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**Water Availability and Quality in the Jordan River Valley and the Zarqa
River Basin: Stakeholders' Perspectives**

A thesis

submitted in fulfilment

of the requirements for the degree

of

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at

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by

Zaid Ahmad Alshawabka



THE UNIVERSITY OF
WAIKATO
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Abstract

The objective of the thesis is to investigate stakeholders' perspectives of the impacts of pollution in the Jordan River Valley and the Zarqa River Basin in Jordan (Arabic: الأردن *Al-Urdunn*). The impacts that pollution has on stakeholders are varied and include physical, emotional, and spiritual impacts.

Classical Islamic Hermeneutics is used as a qualitative methodological approach. Semistructured face-to-face interviews were conducted with 50 participants to understand the environmental effects of contamination in the study area. The interviewees included residents, local farmers, environmental experts, government, NGOs and religious actors. Five in-depth interviews with water industry actors were also undertaken in order to understand water management issues in Jordan.

The study finds that water pollution in the Jordan River Valley and the Zarqa River Basin has affected the economy of the farming community. The pollution has affected the level of income which resulted from farming owing to farmers' using inadequately treated sewage water to irrigate high-value crops. Furthermore, using partially treated sewage water for irrigation causes additional maintenance costs owing to blockage of the irrigation networks.

The pollution has also impacted classical and religious sites on and around the Jordan River Valley and the Zarqa River Basin and led to the loss of fauna and flora. Overall, contamination has had negative impacts on religious, domestic, and international tourism.

The effects of pollution, which include pathogens, bad smells, and the spread of harmful insects such as flies and mosquitoes, have also impacted the health, emotional, and spiritual life of the local community in the Jordan River Valley and the Zarqa River Basin. The interviews revealed that institutional factors such as nepotism, the lack of enforcement of environmental laws, and the lack of political will have led to a lack of accountability. The lack of political will to enforce environmental laws has contributed to the increasing levels of contamination in the region and caused hardships in the community.

The contribution of this research is to allow those stakeholders' whose voices are not usually heard to contribute to a level of commentary that might encourage the government to take action. At a broader level, the research elucidates the issue of

water scarcity in the Middle East and North Africa countries, many of which are experiencing similar issues to Jordan's. The classical Islamic Hermeneutics approach is a beneficial approach that can be applied to research in other situations.

When compared to western countries, the political factors in Jordan, the Middle East, and North Africa are about more than merely managing water. These factors include cultural factors, specifically existing rights and relationships and nepotism. In this context, water management is much more than a technical issue and is also related to political will. Politicians as well as senior managers in the Jordanian water authorities will need to work with the community to solve the problems stakeholders are currently experiencing. As a first step this task should include applying current laws and regulations fully. This step could then be followed by the introduction of a comprehensive water accounting programme to ensure this scarce resource is shared equitably.

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In the Name of Allah, the Most Merciful, the Most Beneficent

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May Allah the Almighty repay all your good deeds.

Zaid Ahmad Alshwabka

زيد أحمد بطمان الشوابكة

Hamilton/New Zealand

25/10/2019

Dedication

*This thesis is dedicated to my parents for their limitless love, support
and motivation*

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Chapter 1: Overview of the Thesis

1.1 Introduction

As for the rest of the world, the greatest environmental challenge facing Jordan is the shortage of freshwater (Hadadin, Qaqish, Akawwi, & Bdour, 2010). More than three-quarters of Jordan's population live in cities where freshwater resources are insufficient to meet current and future demands (Mayrhauser, 2012). The lack of freshwater is worsened by the continued population growth in Jordan caused by natural population growth and the successive influxes of refugees from neighbouring countries such as Palestine, Kuwait¹, Iraq, Syria, Libya and Yemen, all of which have contributed to an imbalance between water supply and demand (Al-Kuisi & Abdel-Fattah, 2010; Mayrhauser, 2012).

The lack of water is aggravated by the fact that Jordan shares most of its surface water resources with neighbouring countries such as Syria and Israel (Al-Omari, Al-Houri, & Al-Weshah, 2013). The inadequacy in river water for domestic purposes is currently compensated for by over-exploiting groundwater, a practice which results in reduced water quality (Kamel & Nada, 2008).

One way that Jordan has overcome its freshwater problem is by making use of alternative water resources, for example, using recycled wastewater for agricultural purposes (Al-Wer, 2009). However, using treated wastewater, and in particular water from the King Talal Dam for agricultural use, is inherently risky. There are three primary reasons for this risk and they are linked to the King Talal Dam. First, because of the domestic and industrial activities in the Zarqa River Basin, untreated wastewater is often illegally discharged into the Zarqa River. This untreated wastewater reaches the King Talal Dam and finally settles down in the Jordan River Valley. Second, although the As-Samra Wastewater Treatment Plant (WWTP) situated in the Zarqa River Basin is designed to treat domestic wastewater, it does not have the capacity to cope with the current support required (Kamel & Nada, 2008). Third, industrial wastewater must be treated at factories initially before

¹ In 1991, the Gulf War forced Palestinians who work in Kuwait to take refuge in Jordan.

reaching the sewage system that is linked to the As-Samra WWTP. If it does not pass through the sewage system, untreated industrial sewage will reach the Zarqa River without any treatment, as the As-Samra WWTP was designed to treat only domestic wastewater (Seder & Abdel-Jabbar, 2011).

This chapter introduces the research. It discusses the research background, including the study area. This discussion is followed by an explanation of the study's objective, its research question, and the significance of the study. The study methodology and methods are then introduced and the outline of the thesis is presented. The chapter concludes by examining the scope and limitations of the research.

1.2 Background of the Kingdom of Jordan

The Hashemite Kingdom of Jordan is a country in the Middle East on the East Bank of the Jordan River. It is bordered by Syria to the north, Israel to the west, Saudi Arabia to the south, and Iraq to the east (McColl, 2005). The Dead Sea is located on the western border between Jordan and the West Bank of the Jordan River. The country has a small coastline on the Red Sea. Jordan is strategically located at the crossroads of Europe, Asia, and Africa. Amman is the most populated city and is the capital of Jordan (McColl, 2005).

Jordan is a semiarid country with a population in 2018 of 10,129,806 people (Department of Statistics, 2018). Islam is the main religion. Approximately 97 per cent of the population are Muslims who coexist with an indigenous minority of Christians who represent 2 per cent of the population and Druze² and Baha'i³ who make up 1 per cent (Central Intelligence Agency, 2018). Jordan is considered to be one of the safest countries in the Middle East; as Dickey (2004) opines, the country prides itself on being a 'safe oasis' in a 'turbulent area'.

Jordan is classified as a state of 'high human development' with an 'upper middle income' economy. Although Jordan is one of the smallest economies in the Middle

² The Druze are an Arabic-speaking esoteric ethnoreligious group originating in Western Asia who self-identify as Unitarians.

³ The Baha'is are people who believe in the Baha'i faith. It is a religion established by Bahauallah in 1863; it initially grew in Iran and parts of the Middle East, where it has faced ongoing persecution since its inception.

East, it is attractive to foreign investors because of its skilled workforce (El-Said & Becker, 2013). The country is also a primary tourist destination (Petra, 2016).

Jordan is a unitary country under a constitutional monarchy (Constitutionnet, 2016). The king retains broad executive and legislative powers (Satloff & Schenker, 2013). The judiciary is independent according to the constitution. The king is the head of the country and commander-in-chief of the army (Greenwood, 2003). He can declare war and peace, ratify laws and agreements, convene and close legislative sessions, call and defer elections, reject the government, and dissolve parliament.

Jordan is a geographically small country with limited natural resources. Ten per cent of the country is under agriculture, while the water area represents 0.4 per cent (Food and Agriculture Organisation, 2008). The country occupies an area of 92,300 km² (Central Intelligence Agency, 2009). In 1991, Jordan faced increased demand for its natural resources due to immigration from Kuwait when 300,000 refugees entered the country as a result of the conflict between Kuwait and Iraq (Shukri, 2017). The country has witnessed successive influxes since 2003, as shown in Table 1.1.

Table 1-1: Number of refugees in Jordan because of regional conflicts in the Middle East.

Year	Country	Iraq	Syria	Libya	Yemen
2003		130,911			
2011			126,5514		
2014				22,700	
2015					31,163

Source: (Department of Statistics, 2015).

These influxes came about because of civil wars and regional conflicts (Achilli, 2015; Francis, 2015; Schyns, Hamaideh, Hoekstra, Mekonnen, & Schyns, 2015; Weinthal, Zawahri, & Sowers, 2015; Alnsour, 2016; Müller, Yoon, Gorelick, Avisse, & Tilmant, 2016; Hussein, 2018).

Jordan is one of the 10 poorest countries in the world for availability of freshwater resources (Food and Agriculture Organisation 2003; Ministry of Water and Irrigation, 2009). Annual water availability per capita decreased from 3,600m³/year

in the year 1946 to 150m³/year in 2017 (USAID, 2017). For the year 2015, the gross water resources were 587 million cubic metres (MCM), while demand was 1,008.8 MCM (Ministry of Water and Irrigation, 2015) leaving a shortfall of 421.8 MCM. Total groundwater extraction for 2015 amounted to 624.3 MCM from 3,138 private and government-owned wells (Ministry of Water and Irrigation, 2015).

The scarcity of water has led to the broad use of nonconventional water resources; presently, 13 per cent of the water resources in Jordan come from these nonconventional resources (Ministry of Water and Irrigation, 2015). The use of nonconventional water resources is expected to increase considerably to minimise the gap between supply of and demand for water (Alfarra, Kemp, Hotzl, Sader, & Sonneveld, 2011; Altz-Stamm, 2012).

The study area for this thesis is the Jordan River Valley (JRV) and the Zarqa River Basin (ZRB) (see Figure 1.1). This valley stretches from the Syrian border in the north to Aqaba in the south of Jordan (Nachbaur, 2004). The two major surface water resources in the study area are the Jordan and Yarmouk Rivers. The source of these two rivers is Syria; both rivers cross Israel before flowing into Jordan, which means that only a small amount of water is available for use in Jordan (Gafny, Talozzi, Al Sheikh, & Ya'ari, 2010). The Zarqa River situated in the Amman Zarqa region is the second largest tributary of the Lower Jordan River after the Yarmouk River (Al-Wer, 2009). It is the third largest surface water resource in Jordan and is the only river system not shared by any other state (Hilal & Alhaija, 2010). It is also the third largest river in Jordan after the Jordan and Yarmouk Rivers (Abu-Sharar, 2006). Its waters are extensively used for agricultural and industrial purposes (Carr, Potter, & Nortcliff, 2011).



Figure 1.1: Jordan River map.

Source: (Ministry of Water and Irrigation, 1998).

Although Jordan has constructed many dams of different storage capacities to store water for domestic, agricultural, and industrial purposes on various rivers, the King Talal Dam (KTD) is central to this study. The Zarqa River reaches the King Talal Dam and its waters are used for irrigation in the Jordan River Valley (Al-Zu'bi, 2007). The King Talal Dam is the largest dam in Jordan (Carr et al., 2011). The dam, which was built in 1977, receives its primary inflow as natural run-off from the Zarqa River in addition to inputs from major springs situated in Jerash city (Hilal & Alhajja, 2010). During summer, when the Zarqa River is dry upstream, the water flow into the King Talal Dam includes untreated wastewater from the As-Samra plant as well as industrial wastewater from neighbouring valleys. During winter, the river flow consists of a mixture of the river water from upstream, the untreated wastewater of the As-Samra plant, and industrial wastewater (Al-Omari & Al-Houri, 2012).

The As-Samra plant has become overloaded and cannot cope with existing requirements (Seder & Abdel-Jabbar, 2011) with the result that the quality of wastewater pumped into the Zarqa River has deteriorated and, therefore, does not

comply with Jordanian environmental standards (Al-Dhahir, 2011). Industrial effluent, along with the disposal of solid waste, contributes to the deterioration of the Zarqa River (Al-Ansari, Al-dardor, Siergieiev, & Knutsson, 2013), because industrial wastewater must be treated for toxins and partly recycled before reaching the As-Samra plant (Fandi, Qudsieh, Muyibi, & Massadeh, 2009). In addition, domestic wastewater in the As-Samra plant must be adequately treated and recycled before being discharged into the Zarqa River (Ammary, 2007; Mara, 2013). However, untreated industrial wastewater is discharged directly into the Zarqa River by industries that are not connected to a sewerage system (Al-Wer, 2009). Furthermore, there are many solid waste disposal sites and industrial service shops located within the catchment area of the Zarqa River Basin. Leachates from those sites contaminate the surface and groundwater (Al-Wer, 2009).

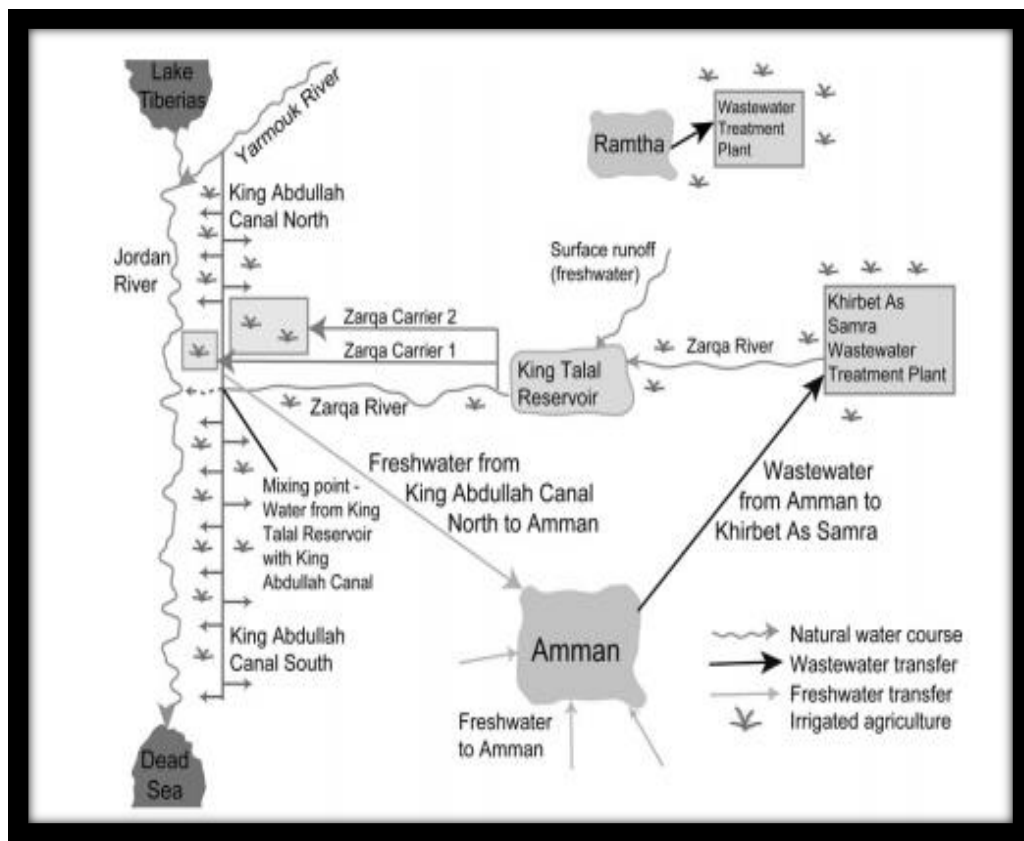


Figure 1.2: The As-Samra WWTP, King Talal Dam, Jordan River, Yarmouk River and Amman catchment area.

Source: (Carr, Potter, & Nortcliff, 2011).

Inefficient wastewater treatment plants, industrial activities, and some agricultural practices in the Amman Zarqa Basin are responsible for the contamination of freshwater. For instance, in 2005, nitrate pollution from industrial fertilisers reached

73 per cent above threshold (50 mg/L) (Al-Kuisi, Al-Qinna, Margane, & Aljazzar, 2009). Industrial activities also generate other harmful elements such as cadmium, cobalt, chromium, copper, lead, nickel, and zinc. For example, the adverse health effects of cadmium exposure at lower levels may be seen not only in kidney damage primarily, but may also have an effect on bones and fractures (Shatanawi & Fayyad, 1996; Järup, 2003; Tchounwou, Yedjou, Patlolla, & Sutton, 2012; Parmar & Thakur, 2013; Soltani et al., 2015).

The Jordan River Valley produces most of the country's fruit and vegetables (Abu-Sharar, 2006). The agricultural significance of the Jordan River Valley can be attributed to its warm climate, because this enables the Jordan River Valley to be cultivated year round, which makes it the country's food store (Courcier, Venot, & Molle, 2005).

Although the Jordan River Valley is categorised as a semiarid area, agriculture prospers due to the use of irrigation (Altz-Stamm, 2012). Higher temperatures are recorded in the valley in winter when compared with other regions, thus enabling the valley to produce crops which cannot be cultivated in the highlands at the same time of the year (Al-Qaisi, 2010; World Climate Guide, 2016). The average temperature in summer is 32°C and 13°C in winter (CIA, 2009), while annual rainfall ranges from 50 mm/year in the southeastern desert to about 650 mm/year in the northwestern highlands (Al-Qaisi, 2010). The part of the Jordan River Valley that is covered by this study stretches from the Syrian border in the north of Jordan to the Dead Sea and is highlighted in Figure 1.2.

1.3 Statement of Purpose and Research Questions

The purpose of this study is to investigate the stakeholders' perspectives of the impacts of pollution in the Jordan River Valley and the Zarqa River Basin. The impacts that pollution has on stakeholders are considered as physical, emotional, and spiritual impacts.

The following research questions will be addressed to answer the central research question:

- What are the local and perceived physical, emotional, and spiritual impacts of pollution on stakeholders in the Jordan River Valley and the Zarqa River Basin?
- What are the institutional determinants of pollution in the Jordan River Valley and the Zarqa River Basin?

1.4 Significance of the Research

The study derives from the need to understand the environmental consequences of pollution in the Jordan River Valley. The study is significant in that it emphasises the perspectives of stakeholders who do not usually have a voice that is heard. The findings are expected to improve an understanding of the way stakeholders view the impacts of pollution in the study area.

Through an understanding of the stakeholders' perspectives of the effects of pollution in the study area, the study will be able to determine the magnitude of the negative impacts of contamination on interested parties. The research should contribute to practice by increasing awareness and hopefully prompting the Jordanian government not only to take action against pollution, but also to enforce the existing laws. In addition, engaging in consultation with stakeholders could offer the Jordanian government a novel and different way for the government to operate in the future.

It is essential to understand the stakeholders' perceptions of the impacts of pollution in the study area, as water contamination affects all aspects of both the surroundings and the conditions in which a person, animal, or plant lives or operates. Furthermore, the contamination affects the right of the next generations to use natural resources and to benefit from a healthy environment. Finally, the matter of people's lives and well-being is critical.

1.5 Research Methodology and Methods

Classical Islamic Hermeneutics was employed as the qualitative methodological approach in this study. The classical Islamic Hermeneutics adopted in this study requires understanding the reasons behind the revelation of a verse in The Holy Quran to understand the intended meaning of the author (Allah) (Mohseni, 2014). In addition, an interpreter must understand other interpretations regarding the verse.

The same reasoning is employed in the analysis in this study as a way to understand the intended meaning of the interview participants.

1.5.1 Qualitative Semistructured Interview

Semistructured interviews were conducted with 55 stakeholders. This method of data gathering was adopted to enhance and validate the knowledge obtained from a documents review. The groups of targeted interviewees were residents, local farmers, government, environmental experts, NGOs, religious actors, and water industry actors.

1.5.2 Content Analysis

A range of materials which included journal articles, television, web page and newspaper articles related to the pollution in the Jordan River Valley were examined. In addition, government documents published by the Ministry of Environment, the Ministry of Water and Irrigation, and the Ministry of Agriculture related to the various impacts of pollution in the study area were examined. The goal of this method was to develop a preliminary understanding on the part of the researcher about the environmental consequences and causes of pollution in the study area and, thereafter, to assist in interpretation of the interviews.

1.6 Scope and Limitations of the Study

This study was conducted in the Jordan River Valley and the Zarqa River Basin. The limitations include the fact that some participants have simple levels of education and rely on the government for their information. Furthermore, following up with them was hindered by certain difficulties such as their nonuse of technology. The researcher also found that some participants were reluctant to talk about the religious impacts of pollution, as they do not want to create problems for themselves with the government, as Jordan claims to respect Islamic-Christian coexistence and takes into account the full duties towards the holy places through the Hashemite custodianship of Muslim and Christian sacred sites in Jordan and Jerusalem.

1.7 Outline of the Thesis

The thesis consists of eleven chapters that are presented and explained in the thesis as follows:

Chapter 1: Overview of the Thesis

This chapter provides a summary of the study. It gives background information designed to provide an overview of the study. It presents the problem statement and research objective, followed by an overview of the methodology and methods adopted to address the research problem.

Chapter 2: Context of the Study

This chapter discusses the context of the study including the background of the study, significance of the study area regarding the agricultural sector, and religious tourism. This discussion is followed by the impacts of poor water quality in the study area on stakeholders.

Chapter 3: Theoretical Framework

This chapter provides a theoretical framework for the current research through using stakeholder theory to guide the analysis and answer the research questions.

Chapter 4: Literature Review

This chapter presents an overall review of the literature around water scarcity, water accounting, and the impacts of water contamination on agriculture, human health, spiritual and emotional relationships, and the well-being of limited income communities.

Chapter 5: Water and Jordan

This chapter covers the water situation in Jordan, including Institutional Arrangement and Water Administration in the Lower Jordan River Basin (LJRB). In addition, it considers water accounting and policies applied in the valley.

Chapter 6: Research Methodology and Methods

This chapter shows the methodology and methods used in this study. The methodology is described. The chapter explains how face-to-face semistructured interviews were used for data collection and how this data was analysed using content analysis computer software.

Chapter 7: Preunderstanding

This chapter shows the sources of the researcher's preunderstanding regarding the water contamination in the Jordan River Valley. This knowledge comes from a review of the literature and the researcher's own experience in the study area.

Chapter 8: Interviews Findings

This chapter reviews the findings from the content analysis of the interviews. It focuses on deterioration in the Jordan River Valley from a stakeholders' perspectives, as indicated in the study findings.

Chapter 9: Documents Findings

This chapter reviews the findings from the content analysis of the secondary data. It focuses on deterioration in the Jordan River Valley and the impacts of pollution from a stakeholders' perspectives.

Chapter 10: Discussion

This chapter presents the interpretation of the findings based on the preunderstanding of the researcher and the context of the study.

Chapter 11: Conclusions and Recommendations

This chapter summarises the study's findings and discussion and provides recommendations along with suggestions for future research.

Chapter 2: Context of the Study - Jordan

2.1 Introduction

Throughout recorded history, the River Jordan has been both a route and barrier between the desert and the plains. It has provided freshwater and a pathway for the armies of Egypt, Persia, Greece, and Rome as they moved toward the arid territories of Arabia. Its banks bear the memory of the battles between the Arabian armies and the Crusaders (Kaufmann & Greenberg, 1960). Finally, Turkish armies fought the British Empire's forces up and down Jordan during World War 1 (Stevens, 1955). The River is also a recurring feature of many significant battles and population movements in Biblical history. It marked the considerable struggles in the lives of Abraham and Joshua, David and Gideon. After centuries of settlement in Palestine, the Jews were driven through the Jordan River to Babylon by Roman conquerors. The Romans left a system of bridges and ferries that emphasised the river's importance to them. The Romans also built a network of weirs and cisterns to irrigate fertile lands in the Jordan River Valley. The valley was also a prosperous centre of a dried fish trade (Stevens, 1965).

