

Academic Year 2018 – 2020

Jordan in Deep Water:

Calling for an effective governance structure to address scarcity

Dissertation submitted by:

Noor Masannat

In partial fulfillment of the requirements for the degree of
ERASMUS MUNDUS MASTER IN GLOBAL PUBLIC POLICY

Supervised by:

Thilo Bodenstein
Central European University

Elisabeth Johansson-Nogues
Institut Barcelona d'Estudis Internacionals

ELECTRONIC SIGNATURE

I hereby certify that this dissertation contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I hereby grant to IBEI and the Mundus MAPP Consortium the non-exclusive license to archive and make accessible my dissertation in whole or in part in all forms of media, now or hereafter known. I retain all ownership rights to the copyright of the dissertation. I also retain the right to use in future works (such as articles or books) all or part of this dissertation.

Name: Noor Naser Masannat

Signature:

Place and Date: Amman, Jordan July 30th, 2020

Word Count: 12,569

ACKNOWLEDGEMENT

I would like to take this opportunity to express my gratitude to the School of Public Policy at CEU and the cohort at IBEI, and to my thesis supervisors Professor Thilo Bodenstein and Professor Elisabeth Johansson-Nogues for their constant guidance throughout my research.

I would also like to thank my friends Carol, Alex, Dina and Zain for the support, encouragement and comfort that they have provided me with, and my Mundus MAPP friends for the company and memories during the past two years.

And most sincerely, I am indebted to my parents and siblings for the endless inspiration, confidence and affection.

"There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people - and the environment - suffer badly."

World Vision

ABSTRACT

Jordan is one of the top water poorest countries in the world, situated in a regional system characterized by instability. This paper aims to analyze Jordan's water scarcity through a case-based study from multiple governance angles, and asks the following research question: does water governance hold the key to improve Jordan's water scarcity? To answer this question, the paper first attempts to give an overall view of the scale of Jordan's water scarcity, including a brief look into the external factors that contribute to Jordan's water scarcity, then mainly analyzes Jordan's water governance structure through looking at the role of the main institutions, private sector and the international community involved in the water sector. Additionally, although this research paper does not provide a detailed analysis of possible solutions or recommendations, this paper claims that there are shortcomings in the focus of Jordan's water governance and finds out that there is more attention given to the supply side than the demand side. The research conducted in this paper makes an original empirical contribution because most of the literature works found on Jordan's water problems look at external factors such as climate change and population growth, while very few analyze the governance structure of the water sector. This paper argues that while external causes play a significant role in aggravating Jordan's water scarcity, the weak water governance performance has a bigger impact on water problems.

Key words: water governance, water scarcity, climate change, refugees, Jordan, MENA

Table of Contents

Electronic Signature	I
Acknowledgement.....	II
Abstract	III
Figures	V
Maps	V
Tables	V
1. Introduction	1
1.1 Background	1
1.2 Research Design.....	2
2. Literature Review	4
2.1 Water Scarcity.....	4
2.2 Water Governance	6
2.2.1 Effective Water Governance	8
3. Case Study: Jordan	10
3.1 Nature and Scale of Jordan's Water Challenge	10
3.2 Jordan's Water Governance Structure	19
3.2.1 Centralized Institutions	19
3.2.2 Lack of strong Private Sector Participation	20
3.2.3 Dependency on the International Community and Donors	22
3.2.4 Water Loss	23
4. Empirical Discussion.....	24
4.1 Analysis.....	24
4.2 Shortcomings in Jordan's water governance policies	29
5. Conclusion.....	32
6. Bibliography.....	35
7. Annexure 1	41
7.1 Thesis Report	41

FIGURES

Figure 1: Total Estimated Available Water From 2010.....	13
Figure 2: Distribution Of Gross Domestic Product (Gdp) Across Economic Sectors From 2008 To 2018 In Jordan.....	15
Figure 3: Main Institutions In The Water Sector	20
Figure 4: Effective Water Governance Structure	27

MAPS

Map 1: Map Of Jordan With Main Water Utilities	12
--	----

TABLES

Table 1: Estimated Water Use In Jordan By Sectors For 2020 And 2040 In Mcm/Year	14
Table 2: Some Potential Impacts Of Climate Change On Water	16
Table 3: Population Of Jordan Over Time, With An Eye On Regional Political Events	18

List of Abbreviations

BOT:	Built-operate-transfer
FAO:	Food and Agriculture Organization
GDP:	Gross Domestic Product
GIZ:	German Economic and Development Co-operation
IPCC:	Intergovernmental Panel on Climate Change
JVA:	Jordan Valley Authority
MENA:	Middle East and North Africa
MOPIC:	Ministry of Planning and International Cooperation
MWI:	Ministry of Water and Irrigation
NGO:	Non-governmental Organization
OECD:	Organization for Economic Co-operation and Development
PMU:	Project Management Unit
SDG:	Sustainable Development Goal
UNDP:	United Nations Development Programme
UNESCO:	United Nations Educational, Scientific and Cultural Organization
UNFCCC:	United Nations Framework Convention on Climate Change
UNICEF:	United Nations Children's Fund
USAID:	United States Agency for International Development
WAJ:	Water Authority of Jordan
WB:	World Bank
WHO:	World Health Organization

1. INTRODUCTION

1.1 BACKGROUND

They say water has memory, and if it can write and speak it would explain the universe to us. Indeed, water is the center piece of all life, it is universal and essential. Water availability and access to it are some of the greatest concerns to all living organisms and institutions. Water covers 70% of our planet and it is easy to think that water is abundant; however, 1.1 billion people worldwide lack access to water and 1.7 billion persons are water scarce.¹ Human populations have controlled many of the natural waterways to allow civilizations to grow, but water systems are increasingly stressed and drying up.

Water shortages have been a constant problem in the Middle East and North Africa (MENA) and other parts of the world, but the Arab countries are lacking behind. The MENA region is home of 7.6% of the world's population but has only 1.4% of the world's freshwater.² One of the poorest water countries in the MENA is the Kingdom of Jordan. In 2015, the available fresh water was around 780 million m³, while water demand for the same year was 1400 million m³.³ The long-term periods of droughts, the impacts of climate change, and the political instability since 1948 in the region with the continuous influx of refugees have further exacerbated Jordan's water scarcity. Moreover, much of Jordan's water supply comes mainly from surface water and then groundwater. However, due to the high population and low water availability, the aquifers have been over exploited. Jordan's water deficit has been accompanied by inefficiency in administration and management and deteriorating water supply networks. Responding to the water problem requires integrated effective approaches that address technical, political and practical challenges.

Academics, ministries, donors and other actors all agree that Jordan is facing water scarcity, but they disagree on the vital causes of water scarcity. The United Nations Development Programme

¹ "Water Scarcity," Organization, World Widelife Fund, accessed May 15, 2020.

² Hussein Al-Rimmawi, "Middle East Chronic Water Problems: Solution Prospects," *Canadian Center of Science and Education* 2, no. 1 (May 3, 2012): 28.

³ "Jordan Water Sector Facts & Figures" (Amman: Ministry of Water and Irrigation, 2015), Facts.

(UNDP) explains that water crisis is largely of our own making; resulting not from natural limitations of water but is rather from deep failures in the water governance.⁴ While there are several factors that lead to water scarcity, this paper focuses on water governance, and asks the following guiding question: does water governance hold the key to improve water scarcity?

The paper attempts to analyze the importance of incorporating an effective water governance that is needed to decrease and stabilize water scarcity and avoid complete water crisis. Water issues can be addressed from various perspectives; there are natural problems such as climate change's effect of precipitation, evaporation and droughts, socioeconomic and political problems that add stress on the limited water resources, and other structural internal problems that deal with fragmentation of responsibilities, knowledge, and practicality within the governance structure of the water sector. This research adds on the water literature of Jordan by explaining those various challenges to Jordan's water governance and goes further by arguing that water governance deserves more attention to address long term water scarcity. The paper does not intent to offer a comprehensive review of water governance literature, but to identify trends and challenges that highlight the importance of adopting a coherent internal governance structure.

1.2 RESEARCH DESIGN

The overall research question tackled in this study is

Does water governance hold the key to improve scarcity?

This research paper has adopted a case-based research as its methodological approach. The reason behind this approach is to analyze and investigate a class of events of interest with the aim to develop theories and generic knowledge on the impact of the causes of the class of events on the water security. There is a good amount of research done that could be found on Jordan's water scarcity but only takes a singular lens and is interested in a single external variable, such as climate change or refugees' influx impact.

⁴ “Effective Water Governance: The Key to Sustainable Water Management and Poverty Eradication,” UNDP (2007b), **quoted in** Charles Batchelor, “Water Governance Literature Assessment” (IIED, 2007), 1.

Despite being case-focused, the intention of this research is not to limit the exploratory variables to Jordan only. The research does not necessarily define a case as a “country observed during a period of time”⁵, but can also stand for a population of cases and is not “directly representative”. The case is broader than itself; the populations can be understood as a region, e.g. the Middle East, or other water scarce countries surrounded characterized by poor governance structure. The research can also be expanded into a comparative case study, such as a comparative analysis between water scarce countries, for example Lebanon, where a researcher can study the similar/different existing water governance structures and how they lead/avoid water insecurity. In addition, the case of Jordan studied in this paper could be considered a deviant case as it tries to probe new or left-out explanations and variables. The justification of the use of a case-based research in this paper is causal; to explore causal governance mechanisms of water scarcity in a single case.

The analysis done in this paper is based on qualitative research. Primary data was obtained from the main institutions of the water sector, including the Ministry of Water and Irrigation (MWI) and the Water Authority of Jordan (WAJ). Secondary sources include data gathered from reports done by the World Bank (WB), the German Economic and Development Co-operation (GIZ), the United States Agency for International Development (USAID), the Organization for Economic Co-operation and Development (OECD) and other international organizations and non-governmental Organization (NGOs) in Jordan and abroad. In addition, for interview statements, online news outlets were used. Other data was obtained from relevant scholarly work.

The main limitation to this research is the lack of accurate and transparent data available on Jordan’s water resources and water utilities’ performance. There are many gaps found in the administrative records, including water supply and water losses. In addition, the quality of the data is rather weak and not comparable between different sources.

The structure of the study is composed as following: first, the paper provides a literature review on water governance and how it is related to the case study adopted; second, the paper examines the

⁵ Matthijs Bogaards, “Case-Based Research on Democratization,” *Taylor & Francis Group* 26 (2019): 62.

case study of Jordan by identifying the scale of the problem and the internal governance challenges in the water sector; third, the paper engages in an empirical analysis on the threats, opportunities and weaknesses observed, discusses the importance of adopting effective water governance structure possible policy solutions on the supply and demand side; and finally the last section of the paper concludes with final remarks and potential future research areas.

2. LITERATURE REVIEW

There are different approaches, multiple working definitions and various interests, perspectives and concerns for water. Understanding the implications of water scarcity and the importance of adopting effective water governance approaches can help in adapting the challenges and effects on the water sector brought by internal governance failures at the supply and demand side, and limiting the further challenges added on the water sector by external challenges such as climate change and regional instabilities.

2.1 WATER SCARCITY

Frank Rijsberman explains that an area is to be considered water scarce when a large amount of people living in that area are considered water insecure and have no access to safe and affordable water to meet their needs.⁶ Some look at scarcity as the relationship between water availability and human population⁷; which is a more relevant approach to the case study looked at in this paper as later will be observed. According to the *Falkenmark Water Stress Indicator*, countries whose renewable water supplies fall under 1,000 m³ per capita experience water scarcity.⁸ For the case of Jordan, the renewable water supply per capita is 60m³,⁹ way below the threshold.

