irrigation

Iraq

Mr. Mohamed Hassan Izzaldeen
Head of Planning Transmission Energy Department

Mr. Mohanad Mamoon Mahmood
Head of Distribution Networks Division
Ministry of Planning and Studies

Jordan

Ms. Salam Ababneh
Project Engineer
Ministry of Water and Irrigation

Mr. Nidal Ali Mohamed Al Qasim
Head of Energy Planning Section
Ministry of Energy and Mineral Resources

Mr. Jamal Mousa Al Batsh
Secretary General Assistance for plant Wealth
Ministry of Agriculture

Lebanon

Dr. Ali Karnib
Professor at the Lebanese University/Consultant

Ms. Mona Chafic Reslan
Member in UNESCO National Commission
Professor at the Lebanese University

Oman

Mr. Mahmood Mohamed AlAzri
Director of Water Resources in Dhofar Region
Ministry of Regional Municipality and Water Resources

Ms. Ruqaiya Ahmed Al Zadjali
Administrative Analyst
Muscat- Oman

Mr. Rashid Ali Al -Abri
Technical Soil and Water Chemical Engineering
Ministry of Agriculture

Palestine

Ms. Laila Ziad Yousef
Director of Project Promotion Department
International Relations Unit
Ministry of Agriculture

Mr. Majdi Ahmed Yahya
Director of Distribution Department
Palestinian Energy Authority

Sudan

Mr. El tayeb Abdelrahman Mustafa
Director of Transmission Project
Director of Projects Department, Sudanese

Mr. Badreldin Mahmoud Abdalla
Technical Office of the Under Secretary of the Ministry of Water Resources, Irrigation and Electricity

Ms. Gawahir Siddig Salim Abashar
Agricultural Engineer
Planning and Agricultural Economic Department

Tunis

Mr. Abderrahman Ouasli
Director
Ministry of Agriculture

Mr. Chihab Ben Nasr
First Engineer
Ministry of Agriculture, Water Resources and Fisheries

Ms. Sona Amdouni
General Engineer
Ministry of Agriculture, Water Resources and Fisheries

Mr. Kamel Zaidi
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