Nowadays, Jordan suffers from scarce freshwater resources because of geographic, climatic, demographic, (Comair, Gupta, Ingenloff, Shin, & D. McKinney, 2013; Tahboub, Zaater, & Khater, 2017) and institutional factors (Denny, Donnelly, McKay, Ponte, & Uetake, 2008). Surface water in the Jordan River originates from the Yarmouk and Zarqa Rivers and the eastern *wadis*⁴ (Gunkel & Lange, 2012). Syria uses the Yarmouk River before it flows into Jordan, while the Zarqa River is under pressure due to the rapid growth of population. The basin also suffers from several water issues ranging from mismanagement to water allocation disputes (Al-Wer, 2009). The water system in the basin is complex, with surface water being mixed with untreated wastewater being stored in the King Talal Dam (KTD). The dam is located at the exit of the basin and its water is used for agricultural purposes in the Jordan River Valley (Al-Kuisi et al., 2009; Al-Kuisi, Mashal, Al-Qinna, Hamad, & Margana, 2014). Using untreated wastewater for irrigation poses significant risks to public health and its use poses a threat not only to the local

⁴(In certain Arabic-speaking countries) a valley, ravine, or channel that is dry except in the rainy season.

farmers but also to the neighbouring societies and the consumers of vegetables that it has been used to irrigate (Scheierling, Bartone, Mara, & Drechsel, 2010).

Over-pumping from the Zarqa River Basin has also affected the base flow of the river. Significant springs along the Zarqa River have dried up entirely, reducing the base flow from 3-4m³/s to less than 1m³/s (Shatanawi & Shammout, 2011). This reduction in flow has created dangerous circumstances that affect the role of the river in terms of producing food crops and promoting rural development for the communities in the basin (El-Rawy et al., 2016).

As the context of this study is Jordan, understanding the contextual information about Jordan is significant in order to interpret the study findings. This chapter introduces the historical, demographic, religious, and political background of Jordan. In addition, the agricultural and religious significance of the Jordan River Valley are explained.

2.2 Historical, Demographic, Religious, and Political Background of Jordan

Jordan witnessed human activity as early as the Paleolithic⁵ period (Christian, Brown, & Benjamin, 2014). The region was populated by Bedouin tribes in the Bronze Era and tribes such as the Edomites and Ammonites united into small kingdoms during the Iron Era (Younker, 1999). In the classical period, Jordan came under Greek and Roman rule. The area's principal population was Arab Nabateans. Under the Romans and Byzantines, Jordan was home to the Decapolis⁶ in the North, with much of the area being designated as Byzantine Arabia. Classical kingdoms located in Jordan such as the Roman-era Nabataean kingdom which had its capital at Petra (Taylor, 2001) left particularly impressive ruins which are popular today with sightseers and filmmakers. The history of Jordan continued with the Islamic Empire, an era which began in the 7th century. Thereafter, Jordan experienced partial crusader control in the mid-Middle Ages (county of Oiltrejordan⁷), was part of the Mamluk Sultanate, which had had its capital in Cairo since the 13th century.

⁵ It is a period in human prehistory identified by the original development of stone tools that forms 95% of human technological prehistory (Christian, Brown, & Benjamin, 2014).

⁶ The Decapolis was a set of 10 cities on the eastern frontier of the Roman Empire in the southeastern Levant in the first centuries BC and AD. The cities constituted a group because of their location, language, culture, and political status, with each functioning as an autonomous city-state reliant on Rome (Rebillard & Rupke, 2015).

⁷ It was the name used during the Crusades for an extensive and partly undefined region to the east of the River Jordan, a region known in ancient times as Edom and Moab. It was also mentioned as Transjordan (Benvenisti, 1972).

Finally, the area was under the control of the Ottoman Empire from the 16th century until World War 1 (Hanioglu, 2010).

In 1916, with the Great Arab Revolution led by Shareef Hussein bin Ali and the ensuing British invasion, the region came under British administration in 1917, and with the British mandate of Transjordan in the early 1920s, it became the Emirate of Transjordan under the Hashemite Emir (Salt, 2011). In 1946, the Hashemite Kingdom of Jordan gained independence and was admitted shortly thereafter to the United Nations and the Arab League. In 1948, Jordan entered into armed conflicts with Israel over lands of the former Mandatory Palestine, effectively gaining control of the entire West Bank and appending it to Jordan with its Palestinian population (Robins, 2004). After 19 years of ruling the West Bank, Jordan lost it in the 1967 War with Israel. The West Bank then became the military base of the Palestinian Liberation Organisation (PLO) in its conflict against Israel (Salibi, 1998).

The ethnic demographics of Jordan include the indigenous Jordanian tribes and the war refugees from adjacent countries. Though the Department of Statistics has conducted many official censuses, it does not document ethnicity or faiths. However, it is believed the bulk of Jordanians are not ethnic Jordanians (Tobin, 2012). The demographic majority are Palestinians, followed by ethnic Jordanians followed primarily by Syrians, Iraqis, Yemenis, with smaller numbers of Armenians, Assyrians, Circassians, Chechens, Mandaean and migrant labourers from Egypt, Sri Lanka, and the Philippines. This complex mix reflects the ethnic and religious diversity of Jordanian society (Tobin, 2012).

Jordan's population is mostly Muslim and Christian. Muslims in Jordan, however, are not a homogenous group. They are overwhelmingly Sunni, although Salafists are increasing in number. This increase is mostly attributed to the impact of Jordanian labourers returning from Saudi Arabia and who bring back the religious ideology they have acquired in that country with them. There are a few Shiites and Druze in addition to a considerable number of nonpractising, secular Muslims (Haidostian, 2014; Halliday, 2003). There is also a small but remarkable Sufi sect comprising chiefly western adherents of an American convert to Islam who is a long-time inhabitant of the capital, Amman (Tobin, 2012).

Tobin (2012) illustrates that such national diversity raises the question: ‘Who is a Jordanian?’ and, in particular, if one needs to be an ethnic Jordanian and a Muslim to be ‘Jordanian’. In the media and in public discussions, these questions of inclusion in the country are continually raised. Christians of Jordanian origins are indigenous clans so they are not a primarily contested group. The acceptance that they are Jordanian is attributable to the longstanding cooperative relationship between the ruling family and the indigenous Christian population (Salibi, 1998). However, the same cannot be said of Christians of Palestinian origins, or minority Christian sects such as the Mormons or Jehovah’s Witnesses. The diversity of faiths, however, is just one building pillar of being included within a structure of the state. Even among the political leadership in parliament, the question of national identity and state inclusion has been an issue. As Tobin (2012) noted, it came to the fore when a statutory instrument was passed that required all members of the Jordanian Parliament to hold only one passport, a Jordanian one.

Jordan is a constitutional monarchy. The lower house of parliament is elected by the Jordanian people, but the upper house (which controls most of the real power) is appointed by the king and then supported by the lower house (Robins, 2004). Over the past several decades, Jordan has enjoyed internal stability owing, in part, to the heritage-based legitimacy of its monarchy, and to the ability of its government to marginalise dissent parties, suppress opposition, and manipulate the boundaries of the electoral constituencies. These measures render the Jordanian parliament, the voice of people, weak. However, as the Arab Spring evidenced, stability is a transitory commodity (Helfont & Helfont, 2012). King Abdullah 2, who, until recently, has been the dominant force behind modernising Jordan, has tended toward a gradualist, evolutionary approach to change (Susser, 2011).

The king’s practice of compiling a list of reforms and handing them to the head of the government to implement has been unsuccessful, often because the prime minister does not share the king’s point of view regarding reform and because Jordan’s parliament is unable to enact the changes that the king demands (Muasher, 2011). More importantly, the nation-wide reform initiatives, which are created by royally appointed committees, draw from a base of narrow elites only and exclude members of dissent movements (Helfont & Helfont, 2012). According to Jordan’s former Foreign Minister, Marwan Muasher, “...efforts to open up the political system have been thwarted by a resilient class of political elites and bureaucrats

who feared that such efforts would move the country away from a decades-old rentier system to a merit-based one.” Ultimately, the king’s national reform programmes, which are meant to strike a balance between the liberal-minded reformers and the traditional, self-appointed trustees of the state often result in appeasing traditional elements at the expense of national reform (Muasher, 2011).

Additionally, ethnic and social divisions play a significant role in the reform process. The core of this division can be seen through the distinction between the so-called East Bankers (indigenous people on the East Bank of the River Jordan) and the West Bankers, or Jordanians of Palestinian origin. Comprising an estimated 55% of the population, Jordanians of Palestinian origin have played a pivotal role in the private sector, while indigenous Jordanians have tended to control the country’s political and security institutions, as well as the army (Helfont & Helfont, 2012). Helfont & Helfont (2012) mention that on a most basic level, Jordanians of Palestinian origin traditionally have been deemed by East Bankers to be less supportive of the monarchy. Sharp (2008) explains that there is a noticeable fear in Jordan that any democratic programmes will cause indigenous Jordanians to give up their political power to Jordanians of Palestinian origin (damaging the traditional political balance of power, which favours the kingship) and move the country in a potentially more radical, Palestine-centric direction. Despite these concerns, Jordanian of Palestinian origin do not represent a unified body. Aside from the fact that there are various levels of citizenship based on when and from where they came, Jordanians who have Palestinian roots belong to different economic classes and carry a broad range of political persuasions (Brown & Hamzawy, 2010). Since most Jordanians of Palestinian origin have been kept out of power through the change of electoral districts and electoral fraud, in general, most prefer an Arab Spring approach which promises to create democratic reforms and a representative constitutional kingship. By contrast, many of the powerful opponents of the Arab Spring approach are East Banker elites who fear to lose their privileged situation and government patronage (Helfont & Helfont, 2012).

Ideological differences in the Jordanian community also constitute the political landscape. Islamic parties are by far the most organised opposition. Of these, the Muslim Brotherhood is the biggest and most active party. Unlike in most other Arab countries, the Jordanian Brotherhood’s political party, the Islamic Action Front (IAF), is not only tolerated but also well integrated into the Jordanian political

landscape. Though its leadership includes upper-class Jordanian families that are of Palestinian origin, the support of Palestinian issues (both in Jordan and in Palestine) has been a chief reason for the organisation. Because of this campaign, much of the IAF's ranks and file includes Jordanians of Palestinian origin who live in Palestinian refugee camps (Bar, 1998). This fact, combined with the fact that a lot of the electoral reforms over the past three decades sought to sideline the Islamic Brotherhood party and its Palestinian base, has made the Jordanian Muslim Brotherhood one of the most influential proponents of political reform. It is significant to note, however, that even the Islamic Brotherhood party has abstained from calling for radical change or the downfall of the monarchy (Wiktorowicz, 2001).

At the other end of the political landscape are the conservative components rooted in East Bank Jordanian tribal politics. These tribes constitute much of the East Bank elite, which traditionally have been the supportive linchpin of the monarchy (Helfont & Helfont, 2012). Though there are signs that this support is fading in some tribal areas, the East Bank tribal elites have been the most vicious opponents of political reform. These tribes see politics through the lens of tribal interests and have boosted a traditional Middle Eastern system of politics where tribal support is given in exchange for land, water, money, and privilege (Buttorff, 2015). Deeply conservative, these powerful tribes are afraid that political reform will come at their expense. As a result, they have created what Tel Aviv University Professor Asher Susser has termed 'a militant and influential ultranationalist movement' which is dedicated to the removal of Palestinian power and real and perceived Palestinian influence on economy instead of cooperation to build the state (Susser, 2011).

2.3 Agricultural Significance of the Jordan River Valley

Artefacts dating back to 400,000 BC have been found in parts of the Badia⁸ and hillsides in Jordan, and even in the foothills of the Jordan River Valley. The first agricultural societies developed between 10,000-5000 BC in the southern part of the Jordan River Valley (Suleiman, 2003). The farming soil was fertile and the water was abundant (Abu-Aisha, 2001). Over the centuries, average rainfall in this

⁸ The Badia, the Jordanian steppe, is a region of semiarid and steppic rangeland in eastern Jordan. It is used for providing pastures for livestock.

part of the country has fluctuated with some seasons suffering droughts. In response, people moved to the north to establish a demographic movement and a change that continues today (Suleiman, 2003).

According to the statistics of the Ministry of Agriculture (MOA), agricultural production in Jordan has increased during the last four decades (Ministry of Agriculture, 2010). As Hamdan and Salman (2005) indicate, the production of vegetables has tripled since 1976. This increase was primarily due to the expansion in projects using treated wastewater in irrigation, the introduction of new hybrid high-yielding varieties, and the use of plastic greenhouses. Production has also grown in response to expanding demand for fresh produce domestically and regionally (Ministry of Agriculture, 2010).

The major vegetable crops produced in Jordan are tomatoes, cucumbers, potatoes, eggplants, and squash. Jordan has two main production areas: the Jordan River Valley, which is a winter crop area, and the Highlands, which produce summer crops. Harvest in the Jordan River Valley begins in early December and continues until May of the following year. In the Highlands, for instance in the Amman-Zarqa region, harvest begins in May and continues through to October (Hamdan & Salman, 2005). Production of fruit has shown upward trends similar to those for vegetables (Hamdan & Salman, 2005).

During the 1990-1999 period, exports of fresh vegetables amounted to about 78% of gross exports of fresh agricultural product. Tomatoes, cucumbers, capsicums, lettuce and squash represented about 84% of total vegetable exports during 1999. Arab Gulf countries and Iraq were the main importers of Jordan's agricultural products during this period (Al-Karablieh, Jabarin, & Tabieh, 2011). Average annual exports during 2000-2009 amounted to about 596,000 tonnes. Fresh produce exports from the Jordan River Valley to the Arab Gulf countries, Jordan's other neighbours, and West Europe represented 54% of fruit and 38% of vegetables grown in Jordan (Ministry of Agriculture, 2010).

The use of treated wastewater for irrigation is vital for the country's agricultural activities (Norton & Jabarin, 2006). Treated wastewater is particularly important in the Jordan River Valley as it costs farmers less than freshwater (Hamdan & Salman, 2005). However, the use of recycled wastewater as a primary source of irrigation is risky (Riemenschneider et al., 2016). Although Jordan has attempted to emphasise

that using treated wastewater for irrigation does not present adverse impacts, negative health effects (Al-Ansari, Aldardor, Siergieiev, & Knutsson, 2013), economic (Norton & Jabarin, 2006) and religious impacts (Faruqui, 2001) have been associated with its use.

One example of the negative economic consequences occurred in 1992 when the Saudi Arabia Government banned vegetable imports, citing biological contamination of product and the use of treated wastewater as its main reasons (Al-Karablieh, Jabarin, & Tabieh, 2011). It took the Jordanian government 18 years to convince the Saudi Arabia government to end the ban. In 1996, a team of Saudi experts visited Jordan on behalf of the Saudi Ministry of Trade and other specialised groups of experts from the Saudi government visited in 2000 to review the ban. However, the teams were not satisfied with procedures applied by the Jordanian government to re-export the vegetables (Al-Karablieh, Jabarin, & Tabieh, 2011). This export prohibition was eventually lifted in 2010 when a new team of Saudi experts visited Jordan (Alarrabnews, 2010). However, the government must provide farmers with guidance on how to use treated wastewater for irrigation and enforce current laws. Otherwise, the country's agricultural production will be vulnerable to future bans on imports to Saudi Arabia.

The problem with food safety of crops grown and irrigated with treated wastewater is not limited to the Saudi Arabian markets (Al-Karablieh, Jabarin, & Tabieh, 2011). In 2017, the United Arab Emirates also stopped importing fruit and vegetables citing biological and chemical contamination of products (Gerasanews, 2017). In addition, many of Jordan's local consumers claim that they doubt whether the vegetables and fruit irrigated with treated wastewater are safe to consume (Al-Karablieh, Jabarin, & Tabieh, 2011).

2.4 Religious Significance of the Jordan River Valley

The Jordan River is of religious significance to three of the divine religions in the world Judaism, Christianity, and Islam (Chryssavgis 2014; Shrestha, 2017). It is the area where most of the prophets were born. In Judaism, Christianity, and Islam purification through water is a method of attaining spiritual purity (Larson, 2011). The first shared belief between the three divine religions is that water has certain holy qualities that give it the power to cleanse the mind, wash away sins, and raise

the spirit to a higher realm. In Judaism, immersion in a ritual bath filled with the holy 'living waters' represents a spiritual cleansing, bringing the believer to a high spiritual state (Chatel, 2014). In Christianity, baptism is the Christian religious rite of sprinkling water on to an individual's forehead or of immersing the individual in water, representing purification or regeneration and admission to the Christian Church. In many sects, baptism is carried out on young children and is accompanied by name-giving (Spinks, 2017). Islam requires purity of body and fineness of mind in worship and water is considered the best means of attaining a state of ritual cleanness (Larson, 2011). The role that the Jordan River plays in these religions is discussed in more detail below.

2.4.1 The Jordan River in Judaism

For the Jewish people, the River Jordan is a symbol of liberation (Zavada, 2015). Its crossing marks the entry into a land of plenty and freedom after the long years of slavery and wandering in the wilderness (Adamson, 2013). After wandering in the desert for 40 years, the Israelites approached the boundary of the Promised Land close to Shittim. Their great leader Moses had passed away and God had transferred power to his successor, Joshua (Adamson, 2013). The River Jordan is significant because the tribes of Israel under Joshua crossed the river on dry ground to get into the Promised Land (American-Israeli Cooperative Enterprise, 1993).

Joshua commanded the people to consecrate themselves by washing themselves, their clothes, and abstaining from intercourse. Then, he assembled them behind the Ark of the Covenant. He told the Levite priests to convey the Ark to the River Jordan (Zavada, 2015). As soon as the priests waded in with the Ark, the water stopped flowing and while the priests waited in the middle of the River Jordan, the whole nation crossed over on dry ground (Zavada, 2015). The book of Joshua presents the details as follows:

The waters coming down from upstream piled up in a single heap a great way off, at Adam, the town next to Zarethan, those flowing away downstream to the Sea of the Arabah (the Dead Sea) ran out completely. Therefore, the people crossed near Jericho. The priests who bore the Ark of the Lord's Covenant stood on dry land exactly in the middle of the Jordan, while all Israel crossed over on dry land until the entire nation had finished crossing the Jordan (Joshua 3:16-17).

The Lord ordered Joshua to have 12 men, 1 from each of the 12 tribes, pick up a stone from the centre of the riverbed (Adamson, 2013). About 40,000 people from the tribes of Gad, Reuben, and the half-tribe of Manasseh crossed over first. Once everyone had crossed, the priests with the Ark of the Covenant came out of the riverbed. As soon as they were secure on dry land, the waters of the River Jordan rushed in (Adamson, 2013).

The people encamped that night at Gilgal. Joshua took the 12 stones they had brought and piled them into a memorial (American-Israeli Cooperative Enterprise, 1993). Joshua told the nation it was a signal to all the nations of the earth that God had parted the waters of the River Jordan, just as he had parted the Red Sea (Zavada, 2015). After that, the Israelites celebrated Passover, and the manna that had fed them for 40 years stopped. They ate the harvest of the land of Canaan (Zavada, 2015). From the time of that crossing, the River Jordan became a river of miracles. It is here, on the banks of the River Jordan, that the Prophet Elijah ascends to heaven, and that the responsibility of prophethood passes to his successor, Elisha (Adamson, 2013). It was here that Naaman the Leper was cured by bathing in the waters of the River Jordan (Adamson, 2013), “so he went down and immersed himself in the Jordan seven times, as the man of God had bidden, and his flesh became like a little boy’s, and he was clean” (2 Kings 5:14).

2.4.2 The Jordan River in Christianity

The River Jordan is immortalised in the holy book of Christianity, the Bible. The River Jordan is referenced about 175 times in the Old Testament and about 15 times in the New Testament (Blank, 2017). The River Jordan also played a significant role in numerous Biblical events (Genesis 32:22-28 RSV, Joshua 3:15-17). For example, the first mention of the River Jordan is when Abraham and Lot parted company:

And Lot lifted his eyes and saw that the Jordan valley was well watered everywhere like the garden of the Lord, like the land of Egypt, in the direction of Zoar; this was before the Lord destroyed Sodom and Gomorrah. So, Lot chose for himself all the Jordan Valley, and Lot journeyed east; thus, they separated from each other (Genesis 13:10-11 RSV).

For Christianity, the river water itself became holy after it was the setting for the baptism of Jesus. The Baptism site ‘Bethany beyond Jordan’, also called

‘Bethabara’ in old texts, has always been the spiritual and geographical pivot of this region (see Figure 2.1). The River Jordan is the only place in the Holy Land that was touched by Abraham, Jacob, Moses Joshua, Elisha, Elijah, John the Baptist, and Jesus Christ, and where their shared legacies still exist (Gafny, Talazi, Al Sheikh, & Ya'ari, 2010). A personal pilgrimage to site of the Baptism in the River Jordan is a meaningful and poignant trip for Christians, as they can appreciate the abundance of the land’s salvation history and its memory of so many prophets, patriarchs, and heavenly inspired messengers (Waheeb, Al-Ghazawi, & Mahmoud, 2013). Bethany beyond Jordan in the Jordan River Valley is the place where John’s baptism of Jesus witnessed the start of the Messiah’s public ministry. In many ways, it is the place where Christianity began once Jesus had been baptised, assured by God, and where Jesus began to touch the lives of ordinary people (Waheeb et al., 2013).



Figure 2.1: Baptism Site in the Jordan River.

Source: (Lobefaro, 2009).

The historical importance of the River Jordan to Christianity can also be illustrated through the Madaba Mosaic Map detailed in Figure 2.2.

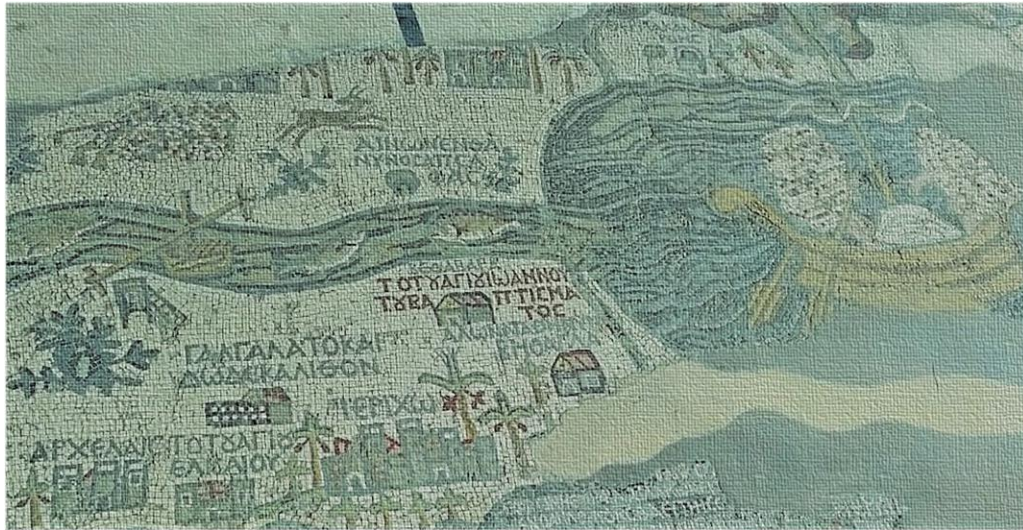


Figure 2.2: Madaba mosaic map.