There are various reasons behind water scarcity. Some include an over exploitation of water bodies without an opportunity for natural recovery. For example, in Jordan, the extraction rates are far higher than natural recharge rates.¹⁰ Others include the consequence of large population growth

⁶ Frank R Rijsberman, “Water Scarcity: Fact or Fiction?,” 2004, 1.

⁷ Ibid, 2.

⁸ Ibid.

⁹ “Efficient and Sustainable Management of Water Resources in Jordan,” Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), accessed May 5, 2020.

¹⁰ “Water Resources & Environment, Investing In A Water-Secure Future Jordan,” Usaid, accessed April 5, 2020.

relative to few available water resources.¹¹ Some provide reasons that are related to the implications of climate change intensifying water crisis.¹² Some scholars also explain that those water challenges are aggravated by uncertainty, whether its tension or conflict,¹³ and extraordinary population growth.¹⁴ On the other hand, there are some scholars who solely argue that water scarcity is a result of the inability to provide adequate infrastructure and technology to store and supply water.¹⁵

In the case study selected for this research paper, water scarcity is highly attributed to poor governance structure in the water sector. In the case of Jordan, water scarcity leads to inequitable water allocation and unequal access. The 6th Sustainable Development Goal (SDG), water and sanitation, aims to “ensure availability and sustainability management of water and sanitation for all,”¹⁶ however, according to World Health Organization (WHO), 1.2 billion people lack access to safe water for domestic use,¹⁷ and in Jordan there were 287,264 people in 2015 who did not have access to safe drinking water.¹⁸

Furthermore, it is critical and very essential to consider the concept of equity in water literature. The term equity, according to Rutgerd Boelens, is related to fairness, social justice and is related to rule-making processes and the distribution of resources in society.¹⁹ Tom Perrault claims that in the context of water governance, equity is having a fair access to drinking water, furthermore, he argues that fairness and justice should be defined in terms of recognizing the needs of the socially excluded and their rights within the context of societal norms and institutions.²⁰ Moreover, he

¹¹ Matti Kummu et al., “The World’s Road to Water Scarcity: Shortage and Stress in the 20th Century and Pathways towards Sustainability,” *Scientific RepoRts*, December 9, 2016, 1–16.

¹² Liliana Miranda, Michaela Hordijk, and Rommy K. Torres Molina, “Water Governance Key Approaches: An Analytical Framework Literature Review,” *Chance2Sustain*, July 2011, 5.

¹³ Ibid.

¹⁴ Kummu et al., *The World’s Road to Water Scarcity*.

¹⁵ Miranda et al, *Water Governance Key Approaches*, 5.

¹⁶ “Goal 6: Ensure Availability and Sustainable Management of Water and Sanitation for All,” Sustainable Development Goal indicators, accessed April 3, 2020.

¹⁷ “2.1 Billion People Lack Safe Drinking Water at Home, More than Twice as Many Lack Safe Sanitation,” World Health Organization, July 12, 2017.

¹⁸ “Jordan Water,” Worldometer.

¹⁹ Rutgerd Boelens, “Equity and Rule-Making,” in *Searching for Equity: Conceptions of Justice and Equity in Peasant Irrigation*, ed. Rutgerd Boelens and Gloria Dávila (The Netherlands: Van Gorcum: Assen, 1998), 16.

²⁰ Tom Perreault, “What Kind of Governance for What Kind of Equity? Towards a Theorization of Justice in Water Governance,” *Water International* 39, no. 2 (2014): 239.

explains that equity in water governance needs to be studied from the perspective of engagement between institutional arrangements, the government and society through which water is distributed and accessed.²¹ The concept of access to water and equity is rather evident in Jordan as locals and refugees compete over limited water resources. Accessibility and equity can be addressed through a good governance structure that encourages participatory in its management policies and promotes transparency in supply and demand.

In her research, Karen Bakker makes a symbolic difference between H₂O and water, she claims: “whereas H₂O circulates through the hydrological cycle, water as a resource circulates through the hydro social cycle – a complex network of pipes, water law, meters, quality standards, garden hoses, consumers, [and] leaking taps;” drawing emphasis on the strong relationship between water and society.²² This distinction indicates how water has a significant meaning and plays an important role in cultural and social practices, and that it is also worth to look at the modes of production and consumption of water at the local and national level to understand the forms of governance that are put in place for it. Furthermore, it is essential to take into consideration the relationship people have with water, for which ever reason or practice, by engaging the public in water related projects to get their feedback and expectations, for successful implementation. In Jordan, there is a lack of professional and efficient engagement of stakeholders with one another and with customers; leading to poor governance and lack of public awareness on water use.

2.2 WATER GOVERNANCE

When defining the concept of governance, many scholars and organizations refer to decision making, solving-problems, political, economic and administrative approaches. For example, according to the OECD, governance helps explain and improve civil society’s participation when it comes to decision making and is a more well-organized approach in solving problems than administrative methods.²³ UNDP defines governance as the political, economic and administrative exercise of an authority when it comes to managing a country’s matters at all levels, and it includes the complex processes and institutions where citizens exercise their rights.²⁴ Matthew Himley

²¹Ibid.

²² Karen Bakker, “From State to Market?: Water Mercantilizaci“n in Spain,” *Pion* 34 (2002): 774.

²³ “Water Governance in OECD Countries: A Multi-Level Approach” (OECD, 2011).

²⁴ “Governance and Development” (UNDESA, UNDP, UNESCO, May 2012), 3.

explains that governance is a broad theoretical framework that analyzes the interaction between institutions and social actors who are involved in the decision making of natural resources under neoliberal capitalism.²⁵ The term governance helps address challenges that a society could face, whether at the local, national or global level from different angles such as environmental, economic, social or political. Governance provides coordination, rules, norms and order.

Governance can be also related to the functions of a government and the interactions between government and non-governmental actors. In recent years, the concept of governance has received more attention from various governments and organizations. For example, the United Kingdom Department for International Development looks at the historical roots of governance to identify authority problems, rethink ‘aid modalities’ and how international factors can undermine national governance matters.²⁶

While there is not one shared definition of governance and despite the theoretical shortages in the concept, governance can be used to assess water issues. There are various definitions and perspectives for water governance. For example, Charles Batchelor defines water governance as a method through which allocative politics are implemented in water management and it generally holds the formal and informal institutions where authority is exercised (distributive governance).²⁷ Petra Dobner and Hans-Georg Frede convey that water governance includes all actions that are involved in guaranteeing a sustainable access to water for everyone.²⁸ For the purpose of this research, the paper looks at Pahl-Wostl’s definition that explains water governance as “the social function that regulates development and management of water resources and provisions of water services at different levels of society and guides the resource towards a desirable state and away from an undesirable state.”²⁹ Therefore, the concept of water governance is more about the process of decision making rather than the decisions themselves, and the impact and significance of

²⁵ Matthew Himley, “Geographies of Environmental Governance: The Nexus of Nature and Neoliberalism,” *Geography Compass*, 2008, 433–451.

²⁶ Batchelor, *Water Governance Literature Assessment*, 2.

²⁷ Ibid, 1.

²⁸ Petra Dobner and Hans-Georg Frede, “Water Governance: A Systemic Approach,” in *Society - Water - Technology*, ed. Reinhard F. Hüttl et al. (Cham: Springer International Publishing, 2016), 82.

²⁹ Claudia Pahl-Wostl, “An Evolutionary Perspective on Water Governance: From Understanding to Transformation,” *Springer* 31 (May 31, 2017): 2921.

institutions that suggest the norms and rules that influence the relationship between humans and ecology.

When studying water governance, one must take into account the varying political, social, economic and the administrative organizations that manage the water resources and services and its delivery. In Jordan, there are various actors involved in the water sector, from public to private, national and international. According to the UNDP, water crisis is a crisis of governance, and water governance deficiency means firstly the failure to provide adequate water for the poor, secondly the absence of apt attention to water regulations and thirdly imbalance between socioeconomic and environmental demands.³⁰ As this paper tries to understand the challenges Jordan faces in its water sector, analyzing the structure of water governance helps identifying the importance of governance in tackling water scarcity.

2.2.1 EFFECTIVE WATER GOVERNANCE

There are several main dimensions to water governance. There is a social dimension that discusses the equitable water use, an economic dimension that talks about the role of water in the economic growth and water efficiency, a political dimension that deals with stakeholders and citizens and their access and ability to influence the political process of water governance, and finally an environmental dimension that refers to sustainability.³¹ While these are the main dimensions to water governance, there are also key elements that ensure good governance. Some of those include transparency, equity and accountability. According to UNDP, good water governance includes rule of law, ethics and a broad participation.³² Good governance also needs a collective decision-making body, effective institutions and legal frameworks.³³

³⁰ “Concepts and Approaches for Effective Water Governance in the Arab Region,” Water Governance in the Arab Region: Managing Scarcity and Securing the Future (United Nations Development Programme, 2013), 72.

³¹ Kanaan Ambalam, “Reallocation of Water Resources in the Arab Region: An Emerging Challenge in Water Governance,” *European Journal of Sustainable Development* 3, no. 3 (October 2014): 283–98.

³² UNDP, *Concepts and Approaches*, 72.

³³ Ibid.

According to Olli Varis and Cecilia Tortajada, for a successful water governance, there needs to be an understanding of modernization and the challenges it brings.³⁴ Varis explains that as water affects people's lives, suitable changes in water governance can make a large positive social impact.³⁵ For example, as many Arab countries are facing political transitions, water governance reforms can increase participation and transparency.³⁶ Morocco, for example, decentralized its water management and let local authorities participate.³⁷ However, reforms in many countries in the MENA region are difficult to take place or are often delayed mostly due to reasons including corruption, weak institutions and lack of public awareness. UNDP's report further argues that roles and responsibilities in the Arab countries are often unclear and there is almost no water governance.³⁸ When studying the Arab region, there are also several challenges in maintaining an effective water governance, including an equitable stakeholder participation and a lack of proficient regulation.³⁹ Furthermore, the region also experiences an unequal water provision, especially in water scarce countries and post-conflict countries. For example, Iraq is unable to provide an efficient amount of water services to its people due to the destroyed water institutions and infrastructure.⁴⁰ As a result, in order to maintain an effective water governance, there needs to be efficiency, inclusivity with a horizontal management, openness, accountability and sustainability.

Furthermore, water governance helps guide and enhance sustainable water management and delivery, and as water becomes scarcer, there is an even more need for an effective water governance that would ensure an equitable and efficient access to water. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), water crisis is not mainly caused by lack of water but is rather a cause of a failure in water governance.⁴¹ While climate change and societal change increase the burden on water resources, it is vital to address water challenges through adapting efficient water management approaches. The Intergovernmental Panel

³⁴ Olli Varis and Cecilia Tortajada, "Water Governance in the MENA Region: Policies and Institutions" (InWEnt, 2009), 19.

³⁵ Ibid.

³⁶ Ibid.

³⁷ UNDP, *Concepts and Approaches*, 73.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ "Water: A Shared Responsibility" (UNESCO, 2006).

on Climate Change (IPCC) acknowledges that governance holds the key in achieving a long-term sustainable solution to water scarcity,⁴² and this paper agrees with this acknowledgement.