Source: (Author).

The Madaba Mosaic Map is a part of a floor mosaic in the early Byzantine church of Saint George in Madaba city in Jordan (Donner, 1992). The map which dates back to the 6th century AD (Jordan Society of Tourism and Travel Agents, 2012) shows the Middle East. Part of the map includes the oldest original map of the Holy Land and it shows Jerusalem.

Specifically, the map shows an area from Lebanon in the north to Egypt in the south, and from the Mediterranean Sea in the west to Jordan in the east. It shows the Dead Sea with two fishing boats and various bridges link both banks of the River Jordan. Fish swim in the River Jordan and return when they approach the Dead Sea. It also shows a lion hunting a gazelle in the Moab desert and palm trees on the west bank of the river (Donner, 1992). The Madaba Mosaic Map has partially helped to facilitate pilgrims' orientation in the Holy Land (Hepper & Taylor, 2004). The Madaba Mosaic Map shows the biodiversity in the past on the Jordan riverbanks. In the past, fauna and flora were abundant.

2.4.3 The Jordan River in Islam

The River Jordan is immortalised in the holy book of Islam, The Quran. The Quran indicates that all regions around Jerusalem and the River Jordan are regarded as blessed (Khalid, 2002), as illustrated by the following verse:

Holy is He who carried His servant by night from the Holy Mosque (in Mecca) to the farther Mosque (in Jerusalem) whose surroundings We have

blessed that We might show him some of our signs. Indeed, He alone is all-hearing, all-seeing. (The Quran 17:1).

The Jordan River Valley also hosts the shrines of many of the Prophet Muhammad's companions. They were martyred and buried on the eastern bank of the River Jordan. In fact, the Jordan River Valley has a unique place in the Islamic history, as it was the first land to which Islam spread out of the Arabian Peninsula (Bader, 2012). Moreover, it was the first link between Islam and non-Arab communities.

In the 1990s, Islamic sacred sites were the object of an additional Jordanian effort to promote Islamic places. The effort was evident through renovated 'shrines of the Companions of the Prophet' and a campaign to raise public awareness about these locations (Katz, 2003). Sadly, the religious significance of the Jordan River Valley has not prevented pollution from reaching the valley.

2.5 Water Scarcity

Water scarcity in Jordan is a complex problem that is not likely to be addressed or abate with the passage of time. Jordan experiences increasing freshwater demands that already exceed obtainability and surface water and groundwater resources are contaminated (Becker, Helgeson & Katz, 2014). At the same time, Jordan greatly depends on water resources outside its borders, in the physical sense through the sharing of rivers and aquifers with adjacent countries as well as indirectly through Jordan's strong reliance on virtual water imports (Hoekstra & Mekonnen, 2012). Water resources with Israel and Syria has resulted in tensions in the past (Gleick, 2014). Moreover, Jordan has experienced enormous influxes of refugees as a result of the continuing conflicts in the neighboring countries, which increases Jordan's struggle to meet domestic water requirements (Talozi, Al-Sakaji & Altz-Stamm, 2015).

Jordan has naturally low water availability. Climate change has caused a drop in rainfall and hence water flows (Alqadi & Kumar, 2014). Based on model simulations for diverse climate change scenarios, Abdulla, Eshtawi & Assaf (2009) found that decreases in rainfall will lead to substantial decreases in runoff and groundwater recharge in the Zarqa River Basin. The percentage of time that the Jordan River Valley and its surroundings will experience moderate, severe, and extreme drought conditions is anticipated to rise in the future (Törnros & Menzel,

2014). Such droughts can have shocking effects when the agricultural and water management practices in place are unsustainable (Kelley, Mohtadi, Cane, Seager & Kushnir, 2015). Moreover, the semiarid condition in the Jordan River Valley, characterized by a mixture of high potential evapotranspiration and low rainfall, causes a lack of salt flushing and leaching of farming soils, leading to alarming soil salinity levels (Ammari, Tahhan, Abubaker, Al-Zu'bi, Tahboub, Ta'Any & Stietiya 2013).

2.6 Chapter Summary

Water is the origin of life. In three predominant faiths, it is described as something sacred, a gift from Allah (Bar & Cohen-Hattab, 2003; Neveu, 2010). Water is needed for almost all human personal tasks, including not only the obvious ones of doing laundry, bathing, and cooking, but also in less apparent fields such as food safety. While in some states, access to freshwater is plentiful, in many parts of the world this is not the case, such as Jordan.

This chapter reviewed historical, demographic, religious, and political background of Jordan, and the significance of the Jordan River Valley. The Jordan River Valley is the border between Jordan and Israel. It extends from the northern tributaries of the Sea of Galilee to the Dead Sea in the south.

The Jordan River Valley is the most significant agricultural region for Jordan. The valley has typical Mediterranean moderate rainy winters and hot dry summers appropriate to producing high-value export crops. The soil of the Jordan River Valley is fertile, making it a source of sustenance in Jordan (Cohen & Stanhill, 1996).

The significance of the Jordan River is not limited to agriculture but also encompasses religious tourism. Jordan is a small country but it has a uniqueness in terms of its cultural, archaeological, and religious sites as these are of importance on a global scale. Religious tourists can visit several religious places linked directly to holy texts and the lives of the prophets Moses, Jesus, and Muhammad. Consequently, religious tourism has the capability to be a significant business in the Jordan River Valley and is one that fits well with the cultural and natural assets in the area (Shunnaq, Schwab, & Reid, 2008). The Lower Jordan River Basin should get everyone's attention because of its diverse significance.

Chapter 3 – Theoretical Framework

3.1 Introduction

A theoretical framework is often defined as a collection of interrelated notions used to guide a particular research project (Cavana et al., 2001; Collis and Hussey, 2009). It can be a single theory, or an integration of several theories, or at a more basic level an approach to understanding certain organisational behaviour (Garcia-Meca et al, 2005). As for this research, stakeholder theory is employed as a theoretical lens to understand and interpret the participants' perspectives about the impacts of pollution in the Jordan River Valley and the Zarqa River Basin.

Rose and Flak (2005) believe that stakeholder theory is not a special theory on an organisation's constituencies but sets out to replace today's dominant neoclassical economic notion of the organisation. Though stakeholder theory started as a theory on private-sector firms, scholars (Chan, Pan and Tan, 2003; Rose and Flak, 2005) also apply it to public-sector organisations.

Confronted with increasing pressure to ensure accountability vis-a-vis customers, inhabitants and beneficiaries, organisational leaders need to decide how to select and implement so-called accountability standards. Yet while looking for suitable standard, they frequently base their decisions on cost-benefit calculations, thus overlooking other significant domains of influence pertaining to more broadly defined stakeholder interest. Management needs to identify and act according to the necessities of all stakeholders. The creation of a dialogical understanding among affected stakeholders cannot be a mere outcome of applying certain accountability standards, but rather must be an essential prerequisite for their use. This requires a stakeholder dialogue prior to making a choice (Rasche and Esser, 2006).

Batchelor, Hoogeveen, Faures and Peiser (2017) explain that a government organisation is accountable for decisions, regulations and public expenditure affecting its residents. People are accountable for their behaviours and the actions they take. Accountability is different from transparency in that it prompts positive or negative responses after a decision or action, while transparency can also prompt positive or negative responses before or during a decision or action.

Section 3.2 provides a basic overview of stakeholder theory followed by key concepts of importance in stakeholder theory. In addition, the section also presents stakeholder theory and public policy. Section 3.3 presents the stakeholder theory and the thesis. Finally, a summary of the chapter is presented.

3.2 Stakeholder Theory

This study employs stakeholder theory to guide the analyses and answer the research questions. Two different views of stakeholder theory, namely normative and managerial will be examined (Gray et al., 1995). Normative stakeholder theory embraces the notion that all stakeholder' interests should be served by an organisation, whereas managerial stakeholder theory is closely aligned with the idea of stakeholder management. Organisations can be anticipated to manage their stakeholders to achieve the best results for the organisation. This implies that the organisation will pay more attention to stakeholders that can impact the organisation and affect its access to the resources it needs to prosper (Oruc & Sarikaya, 2011). The providers of financial resources, such as shareholders and creditors, are normally seen as key stakeholder that managers need to satisfy (Neu et al., 1998). Stakeholder theory provides a system-based viewpoint (Gray et al., 1996), which deems policies of an organisation as a strategy to impact stakeholders and their expectations, thus explaining why the organisation undertakes voluntary disclosure (Deegan and Unerman, 2008). Stakeholder theory deems organisations as part of a system where the organisation can impact and can be impacted by other parties, or stakeholder groups. Diverse stakeholder groups have diverse expectations and viewpoints of the organisation. Thus, the organisation needs to address diverse stakeholders in a different way.

According to the managerial perspective, management will be inclined to address the expectations of the most influential stakeholders (Gray et al., 1996). Influential stakeholders can be recognised as those who control financial resources (Neu et al., 1998). The organisation will disclose according to their expectations, rather than those of non-influential stakeholders. Accordingly, disclosures are assumed to be driven by influential stakeholders, and influential stakeholders' information needs are probable to be reflected in the disclosures provided.

In contrast, the normative view proposes that managers should coordinate organisational objectives and activities for the good of all stakeholders. Thus,

management has a responsibility, not only towards investors, but towards all stakeholders (Hasnas, 1998). In case of stakeholder conflict, management should act to achieve balance among the diverse stakeholders. Based on this type, disclosure is supposed to be driven by responsible behaviour, and disclosures should provide information to the benefit of all stakeholders, not only key stakeholders.

Stakeholder theory can be employed by sustainability reporting to clarify the reasons why corporations select to disclose non-financial information. The development of the domain of sustainability reporting, and more recently integrated reporting, can be seen as the consequences of organisations' responses to a diversity of stakeholder pressures (Guthrie et al., 2010; De Villiers et al., 2014; Manes-Rossi and Cohen, 2017; Montecalvo et al., 2018). "Non-financial reports can be seen as 'response to both public pressure and increased media attention'" (Seele, 2016, p. 67).

3.2.1 Key concepts of stakeholder theory

Stakeholder theory frequently relates to the term 'accountability' which is defined by Mulgan (1997) as the responsibility of one party to another in a relationship where one party entrusts another with the performance of certain obligations. From an accounting view, accountability refers to the responsibility of an organisation to disclose information about its performance, financial position, financing and investing, and compliance in order to help users to make suitable decisions (Australian Accounting Research Foundation, 1990). Under a traditional view, the organisation merely needs to discharge accountability to its shareholders. However within a stakeholder standpoint, an organisation should be accountable to not only the shareholders, but to other stakeholders as well.

Managers of organizations, government and nongovernment actors alike are progressively confronted with expectations relating to 'organisational accountability' based on sound ethical performance (Logsdon and Lewellyn, 2000). As a result, this idea has witnessed increased theoretical recognition during the past decade. Social, environmental and ethical accountability, often also called social and environmental accounting (Gray, 2002) or social, environmental and ethical accounting deals with the measurement, assessment and communication of social, environmental and ethical performance. Whereas there is continuing discussion

about the very nature and theoretical justification of the notion itself (De Colle and Gonella, 2002), in parallel, there is a spread of so-called accountability standards. Standards such as Social Accountability 8000 (SA 8000) or the Global Reporting Initiative (GRI) provide commonly accepted frameworks to measure, verify and communicate accountability related information. Nevertheless, in a rapidly growing jungle of available standards, organisations and their stakeholders face a tough question: which standard is right for their specific situation, their set of requirements? It is noticeable that this decision making process is frequently regarded as a management task. However, this results in what Owen et al. (2000) call 'managerial capture', a situation in which the entire process of social and environmental accounting is controlled by management and the process therefore lacks an accountable determination of scope.

Though stakeholder theory developed from and pertains to the private-sector organisation of the firm, there is interest in applying at least part of the outcomes to the managerial decision-making in public-sector organisations. While some supporters of stakeholder theory are very sceptical concerning this application, inter and intra-governmental decisions processes may take advantage of the application of stakeholder principles (Moon & Vogel, 2008). This appears particularly to be the case concerning large-scale investments in information technology where the risk of failure is markedly high (Scholl, 2006).

3.2.2 Stakeholder theory and the public sector

Despite the opposition from prominent supporters of the theory, the stakeholder notion has found its way into the scholarly discussion of the public administration literature (Tennert and Schroeder, 1999) and public-sector practice. Donaldson and Preston (1995) doubt the value and suitability of such undertaking because they see the stakeholder theory as merely one for a private-sector firm which is governed by basically diverse principles and implications than any public-sector organisation.

However, even though most public-sector managers perform their tasks for diverse aims (e.g., public interest) as opposed to their private-sector counterparts (e.g., survival of the firm, or profit), their decisions have the same capacity to influence individuals or groups pursuing their organisation's objective. Also, others -as in the private sector- can influence public managers and governmental corporations. In other words, Freeman's (1984) stakeholder definition applies to managerial

decision-making also in a governmental context. Instrumental and normative considerations can be used to public-sector stakeholder settings as much as in the private sector. However, as Tennert and Schroeder (1999) found that, public-sector managers lack a suitable toolkit for stakeholder identification and management. This results in the stakeholders' voice being unheard, and neglecting their requirements (Tennet and Schroder, 1999) after public-sector decisions have been made. Since the public-sector manager's self-understanding is shifting from being a public bureaucrat towards the one of a public facilitator, the authors see an even larger need for a strong grounding of stakeholder management in the public sector. Working in the public sector has become a multi-jurisdictional and multi-sector endeavour (Tennet and Schroder, 1999). In other words, the shift from a more hierarchical to a more network-type organisations demands inclusion and management of constituencies (Gomes, 2006).

3.2.2.1 Stakeholder theory and public policy

In several stakeholder diagrams, government is seen as just another stakeholder, similar to the way in which some popular political models depict business as just another interest group competing for political favours (Laplume, Sonpar, & Litz, 2008). Although government may be seen as a stakeholder of sorts, it is far more than just another stakeholder as it is the main player in the public policy process. Likewise, while business is an interest group, it is far more than that because it is the main player in the free market process. A political model might refer to the institution of business as just one more competing interest group, but would certainly not refer to the free market as a competing interest group; this would create a confusing of levels of abstraction. Likewise, the institution of government can be seen as just another stakeholder, but it makes no sense to refer to public policy as just another stakeholder (Buchholz and Rosenthal, 2004).

Public policy and the free market economy are two parts of adjudication within the dynamics of community, representing two means of keeping a suitable balance between the common other and individual interests (Laplume, Sonpar, & Litz, 2008). Such a balance must be sustained for continued growth in a market oriented economy. While market economy cannot be labelled another interest group competing for power, they remain a prevailing force in a free market is business. Likewise, while public policy cannot be named another stakeholder, government is

the prevailing force in the public policy process. What exists here are two diverse levels of abstraction, a theoretical level where public policy and the market system can be related, and a more institutional level where it is suitable to discuss business and government (Buchholz and Rosenthal, 2004).

While most public policy making occurs through government activity, public policy is not the government but a social decision-making process that is similar in abstractive levels to the free market. One can infer that government is just another stakeholder or that business is just another interest group. One can, at another level, speak of government as the main actor in the public policy process, or business as the main actor in the market process. But to speak of government as just another stakeholder and government as the main actor in the public policy process in the same logical tone of voice is to ineffectively categorise (Buchholz and Rosenthal, 2004).

Both of these logic functions are supported in Donaldson and Preston's (1995) discussion of a stakeholder model. These scholars note that stakeholder management needs simultaneous attention to the legitimate interests of all suitable stakeholders – including government as one among the variety of kinds of stakeholders – and that the very foundation of the stakeholder model excludes any undue attention to the interests of any one constituency.

These scholars recognise the problem of self-serving managers and the role of government in providing a legal framework for stakeholder management to be applied. They, thus, raise a major paradox if you will relative to stakeholder theory. Government must make and pass enabling legislation (Freeman, 1998) to make stakeholder management work in the real world and play a dynamic role in seeing that the rules of the game are followed by management as well as other stakeholders. In cases of adverse impacts, affected stakeholders must be able to follow their interests through the court system when all other avenues are closed to them. Government must use its power of pressure when necessary to see that the system is not destabilised by self-serving managers or other stakeholders and there must be a way to alter the rules when they prove unworkable (Gomes, 2006).

The public policy process represents the collective desires of society for public goods and services such as clean air and freshwater, national defence, harmless products, sufficient quantity of affordable, nutritious food, and goods and services that are indivisible and public by their very nature. The marketplace cannot provide them and the expectations of these entities cannot typically be expressed through marketplace transactions (Buchholz, 1982). The public policy process, then, is the suitable way for community to decide about the allocation of resources for the sustainable solution of social problems, rather than by depending on organisations to be socially responsible, precisely recognize stakeholder interests, or respond to some ambiguous ideas of a new social contract (Buchholz and Rosenthal, 2004).

3.3 Stakeholder Theory and the Thesis

The decision making of public organisations is, in fact, a stakeholder-based process in which stakeholders are authorised to exert influences due to power over and interest in the organisation's operations and outcomes (Gomes, 2006). As for this thesis, the government is the major stakeholder while other stakeholders such as residents, local farmers, NGOs, environmental experts, and religious actors, are also important. These stakeholders are affected by the way the government enforces environmental legislation and manages water resources.

The wider stakeholder group have different needs such as enough and high-quality domestic water and adequately treated wastewater for irrigation. Furthermore, they have little influence on the government. In addition, the government does not provide them with enough and accurate information concerning the water situation in Jordan nor does it allow them to participate in decision making. As a result, they are, to some extent marginalised and have little voice.

Classical Islamic Hermeneutics is employed in this thesis as a research methodology. This methodology aims at understanding the intended meaning of the different stakeholders. As a result, it helps to understand the stakeholders' perspectives on the impacts of pollution in the Lower Jordan River Basin, which contributes to making their voices heard.

3.4 Summary

Organisations might choose to disclose social and environmental responsibilities because they believe it is what they ought to do as an organisation, in order to best

address its stakeholders' information needs, or simply because they see it as the right thing to do. This would constitute a normative stakeholder approach, supported by the fact that the sustainability of social and environmental requirements is gaining large prominence at a global level. These efforts could cause some to view social, environmental, and ethical needs as the right thing to do for stakeholders and to improve impression management for customers. As for this research, less influential stakeholders would benefit from this approach, including local farmers, residents, NGOs, religious actors, and environmental experts. Given that civil society's information requirements are likely to concentrate on social matters such as poverty, unemployment, livelihoods, and social wellbeing, a normative approach to stakeholders could result in enhanced social and environmental needs.

Organisational management needs to take care of all stakeholders regardless of whether if they are influential or non-influential stakeholders as different stakeholders have expectations from the public organisation. This cannot be achieved by only applying accountability standards, but rather by listening to all stakeholders and let them effectively participate in the decision making. All stakeholders' needs are part of the government's obligations towards civil society. This is why this thesis has adopted a stakeholder approach. The next chapter is the literature review, which includes a critical analysis of the literature related to water pollution and management and its relation to water accounting.

Chapter 4: Literature Review

4.1 Introduction

The lack of freshwater is a significant issue. Indeed, it is probably the most significant that humanity is currently facing, because problems connected to it affect the lives of millions of people. During the next five decades, problems connected with a lack of freshwater or the contamination of freshwater bodies will affect almost everyone on the planet. Freshwater shortage and needs are growing, and the competition for water among urban, industrial, and farming sectors, as well as other resources consumers, is becoming increasingly intensive (Hamdy, Ragab, & Scarascia-Mugnozza, 2003).

The increasing population of the developing world and their demand for water resources further limit the freshwater available. Large investments in water infrastructure such as effluent disposal and irrigation systems have not satisfied local needs nor met the demands of the emerging countries (Postel, 2014). In addition, contamination of water also acts to decrease the availability of water to satisfy human needs. Furthermore, institutional weaknesses, which are visible in mismanagement of water resources, have posed threats to long-term sustainability in the evolution of the water segment (Hamdy et al., 2003; Klot, 2005).

Competition and disputes among users over freshwater resources have occurred for centuries. Some have been regional disputes, while others have been deliberate attacks on whole water systems, for instance, during the first Arab Gulf War in 1991 (LeRoy, 1995), disputes among Israel and Arabs in 1967 (Cooley, 1984), and disputes in Ethiopia, Egypt, and Sudan in 2012 (Gleick & Heberger, 2014). With increasing worldwide urbanisation, tensions are rising in the face of shortages of freshwater. The growing numbers of people experiencing freshwater stress and scarcity have implications for global security⁹ (Gleick & Heberger, 2014).

The extent to which freshwater becomes a scarce asset, and thus gives rise to a chief source of potential conflict within decades, is attributed to a number of variables, including the pace at which levels of living improve (raising the demand for fresh,

⁹ Global security has been broadly defined to include economic, social, and ecological problems among national or subnational populations (Gleick & Heberger, 2014).

clean water with them) and the degree to which ecological degradation and universal climate change jeopardise both the supply quantity and quality of freshwater resources (Ragab & Prudhomme, 2002). Conflict over water resources and adverse impacts on human health and farming communities are likely to last and escalate (Gleick & Heberger, 2014). Therefore, there is a need for efficient water resources management to increase water supply by raising the efficiency of water use and reducing demand.

Savenije and Van-Der-Zaag (2008) explain that integrated water resources management (IWRM) acknowledge the whole water cycle with all its natural facets, as well as the interests of the water consumers in the diverse sectors of society (or a whole region). Hence, IWRM addresses the human and environmental impacts of water. Decision-making would involve the integration of diverse aims where possible and a trade-off or priority-setting between these goals where needed by carefully weighing these in an informed and clear manner according to societal aims and constraints. Special care should be taken to consider the influencing factors regarding water availability such as geographical disparity and the possible upstream-downstream interactions, the natural seasonal and long-term fluctuations in precipitation, and the implications of current development on future generations (Dukhovny & Sokolov, 2005). To achieve integrated water resources management, suitable legal, institutional and financial arrangements are essential that acknowledge the different sides of integrated water resources management (Savenije & Van-Der-Zaag, 2008).

The world is faced with some have described as a water crisis (Lambooy, 2011). Water crises have always occurred with droughts and floods in different regions and at different times; however, these events are predicted to worsen in the future. In particular, periods of water shortage are expected to become more frequent and extreme. The causes of the present situation are divergent. First, climate change has impacted on precipitation patterns worldwide (Lambooy, 2011). When joined with increased evaporation connected to higher temperatures, considerable droughts are predicted to become commonplace in many areas (Koehler, 2008). It is not only direct water consumption that has aggravated this problem, but also indirect water consumption via the resources embedded within consumer products and food (Money, 2014). A significantly increased population also increases pollution and affects global water quality. The World Business Council for Sustainable

Development (2012, p. 2) argues that approximately 80% of the world's population now live in regions where "the threat to water security is high". This threat poses continuous effects on people and business.