3. CASE STUDY: JORDAN

3.1 NATURE AND SCALE OF JORDAN'S WATER CHALLENGE

The Hashemite Kingdom of Jordan, located on the Western bank of Jordan river and bordered by Saudi Arabia to the South and East, Iraq to the North-east, Syria to the North and Israel and Palestine to the West (see MAP 1) is one of the driest countries in the world and the 5th most water stressed.⁴³ Jordan, an upper-middle income country with a population of 10 million inhabitants, has very limited natural resources and suffers from harsh climate and continuous regional instability. The country depends highly on remittances and grants and imports the majority of its energy and large amounts of its water. The geographic situation of Jordan and the regional conflicts have highly contributed to Jordan's water scarcity.

The country suffers from a great gap between the population's demand for water and the actual availability of water resources. In 2008, there was around 145 m³ of available water per capita, which is drastically below the international average of 1,000 m³ and the absolute scarcity line of 500 m³ per capita.⁴⁴ The demand continues to increase in Jordan; threatening the stability of the country. The available water supply in Jordan is estimated at 892 million m³, with 79% from renewable groundwater sources, 8.3% from non-renewable fresh fossil groundwater, and 13.1% from treated wastewater (see Figure 1).⁴⁵ Additionally, the government of Jordan pumps water to households on an average of 2 times per week.⁴⁶ The average amount of water supplied per Jordanian is 0.09 m³ per day compared to the average regular consumption rate of 0.17 m³.⁴⁷ As a result of water scarcity, sectors in Jordan compete greatly, including for agriculture and domestic uses. Furthermore, Jordan uses surface water and ground water sources to meet its water demand,

⁴² IPCC, "AR5 Synthesis Report: Climate Change 2014" (Geneva, Switzerland: IPCC, 2014).

⁴³ Rutger Hofste, Paul Reig, and Leah Schleifer, "17 Countries, Home to One-Quarter of the World's Population, Face Extremely High Water Stress," *World Resources Institute* (blog), August 6, 2019.

⁴⁴ Yorke Valerie, "Politics Matter: Jordan's Path to Water Security Lies through Political Reforms and Regional Cooperation," *NCCR Trade Working Paper*, April 2013, 14.

⁴⁵ Ibid, 15.

⁴⁶ Ibid.

⁴⁷ Elaine Denny et al., "Sustainable Water Strategies for Jordan" (Ann Arbor, Michigan, International Economic Development Program Gerald R. Ford School of Public Policy University of Michigan, Ann Arbor, 2008), 3.

with an abstraction rate higher than the recharge rate.⁴⁸ The country has a negative water balance of 20%, with a demand of 1.15 billion m³ annually and only a renewable available supply of 850 million m³.⁴⁹ As a result, in order to meet the excessive demand, there is an over-pumping of non-renewable groundwater. For example, 10 out of the 12 major groundwater basins in Jordan are over extracted.⁵⁰ In addition, the rainfall in Jordan is seasonal and unpredictable, with high evaporation rates.⁵¹ The total rainfall averages 8,230 million m³ per year, which is the lowest in the region.⁵² As a result, even a minor change in water levels will have a large impact on several sectors in the country, including agriculture, industry and health.

⁴⁸ USAID, *Investing in a water secure future Jordan*.

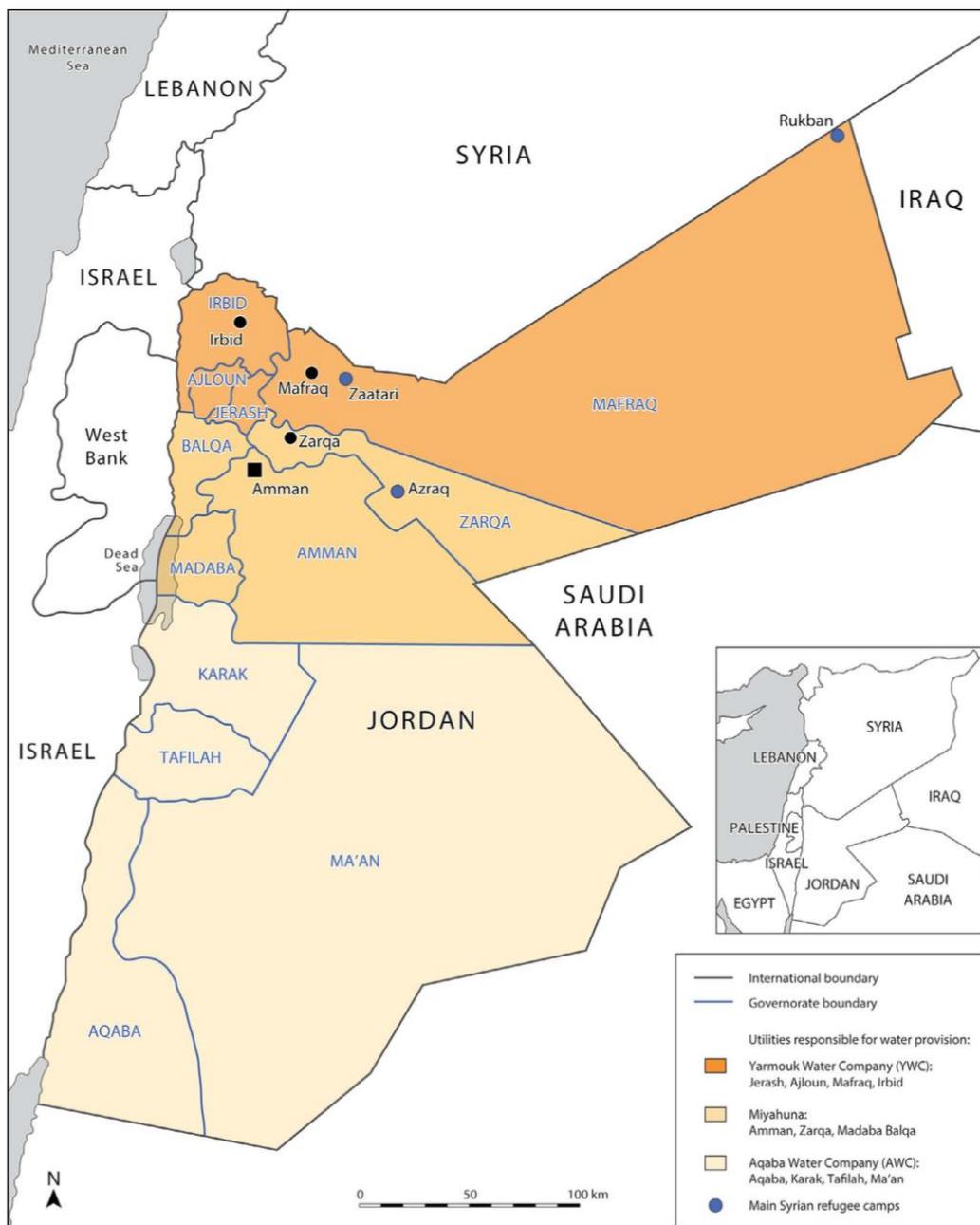
⁴⁹ Denny et al., *Sustainable Water Strategies for Jordan*, 2.

⁵⁰ Elizabeth Whitman, “A Land without Water: The Scramble to Stop Jordan from Running Dry,” News, September 4, 2019.

⁵¹ Christine Draake, “Water Resource Conflicts in the Middle East,” *Journal of Geography*, 1997, 2, **quoted in** Denny et al., *Sustainable Water Strategies for Jordan*, 2.

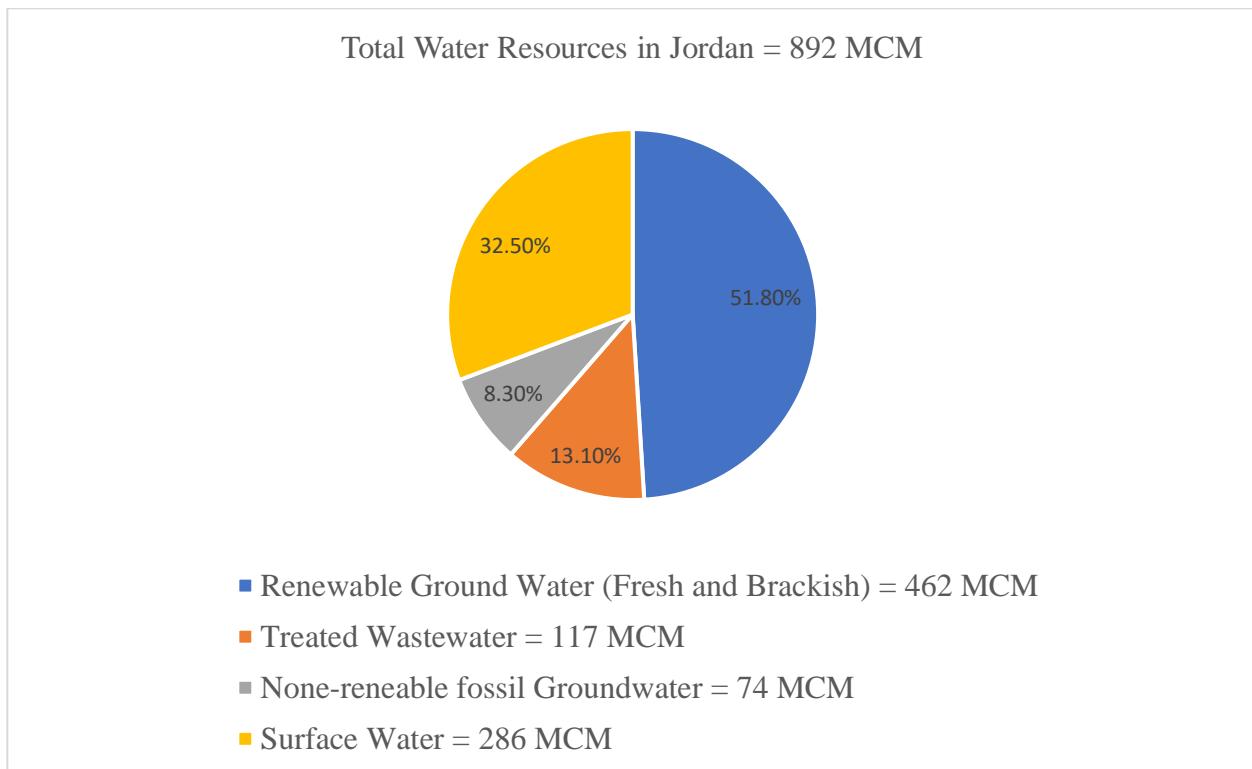
⁵² Valerie, *Politics Matter*, 10.

MAP 1: Map Of Jordan With Main Water Utilities⁵³



⁵³ IIED, 2017.

FIGURE 1: Total Estimated Available Water From 2010⁵⁴



When it comes to managing water resources, it is necessarily to understand the usage of water in different sectors. Water use is mainly divided between the agricultural, industrial and municipal sectors (see Table 1). According to Jordan's Water Strategy 2008 – 2022, the agricultural sector, including irrigation, consumes 72% of Jordan's water supply, while the industrial and municipal sectors consume 28%.⁵⁵ Over the past decades, there has been an increase in municipal water use as income has been increasing and peoples' lifestyles changing, which have resulted in an increase in water consumption with a special focus on urban areas.⁵⁶ As the population continues to grow and the demands rise, water use is expected to escalate as well.

⁵⁴ Author's own presentation of data from MWI, *Water Budget Projected Demand and Resources (2010- 2025)* retrieved from Yorke 2013: 14.

Note: MCM = million m³

⁵⁵ Velma Grover, Abdel Raouf Darwish, and Eliza Deutsch, "Integrated Water Resources Management in Jordan," *The Economic Research Forum (ERF)*, December 2010, 2.

⁵⁶ Ibid, 3.

TABLE 1: Estimated Water Use In Jordan By Sectors For 2020 And 2040 In Mcm/Year⁵⁷

	2020	2040
Total water demand	1602	2236
Domestic	670	1263
Industrial	130	170
Irrigation	802	803
Total water supply	1152	1549
Total water deficit	-451	-687

While the agricultural sector accounts for the largest water consumption in the country, agricultural production contributes only 5.63% towards Jordan's Gross Domestic Product (GDP) (see Figure 2). Nonetheless, there has been some changes in water consumption patterns in the agricultural sector due to various reasons such as technological advancements, drought and economic competition from neighbouring markets.⁵⁸ Despite this decrease, demand for food is still high and continues to rise as population grows; resulting in higher water use for irrigation.⁵⁹ In addition, according to Jordan's Department of Statistics, a trend is observed for overproduction of high-water consuming crops (mainly vegetables) through open canals and unlicensed wells.⁶⁰

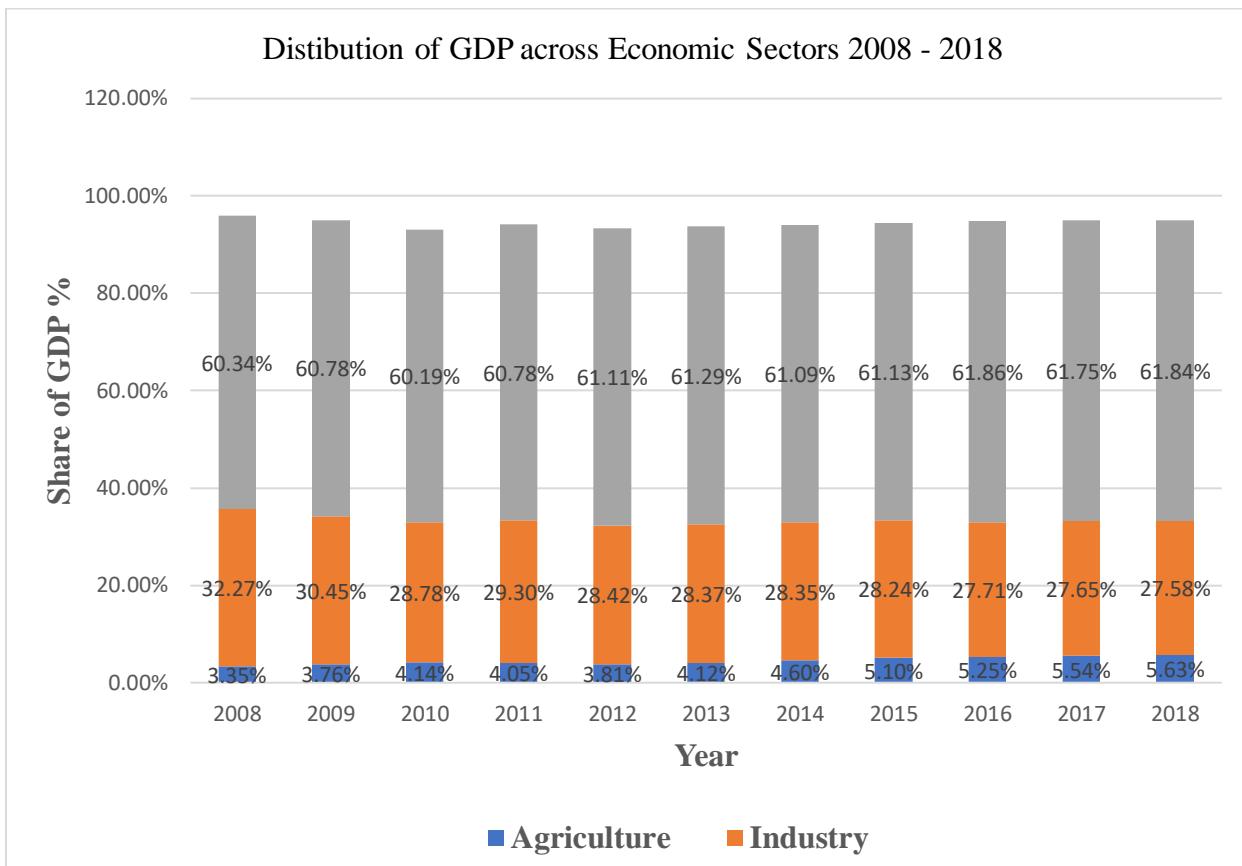
⁵⁷ Data retrieved from the *National Water Master Plan - Ministry of Water and Irrigation 2007* quoted in Grover et al, *Integrated Water Resources Management in Jordan*, 2010.

⁵⁸ Ibid.

⁵⁹ Ibid.

⁶⁰ "Crops Statistics" (Department of Statistics, 2017).

FIGURE 2: Distribution Of Gross Domestic Product (GDP) Across Economic Sectors From 2008 To 2018 In Jordan⁶¹



There are external challenges that add to the pressure on the water systems and result in a full allocation of available water resources. Those challenges include climate change and regional stability, and they play a significant part in Jordan's water scarcity. As mentioned earlier, Jordan's climate is arid and dry, and as the Middle East region is one of the most vulnerable to the impacts of climate change, Jordan's water scarcity is expected to worsen. Jordan is predicted to become drier and according to Jordan's Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), the average temperature is projected to rise by around 1.7 degrees Celsius by 2050; resulting in desertification as water availability decreases and demand

⁶¹ Author's own interpretation of data retrieved from Statista. Statista, 2018.
<https://www.statista.com/statistics/385505/jordan-gdp-distribution-across-economic-sectors/>

increases.⁶² Rising temperature results in higher risks of evaporation and drought that also impact the soil and the water stored in the reservoirs.⁶³ In addition, the quality of water in rivers and groundwater is expected to worsen and climate change is anticipated to reduce freshwater availability by 15% by the end of 2020.⁶⁴ Furthermore, potential impacts of climate change on the water sector also include socioeconomic problems, including agriculture, employment, health and food security, etc, all of which will exacerbate local tensions (see Table 2 for potential impacts on water). Rural communities depend highly on climate sensitive resources for farming and trade, and when water supplies decline, this will affect agriculture and forces the government to decrease water allocations to the agricultural sector and refocus them towards drinking purposes; leaving thousands of famers out of jobs.⁶⁵ The impact of climate change observed on the water sector is deteriorating the water security in the country and leaving vulnerable communities in worse conditions and more responsibility on the water sector for better management of limited water resources.

Table 2: Some Potential Impacts Of Climate Change On Water⁶⁶

Change	Water
Increasing average temperature	Effects on water resources relying on snow melt, effects on water supply
Increasing average precipitation	Increase in water availability in tropical areas, decrease in water availability in arid areas
Extreme rainfall	Negative effects on quality of surface and groundwater, contamination and disruption of water supply
Drought	Water shortages/stress
Heat/Cold waves	Increase in water demand
Rise in sea level	Decrease in freshwater availability/ saltwater intrusion

⁶² “Jordan’s Third National Communication on Climate Change” (The United Nations Framework Convention on Climate Change (UNFCCC), 2014), 123.

⁶³ “Water Governance in The Arab Region” (UNDP, 2013), 33.

⁶⁴ Sundeep Waslekar, “The Blue Peace: Rethinking Middle East Water” (Strategic Foresight Group, 2011), 92.

⁶⁵ Valerie, *Politics Matter*, 32.

⁶⁶ Author’s own interpretation from research

Additionally, there is a regional context to Jordan's water problems that cannot be disregarded. There is an uncertain degree of supply from surface water and groundwater since its majority comes from shared and transboundary sources. There is a lack of effective regional transboundary agreements and are far from equitable. Due to the unequal distribution among riparian states and over extraction as a result of dams, the rivers' flow is lessening. For example, the Yarmouk River, situated in Northern Jordan, shares borders with Syria, the river's upstream riparian, and while Syria had agreed in the 1987 to supply an amount of 208 million m³ per year, Jordan only receives about 50 million m³ per year.⁶⁷ This is mainly due to the many dams and extraction that Syria does, which puts Jordan in a tremendous disadvantage despite the transboundary bilateral agreements. Despite the shared use of those resources, Jordan lacks strategic position against powerful neighbours and does not have bilateral agreements with Syria nor with Saudi Arabia on the joint management and conservation of these water sources, and hence, there is a lack of planned mechanisms for securing water in the future.

In addition, internal demand on water resources is exponentially growing in Jordan due to regional and external conflicts; adding more pressure and need for an effective governance structure that can meet the extra demand. Jordan has one of the highest population growth rates of 1.40%,⁶⁸ exacerbated by regional conflicts. Jordan has witnessed several influxes of refugees across the decades; firstly, with the Palestinian refugees in 1948, then the inflow of Iraqis into the country post the Iraqi War in 2003, the migration of other groups of refugees including Yemenis and Sudanese into Jordan, and most recently, the great influx of Syrian refugees starting in 2011 (see Table 3 for demography of Jordan over time). Those influxes of refugees have put extensive strains on Jordan's limited water, and the demand of water is far exceeding the supply.

⁶⁷ Ibid, 16.

⁶⁸ "Country Comparison: Population Growth Rate," Central Intelligence Agency.

TABLE 3: Population Of Jordan Over Time, With An Eye On Regional Political Events⁶⁹

Year	Population of Jordan	Political Event
1922	225,000	Emirate of Transjordan founded in 1921
1947	473,200	One year before establishment of Israel
1952	586,200	Four years after the 1948 war with Israel
1970	1,508,200	Three years after the six-day war with Israel and the occupation of the WB by Israel
1989	3,144,000	One year before the Iraq-Kuwait war
1993	3,993,000	One year after the Iraq-Kuwait war
2002	5,098,000	One year before the Iraq-US war
2004	5,350,000	One year after the Iraq-US war
2010	6,113,000	One year before the Syrian Civil War
2012	6,388,000	One year after the start of the Syrian Civil War
2015	9,500,000	Three years after the start of the Syrian Civil War

In a news article in Jordan Times, the former minister of the MWI, Hazem Nasser, stated that the influx of the refugees has increased water demand in Jordan by 40% in the northern part of the Kingdom, 10% in the southern part, and by 20% on an average all in all in the country.⁷⁰ Furthermore, the former minister claimed that hosting the refugees has shifted Jordan's strategies into emergency plans.⁷¹ For example, Jordan was working on operating a new project to transport water from the Disi aquifer from the borders with Saudi Arabia to Amman (the capital city of Jordan where water demand is highest); however, due to the influx of refugees and the establishment of the Zaatri camp (the 2nd largest Syrian refugee camp in the world), the Disi became over exploited, operating at 92% of its capacity at an earlier stage than anticipated, in order to meet the demands of the refugees.⁷² As a result, tensions are also rising between local communities and refugees.

⁶⁹ Hussam Hussein, "Understanding Water Scarcity in Arid Regions: A Critical Discourse Analysis of Water Scarcity in the Case of Jordan," 2016, 207.

⁷⁰ Hana Namrouqa, "Jordan World's Second Water-Poorest Country," *Jordan Times*, October 22, 2014.

⁷¹ Hana Namrouqa, "Jordan Seeks Self-Reliance in Water Sector — Ghezawi," *Jordan Times*, May 21, 2018.

⁷² Hana Namrouqa, "Jordan Needs \$750m to Meet Water Demand over next Three Years," *Jordan Times*, January 7, 2014.