As Lambooy (2011, p. 853) notes, "people and business organisations are competing users of freshwater". Humans depend on freshwater for life and business depends on freshwater to support its different activities and to prosper. In the past, business organisations have often been seen to be negligent in water management, treating freshwater as a free commodity as opposed to a valued asset and resource to be managed with care (Christ, 2014; Martinez, 2015). With increasing water scarcity and increased demand, people and business organisations are being forced to become more pragmatic concerning their freshwater management activities, resulting in the need to develop a comprehensive system for water accounting in order to sustain freshwater for current and future generations (Christ & Burritt, 2017a).

This chapter introduces literature on world water scarcity resulting from climate change, increased population, pollution, and the impacts it has on human health, the agricultural community, food security, and human well-being. In addition, the chapter will focus on water accounting and its essential role as a tool of decision-making in managing water resources, improving water productivity and guaranteeing the three dimensions for social, environmental, and economic sustainability. It will also focus on suppliers of water services rather than the receivers of the services. Furthermore, the chapter considers water scarcity in the Middle East and North Africa, the impacts of water scarcity on freshwater resources, and the politics of adaptation. Finally, freshwater scarcity and its implications on politics in the Lower Jordan River Basin are presented.

4.2 World Water Scarcity

After centuries of human development in which water has been an abundant resource in most regions, the situation is now changing to the point where water scarcity has become the most significant threat to the environment. This section sets out the effect of water poverty on food security, human health, people's livelihoods, and social well-being worldwide. It is estimated that nearly 4 billion people, roughly to a half of the world's population or a third of the population in developing

countries, live in areas that will experience severe water shortage within the first quarter of the current century (Mekonnen & Hoekstra, 2016).

Increasing numbers of people live in arid areas that face absolute water poverty by 2025. These regions do not have sufficient water resources to sustain per capita food production from irrigated farming, even at high levels of irrigation efficiency. Neither will these regions be able to satisfy reasonable water needs for domestic, industrial, and environmental objectives. As a result, people in these areas have to lessen water use for farming. Moreover, they need to transfer water to other sectors, which, in turn, decreases domestic food production and leads to the importation of more food (Porkka, Gerten, Schaphoff, Siebert, & Kummu, 2016).

Millions of people face severe economic water shortage. They live in areas where the potential water resources are sufficient to satisfy reasonable water needs until 2025, but in order to do provide sufficient water beyond this point they have to start on significant water development projects – at large cost and possibly doing severe environmental damage – to achieve this goal (Mekonnen & Hoekstra, 2016).

Dramatic tragedies behind water shortage range from the need to carry heavy containers of water several kilometers every day to satisfy households needs e.g., in Africa and India, through to the destitution of farmers who lose their agricultural land because of lack of enough irrigation water to flush salts from the soil, to the loss of wetlands and estuaries because of upstream water overuse (Haddeland et al., 2014).

Water scarcity results in reduced water quality and contamination and has an especially negative impact on the poor. Many, probably most in the poorest societies in developing countries, are forced to drink water that is unsuitable for human consumption. They suffer from skin diseases and sanitary illnesses because of contaminated water used for bathing and a lack of adequate water for washing. However, experts in the field agree that the quantity of water is even more significant than the quality of water in terms of its impacts on public human health (Moe & Rheingans, 2006). Poor water management also worsens human health conditions in addition to increasing ailment vectors that are the scourge of the poor (Moe & Rheingans, 2006).

Perhaps the single most significant impact of water on poor people relates to the production of the types of food consumed by the poor. People below the poverty line in Asia spend around 60% of their total income on cereals (which provide over 72% of their total nutrients) (Seckler, Barker, & Amarasinghe, 1999). It has been projected that over 80% of the total increase in cereal production in Asia since the 1960s has been from irrigated agriculture (Seckler, Barker, & Amarasinghe, 1999).

The single most serious problem in the whole field of water resources management is the problem of groundwater overuse. Many of the most crowded countries of the world – China, India, Pakistan, Mexico, and nearly all of the countries of the Middle East and North Africa – have literally been having a free ride over the past three decades by overusing their groundwater resources. The sanction of mismanagement of this valuable resource is now coming due, and it is no overstatement to say that the results could be painful for these countries, and, given their importance, for the world as a whole (Mekonnen & Hoekstra, 2016).

The groundwater problem has two sides. First, there is a rapid reduction of groundwater primarily due to the worldwide explosion in the use of aquifers and pumps for irrigation and for domestic and industrial water supplies. Second, there is the opposite problem of rising water tables of saline and sodic water and the contamination of groundwater by these and other polluting industrial elements (Seckler et al., 1999).

The first problem that of decline, is a result of the development and rapid spread of small pumps throughout the world. India, for instance, has more that land is irrigated by pumps, yet the extraction of water from wells in India exceeds recharge by a factor of two or more. Thus, almost everywhere in India, groundwater levels decline by 1-3 meters per year. Rivers and lakes dry up as the groundwater recedes and the problem is compounded (Seckler et al., 1999).

The opposite problem that of rising contaminated water tables, is also a severe problem in many regions. At a countrywide level, Pakistan is probably the country most severely affected by saline water tables. Lack of soil leaching using freshwater from the farming areas increases the level of salinity in its soils. Therefore, as salinity and other contaminants enter a river upstream, the downstream users become gradually affected by contamination. Soil fertility and crop productivity

reduce and water becomes undrinkable (Seckler et al., 1999). Another problem is that, as contaminated water table rise, inadequately treated wastewater filters down into the groundwater from discharging cisterns and other wastewater treatment plants so increases the level of pollution (Chen et al., 2018).

4.2.1 Freshwater scarcity and human health

By 2025, the world's population will be over 8 billion people (The World Counts, 2018). In 2010, 1.8 billion people used unsafe water, and 1.2 billion used water from sources or systems with significant sanitary risks (Onda, LoBuglio, & Bartram, 2012b). As a result, water- and sanitation-related illnesses are widespread (Bartram et al., 2015) and nearly 250 million cases of affected people are reported annually, with more than 3 million deaths per annum or about 10,000 people per day. Diarrheal ailments affect children most severely, killing more than 2 million children per annum in emerging countries. Many children are left malnourished, stunted mentally and physically, susceptible to other fatal illnesses, and too debilitated to go to school (Van-Damme, 2001).

The majority of the world's population who live without access to an upgraded water supply or sanitation services are to be found in Asia and Africa. Two-thirds of people without access to enhanced water supply and more than three-quarters of those without access to upgraded sanitation live in Asia (Van-Damme, 2001). The Middle East and North Africa is the most water-scarce area in the planet. The area has only 1.4% of the world's renewable freshwater. As population pressures in the area rises, the demand for water resources will increase (Postel, 2014).

Public health authorities are largely concerned with the growing deterioration of water quality due to industrial, agricultural, and municipal waste and the deficient investments in domestic water supply infrastructure (Van-der-Hoek, 2001; Vörösmarty et al., 2010). This international concern for freshwater quality mirrors the high standards imposed on drinking-water quality by institutions and specialists in the developed countries, where the quality of potable water ranks above all and where the direct use of surface water from irrigation systems for drinking appears intolerable (Kumar, Singh, Chaminda, Van-Quan, & Kuroda, 2014).

Gray (2008) explains that poor surface-water quality is due principally to the disposal of untreated effluent from urban regions into rivers, canals, and lakes. An

alternative is to recycle wastewater for irrigation, an ancient practice being revisited because of increasing water scarcity. Effluent can be seen as a resource with high potential for reuse in irrigation and as one which offers a chance for growing food security in rapidly increasing urban regions (Gray, 2008). Definite environmental and economic benefits result from reuse that first, averts direct contamination of rivers, canals, and other surface water resources and second, disposes of domestic effluent in a low-cost sanitary way, and finally, provides a reliable water supply for irrigation. However, reusing waste water for irrigation carries a number of drawbacks that cannot be ignored: first, human health hazards for the farmers and communities that are in continued contact with effluent (Vicheth, & Dalsgaard, 2005); second, human health dangers for the consumers of vegetables grown and irrigated with untreated wastewater; third, the pollution of aquifers with nitrates; fourth, the build-up of heavy metals and other chemical contaminants in the agricultural soil; fifth, the creation of environments for flies, mosquitoes, and other disease carriers; and, final, possible limiting of marketing options (particularly for export) of farming yield (Van-der-Hoek, 2001).

In order to preserve the health of farmers and consumers, the World Health Organization (WHO) has formulated international guidelines on effluent reuse in farming. The guidelines establish the number of faecal coliform bacteria and worm eggs permitted for unrestricted agriculture (World Health Organization, 2004). If untreated effluent is discharged into surface-water bodies, much larger populations of downstream water consumers could be prone to less certain health hazards (Tyagi, Kazmi, & Chopra, 2008; Li, Wang, Allinson, Li, & Xiong, 2009; Kalavrouziotis et al., 2015). This possibility is especially relevant for arid and semiarid regions such as Pakistan and Mexico where irrigation canals are often the only exposed water bodies. These irrigation canals receive untreated effluent from large municipalities and they are exploited for washing, bathing, and even drinking (Van-der-Hoek, 2001). As Haddadin (2001) points out, outbreaks of cholera in the Middle East have been shown to be caused by the inadequacy of water supplies and the absence of proper treatment of effluent used for agriculture. For instance, Syria, Jordan, and Israel witnessed the occurrence of this infectious disease in the 1970s. The results were a modest death toll, human suffering, and sickness.

4.2.2 Freshwater scarcity and policy

Throughout Central Asia, institutional reform has become important to the objectives of decentralisation and encouragement of private initiative. Moreover, collaborative mechanisms are required to help promote common consciousness and shared action across the various political, economic, and cultural philosophies and practices that these countries embrace (Van-Damme, 2001; Rose-Ackerman & Palifka, 2016).

Conventional policies that treat the drinking-water supply disjointedly from water used for other objectives have limitations. Many water-quality problems and potential resolutions come from the interactions among users, especially between domestic users and agriculture users (Van-der-Hoek, 2001).

Government policy documents on integrated water resources management give the highest priority to the drinking-water supply in water-allocation decisions (Kumar et al., 2014). Rural drinking water may not appear to be an issue because water consumed for domestic purposes constitutes only a small portion of a country's total freshwater consumption (Kumar et al., 2014). In Pakistan, water used for domestic purposes was projected at 26 cubic meters per person in 1990, compared with 1,226 cubic meters of water per person for agriculture. The notion prevails that a minor diversion from the agricultural sector could satisfy the demands of an increasing population for water for domestic purposes. However, reallocation of water among sectors can be hard and the integrated water-management approach is constrained by traditional sectoral thinking and by priorities set by professionals in different disciplines (Van-der-Hoek, 2001).

On the other hand, those who manage water for farming production believe their primary duties are to provide water to satisfy crop-water needs. Although few irrigation administrators understand supplying water for domestic purpose as their mandate, many country dwellers draw their domestic water supply from shallow drinking-water wells. Without accepting this truth, efforts to make irrigation water more adequate might harmfully affect the availability of irrigation water for nonfarming purposes. For instance, improving the quality of agricultural water contributes to increasing the quantity and quality of groundwater in shallow drinking-water wells (Kumar et al., 2014).

In some areas, the availability of shallow groundwater for drinking is a growing problem because of overuse for farming and industrial objectives (Shannon et al., 2010). In some of the chief breadbaskets of Asia, such as the Punjab in India and the North China Plain, water tables are dropping 2 to 3 meters per annum (Van-der-Hoek, 2001). Rich farmers can continue to dig deeper tube-wells with larger, more expensive pumps. However, poor farmers are not able to do so. Van-der-Hoek (2001) believes that dropping groundwater levels threaten food security.

Today, two-thirds of the sewage water produced in the world receives no adequate treatment at all (Van-der-Hoek, 2001). Not all municipalities can afford effluent treatment services. Even if the resources were available, enhanced water quality for human use is not guaranteed. Many of the existing effluent treatment plants are malfunctioning owing to local authorities often favouring high-technology solutions over more suitable, lower-cost substitutes (Van-der-Hoek, 2001).

Most conventional treatment means that the nutrients in effluent are eliminated, which decreases the economic advantages to farmers of this water (Van-der-Hoek, 2001; Drechsel, Drechsel, & Scott, 2010). Restricting the kind of crops being cultivated with untreated effluent to tree or fodder crops that pass less pollution into the food chain is another opportunity, but it is one that is difficult to enforce in many emerging countries. Crop restriction also decreases economic benefits from the use of untreated wastewater, since the vegetables most vulnerable to contamination are also the most profitable (Van-der-Hoek, 2001; Drechsel et al., 2010).

In the future, many farmers in emerging countries will continue or increase the irrigation of high-value vegetable crops with partially treated effluent. Governments may wish to regulate reuse to preserve human health and rural livelihood; however, they are unable to overcome social and institutional barriers. It is urgent, therefore, to develop a framework for assessing diverse opportunities and trade-offs, so that governments and societies can make better-informed decisions (Schwarzenbach, Egli, Hofstetter, Von Gunten, & Wehrli, 2010). The use of municipal wastewater for irrigation can also be deemed as an approach to decrease freshwater demand for agriculture, given that using municipal wastewater for irrigation is common practice in Israel, Jordan, Mexico, Ghana, and other regions.

For instance, in Zimbabwe, new small farmers irrigation regimes are being developed, and ancient ones are receiving further support that can enhance water supply and livelihoods for more farmers (Schwarzenbach et al., 2010). However, farmers must also now renegotiate water rights in the face of increasing competition for water and new water laws to promote additional integrated water resources management. While there is still the possibility of enhancing livelihoods in agriculture, emerging competition for water will drive water consumers to defend and negotiate their water rights when their livelihoods and well-beings are endangered.

4.2.3 Freshwater scarcity and social well-being

Water is the most important factor in rural livelihoods, because of the food security and income opportunities it produces in rainfed and irrigated crop cultivation, fishing, livestock farming, and tourism (Nathanson, 2018). Safe water and proper sanitation services also contribute to improving human health through the drinking water supply, safe food preparation, hygiene, better diet, and recreation. Environmental security relies on people's behaviours in terms of controlling salinity, drainage, and water contamination, managing droughts, and managing land and water to protect those resources (Vincent, 2001).

Unless further action that pays attention to the role freshwater plays in rural livelihoods is taken, freshwater scarcity threatens to change opportunities in agricultural production, employment and exchange, and the relations among these activities in ways that will ignore the small producer (Namara et al., 2010). Freshwater scarcity increases the need for pro-poor development support (Vincent, 2001; Watkins, 2006). Sowers, Vengosh, and Weinthal (2011) confirm that water scarcity can also create severe disruption to livelihoods and well-being, particularly in rural societies. In Syria, continued drought without productive interventions has affected 1.3 million people; moreover, the loss of the 2008 yield has accelerated migration to cities and increased levels of extreme poverty. Numerous studies around the world, including, Ewert, Rounsevell, Reginster, Metzger, and Leemans (2005), and Yoo, Choi, Lee, Oh, and Yun (2013), have evaluated the potential adverse effects and consequences of water scarcity on agro-ecosystems and rural areas for the 2050-2080 period and there is a high confidence level that these adverse outcomes will eventuate. Some of these affect changes in agricultural land

use such as a shift in optimal conditions for farming, deterioration of soils, farming land abandonment and decreased crop yield.

Haddadin (2001) argues that water scarcity leads to unfavourable societal conditions that can worsen and cause political unrest. The political unrest that results from water resources scarcity is parallel to the effect that scarcity has on households in terms of basic requirements for drinking and public health. Other significant elements include having a late response to water scarcity; these elements pertain to the integrity of the environment and the deterrence these elements impart on development investment and economic credibility of the state. This late response to water scarcity, in turn, could affect the creation of new jobs, and increase unemployment, which, in turn, transmit certain social ills. Moe and Rheingans (2006) point out that worldwide water use has increased dramatically in the past few decades due to population growth and the demands of irrigated agriculture. There is increasing recognition that growing water scarcity threatens farming production, diet, human health, and political stability in many nations. Haddadin (2001) explains that, economically, all sectors of the economy experience the adverse effects of water scarcity. Water scarcity means less productivity, especially when water is a key input in the economic process. The result is less profitability and likely losses. Production drops proportionately to the reduction in water supplies. Labour requirements are lessened and farming incomes are low. More importantly, markets that are frequently reliant on supplies from producers facing water scarcity will have to change the sources of their imports to confirm the reliability of supplies (Haddadin, 2001). These producers also suffer from loss of export returns owing to the defamed reputation of farming produce. Examples of negative economic impacts on agricultural yield were seen in three successive years of drought in Israel and Jordan where up to 50% of irrigation water had been cut (Haddadin, 2001).

4.3 The Impacts of Climate Change

Worldwide food security is endangered by climate change and the most critical challenge in the 21st century is to supply enough food for the rising population while sustaining a stressed environment (Lal, 2005). Climate change has resulted in considerable effects on freshwater resources, food security, human health especially for African nations, as well as the whole world (Magadza, 2000). Studies on climate

change effects and adaptation strategies are progressively becoming chief areas of scientific concern with research into, for example, effects on the production of crops such as wheat, maize, and rice (Howden & O'Leary, 1997), freshwater resources in the river basin catchments (Chang, Knight, Staneva, & Kostov, 2002), forests (Lexer et al., 2002), industry (Harle, Howden, Hunt, & Dunlop, 2007), and the native landscape (Dockerty, Lovett, Sünnerberg, Appleton, & Parry, 2005). Crop productivity and agricultural soil water equilibrium have been studied via crop growth models that use parameters from diverse climate models (Reddy & Pachepsky, 2000). More attention is being paid to the dangers connected to climate change and these will raise uncertainty concerning food production (Reddy & Pachepsky, 2000).

Fujihara, Tanaka, Watanabe, Nagano, and Kojiri (2008) pointed out that freshwater scarcity will not arise if freshwater demand does not rise; however, if the irrigated area is extended under current irrigation efficiency rates, freshwater scarcity will occur. Therefore, it is urgent to determine the effects of climate change on crop production and water resources in order to develop likely adaptation strategies. Freshwater accessibility will be one of the limiting constraints for crop production and food security.

4.3.1 Impacts on freshwater availability

Freshwater resources play a key role in human prosperity and crop productivity. The world's farming and freshwater supplies rely on the different components of the hydrological cycle, including the natural renewal of surface water and groundwater resources (Kang, Khan, & Ma, 2009). Freshwater availability issues include how much freshwater can be diverted when the freshwater can be accessed and how much freshwater can be stored in surface and groundwater basins. Assessment of seasonal and long-term freshwater accessibility is not only significant for sustaining human life, biodiversity, and the ecosystem; assessment also plays a role for water authorities and farmers in that it supports their ability to determine farming water management and water allocation. Climate change is a considerable pressure on the hydrological cycle, along with population growth, contamination, land use variations, and other factors (Aerts & Droogers, 2004). In light of the doubts over climate changeability, water demand and socioeconomic, environmental impacts, procedures are urgently needed to use the limited supplies

of freshwater efficiently and to develop some new water resources (Kang et al., 2009).

Many studies such as Guo, Wang, Xiong, Ying, and Li (2002) and Ma, Kang, Zhang, Tong, and Su (2008) have taken into account climate change effects on streamflow as well as spatial distribution of freshwater accessibility under diverse climate conditions across the world. Guo et al. (2002) studied climate change effects on the runoff and freshwater resources in China and pointed out that runoff is more vulnerable to rainfall variation than to temperature increase and that integrated water resources management can help to alleviate climate change. Ma et al. (2008) discussed climate changeability impacts on yearly streamflow in the Shiyang River northwest of China and the results show that owing to the reduced rainfall climate change can lessen 64% of mean annual streamflow; meanwhile, rainfall is more sensitive to the catchment streamflow than to evapotranspiration. Fujihara et al. (2008) analysed the freshwater resources under current and future climate change scenarios in the Seyhan River Basin; they concluded that freshwater scarcity will occur when freshwater requirements rise, e.g., due to the expansion of agriculture; therefore, well-organised water resources use is important in managing future water resource situations. Wurbs, Muttiah, and Felden (2005) provided a freshwater accessibility modelling system to evaluate the freshwater supply capabilities and explore the climate effects on hydrology and freshwater availability for water users. The study's main results are that future climate may reduce the mean streamflow and that its impacts on freshwater availability are various in diverse areas of the Brazos River Basin in Texas.

Climate change impacts on freshwater resources in diverse river basins vary. The frequency of droughts will rise under future climate change conditions. Runoff and streamflow are more sensitive to precipitation than possible evapotranspiration. Well-organised freshwater use and integrated water resources management will be progressively important for reducing the effects of freshwater scarcity and frequent droughts (Kang et al., 2009). These strategies also help to improve crop water productivity.

4.3.2 Impacts on crop water productivity

In the 21st century, global farming has faced a new challenge, namely to augment food production for the Earth's increasing population under increasingly scarce

water resources (Bouman, 2007). This challenge can be met by enhancing crop water productivity (Kijne, Barker, & Molden, 2003; Oweis & Hachum, 2003; Molden et al., 2010). Water productivity is a notion to express the value or benefit derived from the use of water and comprises important facets of water management such as production for arid and semiarid areas (Singh, Van-Dam, & Feddes, 2006). Improving water productivity means either to produce the same production with fewer water resources or to obtain higher crop yields with the same amount of water resources (Zwart & Bastiaanssen, 2004). While Bouman (2007) recommended that just 'improving water productivity' may not resolve the dual challenge, so it is essential to understand the latent mechanism of improved water productivity. Existing studies suggest that climate is the single most significant determinant of farming productivity, principally through its impacts on temperature and water systems (Oram, 1989). Climate change effects on crop water productivity are affected by many uncertain determinants (Carter, 1999), amongst which are agricultural soil features such as soil water storage (Eitzinger et al., 2001), the long-term condition of farming soil fertility (Sirotenko, Abashina, & Pavlova, 1995), climate variables, and improved atmospheric CO₂ concentrations (Amthor, 2001). All of these elements will affect the estimation of climate change effects on crop productivity.

Van-de-Geijn and Goudriaan (1996) found that climate change impacts on crop growth can be adjusted by effective agricultural procedures like increasing the depth at which seeds are planted and by changing to the amount of fertiliser that is used; meanwhile, these procedures can increase water productivity by 20%-40%. Howden and Jones (2004) found that altering planting dates and varieties are good measures to improve crop benefit. Gunasekera, Kim, Tulloh, and Ford (2007) reported that the key farming income of commercial productions in Australia would decrease 9%-10% by 2030 and 13%-19% by 2050. Meanwhile, it is urgent to sustain high productivity and supply some new adaptations and alleviation technologies to deal with potential climate effects. Kijne et al. (2003) reported that water productivity could be increased by improving investments in farming infrastructure and research rather than rising investments in irrigation network systems. Khan, Hafeez, Rana, and Mushtaq (2008) examined the application of a thorough systematic approach of water accounting using remote sensing and geographical information system (GIS) and groundwater modelling to assess water-

saving choices by tracking nonbeneficial evaporation in China. The lumped water balance analysis of 1988–1990 demonstrated that the most substantial unaccounted flows are through fallow evaporation and can be in the range of 50%. There is, therefore, an urgent necessity to enhance crop water productivity by decreasing evaporation from fallow land. However, decreasing evaporation is only possible after the determination of fallow land through land use categorisation and then verification of fallow evaporation figures through developed tools like remote sensing, which provide a more realistic estimation of evapotranspiration ET in a spatiotemporal distributed format. Li and Barker (2004) found that the alternate wetting and drying irrigation technique could improve water productivity for paddy irrigation in the People's Republic of China.

Freshwater productivity concerned with water-saving irrigation is reliant on the aquifer level and evapotranspiration (Govindarajan, Ambujam, & Karunakaran, 2008). For farmers and experts, crop water productivity is a significant index for appraising water saving and water investments. Meanwhile, it is inversely associated with vapour pressure (Zwart & Bastiaanssen, 2004). Crop water productivity can be improved significantly if irrigation is diminished and the crop water shortage is broadly induced. Climate change will affect temperature and precipitation. In the reduced rainfall regions, the irrigation amount will rise for optimal crop growth and production, but this rise may reduce crop water productivity. Therefore, it will be a considerable challenge to improve crop water productivity at all levels (Kijne et al., 2003). In the case of reduced precipitation, farmers will be forced to depend mostly on treated wastewater. This dependence may increase the salinity of farming soil, which reduces its quality.

4.3.3 Impacts on farming soil

Farming soil water equilibrium¹⁰ is significant for water management and water use strategy (Meehl et al., 2007; Kang et al., 2009). Climate change will make temperatures and rainfall fluctuate and, as a result, influence farming soil evaporation and plant transpiration. Meehl et al. (2007) projected that mean annual rainfall will improve in the tropical areas and at high northern latitudes and decline in the subtropics. Meanwhile, rainfall may improve in one season, while it may

¹⁰ It is the flow of water in and out of a system. A system can be one of several hydrological domains, such as a column of soil or a drainage basin.

decline in another. Over most parts of the Earth, the mean annual runoff will rise; however, there are still some significant regions where runoff will decrease such as Middle East, Europe, Central America, Northern Africa, Southern Africa, major parts of Southern and Western Australia and different regions of South America. All of these decreases in runoff may impact on the regional agricultural soil water balance under different climatic conditions (Meehl et al., 2007).

Farming soil water balance is a reliable way to compute crop water requirements and water use effectiveness. Fischer, Tubiello, Van-Velthuisen, and Wiberg (2007) analysed the climate change effects on irrigation requirements according to daily water equilibrium and concluded that alleviated climate can lessen effects on farming water requirements by about 40% in comparison to unalleviated climate. De Silva, Weatherhead, Knox, and Rodriguez-Diaz (2007) studied climate change effects on irrigation water requirements and the water equilibrium of paddy rice for the 2050s in two diverse climate scenarios in Sri Lanka and they concluded that average paddy irrigation requirements will rise by 23% and 13% respectively. Eitzinger, Štastná, Žalud, and Dubrovský (2003) assessed climate change effects on farming soil water equilibrium under four climate scenarios, and the results show that the factors which affect the farming soil water equilibrium also have impacts on sustainable crop production and water resources in farming. De Silva et al. (2007) reported that, although applying higher levels of irrigation can result in advanced yields, farmers sometimes need to stop using higher levels of flooding, especially in the case of heavy soil, as the practice leads to high runoff.

Climate change effects on agricultural water equilibrium will present changes in farming soil water storage, aquifer level, and soil humidity status; in addition, they can provide some information about irrigation quantity. The water equilibrium will vary with rainfall and evapotranspiration and the resultant fluctuations in farming soil moisture status (De Silva et al., 2007).

States such as China (Postel, 2014) and Jordan (Sowers et al., 2011) that suffer from freshwater scarcity rely on treated effluent as a substitute source of water for irrigation. Kruse & Barrett (1985) illustrate that effluent irrigation may result in the transport of heavy metals to fertile agricultural soils that affect farming soil flora and fauna and may lead to crop pollution. Some of these heavy metals may bio-accumulate in the farming soil, while others such as cadmium and copper may be

redistributed by agricultural soil fauna such as earthworms (Kruse & Barrett, 1985). Heavy metals from industrial wastewater have polluted the farming lands around the People Victory Canal in China. Dangerous health effects have obliged the farmers to abandon their farming lands, with consequences for the livelihoods, food security and well-being of the local societies (Hanjra, Blackwell, Carr, Zhang, Jackson, 2012). Moreover, treated wastewater irrigation can add extra salts and nutrients to the farming soil and these have the potential to impact on aquifer quality through leaching below the root zone. The extreme effect relies on a host of determinants, including depth of water table, quality of aquifer, farming soil drainage, hydraulic conductivity, the scale of effluent irrigation, magnitude of freshwater used with treated wastewater, and agricultural practices (Khan & Hanjra, 2008). Intensified use of treated wastewater changes the chemical structure of the soil, which causes reduced quality of agricultural land, and may lessen crop yield.

4.3.4 Impacts on crop yield

The variations in crop production-related climatic variables will perhaps have key effects on regional as well as worldwide food production (Abraha & Savage, 2006). Abraha & Savage (2006) illustrate that the possible effects of climate change on crop yield can be determined either by experimental data or by crop growth simulation models. Studies about wheat production influenced by climate change are primarily concerned with future CO₂ levels. Ortiz et al. (2008) discussed how wheat can adapt to climate change in the Indo-Gangetic Plains for the 2050s and proposed that worldwide warming may decrease productivity in critical temperature regions; it is, therefore, urgent to develop some heat-tolerant wheat germplasm to alleviate climate variability. Anwar, O'Leary, McNeil, Hossain, and Nelson (2007) investigated expected climate change effects on wheat yield in southeastern Australia, and their results show that increased CO₂ level can decrease the median wheat yield by about 25%. Luo, Williams, Bellotti, and Bryan (2003) discussed climate change effects on wheat production under all CO₂ levels in Southern Australia for the 2080s; the study's results indicate that it is possible that the wheat produced will be of lower quality. Soler, Sentelhas, and Hoogenboom (2007) analysed the effects of planting dates and diverse weather on maize yield in Brazil; this study shows that a later planting date will reduce average yield by 55% under rainfed conditions and by 21% under irrigated conditions. Popova and Kercheva (2005) analysed the maize production under precise irrigation and deficit irrigation

for a three decade-period in Sofia Bulgaria. Their research demonstrates that average productivity under the dry growing season will be 60% less than that under a sufficient farming soil humidity condition. Akpalu, Hassan, and Ringler (2008) studied the climate effects on maize yield in the Limpopo Basin of South Africa and showed not only that increased temperature and precipitation are positive for the crop yield, but also that the rainfall is more significant for crop yield than the temperature. Parry, Rosenzweig, Iglesias, Fischer, and Livermore (1999) projected climate potential variabilities in the main grain cereals and soybean crop yield. They found that climate variability will reduce yields at lower latitudes.

Climate change effects on crop yield are diverse in various regions. The crop yield can be improved with irrigation application and rainfall increase during the crop's growth; meanwhile, crop yield is more vulnerable to rainfall than to temperature levels. If freshwater accessibility is diminished in the future, agricultural soil of high-water-holding capacity will be better to lessen the effects of frequent drought and enhance the crop production (Popova & Kercheva, 2005). With climate variability, the growing period for crops will diminish and the planting date of crops will need to be modified to achieve higher crop production. Climate change can also lessen the crop rotation period, so farmers need to take into account crop varieties, crop densities, sowing dates, and fertilisation levels when planting crops (Cuculeanu, Tuinea, & Bălteanu, 2002).

The positive impacts of climate variability on farming are concerned with the increase in levels of CO₂, crop growth increases in higher latitudes and montane ecosystems. The negative impacts include the increased incidence of pests and ailments and farming soil degradation owing to temperature change (Lal, 2005). These issues have induced experts to develop more crop varieties suitable for the altering climate and degrading agricultural soil in order to obtain satisfactory yield for the growing population (Kang et al., 2009).

Freshwater scarcity because of climate change may result in using treated sewage water as a substitute source for irrigation water. Improved irrigation infrastructure is vital for enhanced performance of irrigation systems. Dysfunctional infrastructure can decrease the availability and reliability of freshwater supplies, leading to crop yield and income loss. Off-farm irrigation canals, supply channels, and irrigation systems may be clogged due to the practice of disposing of waste

materials into the rivers, side valleys, and channels, which, in turn, leads to reduced crop productivity (Hanjra et al., 2012). The resultant reduction in crop yield, thus threatens food security.

4.3.5 Impacts on food security

Food security is defined by the Food and Agriculture Organisation (2002) as a “situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. The definition involves four facets of food security, namely food availability, food accessibility, food stability, and food utilisation (Schmidhuber & Tubiello, 2007). However, the existing studies have concentrated on climate change on food availability and scarcely refer to the effects of the potential rise in climate change and frequency and intensity of extreme events on food security. Bruinsma (2002) mentioned that biotechnology could be a strategy to recover and advance food security and decrease environmental pressure. Meanwhile, modified crop varieties, waterlogging, resisting drought, salinity, and extreme climate can increase the crop planting area such as in the agricultural degraded soils and, as a result, increase food accessibility in the future.

Climate change will affect food quality because of growing temperatures and declining crop growth period. Droogers (2004) analysed climate change effects on food security and concluded that in order to raise total grain production, there is a need to extend the crop area, otherwise, food security will decline. Alcamo, Dronin, Endejan, Golubev, and Kirilenko (2007) evaluated current and future climate scenario effects on food security and water accessibility in 2020 and the 2070s and provided some measures to increase potential crop production such as diversifying crops and extending the rainfed and irrigated farming areas. Droogers and Aerts (2005) analysed climate change effects on food quantity and security and pointed out that augmenting crop areas can enhance food quantity but will decrease food security, while dropping water allocation for irrigation and reducing the crop area can enhance ecological quantity and security. Luo et al. (2003) discovered the potential impacts of climate change on South Australian wheat by testing diverse CO₂ concentration levels. Their results showed that climate change could worsen the wheat’s quality at drier regions. Khan, Hanjra, and Mu (2009) reviewed water management and crop production in relation to food security in China. Their study

indicated that there is a need to integrate the elements of climate, food, energy, environment, and population when discussing future food security in China and globally because climate change is one of the significant factors water managers take into account.

Food security is becoming progressively significant for human beings all over the world. Food accessibility and food quality are still considerable challenges for experts due to changing climate. Food security is always studied in relation to CO₂ concentration effects under changing climate scenarios (Kang et al., 2009).

The increase in precipitation will raise crop yield. Crop yield is more sensitive to rainfall than to temperature. If water availability is decreased in the future, soils of high-water holding capacity will be better able to lessen the impact of climate change while sustaining crop yield. If irrigated regions are expanded, total crop production will grow; however, food and environmental quality may degrade. In this case, the need for water accounting system becomes urgent.

Many sectors and systems (e.g., water supply, sanitation, agriculture, human health, industry, and tourism) are dependent on water resources and their availability, so that changes in hydrological regimes and water quality due to climate change will have socioeconomic impacts. These climate-driven hydrological changes will combine with other pressures on water resources such as population growth, land-use change, urbanisation, changes in life styles, increasing water demand, and environmental pollution to challenge water management in the 21st century. This challenge creates the need for effective water management and sophisticated water accounting systems.

4.4 Water Accounting

Water accounting is a programme of organising and showing information relating to the physical sizes of water in the environment and economy as well as the economic sides of water supply and use (Vardon, 2007). Freshwater scarcity is not only limited to some parts of the world, but can impact economic, environmental, and social sustainability worldwide (Ahmad, Tower, Plummer, & Aripin, 2010). In addressing the matter through policy and management, significant stakeholders such as governments, NGOs, environmentalists, corporations, and the public recognise the importance of high-quality information. They also recognise the

necessity for this information to be reported systematically to confirm that it is related, reliable, comparable over time and across entities, and comprehensible (Muller, 2012). Water scarcity has many consequences, and it is possible that these consequences can be treated by diverse reporting approaches called water accounting systems (Vardon, Lenzen, Peevor, & Creaser, 2007). Various programmes of water accounting can play a part in conflict alleviation and dispute settlement within and across state and national boundaries and across time (Ahmad et al., 2010).

At the extreme, this alleviation refers to alleviation and settlement of what some would argue are the most significant pressures to national and world-wide security – water wars (Kliot, 2005). If the same rigorous method to identifying, measuring and reporting freshwater balances and trans-borders flow, rights to freshwater, and commitments to deliver freshwater is adopted and understood by parties involved in transactions that have potential to create conflict, the common understanding decreases information asymmetry (Slattery, Chalmers, & Godfrey, 2012). In turn, this rigorous method generates clarity about the exercise of property rights as well as about societal and equity effects of water movement and transaction. This method will also provide information to simplify longer-term water management decision-making for present and future generations' access to this scarce asset. Universally, a range of approaches to recording or reporting water information can be named 'water accounting' (Slattery et al., 2012). Coupled with benefits of water accounting in addressing water conflicts, water accounting in the form of data plays a crucial role in improving economic sectors such as agriculture, which in turn, enhances livelihoods.

Water accounting is applied in order to improve water productivity (Molden & Sakthivadivel, 1999). Agriculture and beverage companies are large consumers of water (Kijne et al., 2003; Molden et al., 2010; Perry, 2011). Namara et al. (2010) argue that improved water productivity is accomplished through interventions to enhance agricultural water management. This approach can contribute to poverty reduction through several pathways. First, access to reliable irrigation water raises crop production, improves agricultural investments and employment chances, and stabilises income and consumption. Second, water accounting boosts the utilisation of other yield-enhancing inputs and permits diversification into high-value products such as agricultural production with no crop restrictions, improves nonfarm outputs

and employment, and achieves multiple needs of households. Third, it may contribute positively to diet, human health, social equity, human well-being and environment (Namara et al., 2010).

Environmental concerns and accounting for water are inseparably linked and so water accounting needs to be “a method of organising and presenting information relating to the physical volumes of water in the environment and economy as well as the economic aspects of water supply and use” (Vardon et al., 2007 p. 650). In other words, water accounting concentrates on the valuation and the provision of comprehensive information about water supply, demand, and water productivity. More detailed water accounts will provide extra information on socioeconomic facets of water supply and demand such as the costs of supply and tariffs charged and employment generated (Lange, Mungatana, & Hassan, 2007).

4.4.1 Water accounting in Australia

Water is of significance to all facets of life, society, and our natural environment. The accelerated growth in worldwide population over the last century, joined with intense economic development, is resulting in unprecedented pressure on this valuable asset. The present world population of 6.7 billion is anticipated to rise to 9 billion by 2050, but even in a country like Australia with small population growth, there is considerable pressure on the water supply (Ahmad et al., 2010).

Water is hardly scarce given the Earth is mostly covered with water and Australia, the island continent, is surrounded by water. It is the composition of the water that is problematic, as 97.5% is saline and only 2.5% freshwater. Of that, only a fraction is usable freshwater for ecosystems and human consumption, since approximately 70% of the world’s freshwater resource is locked in glaciers and icebergs rendering it inaccessible for human use (Ahmad et al., 2010). Furthermore, in Australia, much of the land-based water is salty; moreover, ancient aquifers resources such as the Yarragadee are also mostly inaccessible as renewal is limited and large-scale withdrawal may lead to ecological regression (Tremayne, 2010).

As mentioned earlier, scarcity and use of freshwater are a worldwide concern. Physical water scarcity is a calamitous reality and poses a threat to economic development and human well-being. The apparently persistent conduct of human activity to embrace development and advancement continuously in our increasingly

technocratic-industrial societies is powering the demand for this vital resource (Rose et al., 2012).

Water management requires balancing a set of economic interests, environmental concerns, and social matters (Holbrook, 2009). Each party has a duty to confirm that each drop is being managed professionally and allocated efficiently in a way that is environmentally sustainable. Sustainability, the favourite aim of development and environmental management (Brown, Hanson, Liverman, & Merideth, 1987), is normally defined as “meeting the needs of the present without compromising the ability of future generations to meet their needs” (World Commission on Environment and Development, 1987, p. 43). Developed nations, e.g., the USA, the UK and Australia have made a lot of progress in this field, while emerging nations such as Jordan and the United Arab Emirates (UAE) are still in the early stages of doing so (Jahamani, 2003). With regard to sustainable water resources management, the objective is to sustain freshwater resources accessible for future generations without threatening their quality in the long term (Mudd, 2008).

In Jordan, a semiarid country, the Ministry of Water and Irrigation is responsible for water management and it provides data concerning water exploitation, water supply, and demand for various sectors. By monitoring pilot wells, the ministry can evaluate the quantity of water and the variations in quantity, in each groundwater layer. This information then allows for an assessment of what quantity of water has been exploited and how much water has infiltrated into aquifers over a calendar year. In general, most freshwater used for domestic purposes is abstracted by the public sector (Raddad, 2005). Gleick (1998) suggests that sustainable use of freshwater should be an integral part of long-term water planning, as without it human and ecological survival are seriously jeopardised.

The basis of water sustainability includes the conservation of the desired flow of benefits to a certain group or place indefinitely (Du Preez, 2017). In other words, sustainability includes the conservation of benefits, which contain the stock and flow of water to present users, without lessening the benefits to future users. Australia is one of the most arid nations, yet it has one of the world’s highest per capita uses of water (Ahmad et al., 2010). In Australia, this resource is scarce when compared to other countries. Many regions have low average precipitation and there

have been high and growing levels of drought especially over the 2000s (Ahmad et al., 2010).

Obviously, well-organised management of water resources is urgently required to ensure sustainable utilisation of this valuable and nonsubstitutable asset. As a result, thorough accounting with strong communication and better measurement for water is certainly a prerequisite (Ahmad et al., 2010).

The Australian Bureau of Meteorology has a strong mandate to make the 'National Water Account' (Signori & Bodino, 2013). The goal is to help meet the information requirements of various stakeholders and enhance the public understanding of water resources in Australia (Godfrey & Chalmers, 2012). The question is how best to achieve this goal. An autonomous advisory Water Accounting Standards Board was formed to oversee the development of the Water Accounting Conceptual Framework and water accounting standards. The Water Accounting Conceptual Framework provides the conceptual parameters for water accounting and help in the development of Australian Water Accounting Standards as well as the preparation and presentation of General-Purpose Water Accounting Reports (Godfrey & Chalmers, 2012).

In contrast to other worldwide developments, General-Purpose Water Accounting Reports concentrate on the supervision and measurement of and reporting about water rather than providing statistics about water (Slattery et al., 2012). Australian Water Accounting Standards set out the minimum reporting requirements (Ahmad et al., 2010). The Water Accounting Standards Board's (2009) documents reveal that the Water Accounting Conceptual Framework principally reflects the International Accounting Standards Board's (2001) framework for 'normal' accounting (Ahmad et al., 2010). The 'framework' document has eight separate statements ranging from definitions to qualitative characteristics, recognition, compliance, and assurance (Signori & Bodino, 2013). For example, there is a considerable emphasis on recognition of core accounting-looking financial statements.

In general, it is mandatory for water-reporting entities to report volumetric information on both a 'physical flow' basis and an 'accrual' basis. The former is reported in the Statement of Physical Water Flows, and the latter is reported in the

Statement of Water Assets and Water Liabilities (equivalent to the balance sheet in financial reporting) and the Statement of Changes in Water Assets and Water Liabilities (similar to the profit and loss statement) (Ahmad et al., 2010).

In the Statement of Water Assets and Water Liabilities, the assets record the quantity of water held in basins and the water stored in aquifers, while the liabilities document the allocation of the accessible water to diverse user sets (Lowe, 2008). Meanwhile, 'equity' represents the magnitude of water that is not allocated for any specific use (Lowe, 2008). The Statement of Changes in Water Assets and Water Liabilities is a summary of all inflows and outflows during the reporting period. Water inflows consist of rainfall on the catchment, while outflows include water use, evaporation, and seepage into underground (Ahmad et al., 2010).

The Water Accounting Standards Board framework states that the principal unit of account is water rather than money and obviously calls for the provision of both physical flow and accrual accounting reports. The Water Accounting Standards Board's (2009) innovations stop there, as none of direct reporting is concerned with the price, estimate, or quality of water. Over time, the recognition and reliable measurement of water would be reliant on the cost of items in monetary value. As recommended by Godfrey and Chalmers (2012), the development of water accounting Australian context may possibly have some effects on policy-making in the national and worldwide arenas. They also argue that the integrated skills of water and financial accounting specialists could provide better water accounting standards. Finally, Lowe (2008) advocates that financial accountants should play a key role in managing Australia's water resources by applying numerous methods such as depreciation, provisions, and contingences in water accounting.

4.4.1.1 General purpose water accounting

General-Purpose Water Accounting draws upon the internationally accepted approach to general-purpose financial reporting (Chalmers, Godfrey, & Potter, 2012). It is a system of water accounting that sets as its primary aim the provision of information useful to users, both external and internal, for making and assessing decisions about the allocation of resources (Water Accounting Standards Board, 2009). The origin of the system is the National Water Initiative (Council of Australian Governments, 2004) which initiated a range of reforms in the Australian water industry. An intergovernmental treaty on the plan for the management of

Australia's water, the National Water Initiative, established the foundation for water accounting standards setting in Australia (Chalmers et al., 2012). A significant assumption underpinning the National Water Initiative is that high-quality information is vital to enable well-built decision-making relating to water management (Signori & Bodino, 2013). Consistent with this assumption, a significant recommendation in the National Water Initiative is to develop water accounting to:

guarantee that suitable measurement, monitoring and reporting systems are in place in all authorities, to backup public and investor confidence in the quantity of water being traded, extracted for consumptive purpose, and recovered and managed for ecological and other public benefit outcomes. (Council of Australian Governments, 2004, p. 80)

As part of the reform procedure, the Australian Commonwealth Department of Agriculture, Forestry and Fisheries engaged Sinclair Knight Merz (SKM)¹¹ to do a stock take of Australia's water accounting practices (Sinclair Knight Merz, 2006). The report's recommendations comprised founding water accounting as a discipline and came at a time when the conditions were conducive to its acceptance (Signori & Bodino, 2013).

The Sinclair Knight Merz report obviously acknowledged the necessity for intellectual infrastructure in developing the discipline and realised the role that accountants could perform in developing a system of water accounting and building capacity to keep its development and application going (Chalmers et al., 2012). As noted in the Sinclair Knight Merz report: "...in particular an infusion of qualified accountants and the integration of their skills and perspectives with water industry practitioners and policy formulators" (Sinclair Knight Merz, 2006, p. 5) was required.

It seems that the recommendations in the report were significant, not only for asserting the necessity for change, but also for the involvement of professional accountants (Signori & Bodino, 2013). Actioning Sinclair Knight Merz's recommendations, the National Water Commission founded a Water Accounting Development Committee to develop water accounting standards. At its inception, the committee included expertise from government, academic, and industry sectors

¹¹ SKM is an international firm with global capability in strategic consulting, design, and delivery.

and drew upon disciplines related to water management, water policy and financial accounting (Chalmers et al., 2012).

As such, water accounting standards setting in Australia began formally in 2007 with the establishment of the Water Accounting Development Committee. Early on, the Water Accounting Development Committee commissioned or otherwise contributed to a number of related schemes which comprised a study of the information necessities of current and potential users of water accounting reports (Signori & Bodino, 2013). Several contributors to, and members of, the original Water Accounting Development Committee also realised commonalities between the National Water Initiative aim and the decision-usefulness aim underpinning various versions of the financial reporting conceptual framework. Consequently, the National Water Commission also commissioned financial accounting academics to draft a conceptual framework for General-Purpose Water Accounting (Chalmers et al., 2012). That conceptual framework was accepted by the Water Accounting Standards Board which succeeded the Water Accounting Development Committee in 2009. The financial accounting-aligned water accounting conceptual framework now constitutes the architecture for the development of water accounting standards in Australia (Signori & Bodino, 2013).