3.2 JORDAN'S WATER GOVERNANCE STRUCTURE

Jordan's water sector framework constitutes of highly centralized governance and politics, with institutions and agencies that lack communication and cohesiveness; leading to overlapping responsibilities and weak water management efforts. In addition, while the water sector relies deeply on private experts, including international actors; there is still a lack in strong involvement of the private sector in addressing water related issues that the government cannot address.

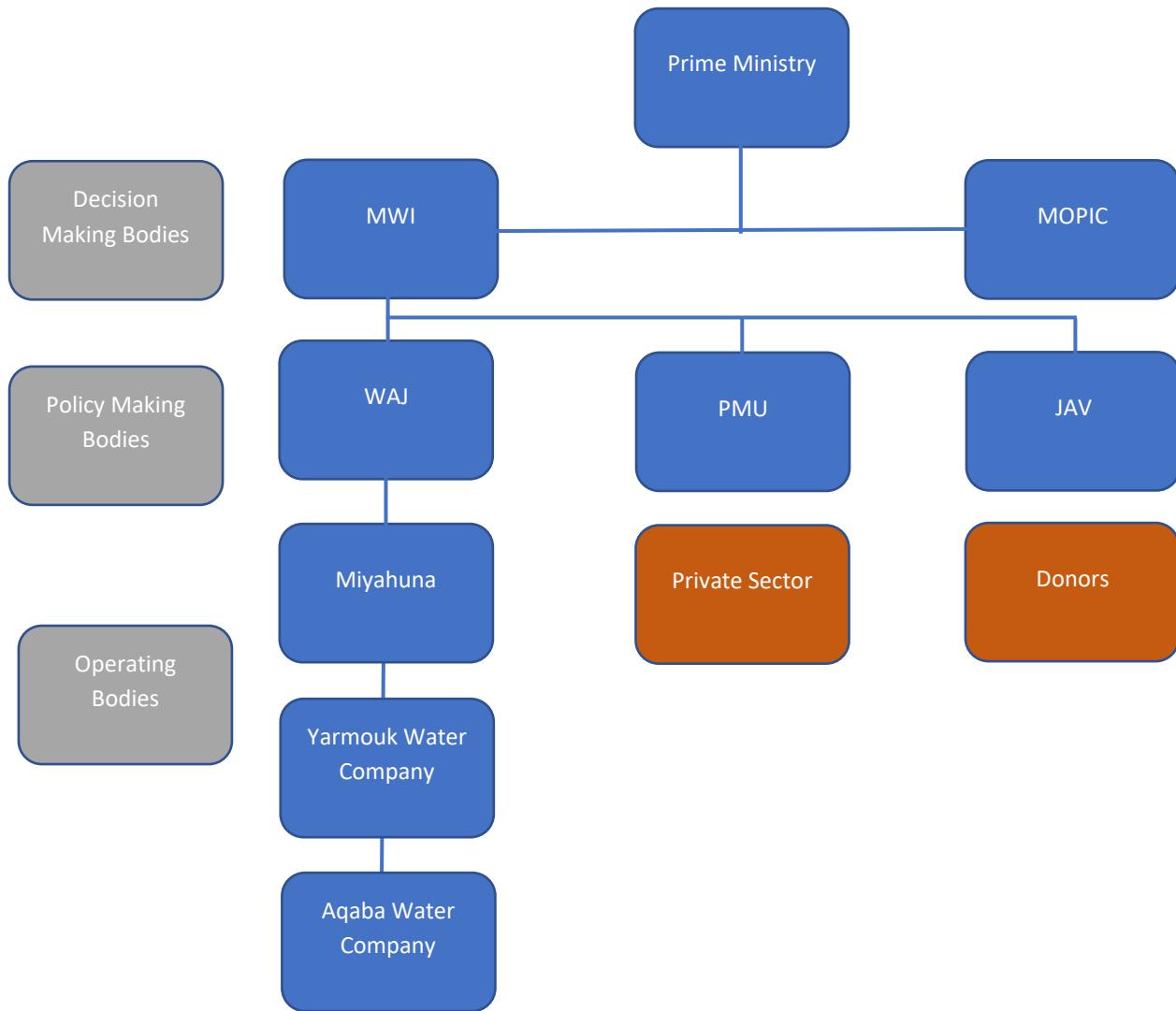
3.2.1 CENTRALIZED INSTITUTIONS

The Jordanian water sector holds various players from national to international and public to private (see Figure 3 for main institutions). The existence of many centralized institutions and organizations lead to a complex governance structure.⁷³ At the national level, the MWI established in 1988, is the main public water institution in Jordan. MWI is a regulatory body that is responsible for the general strategic and planning of water and sanitation, it develops laws, policies, and international and national partnerships with private sector and is responsible for the supervision and monitoring of programmes' implementation. Under the MWI operates the WAJ that is responsible for the organization of water supply and wastewater treatment, mainly in the highlands, and the operation of water resources. If groundwater resources become threatened at any point, WAJ has the authority to manage them by controlling the groundwater pumping licenses. The third national institute is the Jordan Valley Authority (JVA), which also operates under the MWI. JVA's main mandate is to protect the water resources in the Jordan Valley and to provide a plan for comprehensive development, including farming and industrial purposes. In addition to these main institutions, there is the Project Management Unit (PMU) that was established in 1990s under WAJ. PMU is responsible for the regulation of water supply and wastewater utilities, in addition, the encouragement and promotion of the private sector participation in the project planning and implementation in the water sector. As for the Ministry of Planning and International Cooperation (MOPIC), its role is in facilitating project proposals to donors and other donor-related activities in the water sector. There is a lack of integration in water management efforts as a result of the limited communication between the existing institutions, the lack of information available on each

⁷³ Information about main institutions and their roles was retrieved from the MWI webpage.
<http://www.mwi.gov.jo/Intro/Pages/default.aspx>

institution's performance, and an overlap of accountabilities that constrain the agencies from implementing effective water governance.

FIGURE 3: Main Institutions In The Water Sector⁷⁴



3.2.2 LACK OF STRONG PRIVATE SECTOR PARTICIPATION

Since the 1990s, there has been an ongoing programme to corporatize water operations through commercially run water companies.⁷⁵ There are three water utilities in Jordan that are accountable for providing water in Jordan. The first one is a state utility named Miyahuna, owned by WAJ and

⁷⁴ Author's own interpretation

⁷⁵ OCED, *Water Governance in OECD Countries: A Multi-Level Approach*, 22.

operates through commercial units, and is responsible for water distribution and wastewater in Amman, Zarqa, Balqa and Madaba.⁷⁶ Miyahuna operates mainly in an urbanized area with competent infrastructure and serves water to around 2.54 million residents and wastewater collection services to over 2 million residents.⁷⁷ The second utility is Yarmouk Water Company, it used to be maintained by a French company, Veolia, but became state-owned in 2010 and is also owned and managed by WAJ and covers water provision to Irbid, Jerash, Ajloun and Mafraq.⁷⁸ Yarmouk utility supplies around 250,000 customers, mostly in rural settings, and it is the most corporatized utility operating through commercial orientation.⁷⁹ The third utility is Aqaba Water Company, operating under WAJ and supplies water to Aqaba, Karak, Tafileh and Ma'an.⁸⁰ Those three utilities serve water to around 45% of the population and account for 70% of the total water supply, while WAJ is responsible for the other 30%.⁸¹

There is not much of space for utilities and other actors for decision-making, as most of the policy making takes place at the national level. WAJ exerts a large amount of influence on the operational and organizations activities of the utilities; for example, WAJ appoints the board members and the employees of the utilities.⁸² In addition, Mihayuna and Yarmouk rely on donors and WAJ for capital investment, operation and maintenance.⁸³ According to USAID, the limited autonomy noted plays a significant role in the structural weakness and inefficiency of the utilities.⁸⁴ This leads to administrative gaps and sometimes overlapping of responsibilities. In Jordan's National Water Strategy for 2016 – 2025, there was a recognition of this centralized national power, nonetheless, some by-law changes aimed to strengthen MWI strategic leadership led to further deteriorated service provision at the local level.⁸⁵ To transform the utilities into truly commercialized and corporatized entities, more legal and managerial autonomy is needed.

⁷⁶ MWI, *National Water Strategy (2016-2025)*, 18.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Ibid.

⁸⁰ Ibid.

⁸¹ OECD, *Water Governance in OECD Countries: A Multi-Level Approach*, 23.

⁸² MWI, *National Water Strategy (2016-2025)*, 19.

⁸³ Ibid

⁸⁴ "Institutional Support and Strengthening Programme (ISSP) Institutional Assessment Report" (USAID, October 2011a), **quoted in** OECD, *Water Governance in OECD Countries: A Multi-Level Approach*, 25.

⁸⁵ MWI, *National Water Strategy (2016-2025)*, 19.

3.2.3 DEPENDENCY ON THE INTERNATIONAL COMMUNITY AND DONORS

For the past decades, donors have been providing a great amount of financial and technical support for the inception of activities held by the private sector in Jordan's water sector. For example, in 1999, to support the implementation of the Amman management contract,⁸⁶ the WB provided the MWI with a 5 million USD loan.⁸⁷ In addition, the German government supported the MWI and WAJ in enhancing the wastewater treatment plants' management by funding the Madaba management contract.⁸⁸ In addition, donors have been playing an essential role in attracting private investments. For example, there was a deal agreed upon between private sector, government and donors to contract a wastewater treatment plan company, As Samra Built-operate-transfer (BOT), which included 46% funding from USAID, 45% funding from the private sector, and 8% from the government of Jordan.⁸⁹ This project was acknowledged to be an innovative funding structure that has never been used before in the Middle East.⁹⁰

In addition, while the refugee crisis added to the socioeconomic stress that is already present in Jordan, the use of refugee seems to also influence donor support. Every year from 2014 to 2018, Jordanian government asked for 240 million USD of support for the water sector as a result of the Syrian refugee crisis.⁹¹ In 2015, the former Minister of Water, Hazem Al Nasser, stated at a national conference on water and sanitation organized with the United Nations Children's Fund (UNICEF) that “if the required funds (\$750 million for 2015–2017) are not secured, there will be a negative impact on Syrian refugees' health, security and environment”.⁹² The refugee discourse also impacted water governance in the country by changing the initial priorities of projects being implemented in order to seek water security. For example, the focus of the Disi and the Red Sea – Dead Sea projects was changed to create a Jordan National Water Carrier and a desalination plant in Aqaba to meet the water demands of the Jordanian citizens and refugees in the country.⁹³ This

⁸⁶ Amman management was a public-private partnership between WAJ and a French company to manage water and wastewater in Amman and to strengthen the capability of the staff and the technical structure.

⁸⁷ OECD, *Water Governance in OECD Countries: A Multi-Level Approach*, 35.

⁸⁸ Ibid.

⁸⁹ Ibid, 27.

⁹⁰ “MIGA Backs Wastewater Treatment Plant in Jordan,” *MIGA*, July 24, 2013.

⁹¹ Hussam Hussein et al., “Syrian Refugees, Water Scarcity, and Dynamic Policies: How Do the New Refugee Discourses Impact Water Governance Debates in Lebanon and Jordan?,” *Water* 12, no. 2 (January 22, 2020): 10.

⁹² “Contracted Aid for Kingdom up in 2017, but Grants Directed to Support Budget Shrink,” *Jordan Times*, February 21, 2018.

⁹³ Hussein et al., *Syrian Refugees, Water Scarcity, and Dynamic Policies*, 10.

switch in focus from a regional towards a national and local dimension attracts international donors' interest. Nonetheless, although many international NGOs and organizations have provided assistance, they withdrew before significant changes occurred in the water sector.⁹⁴

There is a gap between the support required and the external assistance received. According to Miyahuna utility, there is a lack of understanding by NGOs on local context and their intervention, and so there is a need for more cultural understanding during strategic interventions by the international community.⁹⁵ However, providing initiatives that are both hard and soft measures such as installations and trainings adapted to the local context is sometimes difficult for NGOs as they have to also meet the donors' expectations.

3.2.4 WATER LOSS

In addition to the incohesive centralized governance structure, water losses and waste restrict water governance in Jordan. There is no adequate monitoring system that is essential for information and data gathering of available water for proper water resource management planning. This is mainly due to the lack of appropriate metering system that results in an overuse of water resources.⁹⁶ As a result, a culture of waste, especially in the agricultural sector, is observed as farmers and households pay water prices that are below the actual cost of the water being supplied.⁹⁷

Additionally, big proportions of the water supplied is lost because of the old and weak infrastructure.⁹⁸ As Jordan's urban areas are situated significantly above the available water resources, there is a large distance between the water source and the urban areas; hence, as water gets transported, more water loss and leakages are detected. MWI notes that around 52% of the total water produced for municipal uses is unreported.⁹⁹ This loss of water is a result of various

⁹⁴ Loan Diep et al., "Water, Crises and Conflict in MENA: How Can Water Service Providers Improve Their Resilience?," *IIED*, October 2017, 47.10/13/2020 11:17:00 AM

⁹⁵ Ibid, 27.

⁹⁶ Grover et al., *Integrated Water Resources Management in Jordan*, 5.

⁹⁷ Ibid, 6.

⁹⁸ Mohamed El-Ashry et al., *Arab Environment: Water: Sustainable Management of a Scarce Resource* (Beirut: Arab Forum for Environment and Development, 2010), 92.

⁹⁹ MWI, *National Water Strategy (2016-2025)*, 15.

factors including illegal extraction, non-operational meters, weak law enforcement, lack of individual awareness for water waste, and poor quality of water pipes.

In addition to the weak infrastructure and water loss in the municipal sector, there is also mismanagement of water in the agricultural sector. According to the Food and Agriculture Organization (FAO), the water sector in Jordan allocates a high level of water to the agricultural sector due to the increase of irrigated land areas and rain-dependent crops, with agricultural water withdrawal of 53.13% as of total water withdrawal.¹⁰⁰ Most of the cultivatable land in Jordan lies beyond the appropriate area for rain-fed agriculture.¹⁰¹ FAO also explains that the rain-fed agricultural land in the country is getting lost due to climate change impact on precipitation levels that leads to unpredictable production, and an urban expansion that uses rain-fed land for urban practices.¹⁰² In addition, the irrigation methods used, such as the traditional flood irrigation systems, and leakage and evaporation during transport are also accountable for water loss.¹⁰³

4. EMPIRICAL DISCUSSION

4.1 ANALYSIS

Based on the analysis done, there are some drawbacks, risks, and opportunities observed in Jordan's water governance:

- Drawbacks:
 - Lack of data availability on water
 - High leakages during water provision
 - Inadequate technical services and infrastructure
 - Lack of proper metering and monitoring systems
 - Lack of public participation and awareness
 - Centralized institutions
 - Overlap of responsibilities among authorities and utilities

¹⁰⁰ "AQUASTAT: Jordan," Food and Agriculture Organization of the United Nations (FAO), 2016.

¹⁰¹ Ibid.

¹⁰² Ibid.

¹⁰³ Grover et al., *Integrated Water Resources Management in Jordan*, 6.

- Risks:
 - Climate change
 - Regional instability
 - Tension between local community and refugee communities
 - Deteriorating water quality
 - Declining foreign aid

- Opportunities:
 - Increase private sector participation for more funding and expertise
 - Improved infrastructure
 - Better understanding of local context by the international community
 - Decentralized institutions for better coordination
 - Stronger engagement with the public and raising awareness on water use

The disadvantages, risks and opportunities observed can be translated into whether Jordan can address some of the distortions in the water sector into actions and build institutional capacity that is needed for an effective sustainable governance.

International organizations and experts have recognized that their technical and financial support towards the water sector is not enough because there is a lack of political will to prioritize policies and regulatory framework needed to create the optimal use of scarce water resources for a water-secure future in Jordan, and donor-funded projects highly influenced by politics. For example, according to USAID,

“Most people agree they are over pumping. Most donors have tried to tackle the problem and with marginal success. Everybody agrees it’s a problem, but nobody would take the next step.”¹⁰⁴

¹⁰⁴ “Reuse Steps Up in Water-Poor Jordan,” EMWIS, April 15, 2011.

Jordan is a vital strategic ally of Western powers as it provides “an oasis of moderation and stability in a tumultuous region” in the Middle East.¹⁰⁵ Located on the borders of Israel, Syria, Iraq and Saudi Arabia, Jordan is constantly politically and economically affected by regional instabilities. Nonetheless, despite the turbulences surrounding it, Jordan, through the leadership of His Majesty King Abdullah II, has been managing to pursue internal and external peace. Recognizing Jordan’s strategic importance, the international community provides Jordan with financial support through loans and aid programmes. One of the strongest economic supports given to Jordan is dedicated towards the water sector.¹⁰⁶ Due to constant budget deficits, high debts, Jordan cannot fund rebuilding its own water infrastructure and developing the sector to the needed levels for economic growth. USAID has been the largest donor to the water sector, followed by Germany and Japan.¹⁰⁷ Despite the assistance received by the international community, there is a lack of collaboration between the water sector and the donors. Jordan has developed a dependency nature on international donors for large projects to meet water needs, instead of shifting from a supply-oriented attitude towards demand management of limited water resources.

Looking at the analysis made, this research argues that while external factors including climate change, population growth and lack of desirable agreements on shared water resources with neighbouring countries contribute to Jordan’s water crisis, water scarcity is highly attributed to the weak governance structure. To cope with the water crisis that can endanger internal stability, there is a need for an effective water governance structure that implements needed policies to protect groundwater, pushes for sustainable water-secure future and adopts a coherent set of reforms needed for water demand management through a collaborative backed up approach by the private sector and the international donor community for technical and financial assistance.

Jordan has been trying to answer its water resource problem through water reforms and cooperation with donor agencies to strengthen the capacity of its institutional frameworks. For example, Jordan asked the WB’s assistance in updating its Water Sector Review through a five-year plan that encourages private-sector participation to improve the performance level of service providers and

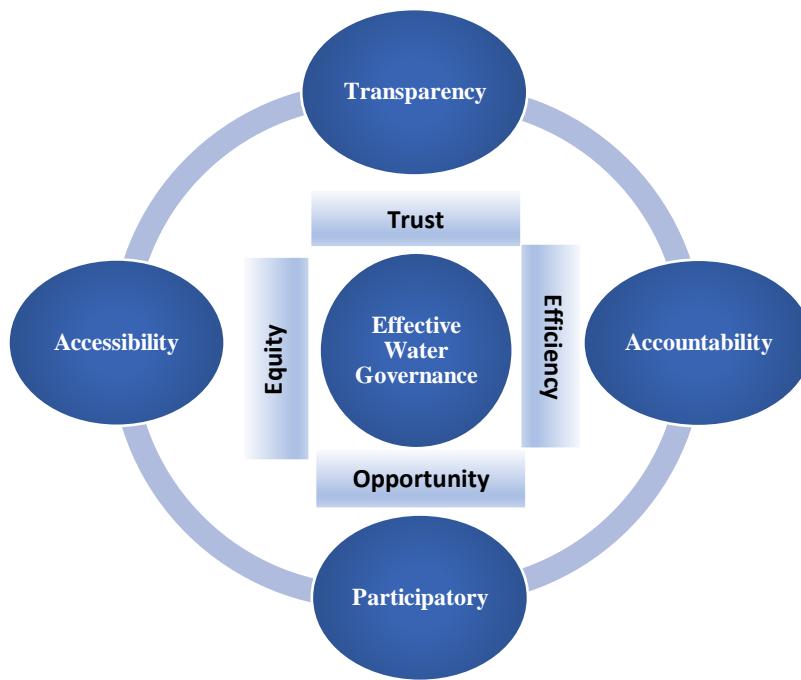
¹⁰⁵ “Jordan Country Development Cooperation Strategy 2013 – 2017” (USAID, 2015), 1.

¹⁰⁶ Valerie, *Politics Matter*, 36.

¹⁰⁷ Ibid, 37.

the efficiency of the water sector.¹⁰⁸ However, the pictured benefits are not realized, and there is yet effective good governance to be achieved. Effective governance needs to be addressed from various principles (see Figure 4).

FIGURE 4: Effective Water Governance Structure¹⁰⁹



There is a dire need for effective water governance in Jordan that enables inclusion, efficiency and sustainability. The social changes and the rapid growth rate Jordan is witnessing are negatively increasing pressure on water ecosystems and demand is far exceeding supply. There is also a challenge of meeting demand of good quality water and not all parts of the population can afford access to good water. The allocation of water is disrupted by political competition between sectors and stakeholders as water is essential for economic activity.

Effective governance helps in ensuring that water is divided in an equitable and reliable manner. One of the major problems Jordan faces in almost all its governmental sectors is lack of accountability; where personal gain is more attractive than the general well-being of the population. This is also evident in water governance where investments are discouraged, there is an unequal

¹⁰⁸ Rebhieh Suleiman, Lisa Van Well, and Jan-Erik Gustafsson, "Governance of the Amman Water Utility," *Development in Practice* 18, no. 1 (February 2008): 54.

¹⁰⁹ Author's own interpretation

distribution of water resources, exclusion of certain stakeholders in decision-making processes, and revenues used for other reasons instead of improving water services for the poor.

In addition, the centralized nature of the governance structure promotes exclusion and inefficiency. While on the other hand, participatory would allow a bottom up approach and inclusion of private sector and civil society organizations to take part in the decision-making. Such “bottom-up demand-driven”¹¹⁰ approaches would give space for experience, transparency, and accountability. From a stakeholder perspective, water governance in Jordan’s case also includes the donor community and the private sector. For example, as the WB provides the Jordanian water sector with investments and projects, it also has a role in influencing policies in the governance of water in Jordan.

There is also a need for transparency and accessibility for an effective governance. In 2002, there was 5% incremental increase in water tariffs that consumers neither knew about nor consulted with, and this has caused public distrust.¹¹¹ Lack of transparency results in further exclusion in the society and skepticism. Public involvement needs to be part of the governance process to promote efficiency and to be able to manage the limited water resources appropriately. All stakeholders need to be informed in the decision making, and all public representatives need to participate through a bottom up approach. Transparency also provides an opportunity for public awareness on water use and encourages water conservation.

There is low awareness among Jordanians on the dangers of water scarcity, and that is worrisome when looking at how water available resources per capita in Jordan is one of the lowest in the world. Hence, engaging with the public on water challenges is key. For example, with regards to the Disi project, the WB held public consultations in Amman and Aqaba (the two regions mostly affected by the project), in order to get an understanding of customers’ opinions and expectations from the project to anticipate changes in water consumption patterns that might affect the potential

¹¹⁰ A bottom-up approach is a process where decision-making originates from the lower level and moves upward. The demand-driven approach is a strategy where the people themselves decide on initiatives and take responsibility for improving the situation, rather than depend on the government.