Relative to other systems of water accounting that have arisen over the last decades, the distinguishing feature of General-Purpose Water Accounting is the concentration on providing information that is useful to stakeholders who otherwise could not command the information for making-decisions concerning the allocation of resources (Ahmad et al., 2010). These resource allocation decisions comprise, but are not limited to, valuations of accountability for water management and the consequent allocation of environmental, social or economic resources (Water Accounting Standards Board, 2009).

When there was a perceived necessity for a more thorough water accounting approach providing a strong information base for water-related decisions by various stakeholders as well as policymakers and water markets, General-Purpose Water Accounting provided a seemingly evident solution (Slattery et al., 2012). After all, at its most fundamental level, accounting is an information system, a strict means of capturing considerable numbers of transactions involving scarce resources and reporting those transactions in significant ways. Building on the accounting system, General-Purpose Water Accounting is designed to be a strict means of capturing

many water-related transactions (e.g., sales of water), transformations (e.g., evaporation) and events (e.g., drought, flooding) and reporting them in meaningful ways (Chalmers et al., 2012).

It should be noted that General-Purpose Water Accounting developments concentrate on recording and reporting in units of volume (e.g., mega-litres), rather than in monetary terms (Chalmers et al., 2012). This approach is an evident indication that the Water Accounting Standards Board is aware of improving the recording and reporting of information concerning water, while at the same time sidestepping the potential adverse consequences that can emerge when accountability and performance are redefined in financial terms for the first time (Young, 1996). Nevertheless, with prevalent support for the development of a general-purpose approach, much work has since concentrated on the issue of implementation in terms of the development and a joint understanding of definitions and notions to enable the stated aims of the framework to be accomplished (Chalmers et al., 2012).

4.4.2 Water accounting in California

California's variable climate means that the state must manage water carefully. Droughts are common and even in wetter seasons the state encounters multiple, often-competing demands for water. To allot its water supplies efficiently and justly and decrease conflicts over water, California needs a more reliable, full, and transparent system of water accounting to measure, process, and disseminate data on water availability, rights, and use (Escriva-Bou, McCann, Hanak, Lund, & Gray, 2016).

Water accounting is the groundwork of effective water management. It comprises methods, tools, and practices to evaluate the capacities of water available and used throughout a water system. Water accounting is significant to all scales of water management from large river basins to local irrigation regions or urban water utilities (Gray et al., 2015).

Although some forms of water management and tracking have long traditions, the use of the term 'water accounting' is relatively new. It mirrors recent efforts in Australia and by global organisations to draw parallels with the financial field of accounting and develop comparable standards for tracing water. The parallel with financial accounting is straightforward. Water is an asset that can be utilised in the

present, saved for future usage, and traded or swapped. In addition, water rights and other claims on obtainable water (e.g., environmental obligations and restrictions) are liabilities on Californian water assets. Given the complexities of the water cycle and the problems of precisely measuring many facets of water availability and use, even sophisticated water accounting systems encompass more uncertainties than traditional financial accounting does. However, the accounting notion is a useful one for organising water data to ease strategic decisions on water system oversight and management at all scales (Escriva-Bou et al., 2016).

California is a large, geographically varied state, and its water systems are both bodily unified and managerial independent. Water storage and delivery infrastructure connects the state's northern watersheds to its southernmost societies and the rivers of the Sierra Nevada to the coast. Yet, hundreds of autonomous regional and local water systems serve California's cities, suburbs, and farms. In most places, California also has distinct approaches to managing surface water and aquifers, even though the use of one frequently affects the availability of the other. An extra layer of complexity is the lack of transparency on how much water is kept for environmental objectives. This combination of interconnectedness of flows and disintegration of management makes it particularly important, but also very challenging, for California's citizens to understand water availability and use from the state-wide and regional viewpoints and not just in a local context (Hanak, 2011).

Though California is making progress on water accounting, more efforts will be required to enable the state to manage scarce water supplies professionally, fairly, and transparently. There are four water management challenges where can be addressed by water accounting. These include improving surface water allocation in times of deficiency, enhancing groundwater management, strengthening ecological water management, and expanding water trading chances (Hanak, 2011; Garrick, 2015).

California needs to adopt an overarching goal of modernising its water accounting. Major state agencies, including the Water Board, the Department of Water Resources, and the Department of Fish and Wildlife, should develop a joint water accounting framework, including a process for timely vetting and updating of data they receive from water right holders. This accounting framework should be administered by a standing interagency office with devoted funding. An oversight committee of key stakeholders and autonomous technical and authorised experts

should guide and support this process, supervise periodic auditing, and confirm that the system provides users with data required to manage water effectively and to hold managing agencies accountable (Hanak, 2011).

This statewide effort should seek to leverage the strong Supervisory Control and Data Acquisition systems that most significant urban utilities and many irrigation regions already use to support their daily processes and planning. These systems are already funded, tested, and dependent on locally and so they could become the foundation for the gathering larger regional and state accounting systems required for managing water rights, implementing the Sustainable Groundwater Management Act, managing ecosystems, and other purposes (Escriva-Bou et al., 2016).

California has been making advancement on several fronts, but continuous action is required. Although better information alone will not address California's water problem, such information is crucial for effectively managing the state's scarce water resources. Making a commitment to thorough, authoritative, and user-oriented water accounting now will help California address periodic droughts and prepare for a challenging future (Escriva-Bou et al., 2016).

4.4.3 Customer disclosures and impression management in the water industry

Annual reports “are intended to be a legitimate and trustworthy medium through which management communicate information” (Yuthas, Rogers, & Dillard, 2002, p. 141). Nevertheless, they have also been criticised as being “a highly sophisticated product of the corporate design environment, the main purpose of which is to proactively construct a particular visibility and meaning” by communicating “a picture of the organisation” (Stanton & Stanton, 2002, p. 478). Further, the ‘front-end narrative’ disclosures within annual reports have been recognised as, either a possibly significant and valuable source of corporate data to investors and other consumers (Kent & Zunker, 2013) or supposed to comprise “managerial discretionary disclosure choices that are opportunistic and constitute impression management” (Merkel-Davies & Brennan, 2007, p. 117).

Impression management has been argued to be the process by which management transport their specification of reality through narrative, quantitative, and visible disclosures in the annual reports both to manage the business picture and to report

the performance of management (Samkin & Schneider, 2010). From this viewpoint, annual reports are “instruments of impression management” (Arndt & Bigelow, 2000, p. 501). More frankly, Dhanani and Connolly (2012, p. 1144) asserted that disclosures in annual reports can be seen as a “misspecification of organisational reality”. This perception raises wider concerns about the trustworthiness of the annual reports (Canada Centre for Financial Reporting, 2013) and questions the anticipation that corporate narrative disclosures (or the management commentary) will be neutral and possess the central qualitative characteristics of relevance and faithful representation (International Accounting Standards Board, 2010).

Legitimacy has long been identified as a significant organisational resource (Ashforth & Gibbs, 1990). Insofar as corporations are perceived to be legitimate, they will find it easier to entice economic resources and gain the social and political support necessary for their sustained fruitful operation (Callway, 2012). However, securing legitimacy for organisational activity is far from straightforward and often becomes problematic (Ogden & Clarke, 2005). Elsbach and Sutton (1992, p. 700) comment, “Acquiring and maintaining legitimacy are chronic difficulties for most organisations, regardless of how widely supported they have been in the past”. These problems may arise from many causes, but as Neu, Warsame and Pedwell (1998, p. 265) point out, “contradictions invariably exist between the organisational activities used to generate profits in a competitive global economy and other social values”.

Institutional theorists have argued that organisations may secure legitimacy when stakeholders support an organisation’s goals and activities (Elsbach & Sutton, 1992, p. 700), a position emphasised in Suchman’s (1995) thorough discussion of legitimacy. Suchman (1995, p. 574) defines legitimacy “as a generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs and definitions”. The import of legitimacy as a ‘perception’ or ‘assumption’ on the part of an organisation’s public is that, although legitimacy may be owned objectively, it is formed subjectively (Ogden & Clarke, 2005). Accomplishing legitimacy, therefore, relies principally on firms adopting suitable institutional structures and practices in terms of predominant cultural norms, beliefs, rituals, and symbols, and by conforming with prevalent understandings of what is deemed ‘proper, adequate, rational and necessary’ (Meyer & Rowan, 1977). Certainly, problems arise when

firms disregard such understandings, or are confronted by a diversity of stakeholders with dissimilar demands and diverse interpretations of what are the most suitable organisational structures and practices. In response, institutional philosophers have proposed that organisations may cope with these problems by adopting institutionalised structures and practices which turn attention from activities which are no longer recommended or have become debated (Meyer & Rowan, 1977). However, while such ‘decoupling’ provides a beneficial view of how firms may cope with conflicting demands, it is an imperfect opinion. Organisations may also make use of spokespersons (Elsbach & Sutton, 1992) or written accounts (Arndt & Bigelow, 2000) to provide positive interpretations of debatable actions. These interpretations involve impression management strategies as a way of depicting organisational structures and practices in ways which are intended to secure endorsement and support (Ogden & Clarke, 2005).

This impression management is progressively evident in external corporate reporting where what is reported and how it is done is perceived as capable of influencing how corporations are perceived (Ogden & Clarke, 2005). As written self-descriptions are one of the most direct means “of creating a desired identity”, annual reports may be seen by definition as “instruments of impression management” (Arndt & Bigelow, 2000, p. 501). Managers have progressively gone beyond the legal necessities to report financial data to shareholders and use corporate reporting to celebrate corporate successes, in order to show favourable pictures of the business and thereby improve the legitimacy with which its activities are seen (Deegan, 2002). Financial reporting itself is often informed by impression management (Beattie & Jones, 1999), as is the reporting of social and ecological issues (Clarke, 2005). More generally, annual reports have been depicted as a way of communicating a certain corporate picture or message (Ogden & Clarke, 2005; Cooper & Slack, 2015). Ogden and Clarke (2005) attempted to take the issue of how corporations use corporate reporting for legitimacy objectives further by investigating an extreme case of the legitimacy problem: the necessity for a wholly new foundation for corporate legitimacy and so they examined the practices of 10 regional water authorities in England and Wales following their privatisation in 1989.

The 10 water authorities varied in magnitude. Their transfer to the private sector was part of a broader government programme. Privatisation is a frame-breaking

event that forces managers to adopt dissimilar viewpoints on how best to manage than those they had previously adopted (Pheko, 2013). For the public limited water companies, long embedded in public sector systems of management and accountability, privatisation instigated a process of essential transformation. They now had to respond to wholly diverse corporate imperatives, chiefly the necessity to earn profits to meet the expectations of their new possessors, their stakeholders. This transformation process also involved ‘institutional upheaval’ (Newman, 2000). The public limited water companies first had to give up the institutional structures and actions of the public sector to which they had been firmly coupled and the sources of legitimacy that adherence to them had provided. Second, the public limited water companies needed to obtain a markedly diverse organisational legitimacy that was consistent with the institutional structures and actions of the private sector to which they now belonged (Ogden & Clarke, 2005). More specifically, they needed to establish their legitimacy with a new set of ‘publics’, comprising their new ‘customers’. However, it was evident from the nature of their privatisation that they would experience significant problems in trying to accomplish this new legitimacy. The public limited water companies were regional monopoly suppliers of water services, and although the government justified their transfer to the private sector in terms of advantage to clients, privatisation did little to change their monopoly character. In this sense, there was a broad discrepancy between this character and the model, however idealised, of private sector corporations operating in competitive markets in which the provision of commodities and services is seen to be customer-led (Ogden & Clarke, 2005).

4.5 Water Scarcity in the Middle East

The Middle East is the first region of the world to suffer significantly from water shortage (Allan & Allan, 2002). The rapidly increasing nonfarming water needs of many countries in the region can generally not be met by additional exploitation of water resources except through either the development of expensive desalination services or the reallocation of water resources from irrigation. Such a move could bring major societal and political transformation and the danger of worsening existing inequalities and regional tensions (Chenoweth et al., 2011).

In most communities, the population of rural regions is generally not very wealthy. In the Middle East, the livelihoods of the poor rely on farming and its supporting

services. Their income improves in good seasons and lessens in bad ones. Water scarcity impacts on their lives because irrigation water rationing is the usual measure taken in response to the lack of water and water rationing reduces farming output (Haddadin, 2001). When rationing irrigation water, orchards are given priority because of the high capital invested in growing them, and horticultural and field crops receive minor priority. Orchards are generally owned by well-to-do farmers and horticultural and field crops are planted by the poor. In other words, irrigation water rationing harms the poor more than it does the rich (Haddadin, 2001).

4.5.1 Climate change, water resources, and the politics of adaptation

As a mostly arid region, the Middle East and North Africa (MENA) are particularly susceptible to climate change-driven effects on water resources, promoting adaptive governance approaches to deal with augmented hydrological danger remains a low priority for the political leadership (Sowers et al., 2011). Social, economic, and political aspects of any country are affected by climate change. In general, climate change acts as a ‘danger multiplier’ for oversensitive countries and populations (Evans, 2008). Yet climate impacts will not be similarly distributed and much will rely on national resources and adaptive capacities (Sowers et al., 2011).

Climate change joined with high demographic growth will intensely impact on the obtainability and quality of freshwater resources in the MENA region (Suppan, Kunstmann, Heckl, & Rimmer, 2008). Speeding up in climatic change will possibly make drought periods longer and precipitation events more variable and concentrated, also raising probabilities of desertification because of inappropriate agriculture. These effects on the water sector, in conjunction with deteriorating freshwater quality and increasing demographic growth, are already evident in much of the MENA. Over-exploitation of aquifers and their pollution, salinisation of farming land, and lack of urban water have sparked some policy reforms and adaptive measures, albeit under situations of crisis management (Sowers et al., 2011).

Adaptation means developing institutional and political capacities to guarantee suitable water supply and water quality in the face of escalating dangers from climate change-related effects (Smit & Wandel, 2006). Another requirement of adaptation is confirming equitable access for susceptible populations. Most MENA

nations already employ a diversity of supply-side measures, including weirs, freshwater transfer schemes, desalination, and reuse of recycled effluent (Allan & Allan, 2002). Water experts in the MENA, in concert with global institutions, progressively advocate demand management to promote preservation and increase efficiency. This approach has encouraged experiments in public-private partnership, user associations, and privatisation of water services. Likewise, water specialists have embraced the integrated water resources management explained by regional water professionals as enhancing cross-sectoral planning and harmonisation by government ministries (Sowers et al., 2011). Yet in practice, MENA governments continue to concentrate most of their resources on large-scale supply-side projects, progressively tapping fossil aquifers and building desalination stations (Sowers et al., 2011).

Sowers et al. (2011) argue that water resource planning in the MENA does not sufficiently address issues of equity in water access, linkages to population growth, or a more comprehensive role for political mobilisation around resource access. Cumulative population growth, for example, is treated as a driver of water scarcity, prompting nations to allot ever larger resources to obtain more supplies (Chenoweth et al., 2011). Much of the water found through water diversions, desalination, and aquifer extraction, however, is used by privileged users, whether in cities or larger farming operations. Poor and marginalised farmers and societies must often pay for freshwater from private providers at rates many times those paid by publicly supplied users (Bou-Zeid & El-Fadel, 2002).

Likewise, governments and water specialists in the MENA region have thus seen little cause to seriously engage social actors in considering water dangers. Legacies of centralised regimes of planning and revenue distribution have rendered multiscale governance mechanisms powerless regarding organisational capacities and integration with local constituencies (Sowers et al., 2011). Cities, provinces, towns, villages, and other considerable levels of government are not substantial players in identifying susceptible populations or planning for augmented hydrological risks. Voluntary associations are firmly structured in most of the authoritarian states of the area, while a diversity of communal services, charities and forms of Islamist collective mobilisation are frequently perceived as a danger to state integrity and legitimacy (Sowers et al., 2011). While the literature emphasises the significance of societal capital to adaptive governance (Adger,

2003; Pelling & High, 2005; Dietz, Ostrom, & Stern, 2008), many authoritarian systems in the MENA have, nonetheless, sought to weaken, disorganise and co-opt social mobilisation and organisation (Kassem, 2004; Fahmy, 2012). The result is that main capacities for adaptive governance to freshwater scarcity are not encouraged; rather than engaging social actors, leaders continue to depend mostly on technical solutions to increase supply (Sowers et al., 2011).

4.5.1.1 Vulnerability to climate change within the Middle East and North Africa

It is ever more apparent that the poorest states and populations will face the biggest costs of climate change (Stern et al., 2006). The adverse effects of universal climate change represent an immense transfer of environmental harm to susceptible areas and emerging states that have few historical parallels. States and populations that only marginally contributed in the long-term accumulation of greenhouse gas emissions will tolerate the chief impact of the costs of water-related adaptation to climate change. Many emerging countries already face severe structural economic issues, governance challenges, and ecosystem pressures (Lemos & Agrawal, 2006).

As a region, the MENA is characterised by significant differences in wealth and differently structured economics. One of the most substantial divides has been between those states that can afford to access or produce new sources of water and those that face severe financial problems in trying to do so. The oil-exporting states, including Saudi Arabia, the United Arab Emirates, Kuwait, and Libya, exceeded their renewable freshwater resources a few decades ago and depend on a combination of desalination, recycled effluent, and exploration of aquifers to meet growing demands (Sowers et al., 2011). Israel, likewise, is largely concentrating on desalination and reuse of effluent. All of those states also use more water per capita than poorer states do (Sowers et al., 2011). The other countries in the region fall largely into two groups: those endowed with more considerable surface water resources (Turkey, Egypt, Sudan, Lebanon, Iraq, and Iran) and those that depend on aquifers but struggle to mobilise the kind of investments needed to secure new large-scale water resources (Jordan, Yemen, Algeria, and Tunisia). Some countries (Syria, Morocco) rely on both surface water and aquifers resources (Sowers et al., 2011).

Many people of the MENA region already cope with insufficient, contaminated water supplies. Particularly in open urban regions, countries have shifted the burden

of accessing water onto households and persons, who must organise for private and expensive water deliveries (Postel, 2014). Others suffer from freshwater rationing, where water is provided for only a day a week. For instance, many houses in Jordan and Palestine have freshwater storage tanks on the roof to amass water for later use. Poor households and farmers also access water through illicit connections and direct use of irrigation or drainage canals (Sowers et al., 2011).

While almost all states in the region have sought to enlarge water distribution and storage regimes through weirs and canals, substantial demand management of water consumption was not taken until acute droughts and dropping water supplies in groundwater and weirs became dangerous. This has been the case in Israel, Saudi Arabia, Bahrain, Palestine, Qatar, Kuwait, and Morocco and progressively in Jordan, Algeria, and Yemen. Nonetheless, farming products account for a significant share of merchandise exports from many MENA nations (Sowers et al., 2011; Postel, 2014). Changes in farming production in the MENA countries due to lack of freshwater induced by climate change and changes in freshwater allocation will dangerously affect agricultural constituencies in the absence of effective country and community interventions (Sowers et al., 2011).

4.5.1.2 Impacts of climate change on precipitation

Forecasts for future renewable water resources in the MENA region are pessimistic, and climate change and growing demands are likely to intensify the water crisis in the MENA region. The Levant (Syria, Lebanon, Israel, Jordan, and Palestine) will be one of the regions in the Middle East most affected by changes in rainfall. Most climate models forecast a reduction in rainfall and a surface temperature increase in the Eastern Mediterranean (Alpert, Krichak, Shafir, Haim, & Osetinsky, 2008), which will lead to reduced water availability and augmented water deficit in the Lower Jordan River Basin (Israel, Palestine, and Jordan) (Sowers et al., 2011). High-resolution climatic models concluded in the Middle East forecast an increase in mean yearly temperature up to 4.5C° matched with a 25% decline in mean yearly rainfall towards the end of the 21st century (Suppan et al., 2008). These and other models also forecast alterations in spatial rainfall distribution whereby rainfall in the northern section of the Levant will experience larger decreases than in other parts of the region (Steinberger & Gazit-Yaari, 1996; Suppan et al., 2008).

Rainfall is projected to drop by 25% in the Upper Jordan River catchment and aquifer recharge regions in northern Israel, Lebanon, and Syria (Suppan et al., 2008). In Jordan, the average yearly water yield (i.e., groundwater replenishment) is anticipated to drop by a percentage ranging from 45% to 60% as a result of a 2C° increase in temperature in combination with a drop in rainfall (Oroud, 2008). Therefore, the current water shortage in Jordan is anticipated to increase further. According to the 2007-2008 Human Development Report, similar shortages are predicted for Syria, where a 50% drop in renewable water availability is anticipated by 2050 when compared with 1997 levels. Climatic models for Turkey anticipate a substantial reduction in rainfall (Gao & Giorgi, 2008) that would need additional withdrawals from the Tigris and Euphrates River systems to meet farming demand in southeast Turkey. The increase in upstream extractions by Turkey and the decrease of the Tigris and Euphrates River flows to downstream Syria and Iraq could have devastating impacts on the water accessibility in these countries.

4.5.1.3 Water scarcity, climate change, and farming

Because the MENA region is largely semiarid to arid, primary farming production depends on public or private irrigation that consumes surface water, aquifers or some combination of the two. The water and farming sectors are, therefore, firmly linked. In most of the MENA states, the farming sector is the major consumer of water (Sowers et al., 2011). On average, water for farming accounts for about 80% of water budgets, but reaches 90% and above for six states in the region. Consequently, reallocations of freshwater under conditions of scarcity will most possibly be at the expense of the farming sector, as has already been the situation in Yemen, Jordan, Israel, and Libya. The farming sector also accounts for a substantial share of employment in some states, accounting for 28% of employment in Egypt, 44% in Morocco, and 50% in Yemen (World Bank, 2007, p. 61).

The liberalisation of farming sectors that was pursued by governments across the region during the 1980s and 1990s has thrown up new challenges for managing irrigation demand (Achthoven, Merabet, Shalaby, & Van-Steenbergen, 2004). Public authorities have withdrawn from setting crop prices and quotas for most crops and increasingly withdrawn subsidies on some foodstuffs (Achthoven et al., 2004). Farming demand for water has increased in response to growing food prices and the spread of new pumping technologies. With mobile diesel pumps, farmers

in the region can directly access aquifers, contributing to over-exploitation of groundwater sources (Achthoven et al., 2004).

National water authorities are unable to prevent large investors from appropriating water at wells (Sowers et al., 2011). For instance, in Jordan, approximately 2,000 groundwater wells are overused and at least half of these were constructed illicitly (Sowers et al., 2011). In Gaza, the Palestinian Water Authority was unable to prevent extensive digging of wells. One water expert assumed that in 1994 there were only about 2,000 groundwater wells in Gaza, but by the year 2000 at least another 1,000-groundwater wells had been dug. Likewise, in Yemen, government officials have been unable to prevent the illicit digging of groundwater wells to support the cultivation of qat¹² in the Sanaa basin (Kasinof, 2009). In Libya and much of North Africa, decreasing groundwater levels in coastal areas are also attributable to uncontrolled and illicit pumping for farming. In all these areas, over-pumping increases seawater intrusion and the flow of other salty sources, ultimately limiting possibilities for further agriculture (Sowers et al., 2011).