¹¹¹ Suleiman, *Governance of the Amman Water Utility*, 61.

benefits of the project.¹¹² Such action would allow securing political acceptability of private projects and consensus building, to avoid resistance and lack of trust. MWI and some NGOs have been working on water conversation and public awareness campaigns on water value, costs and benefits of water management and wastewater treatment plants.¹¹³ Nonetheless, there is also a need for stronger engagement with the public on the different aspects of the water sector. According to WAJ, there are around 22 user associations that allow the public to participate in assessments and provide their feedback on new projects; however, consultation with the public has not been consistent.¹¹⁴ Although the government recognizes the importance of customer engagement, there is no transparency being delivered to the public. For example, there is neither information available to the public on the performance of Miyahuna and Yarmouk utilities, nor access to customers' satisfaction surveys.¹¹⁵ WAJ has a dedicated page on its website for customer complaints, but the results are not accessible online. All of this also leads to an increase in resentment by Jordanians towards government authorities.

4.2 SHORTCOMINGS IN JORDAN'S WATER GOVERNANCE POLICIES

There is a range of options available on the supply side to address Jordan's water scarcity; however, those options mostly suffer from political, financial and environmental costs that make them less feasible. The MWI focuses on large physical projects to improve the quality and availability of water; nonetheless, these projects they mostly lack money, integration and time.¹¹⁶ In addition, these projects are not designed to provide sustainable supply of freshwater in the future, and there is a huge reliance on donors and lack of coordination between implementing agencies, which all affect the success of these projects.¹¹⁷

For example, there are the Disi Aquifer, the Red Sea – Dead Sea Canal, and the Desalination at Aqaba projects all which are considered to increase the supply of water but have multiple disadvantages. The Disi project is designed to provide around 100 million m³ of water per year by

¹¹² OECD, *Water Governance in Jordan*, 41.

¹¹³ Ibid, 43.

¹¹⁴ Ibid, 40.

¹¹⁵ Ibid.

¹¹⁶ Denny, *Sustainable Water Strategies for Jordan*, 8.

¹¹⁷ Ibid.

building a 325 km long pipeline from Jordan-Saudi Arabia border to the capital Amman, and is being built by a Turkish company who will be selling the water for 40 years before the government of Jordan takes ownership.¹¹⁸ There are several disadvantages found around the exaction of this project. For example, the cost of this project is very high; it is estimated to cost 1.1 billion USD, in addition to other operational costs.¹¹⁹ Also, the project's location across the borders with Saudi Arabia could lead to political sensitivity when it comes to exploitation. In addition, there are risks associated with leakages and pipeline deterioration. Another example is the Red Sea – Dead Sea Canal that aims to connect the two seas with a 180 km canal that provides 850 million m³ per year of fresh water to Jordan, Palestine and Israel, and to provide hydroelectric power plants and desalination facilities.¹²⁰ However, while this canal project could provide an opportunity for regional cooperation and would save the Dead Sea from water loss, the cost of the project is extremely high with an estimate of 4 billion USD,¹²¹ along with the political hurdles between the Arab States and Israel that could lead to unexpected obstacles for the project in the future.

In addition to the large projects, the MWI has tried to enhance water provision through updating the water network and increasing public-private partnerships. Nonetheless, there is still lack of efficient data available. For example, there is data suggested by MWI that indicates there is a 45% of water loss during transfer and so there is a need for major constructions to improve water network to avoid water loss.¹²² However, there is no data available about the network to understand how much each company or service provider is losing or enhancing water provision. As for the public-private partnerships, the WAJ has been privatizing water services since 1999 and has tried to engage private partnerships in the management strategies to incorporate private knowledge and expertise into public projects; however, there is not much data on the benefits of public-private partnerships and how successful the projects have been.

¹¹⁸ Wes Fry et al., “Human Rights Risk Assessment: Disi Water Conveyance Project Financial Sector Perspective,” *NomoGaia*, October 28, 2015, 14.

¹¹⁹ Ibid, 3.

¹²⁰ “Greater Amman,” Water Technology, accessed June 10, 2020.

¹²¹ Ibid.

¹²² MWI, *National Water Strategy (2016-2025)*, 15.

While it is important to enhance water provision; there needs to be a larger focus on policy options from the demand-side to provide sustainable water management for the long-term. As mentioned in the earlier sections, the agricultural sector is the highest water consumer in Jordan and account for only a small percentage of the total GDP. In addition, for 1 cubic meter of water put in agriculture, agriculture gives back only 0.42 USD per cubic meter of water.¹²³ These patterns found in the sector suggest the need for reallocation of water away from agriculture by training technicians, improving the irrigation mechanisms, developing needed support for the long term capacity, and transition towards low-water high-return crops. This transition however could lead to political obstacles and pressure on farmers; hence, in the short term, farmers need to be provided with other sources of livelihood as they shift production to avoid unemployment. Such sources could include subsidies, removing tariffs on imported goods, and for the longer term, education and training.

To address water use issues and water loss from the demand side, there is an essential community-based work needed to promote water conservation projects and public awareness. Initiatives done at the local level, whether by the government or NGOs, help communities themselves choose what initiatives are most efficient for them in the long term. These projects could also foster cooperation between the government, NGOs and donors to provide solutions tailored to the needs of the local communities. In addition, as many individuals and households across various sectors lack overall knowledge regarding good water management, public awareness campaigns are a must to understand where water comes from and to reduce the demand of water. Furthermore, to minimize illegal extraction and drilling of water, there is a high need for stricter enforcement of regulations especially against water abusers for greater compliance.

To help in promoting local initiatives and promote water conservation, Jordan needs to enhance its institutional capacity for an efficient water governance. Jordan needs to develop comprehensive and strategic plan that is also accommodated to potential climate change impacts and regional instability. As a result, water needs to become a priority as an issue itself. In addition, the water sector needs to improve the access to accurate and complete water data for higher chances in

¹²³ Denny, *Sustainable Water Strategies for Jordan*, 11.

successful projects. The government can engage academic and research institutes for more resources. Moreover, there is a need for better communication between sectors for better coordination. There is usually some distrust towards the government and its ability to address peoples' concerns. Therefore, decentralization of water management by engaging the public in the planning from bottom-up approach and increase availability of information can improve the water governance structure.

Hence, water scarcity in Jordan is framed by internal policies that mostly focus on the supply side through implementing large costly water projects, instead on policies that focus more on demand management. There is a need for strategies that promote adaptive water governance, encourage societal engagement that involves the participation of all actors, private and public, and is not oppressed or constrained by centralized institutions.

5. CONCLUSION

Jordan, located at the heart of the Middle East in a turbulent region, is a middle-income country that is shaped by geopolitics and scarcity in natural resources. The country is characterized by its dry and arid climate and has been significantly affected by regional unrest in neighbouring countries, which led to influx of refugees that have further strained Jordan's scarce natural resources, particularly water. There have been large investments by the private sector, donors and the international community in the supply side of water in the past decades, however, water deficit continues to grow the gap between supply and demand.

The external threats imposed on Jordan's water scarcity are rather unpredictable, but to cope with the water challenge, internal issues with regards to governance need to be progressed. The centralized nature of the water sector has played a big role in delaying and resisting some reforms needed to strengthen the water-sector, enforcing legislation, improving management and involving the private sector. The PMU was established in the 2000s to monitor corporatized water companies and promote private sector involvement, however, as responsibilities among institutions, including the MWI, WAJ and JVA, are overlapped, it has been difficult to progress. There is a lot of political influence and traditional ties to the public sphere in the water institutions, leading to potential positive outcomes unfulfilled. There is also poor communication over services and a lack of

coordination towards cross-sector planning and implementation. As a result of the absence of a comprehensive approach for efficient governance, there are constant interruptions in operations. In addition, institutional weaknesses are intimately linked to governance and policy problems, some of which include lack of strong regulatory framework with definite penalties that prevent future illegal use of groundwater.

There are several gaps in the regulatory framework of the water sector. There is a lack of monitoring operators that are needed to promote cost efficiency and decent data collection. The data being collected from utilities and governorates is being done through various methods with no systemic coordination.¹²⁴ Despite the already existing external challenges on Jordan's water crisis, the government has failed to follow up on its commitment for a water-secure future through implementing policies that are needed to reduce water deficits and build necessary institutions and infrastructure to provide and manage scarce water sustainability in the country. The water sector lacks the capacity to manage competing demands by the various sectors and the populations in the country. Actors and utilities, including donors and private sector, are also constrained politically due to the centralized characteristics of water governance and instead they operate from a weak organizational structure, portrayed by inter-agency competition. All of this suggests that while there is a supply/demand challenge due to reasons such as climate change and an influx of refugees, water crisis is very much a governance problem.

This research paper argues that adopting an effective water governance holds the key to improve Jordan's water scarcity, by matching demand with sustainable supply. The research conducted in this paper reveals that there is an absence of good governance in Jordan's water sector; there is a lack of: transparency, inclusion of consumers and other informal stakeholders in the decision-making and consultation processes, public awareness on water uses, and accountability.

There is a need for investment in accurate metering and data collection, water conservation to raise public awareness on water use and loss, especially in the agricultural sector, lessen the dependency on nonrenewable ground water resources by diversifying water resources, investment in efficient

¹²⁴ OECD, *Water Governance in Jordan*, 34.

infrastructure for transportation and pipes to avoid leakages, and adoption of integrated water management systems that take into account the impact of climate change and population growth. In addition, decentralizing the water sector institutions is fundamental, to allow the private sector and international donors provide the technical and financial support needed to implement the required initiatives and steps for an efficient water governance. Efficient and good water governance can be approached by: increasing transparency and public awareness for trust, promoting participatory and decentralization for more opportunity, implementing accountability to fight corruption and encourage efficiency, and working on accessibility for equity among population.

This paper not only contributes to Jordan's water literature by providing an analysis on Jordan's water governance structure, but also provides an analysis that can be adopted by other countries in the MENA region where significant problems exist or are emerging concerning the scarcity of water resources, and where there is a lack of efficiency in water allocation. Arab countries suffer from weak water governance structure due to incompetent policies and institutions. To date, water has not always been a priority in institutional reforms; therefore, this paper hopes to advance water reform agenda and push for faster and urgent improvements in the water governance.

Potential future research could include specific water policies and strategies for an integrated approach to manage demand and supply. Special attention needs to be given to all stakeholders (including customers, NGOs and the private sector), institutional capacity and regulatory systems to improve water management and services. In addition, given the findings of this study and the disadvantages, risks and opportunities identified in the earlier section, future research could investigate the implications of other discourses, whether socioeconomic, environmental or political, on water governance debates.

6. BIBLIOGRAPHY

A. Books and Book Sections

Dobner, Petra, and Hans-Georg Frede. “Water Governance: A Systemic Approach.” In *Society - Water - Technology*, edited by Reinhard F. Hüttl, Oliver Bens, Christine Bismuth, and Sebastian Hoechstetter, 79–87. Cham: Springer International Publishing, 2016.

El-Ashry, Mohamed, Najib W Saab, Bashar Zeitoon, and Muntadá al-‘Arabī lil-Bī’ah wa-al-Tanmiyah. *Arab Environment: Water: Sustainable Management of a Scarce Resource*. Beirut: Arab Forum for Environment and Development, 2010. https://wedocs.unep.org/bitstream/handle/20.500.11822/9575-Arab_Environment_3_Water-2010ArabEnvironment_Water_2010.pdf.pdf?sequence=3&isAllowed=y.

Pahl-Wostl, Claudia. “An Evolutionary Perspective on Water Governance: From Understanding to Transformation.” *Springer* 31 (May 31, 2017): 2917–2932. <https://doi.org/10.1007/s11269-017-1727-1>.

OECD. *Water Governance in Jordan: Overcoming the Challenges to Private Sector Participation*. OECD Studies on Water. OECD, 2014. <https://doi.org/10.1787/9789264213753-en>.

B. News Articles

“Contracted Aid for Kingdom up in 2017, but Grants Directed to Support Budget Shrink.” *Jordan Times*, February 21, 2018. <https://www.jordantimes.com/news/local/contracted-aid-kingdom-2017-grants-directed-support-budget-shrink>.

“MIGA Backs Wastewater Treatment Plant in Jordan.” *MIGA*, July 24, 2013. <https://www.miga.org/press-release/miga-backs-wastewater-treatment-plant-jordan>.

Namrouqa, Hana. ““Jordan Needs \$750m to Meet Water Demand over next Three Years.”” *Jordan Times*, January 7, 2014. <https://www.jordantimes.com/news/local/jordan-needs-750m-meet-water-demand-over-next-three-years>.

———. “Jordan Seeks Self-Reliance in Water Sector — Ghezawi.” *Jordan Times*, May 21, 2018. <http://www.jordantimes.com/news/local/jordan-seeks-self-reliance-water-sector---ghezawi>.

———. “Jordan World’s Second Water-Poorest Country.” *Jordan Times*, October 22, 2014. <http://www.jordantimes.com/news/local/jordan-world's-second-water-poorest-country>.

Whitman, Elizabeth. "A Land without Water: The Scramble to Stop Jordan from Running Dry." News, September 4, 2019. <https://www.nature.com/articles/d41586-019-02600-w>.

"Reuse Steps Up in Water-Poor Jordan." EMWIS, April 15, 2011. <http://www.emwis.org/thematicdirs/news/2011/04/reuse-steps-water-poor-jordan>.

C. Journal Articles and Reports

Al-Rimawi, Hussein. "Middle East Chronic Water Problems: Solution Prospects." *Canadian Center of Science and Education* 2, no. 1 (May 3, 2012): 28–34. <https://doi.org/10.5539/eer.v2n1p28>.

Ambalam, Kanaan. "Reallocation of Water Resources in the Arab Region: An Emerging Challenge in Water Governance." *European Journal of Sustainable Development* 3, no. 3 (October 2014): 283–98. <https://doi.org/10.14207/ejsd.2014.v3n3p283>.

Bakker, Karen. "From State to Market?: Water Mercantilization in Spain." *Pion* 34 (2002): 767 ^ 790. <https://doi.org/10.1068/a3425>.

Batchelor, Charles. "Water Governance Literature Assessment." IIED, 2007. <https://pubs.iied.org/pdfs/G02523.pdf>.

Boelens, Rutgerd. "Equity and Rule-Making." In *Searching for Equity: Conceptions of Justice and Equity in Peasant Irrigation*, edited by Rutgerd Boelens and Gloria Dávila, 16–34. The Netherlands: Van Gorcum: Assen, 1998.

Bogaards, Matthijs. "Case-Based Research on Democratization." *Taylor & Francis Group* 26 (2019): 61–77. <https://doi.org/10.1080/13510347.2018.1517255>.

"Concepts and Approaches for Effective Water Governance in the Arab Region." Water Governance in the Arab Region: Managing Scarcity and Securing the Future. United Nations Development Programme, 2013.

Denny, Elaine, Kristina Donnelly, Roland McKay, Geoffroy Ponte, and Tetsuya Uetake. "Sustainable Water Strategies for Jordan." International Economic Development Program Gerald R. Ford School of Public Policy University of Michigan, Ann Arbor, 2008. <http://www.umich.edu/~ipolicy/Policy%20Papers/water.pdf>.

Diep, Loan, Tim Hayward, Anna Walnycki, Marwan Husseiki, and Linus Karlsson. "Water, Crises and Conflict in MENA: How Can Water Service Providers Improve Their Resilience?" *IIED*, October 2017, 72.

Draake, Christine. "Water Resource Conflicts in the Middle East." *Journal of Geography*, 1997, 2.

- Fry, Wes, Dr Kendyl Salcito, Mark Wielga, and Elizabeth Wise. "Human Rights Risk Assessment: Disi Water Conveyance Project Financial Sector Perspective." *NomoGaia*, October 28, 2015, 37.
- Grover, Velma, Abdel Raouf Darwish, and Eliza Deutsch. "Integrated Water Resources Management In Jordan." *The Economic Research Forum (ERF)*, December 2010, 40.
- Himley, Matthew. "Geographies of Environmental Governance: The Nexus of Nature and Neoliberalism." *Geography Compass*, 2008, 433–451. <https://doi.org/10.1111/j.1749-8198.2008.00094.x>.
- Hussein, Hussam. "Understanding Water Scarcity in Arid Regions: A Critical Discourse Analysis of Water Scarcity in the Case of Jordan," 204–13, 2016. <https://pdfs.semanticscholar.org/b85e/1e57968eeaed09f9988d1a1bebb76dcc65b4.pdf>.
- Hussein, Hussam, Alberto Natta, Abed Al Kareem Yehya, and Baha Hamadna. "Syrian Refugees, Water Scarcity, and Dynamic Policies: How Do the New Refugee Discourses Impact Water Governance Debates in Lebanon and Jordan?" *Water* 12, no. 2 (January 22, 2020): 15. <https://doi.org/10.3390/w12020325>.
- "Institutional Support and Strengthening Programme (ISSP) Institutional Assessment Report." USAID, October 2011a.
- IPCC. "AR5 Synthesis Report: Climate Change 2014." Geneva, Switzerland: IPCC, 2014. <https://www.ipcc.ch/report/ar5/syr/>.
- "Jordan's Third National Communication on Climate Change." The United Nations Framework Convention on Climate Change (UNFCCC), 2014.
- "Jordan Country Development Cooperation Strategy 2013 – 2017." USAID, 2015. <https://www.usaid.gov/sites/default/files/documents/1883/Amended-Jordan-Country-Development-Strategy-March-2015.pdf>.
- Kumu, Matti, Joseph Guillaume, Hans Moel, Stephan Siebert, and Philip Ward. "The World's Road to Water Scarcity: Shortage and Stress in the 20th Century and Pathways towards Sustainability." *Scientific Reports*, December 9, 2016, 1–16. <https://doi.org/10.1038/srep38495>.
- Miranda, Liliana, Michaela Hordijk, and Rommy K. Torres Molina. "Water Governance Key Approaches: An Analytical Framework Literature Review." *Chance2Sustain*, July 2011, 1–23.

- “National Water Strategy (2016-2025).” Ministry of Water and irrigation, 2016.
[http://www.mwi.gov.jo/sites/en-us/Hot%20Issues/Strategic%20Documents%20of%20The%20Water%20Sector/National%20Water%20Strategy\(%202016-2025\)-25.2.2016.pdf](http://www.mwi.gov.jo/sites/en-us/Hot%20Issues/Strategic%20Documents%20of%20The%20Water%20Sector/National%20Water%20Strategy(%202016-2025)-25.2.2016.pdf).
- Perreault, Tom. “What Kind of Governance for What Kind of Equity? Towards a Theorization of Justice in Water Governance.” *Water International* 39, no. 2 (2014): 233–245.
<https://doi.org/10.1080/02508060.2014.886843>.
- Rijsberman, Frank R. “Water Scarcity: Fact or Fiction?,” 2004, 14.
- Suleiman, Rebhieh, Lisa Van Well, and Jan-Erik Gustafsson. “Governance of the Amman Water Utility.” *Development in Practice* 18, no. 1 (February 2008): 53–65.
<https://doi.org/10.1080/09614520701778355>.
- Valerie, Yorke. “Politics Matter: Jordan’s Path to Water Security Lies through Political Reforms and Regional Cooperation.” *NCCR Trade Working Paper*, April 2013, 143.
- Varis, Olli, and Cecilia Tortajada. “Water Governance in the MENA Region: Policies and Institutions.” InWEnt, 2009.
<https://www.thirdworldcentre.org/wp-content/uploads/2015/03/inwentsearep.pdf>.
- Waslekar, Sundeep. “The Blue Peace: Rethinking Middle East Water.” Strategic Foresight Group, 2011.
https://www.strategicforesight.com/publication_pdf/40595Blue%20Peace_Middle%20East.pdf.
- “Water: A Shared Responsibility.” UNESCO, 2006.
<https://portals.iucn.org/library/sites/library/files/documents/Bios-Eco-Aqua-017-2.pdf>.
- “Water Governance in OECD Countries: A Multi-Level Approach.” OECD, 2011.
<https://www.oecd-ilibrary.org/docserver/9789264119284-en.pdf?Expires=1595853737&id=id&accname=ocid77016197&checksum=0630C618781CA48F213C4134E0E8B5CB>.
- “Water Governance in The Arab Region.” UNDP, 2013.

D. Websites

- Central Intelligence Agency. “Country Comparison: Population Growth Rate,” 2020.
<https://www.cia.gov/library/publications/the-world-factbook/fields/344rank.html>.

“Crops Statistics.” Department of Statistics, 2017. http://www.dos.gov.jo/owa-user/owa/FOCAL_AGR.agr_kk?LANG=E&dis=0.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). “Efficient and Sustainable Management of Water Resources in Jordan.” Accessed May 5, 2020. <https://www.giz.de/en/worldwide/17213.html>.

Food and Agriculture Organization of the United Nations (FAO). “AQUASTAT: Jordan,” 2016. <http://www.fao.org/nr/water/aquastat/data/query/results.html>.

“Governance and Development.” UNDESA, UNDP, UNESCO, May 2012. https://www.un.org/millenniumgoals/pdf/Think%20Pieces/7_governance.pdf.

Hofste, Rutger, Paul Reig, and Leah Schleifer. “17 Countries, Home to One-Quarter of the World’s Population, Face Extremely High Water Stress.” *World Resources Institute* (blog), August 6, 2019. <https://www.wri.org/blog/2019/08/17-countries-home-one-quarter-world-population-face-extremely-high-water-stress>.

“Jordan Water Sector Facts & Figures.” Amman: Ministry of Water and Irrigation, 2015. <http://www.mwi.gov.jo/sites/en-us/Hot%20Issues/Jordan%20Water%20Sector%20Facts%20and%20%20Figures%202015.pdf>.

Sustainable Development Goal indicators. “Goal 6: Ensure Availability and Sustainable Management of Water and Sanitation for All.” Accessed April 3, 2020. <https://unstats.un.org/sdgs/report/2017/goal-06/>.

USAID. “Water Resources & Environment, Investing In A Water-Secure Future Jordan.” Accessed April 5, 2020. <https://www.usaid.gov/jordan/water-and-wastewater-infrastructure>.

Water Technology. “Greater Amman.” Accessed June 10, 2020. https://www.watertechnology.net/projects/greater_amman/.

World Health Organization. “2.1 Billion People Lack Safe Drinking Water at Home, More than Twice as Many Lack Safe Sanitation,” July 12, 2017. <https://www.who.int/news-room/detail/12-07-2017-2-1-billion-people-lack-safe-drinking-water-at-home-more-than-twice-as-many-lack-safe-sanitation>.

World Widlife Fund. “Water Scarcity.” Organization. Accessed May 15, 2020. <https://www.worldwildlife.org/threats/water-scarcity>.

Worldometer. “Jordan Water,” n.d. <https://www.worldometers.info/water/jordan-water/>.