Reliance on unaccounted-for pumping, whether legal or illegal, also mirrors substantial difficulties in state provision of public goods, that is, the reliable provision of good quality irrigation water to farming communities. As in many other state-controlled regimes in the MENA, irrigation and drainage systems suffer from insufficient maintenance, substantial losses, and growing demand from a variety of users. Total water statistics conceal the fact that many users, particularly at the tail ends of irrigation canals, encounter periodic and unpredictable water shortages due to poorly maintained infrastructure and increased withdrawals by upstream users (Sowers et al., 2011).

Within this constrained context, climate-related effects on farming are anticipated to be substantial (Cline, 2007). Many crops are already grown at the extremes of their tolerances to heat and salt and growing temperature is anticipated to reduce yield and shift agriculture patterns (Eid, El-Marsafawy, & Ouda, 2007). Egyptian agronomists have projected climate effects on farming, merging standard universal circulation climate models with multiyear, multicrop models to imitate outcomes under a diversity of cropping regimes and management interventions. Most crops

¹² Qat is a shrub of the staff-tree family that is grown in the Middle East especially Yemen for its leaves and buds which are the source of a habituating stimulant when chewed or used as a tea.

under these imitative models demonstrated augmented water requirements due to higher temperatures and reduced yields (Eid et al., 2007).

A further facet of the fragility of the farming sector is the anticipated degradation of the quality of water for irrigation connected directly and indirectly with climate change. Long-term salinisation has been detected in many of the aquifer regimes in the MENA, including Morocco (Bouchaou et al., 2008), Israel (Vengosh et al., 2005), the Jordan Valley (Marie & Vengosh, 2001; Farber et al., 2004), and in the Mafraq (Rimawi & Al-Ansari, 1997) and Azraq (Al-Kharabsheh, 2000; Bajjali & Hadidi, 2005) basins in Jordan. A total decline in aquifer replenishment would increase these salinisation phenomena. Progressively, salty irrigation water is predicted to severely decrease land suitability for vegetable and fruit tree farming in the Lower Jordan River Basin of Israel, the Palestinian National Authority territories, and Jordan (Sowers et al., 2011).

4.5.1.4 The political economy of adaptation

A study by the World Bank (2007) found that formal water policies and authorities in the MENA scored substantially better than a comparable set of authorities in 27 low and middle-income nations in terms of formal regulatory frameworks and organisational capacities. As the World Bank (2007) also observed, however, administrative water capacities have not yet translated into commensurate gains in water efficiency, preservation or user participation. Yet managing water demand, enhancing the efficiency of freshwater use, and promoting preservation will be chief components in responding to climate-driven impacts on the water sector (Sowers et al., 2011).

Demand management and a participatory water approach typically depend on better interaction with societies and local authorities than on policies applied by centralised water provision and planning. Much of the environment and development literature has confirmed the significance of societal capital, state-society synergy, public-private partnerships, community-based resource management, and coproduction of public goods in promoting effective policy interventions (Ostrom, 1991; Evans, 1997; Lemos & Agrawal, 2006). These types of rooted linkages or nested institutions are also progressively invoked in explaining flexibility and adaptive capacity of governance regimes (Ostrom, 1991; Dietz et al., 2008).

Water policy innovations, however, face substantial problems in the MENA, given the nature of political regimes and the political-economic interests bestowed within them. First, water management remains centralised in public authorities created for both bureaucratic and ideological causes in supply-side approaches to water management. At the same time, existing centralised regimes of water allocation, through irrigation systems and municipal freshwater supplies, produce privileged constituencies, in both cities and rural regions (Allan, 2002). Ultimately, the authoritarian and quasi-democratic regimes of the Middle East and North Africa have destabilised reserves of societal capital. The extensive mistrust of governmental authorities and the intentions and overextended and underfunded state authorities mean societal actors often develop substitute means to access resources and seek to avert entanglement in government initiatives. These features of the political landscape make enacting substantial water policy reforms difficult (Sowers et al., 2011). In addition to these political restrictions, the politics of water scarcity worsen the critical water situation in the Middle East and North Africa, and particularly in Jordan (Haddadin, 2001).

4.6 Water Scarcity in Jordan

As a result of an increasing population and growing municipal and industrial demands for water, Jordan is faced with chronic and severe water scarcity. In addition, there are limited opportunities in the short term for securing substantial extra water resources through technological innovation or transboundary approaches. Therefore, there appears to be significantly greater potential in following an integrated water resources management approach which connects water supply and demand for diverse sectors with factors external to the water sector in a focused effort to balance demand levels with sustainable supplies (Scott, El-Naser, Hagan, & Hijazi, 2003).

One of the most worrying factors in the water situation in Jordan is the absence of political will – corruption in the view of donors agencies water experts, and Jordanian water reformers – in coping with a crisis that potentially threatens the nation’s internal stability (Yorke, 2013). Resolutions rely on the country’s national leaders finding the political will to make rational decisions and apply the laws and policies that will make a change. Taking these actions will diminish the water shortage, protect aquifers, and enhance the state’s capacity to deal with the problem,

a problem in which decision-makers themselves, because of a combination of their actions and indifference, are perceived as part of the problem. This broadly-held view and the dissatisfaction it has produced are of such importance that the conditions informing it deserve careful analysis (Yorke, 2013).

Increased water stress resulting from water scarcity in Jordan would not only adversely affect farming, its supporting sectors, economic growth, employment, food security, and human health but also aggravate socioeconomic problems and spark internal and external political tensions (Haddadin, 2001; Yorke, 2013).

4.6.1 The politics of water scarcity in the Jordan River Valley

There is a debate between those scholars who claim that there is a relation between ecological issues and security concerns and those scholars who reject such a relationship (Dabelko & Simmons, 1997). Those who claim there is a connection may be separated into two camps: the fundamentalists and the holists (Dabelko & Simmons, 1997). The fundamentalists argue that problems such as ecological degradation and resource over-exploitation have security consequences in that they can result in political conflict and even violent strife within and between countries (Westing, 1986; Gleick, 1991; Molvaer, 1991; Homer-Dixon, 1991, 1994; Wolf, 2006; Barnaby, 2009). For fundamentalists, the ecological side is simply absorbed into an extended definition of security (Imber, 1991). In this view, wars will occasionally occur between nations which are faced with growing scarcity of common water sources (Dolatyar & Gray, 2000).

The holists argue that the relationship between the environment and security is much deeper than the state-centric fundamentalists perceive and that it is one that demands a new kind of security (Imber, 1991). In the holistic view, security has to be redefined to embrace worldwide ecological fears such as ozone layer exhaustion and climate change that pose hazards to the well-being of all nations and all peoples on the Earth (Ullman, 1983; Brown, 1986; Mathews, 1989; Mische, 1989; Renner, 1989; Myers, 1997; Dalby, 1992, 1998; Gore, 2013). Coping with such fears needs the raising of universal awareness about their seriousness and exerting pressure on countries to take mass action. Holistics view water scarcity as a worldwide security problem which requires an international response. Until that happens, skirmishes over water could occur anywhere in the world. The Jordan River Valley offers a

case that illustrates the politics of water scarcity in the Middle East (Dolatyar & Gray, 2000).

Although it is the smallest watershed shared by more than two nations in the Middle East, the Jordan River Basin has been the focus of the most attention because of the political tension in the region. Furthermore, of all the water systems in the Middle East, the Jordan River Basin is the one that is most often cited as a source of grave conflict and the likeliest to explode into a water war (Cooley, 1984; Gowers & Walker, 1989; Gleick, 1994; Bulloch, 1995; Mastrull, 1995; Haddadin, 2001; Barnaby, 2009; Amery & Wolf, 2010).

Jordan, which has grave water scarcity and is hazardously over-drawing its aquifers, depends on the Jordan River and its tributary, the Yarmouk River, to meet its key water needs. Israel, which is also intensely short of water, obtains about one-third of its entire water consumption from the Upper Jordan River Basin and it has strictly restricted Palestinians' use of groundwater underlying the Palestinian territories (Postel, 2014).

There are two potential sources of water wars in the Jordan River Basin. The first source is the Jordan River itself. Since local water resources were inadequate to satisfy increasing Israeli needs, the only apparent substitute, the Jordan River regime, figured expressively in Israel's development plans (Lowi, 1995). Second, the ethnocentric conflicts and territorial disputes between the riparian countries and skirmish between Israel and its Arab neighbours suggest that water wars are to be expected (Dolatyar & Gray, 2000).

The Arab response to Israeli development strategies was twofold. On the one hand, the Palestinian Liberation Organisation (PLO) used armed action against the Israeli National Water Carrier (Zarour & Isaac, 1993). On the other hand, the Arab League decided to help Syria, Lebanon, and Jordan to divert the headwaters of the Jordan River. Israel responded to this dual threat by mounting armed attacks on the Syrian construction locations; a series of clashes occurred which, according to many observers, finally resulted in war in June 1967. Ariel Sharon, later Israel's defence minister, clarified the point when he stated that "people generally regard 5th June 1967 as the day the Six-Day War began, that is the official date. But in reality, it started two and a half years earlier, on the day Israel decided to act against the

diversion of [the] Jordan [River]" (Bulloch, 1993). Morris (1997) stated that Israel's search for water security could be deemed one of the primary causes of the 1967 War. Shaheen (1997) quotes a UN cease-fire overseer in the demilitarised zone, General Odd Bull, who referred to the 1967 War as a war for control of water resources. Cooley (1984) claims that the endless struggle for the waters of the Jordan, Yarmouk, and other life-giving Middle East rivers was a primary reason of the 1967 Arab-Israeli War.

The second water-related conflict concerns the Litani River. As water demand in Israel grew in line with its increasing population, it was clear by the early 1980s that rehabilitation of the Negev Desert could not be accomplished without further water resources. Given the high costs of desalination and the contamination of surface water and groundwater, Israel needed other natural supplies of freshwater and Lebanon was an adjacent state with excess water resources (Hewedy, 1989; Dolatyar & Gray, 2000). In 1978 and 1982, Israel attacked Lebanon. Although the officially declared aim was military security, some analysts such as Hewedy (1989) posited that the real purpose behind the attacks was water security and that the wider incentive for the attack of Lebanon in 1982 was to retain the water resources of the Litani River. The announced purpose to defend the northern borders from Palestinian attacks is not convincing to most military analysts. Rather, the military action seems to have been directed at finally seizing control of the Litani River. Bulloch (1995) and Amery (1997) make similar claims. Shaheen (1997) mentions that a former Egyptian Foreign Minister, Mahmoud Riyadh, illustrated that the Israeli invasion of Lebanon in 1982 was not to secure Upper Galilee as is alleged; the basic purpose has been to occupy Southern Lebanon to exploit the Litani River to meet the increasing need for water in state of Israel.

Notwithstanding appearances to the contrary, neither of the two situations of water conflict outlined above supports the concept of water wars. With regard to the Six-Day War, first, as Wolf (1998) points out, there was a time-lag of a year after the initial Israeli military invasions on Syrian construction locations before the outbreak of war in 1967. Second, as Kliot (2005) argues, so far as Syria was concerned (a state which has a relative abundance of water), the diversion plan was principally an excuse to provoke Israel into military action which would lead to immense Arab revenge. Therefore, water was a tool, not a cause, of the 1967 War or, at least, an insignificant cause. Dellapenna (1995) takes a different perspective

on the tensions over water in the region, claiming that water may become the grounds for building peace in the region if the chance to cooperate over freshwater resources is correctly seized.

4.7 Chapter Summary

This chapter introduced global freshwater scarcity and its impacts on human health, social well-being, and agriculture. In addition, climate change, freshwater resources, and the politics of adaptation were addressed. Furthermore, this chapter introduced freshwater scarcity in Jordan and the politics of water scarcity in the Jordan River Valley.

Human activity is transforming Earth's natural systems in ways that are profound, persistent, and accelerating. This alteration is producing a suite of health impacts that remain, in many instances, poorly characterised. However, sufficient evidence exists that nearly every dimension of human health is being affected and that it is likely that the burden of ill-health connected with these collective ecosystem changes is large and growing.

Climate change impacts on crop production are often integrated with its impacts on water productivity, agricultural soil water equilibrium, and soil fertility. Global warming will affect temperature and precipitation, which will directly have impacts on the status of soil humidity and aquifer levels. Crop yield is restricted in terms of crop varieties and planting areas, farming soil degradation, growing climate and water obtainability during the crop growth period. As temperatures rise and rainfall patterns change in the future, freshwater accessibility and crop yield will also reduce. If the irrigated regions are extended, total crop production will increase; however, food and environmental quality may deteriorate. Farming soil evaporation and plant transpiration will be altered with climate change; thus, water use efficiency may decline in the future. Water accounting is needed to increase water productivity.

The imbalance between population growth and water resources strains societies and could result in political instability. On the societal side, water scarcity adversely affects job opportunities, farm revenues, and the credibility and reliability of farming exports. Economically, the adverse effects of a shortage of water are demonstrated in less production of goods, especially farming goods and the loss

working hours because of the hardships communities face because of water scarcity.

Signori and Bodino (2013) argue that water supports society's livelihoods and preserves ecosystems. Water is, therefore, deemed a public commodity that requires a public interest in and, accordingly, public accountability for its use, management, and protection. Following this line of reasoning, attention should be drawn to the necessity for accountability to be 'public' or at least shared by diverse stakeholders (government, at national and global levels, water industries, societies, environmentalists, and NGOs).

The next chapter is on water and Jordan. This chapter deals with water management in Jordan and water accounting in the Lower Jordan River Basin. The chapter also uncovers the situation of accountability in the basin.

Chapter 5: Water and Jordan

5.1 Introduction

Jordan is semiarid (Alqadi & Kumar, 2011) and, therefore, has naturally low freshwater availability. Climate change has caused a drop in rainfall and, hence, surface water flows (Hötzl et al., 2008; Alqadi & Kumar, 2014). Abdulla, Eshtawi, and Assaf (2009) found that the decrease in precipitation leads to substantial reductions in runoff and groundwater recharge in the Zarqa River Basin. The number of times that the Jordan River Valley will experience moderate, sharp, and extreme drought situations is anticipated to grow in the future (Törnros & Menzel, 2014). Such droughts can have disastrous effects when the agricultural practices and water management systems in place are unsustainable (Kelley, Mohtadi, Cane, Seager, & Kushnir, 2015).

Naturally, low freshwater availability in Jordan is decreased further by over-exploitation of shared surface water resources by upstream and adjacent countries. Both the Jordan River and the Yarmouk River have been depleted by upstream over-consumption in Israel and Syria (Haddadin et al., 2010). The sharing of trans-boundary Rivers has led to challenges and anxieties.

In 1994, Jordan and Israel signed a peace agreement that included agreements on surface water allocations (Haddadin, 2011). Jordan is allowed a specific outflow from Lake Tiberius situated in Israel into the Lower Jordan River. The present national water strategy of Jordan assumes $50 \times 10^6 \text{m}^3/\text{year}$ of surface water to be acquired by the peace agreement (Ministry of Water and Irrigation, 2010b). When, in 1999, the region was hit by a drought event, the agreed water allocation was threatened and bilateral conversations temporarily broke down before the two parties found a resolution (Schenker, 2014). With minimal outflow from Lake Tiberius being controlled by Israel, the Lower Jordan River relies chiefly on inflow from its principal tributary, the Yarmouk River (Van-Aken, Molle, & Venot, 2009).

Jordan and Syria signed a treaty on sharing the Yarmouk's water in 1987 (Kliot, 2005; Schyns et al., 2015). Nonetheless, these countries have experienced continued pressures over the building and operation of Syrian dams on the river (Gleick, 2014a). Namrouqa (2012), Yorke (2013), Shami (2014), and Haddadin

(2014) reported ‘persistent violations’ of the bilateral treaty by Syria, thereby depriving Jordan of its rightful water share.

Current water demand in Jordan exceeds the insufficient renewable water resources available in the country. Agricultural water demand is increasing (by 38% in the period 2000–2010), according to Alqadi and Kumar (2014) despite efforts to enhance irrigation efficiency and help farmers to grow less-water-intensive crops (Scott et al., 2003). The supply of water does not meet the domestic demand with the shortfall continuing to increase by 40%–46% in the period 2000–2010 (Alqadi & Kumar, 2014). This increase is due to rapid population growth caused by a high rate of natural population growth and ongoing massive waves of refugees (Talozi, Al-Sakaji, & Altz-Stamm, 2015).

Over-consumption of Jordan’s surface water and groundwater resources is connected to several environmental effects. Due to the high amount of usage along its course, the Jordan River has narrowed to a small creek by the time it enters the Dead Sea, with immediate discharge now being less than 5% of historical levels (Becker, Helgeson, & Katz, 2014). This diminution in river water has led to an alarming drop in the level of the Dead Sea, which, in turn, has led to the lowering of groundwater tables in nearby aquifers (Alqadi & Kumar, 2014).

Problems of surface and groundwater contamination are extensive in Jordan, a situation which increases water scarcity (Schyns, Hoekstra, & Booij, 2015). Inadequate treatment of industrial and domestic wastewater and over- and misuse of fertilisers and pesticides contaminate these resources (Hadadin, Qaqish, Akawwi & Bdour, 2010). Contamination of groundwater is worsened by over-pumping, which leads to a high concentration of salts and other contaminants (Al-Ansari, Ibrahim, Alsaman, & Knutsson, 2014; Al-Kuisi et al., 2014). Hotspots of groundwater deterioration in the regions of Amman and Zarqa have been mapped by Alqadi, Kumar, and Khormi (2014). The decline of water quality in Jordan is also partly a trans-boundary issue. The Lower Jordan River Basin has suffered from agricultural runoff, wastewater, and a lack of water governance from all riparian states (Scott et al., 2003; Kliot, 2005; Schyns et al., 2015).

Administratively, the Zarqa River Basin is located in five cities, namely Amman, Zarqa, Jerash, Balqa, and Ajloun. However, a single basin authority has not been

set up to manage the basin resources and improve their uses and quality (Jiries, 2011). On the contrary, accountability is missing between the various governmental authorities that are involved, mainly the Ministry of Water and Irrigation, the Ministry of Environment and the Ministry of Agriculture (Shatanawi & Shammout, 2011).

As the study area is the Jordan River Valley and the Zarqa River Basin, it is important to understand water accounting in the region, as water accounting is a tool used to assist in water management. This chapter introduces the institutional arrangement and water administration in the area, the environmental and water legislation, and institutional determinants that govern the ecological situation.

5.2 Institutional Arrangement and Water Administration in the Lower Jordan River Basin

Three central public agencies are now responsible for the water sector in Jordan. These are the Jordan River Valley Authority (JVA), the Water Authority of Jordan (WAJ), and the Ministry of Water and Irrigation.

The Jordan Valley Authority is the government organisation in charge of the social and economic development of the Jordan River Valley (JRV) (Suleiman, 2003). It was established in 1972 as the Jordan Valley Commission. In 1977, it was renamed 'the Jordan Valley Authority' under the Jordan Valley Development Law Number 18. Its emergence as a permanent development planning body for the Jordan Valley was a pivotal new initiative in the notion of evolution of integrated planning in Jordan (Mallat, 2001). In 1988, this law was replaced by the Jordan Valley Development Law No. 19 to create a general law aimed at carrying out integrated water and socioeconomic projects, taking into account all aspects relevant to development (Mallat, 2001).

The duties of the Jordan Valley Authority extend beyond the development of infrastructure and waterworks and include the development of water resources and providing suitable environmental conditions to protect resources and facilitate reasons for the welfare of the valley (Daher, 2001). Although the responsibilities of the Jordan Valley Authority are identified by the Jordan Valley Development Law Number 19/1988, the JVA lacks autonomy and has a conflict of interest and inequitable mutual relationship with several government institutions, creating

ambiguity concerning the statement of its mission (Nortcliff, Carr, Potter, & Darmame, 2008). The authority provides services for other agencies, while all revenues and sale taxes accrue to the central public treasury (Daher, 2001).

The Water Authority of Jordan is an independent corporate body with financial and administrative independence, but its provisions could be, to some extent, in contradiction with rules binding the government. Denny, Donnelly, McKay, Ponte, and Uetake (2008) argue that the royal court affects the official authorities regarding water management. As a result, the ministers have no political will to change unless they receive orders from the court. The Water Authority of Jordan is responsible for managing all the water and sewerage systems and related projects. Its duties encompass areas of development survey, regulation of water resources, and study, design, construction, operation, and administration of water and public sewerage systems (Suleiman, 2002).

The Ministry of Water and Irrigation was established under by-law 54/1992 at the suggestion of the government and was approved by the Jordanian parliament. The duties of the ministry include the formation of national water policies and strategies, planning water resources and development, procuring financial revenues, and monitoring water and wastewater projects. The establishment of the ministry was in response to Jordan's recognition of the need for a more integrated approach to efficient national water management (Nemer, 2001; Suleiman, 2003). The ministry has taken over the control of both of the above-mentioned water authorities, in order to develop integrated water resources management and issue water legislation regulating the water sector in the valley (Suleiman, 2003).

5.3 Environmental Legislation in Jordan

In Jordan, a series of environmental laws have been enacted. These laws deal with the problems relating to preserving the environment and its natural resources (Seder & Abdel Jabbar, 2011). This legislation aims to protect and improve the quality of the Jordanian environment by sustaining and conserving Jordan's environmental resources and contributing to sustainable development (Al Zu'bi, 2011). As is shown in Table 4-1, Jordanian legislation relating to the environment and its natural resources can be categorised into seven areas. These deal with: surface and ground waters, wastewater treatment and reuse, solid waste disposal, land usage, public health, ambient air pollution, and chemicals and fertilisers (Seder & Abdel Jabbar,

2011). The diversity of these laws emphasises that Jordan addresses most aspects of environmental preservation through its environmental regulations. Abu-Sharar (2006) argues that Jordan's suffering from a shortage of water resources is not owing to weak laws but poor management of current water supplies. The authority is an independent corporate body with financial and administrative independence, but its provisions could be, to some extent, in contradiction with rules binding government. Doctor Abdullah Al-Akaylah, a former minister and Member of Parliament, emphasises that no grand project in Jordan is implemented without obtaining approval from the royal court (Al-Otain, 2017). Venot and Molle (2008) demonstrate that increasing pumping of groundwater for agricultural purposes has exceeded its safe renewable yield. In order to elucidate the unsustainable use of groundwater for irrigation, Nortcliff et al. (2008) explain that no serious attempts have been made to enhancing natural recharge into these supplies. In addition, applying water standards to all people without exemption, encouraging freshwater harvesting practices, or adopting water preservation measures, especially in agriculture, are procedures that governments have not committed to.

Using untreated wastewater for irrigation is considered one of the primary sources of environmental contamination in Jordan (Schyns et al., 2015). Though recycling of wastewater is a necessary component of water resources management where the supply of water is insufficient and the demand is rapidly growing, recycling presents some dangers to public health and the environment (Atef Al-Kharabsheh & Taany, 2005). Nazzal, Mansour, Al-Najjar, and McCornick (2000) assert that a prerequisite to improving management of the recycled wastewater is establishing a practical framework of standards and laws that help to ensure public health and low environmental impact. The legal framework must also be flexible enough to adjust to local conditions and the economic basics of the situation (Atef Al-Kharabsheh & Taany, 2005). Laws, standards, and regulations for wastewater reuse for irrigation must also be able to evolve in line with changing physical, social, economic and environmental circumstances (Tarawneh, Hadadin, & Bdour, 2008).

Table 5-1: Jordanian environmental legislation.

Jordanian Environmental Legislation						
Freshwater	Wastewater	Solid wastes	Chemicals & fertilisers	Public health	Air pollution	Land use
Jordanian Standards No. 286/1997 Drinking Water	Jordanian Standards No. 202/1991 Treated Industrial Wastewater	Environmental Protection Law No. 52/2006	Environmental Protection Law No. 52/2006	Jordanian Standards No. 73/1990 on Motor Vehicles	Jordanian Standards No. 73/1990 on Motor Vehicles	Environmental Protection Law No. 52/2006
Jordanian Standards No. 287/1982 Drinking Water	Jordanian Standards No. 893/1995 Treated Domestic Wastewater	Public Health Law No. 21/1977	Agriculture Law No. 20/1973	Jordanian Standards No. 1052/1998 Motor Vehicles	Jordanian Standards No. 1052/1998 Motor Vehicles	Jordan Valley Law No. 19/1988
By-Law No. 26/1977 Subsurface Water Control	Jordanian Standards No. 1145/1996 Reuse of Treated Wastewater	Industrial Cities Corporation Law No. 59/1985	Public Health Law No. 21/1977	Jordanian Standards No. 1140/1999 Ambient Air Quality Standards	Jordanian Standards No. 1140/1999 Ambient Air Quality Standards	Agriculture Law No. 20/1973
Environmental Protection Law No. 52/2006	Water Authority Law No. 18/1988	Municipalities Law No. 29/1955		Public Health Law No. 21/1977	Public Health Law No. 21/1977	Natural Resources Law No. 12/1968
Water Authority Law No. 18/1988	Jordan Valley Law No. 19/1988			Agriculture Law No. 20/1973	Environmental Protection Law No. 52/2006	
Jordan Valley Law No. 19/1988	Public Health Law No. 21/1977			Municipalities Law No. 29/1955	Industrial Cities Corporation Law No. 59/1985	
Agriculture Law No. 20/1973	Industrial Cities Corporation Law No. 59/1985			JS No. 1189/1999 Maximum Allowable limits of Air Pollutants Emitted from Stationary Sources	JS No. 1189/1999 Maximum Allowable limits of Air Pollutants Emitted from Stationary Sources	
Public Health Law No. 21/1977	Municipalities Law No. 29/1955					

Source: (Al-Zu'bi, 2011).

Several ministries in Jordan collaborate with the Ministry of Environment in implementing environmental legislation aimed at protecting the environment and its natural resources (Al-Zu'bi, 2011). The categorisation of the environmental laws is detailed in Table 5-1. Abu-Sharar (2006) explains that the principal

environmental legislation is the environmental protection Law No 52/2006. This environmental law forms the backbone of environmental protection in Jordan.

In addition, there are a number of standards covering treating domestic and industrial wastewater such as Jordanian Standard No. 202/1991, Jordanian Standard No. 893/1995 and Jordanian Standard No. 1145/1996 (see Table 5-2). In addition, the legislation does not ignore the statutory protection for freshwater. This legislation includes several standards relating to agriculture and organising industrial cities as industrial activities form a significant source of water and air contamination in Jordan. The enforcement of these laws represents one of the essential tools that convert them from written texts into acts in place.

Table 5-2: Major Jordanian environmental legislation.

Legislation Relating to the Environment	Purpose
Environmental Protection Law No. 52 of 2006	This law considers the Ministry of Environment to be the qualified authority for the protection of the environment in Jordan. The official authorities shall be bound to carry out the instructions and decisions issued under the provisions of this law, which gives the ministry all the judicial powers it requires for carrying out the law. The issuing of the Environmental Protection Law was a significant development in environmental protection in Jordan. It provides a solid foundation for the inclusion of principles that are more specific along with steps and substantive requirements of a sectoral nature. Furthermore, regulations organise particular areas such as air protection, water protection, nature conservation and environmental impacts (Ministry of Environment, 2006).
Legislation Relating to Wastewater	Purpose
Jordanian Standards No. 202/1991 Industrial Wastewater	This standard is concerned with the conditions and parameters required for industrial wastewater produced from all industrial activities and which needs to be discharged into the surface water or which feeds naturally into the groundwater or which is aimed at use for agricultural activities (Seder & Abdel Jabbar, 2011).
Jordanian Standards No. 893/1995 Treated Domestic Wastewater	This standard is intentionally set to determine the conditions that the reclaimed domestic wastewater which is discharged from wastewater treatment plants should meet to be released or used in the different fields stated in this standard (Seder & Abdel Jabbar, 2011).
Jordanian Standards No. 1145/1996 Reuse of Treated Wastewater	This standard provides strict control of the process of sludge conversion to organic soil conditioner for agriculture. Moreover, it limits the places that such converted sludge can be used for soil enrichment. The standard also defines the times during which the digested sludge can be utilised and applied to agricultural soils (Al-Zu'bi, 2011).
Legislation Relating to Freshwater	Purpose
Water Authority Law No.18-1988	Water Authority is responsible for developing, protecting, conserving and managing all water resources and sewer projects (Al-Zu'bi, 2011).
Jordan Valley Authority Law No. 19/1988	Jordan Valley Authority is responsible for all activities within Jordan Valley boundaries including water, irrigation and construction work (Al-Zu'bi, 2011).
Ministry of Water and Irrigation By-law No.54/1992	This law enables the Ministry of Water and Irrigation to be the official body responsible for the overall monitoring of the water sector, wastewater systems, water supply and related projects, planning and management, the formulation of national water strategies and policies, information systems, research and development, and procurement of financial resources. Its role also includes the provision of centralised water-related data and the standardisation and consolidation of data (Saidam & Ibrahim, 2006).
Jordanian Standards No. 286/1997 Drinking Water	This Standard addresses the standard requirements and quality control for drinking water (Al-Zu'bi, 2011).
Legislation Relating to Municipal and Rural Affairs	Purpose
Municipalities Law of 2011	This law gives specific responsibilities of the municipalities and states that the council is responsible for the provision of water to the residents, and for the determination of the means which are used for this purpose. These include isolation of pipelines, determination of tariffs and fees, the organisation of

water allocation, and the prevention of contamination of springs, pools, canals, and cisterns (Ministry of Municipal Affairs, 2011).

Legislation Relating to Agriculture	Purpose
Agriculture Law of 2002	This law is concerned with agriculture, forestry, and fisheries, and with the management and protection of animal, wildlife, and plant resources (Ministry of Agriculture, 2002).
Legislation Relating to Industrial Cities	Purpose
Industrial Cities Corporation Law No. 59/1985	The Industrial Cities Corporation Law relates to the study, planning, establishment, and management of industrial cities in Jordan (Al-Zu'bi, 2011).

Source: (Author).

5.3.1 Background to water legislation in Jordan

In the first decade of the last century, the Ottoman Sultan, Abdul Hamid II, enacted the first water law in the Transjordan region. That law provided the basis for the regulation of conflicts over water and land tenure. The chief principles of this law remained in Jordan until they were superseded in 1952 by the Law of Water and Land Settlement. The first water law did not pay attention to wastewater treatment as much as the Law of Water of 1952 did. Wastewater collection has been practised in Transjordan in a limited way since 1930 when it began in Salt, a city about 30km west of the capital, Amman. Some wastewater treatment was conducted using fundamental physical processes. Generally, during the period 1930s-1950s, septic tanks and cesspits were used and greywater was often exploited for watering gardens. This practice resulted in environmental and public health risks as populations grew (Nazzal et al., 2000). Carr et al. (2011) show that since the establishment of the As-Samra WWTP there have been agricultural challenges associated with using reused water for agriculture such as salinity of farming soil, irrigation system damage, marketing of produce, and human health risks.

Municipality Law Number 29/1955 gave the public authorities of Amman and other legally constituted districts the legal capacity to build and operate water systems and to define standards for water system construction and to set charges for water use (Al-Zu'bi, 2011). The law also explicitly entrusted the government's water agency with the responsibility to prevent the contamination of water supply springs, canals, and basins or weirs (Seder & Abdul-Jabbar, 2011). The law also gave the government the authority to construct public sewers and to undertake the

‘management and supervision of the sewers’. This legislation applied only to the defined region of the municipality. Interestingly, the law provided the districts with authority to develop concessions for the operation of public utilities by private-sector operators and constructors so long as such concessions did not exceed 30 years (Nazzal et al., 2000).

The Natural Resources Authority was founded in 1965 to manage, develop, and conserve Jordan’s natural resources. Ultimately, the public agency was given power over mineral sources and petroleum, as well as policy setting on water resources development and irrigation (De Albuquerque, 2014).

In 1966, the Jordanian government adopted the Building, Rural and Urban Planning Law number 79. The code provided government agencies with the power to regulate ‘the deposition, collection or discharging of wastewater’ that might create a nuisance or damage (Nazzal et al., 2000). The statute also gave the city councils the authority to issue a notice of harm or damage and to order the offender to rectify the situation within the period specified in the notification. Under the law, if the person responsible failed to remove the damage, the city council was granted the power to conduct the work and claim the expenses for such work through the courts (Nazzal et al., 2000).

The primary public health framework for wastewater control was established by Public Health Law Number 21/1971 (De Albuquerque, 2014). The law provided the Ministry of Health with the power to monitor and regulate wastewater outflows and the design of wastewater facilities. The law also regulated and developed sewers in new municipalities and restricted the number of connections that could be added to any particular treatment plant or sewer in terms of the accepted and approved design. The law also allows tankers that discharge wastewater in places not designed for the purpose to be punished (Nazzal et al., 2000).

In 1977, as mentioned earlier, the Jordan Valley Authority was founded by Law Number 18. Under this law, the authority gained the broad power to plan and develop reclaimed water and freshwater supply projects in the Jordan River Valley (Abu-Sharar, 2006).

In 1987 and 1988, the Water Authority of Jordan developed a comprehensive law, WAJ Law Number 18/1988, to control discharges of industrial activities to public

sewerage (Nortcliff et al., 2008). The law, the 'Instructions for Commercial and Industrial Wastewater' provides the legal basis to prevent the entry of toxic and damaging substances and liquids to Jordan's public sewerage (Al-Zu'bi, 2011). The law was needed because the As-Samra WWTP and other plants are not designed to treat industrial wastewater which is more dangerous to the environment and human health than domestic sewage (Al-Wer, 2009).

In 1991, after discussions with the Water Authority of Jordan, the Ministry of Planning, the Ministry of Health, and others, the Jordan Standards and Metrology Organisation published a standard to regulate the discharge of industrial effluent (Suleiman, Van-Well, & Gustafsson, 2008). The 1991 law superseded the 1983 martial law¹³ on discharges of industrial effluent. The Jordanian standards include a set of criteria governing the treatment quality wastewater that can be discharged, for irrigation purposes or recharge of groundwater, into a number of receiving waters (Nazzal et al., 2000).

Although major improvements have been made to Jordanian legislation and standards relating to reuse of wastewater, the critical situation for water indicates the need for further progress in this area. The need to improve wastewater reuse standards is due to the expected rapid growth in supplies of treated wastewater that will be necessary for Jordan to expand the use of reclaimed wastewater in farming activities and to promote industrial recycling of water in the future (Al-Zu'bi, 2011). Using treated wastewater for farming purposes, as a substitute for freshwater, contributes to creating water balance in the Jordan River Valley and reduces the adverse effect of depleting surface and groundwater.

5.4 Water Management in the Lower Jordan River Basin

The Jordan River is an international river which drains a total of about 18,000km² of four adjacent countries to Jordan; Syria, Lebanon, Israel, and Palestine (Suleiman, 2003). Its three tributaries originate from Lebanon and flow southward into Lake Tiberius. With the outflow of the Jordan River from Lake Tiberius almost entirely diverted by Israel to the Negev Desert, the Lower Jordan River receives its water primarily from its main tributary, the Yarmouk River, as shown in Figure 4-

¹³ This law was enacted during the armed confrontation between the Jordanian army and the Palestinian organisations in 1970. The Jordanian government repealed this law in 1989.

2. As stated earlier, Jordan is one of the countries with the scarcest water resources in the world (Al-Mashaqbeh, Ghrair, & Megdal, 2012). Due to both a lack of physical water and high demographic growth during most of the second half of the 20th century (Courcier, Venot, Molle, Suleiman, & Jridi, 2005; Al-Zboon & Al-Suhaili, 2009), it has been estimated that the domestic water supply is now only 126 litres per capita per day (Ministry of Water and Irrigation, 2015), while, for example, in Australia it is 340 litres per capita per day (Riverina Water County Council, 2016). The quantity of water used in the Lower Jordan River Basin amounts to 503 million cubic metres per year (Mm³/year) including 178 Mm³/year in the Jordan Valley and 325 Mm³/year in the Highlands (Ministry of Water and Irrigation, 2016).

The Lower Jordan River Basin includes three quarters of Jordan's total population, most of its leading industries, and 80% of its irrigated agriculture. It is endowed with 80% of the country's water resources and utilises 75% of these (Venot, Molle, & Courcier, 2008). During the period 1950 to 2000, this basin experienced a quick and comprehensive process of mobilisation of its scarce water and resources that has led to its gradual closure; almost no water remains to be mobilised and utilised, while demand, especially in urban areas, keeps increasing (Courcier et al., 2005). Water users and different economic sectors are contending for the same rare resources. This situation has led to quantitatively and qualitatively decreasing water resources (Al-Mashaqbeh et al., 2012).

The primary interactions and water allocation difficulties in the Lower Jordan River Basin are displayed in Figure 5.3. Amman and other cities are provided with water from the Jordan River Valley, aquifers, and imports from other basins. To meet the increasing water demand, there is a need to first, enhance inflow from the Yarmouk River (Haddadin, 2009), second, transfer more water from the Jordan Valley to Amman, third, minimise over-exploitation from aquifers by irrigated agriculture in the Highlands to preserve water quality, avoid overdraft and reallocate water to municipalities, and, finally, depend on imports from other basins as little as possible (Denny et al., 2008).

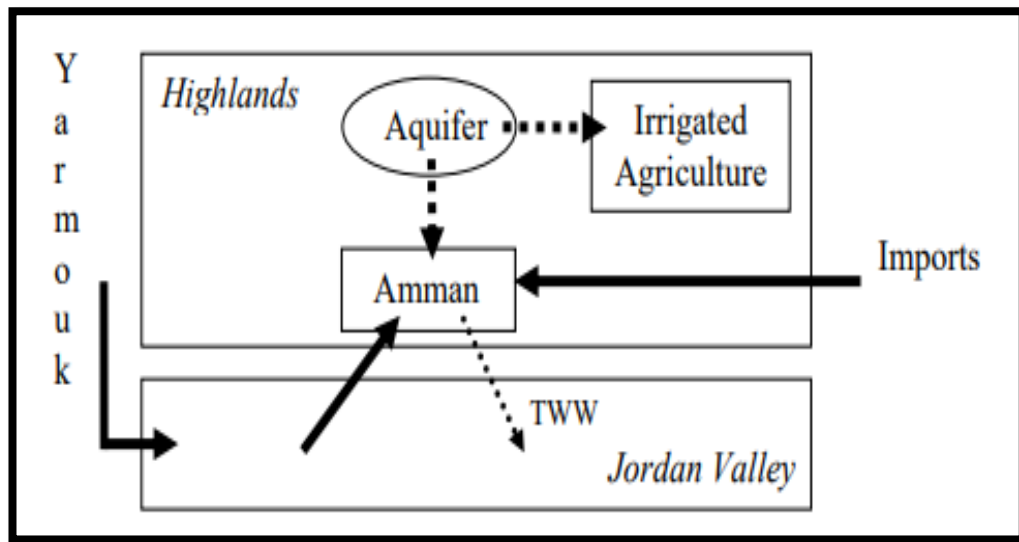


Figure 5.3: Schematic representation of main water flows in the Lower Jordan River Basin.

Source: (Courcier et al., 2005).

The Lower Jordan River Valley represents 40% of the entire Jordan River Valley but only 7.8% of Jordan's territory (Ayadi, 2006). Nevertheless, irrigated farming, which utilises 70% of the national water resources, is also chiefly concentrated in the valley (Venot et al., 2008). From west to east, the Lower Jordan River Valley is divided into two central areas; the Jordan River Valley and the remaining part referred to as the uplands (see Figure 5.4).

The Jordan River Valley comprises a 130km stretch between the Yarmouk River in the north and the Dead Sea in the south. Its altitude varies from 200m in the north to 400m below sea level in the south (Ayadi, 2006). Its climate is arid to semiarid starting from south to north. Agriculture is prosperous thanks to networks fed by a canal that irrigates 20,000 hectares (Samuels, Smiatek, Krichak, Kunstmann, & Alpert, 2011).

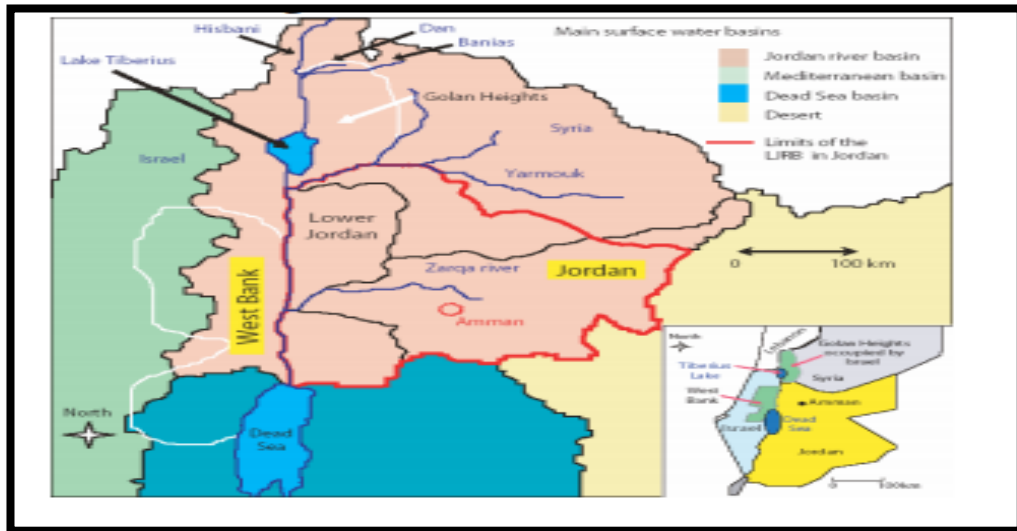


Figure 5.4: The Lower Jordan River Basin in Jordan.

Source: (Courcier et al., 2005).

5.4.1 Drivers of the closure of the Lower Jordan River Basin

During the first half of the last century, the Jordan River had a flow of 1.3 billion cubic metres per year. In 2010, the original flow rate of the Jordan River into the Dead Sea¹⁴ varied between 20 and 30 Mm³/year (Moser, 2010). Half of this amount used to come from the Upper Jordan River through Lake Tiberius but is now redirected by Israel to its National Water Carrier (Kliot, 2005). The Yarmouk River and the Zarqa River are now the two chief contributors to surface water resources in the Lower Jordan River Basin (Mehyar, Al Khateeb, Bromberg, & Koch-Ya'ari, 2014). Several short-lived streams of the lesser significance named 'side-wadis' also cut into two steep banks and feed the Lower Jordan River. The Zarqa River is the only national river in Jordan. It originates from Amman, so it is vulnerable to the groundwater level. Groundwater resources originate from four central groundwater basins, namely the Amman-Zarqa Basin, the Yarmouk River, the side-wadis, and the Jordan River Valley (Hötzl, Möller, & Rosenthal, 2008).

Historical appraisal of the different water resources development and use within the Lower Jordan River Basin demonstrates the gradual 'artificialisation' of the river basin (Suleiman, 2003). This transformation is due to the unwise institutional

¹⁴ The Dead Sea constitutes a part of the water border between Israel and Jordan. It is a salty lake whose banks are more than 400m below sea level. The Dead Sea is considered the lowest land point on the Earth.

politics and the increasing pollution originating from the growth in various industrial activities accompanying urbanisation (Denny et al., 2008). The situation around 1950 was different when only 10,000 hectares were irrigated, groundwater was untapped, and freshwater flowed to the Dead Sea. That situation can be compared to the current situation where 46,000 hectares are irrigated and nearly all surface water resources are tapped and committed. In addition, groundwater is being highly exploited, leaving only a little water to reach the Dead Sea, and making the sea a salty sink (Courcier et al., 2005).

First, partial alteration of the Jordan River flow enacted by Israel and the Yarmouk River enacted by Syria led to a reduction of the total inflow into the Lower Jordan River Basin from 3,300 to 2,600 Mm³/year between the 1950s and the 2000s. Second, a high population growth associated to both a high natural growth rate (2.2% per year) (Geoba.se, 2017), successive waves of migrations, and the steady development of urban areas such as Amman-Zarqa have led to rising water demand (Venot et al., 2008). Despite a notable degree of infrastructural development, these two trends inevitably led to a sharp reduction of the per capita water availability. Estimated at 3,600m³ in 1946, the renewable freshwater per capita and per year reduced to 163m³ around 2000 and is anticipated to further drop to 90m³ in 2025. Consequently, Jordan needs a comprehensive plan for water management and a serious intention to implement it in the long term (Suleiman, 2003; Hoff, Bonzi, Joyce, & Tielbörger, 2011). As an example of the lack of water management, freshwater supply in the municipalities expanded through the development of public wells in and around urban regions and water transfers from neighbouring aquifers without taking into consideration the unsustainability of these practices in the long term. In the 2000s, domestic and industrial exploitation amounted to 205Mm³/year as opposed to 10Mm³/year in the early 1950s (Suleiman, 2003).

Second, irrigated agriculture was developed, on the basis of social (integrating Palestinian refugee populations to create jobs for them), political (fostering stability in the Middle East after the creation of Israel through investment in agriculture) and economic (improving Jordan's development through augmented revenues from agriculture sector) objectives (Courcier et al., 2005). Farming is now the primary user of the country's scarce resources. In the Highlands where most of the natural springs which feed the Yarmouk River and the Zarqa River are located, several

government projects¹⁵ aimed at settling Bedouins were implemented in the 1960s; land was irrigated by deep public aquifers. Although these projects concentrated on subsistence farming, they appear to have failed in most cases. Many Bedouins adopted the notion of using public groundwater wells for agriculture during the 1980s and the early 1990s. Later, they started digging their own unauthorised private wells and engaged in selling water to farmers. This practice resulted in dramatic over-exploitation of groundwater. In the 2000s, about 185Mm³/year of irrigation water was utilised in the Jordan River Valley (Courcier et al., 2005).

Figure 5.5 demonstrates water resources in the Lower Jordan River Basin. Of its 470Mm³, 200Mm³ of the Yarmouk River water goes to Syria, 90Mm³ to Jordan, and 110Mm³ to Israel, while the rest goes to Tiberius Lake. The Jordan River Valley is divided into three parts. The northeast part receives 55Mm³ from the Yarmouk River and the middle section receives 10Mm³ from the Yarmouk River along with 55Mm³ of mixed water from the Yarmouk and the Zarqa Rivers. However, the southern part receives 90Mm³ from the King Talal Dam, which helps to explain why the pollution in the central and southern parts is higher than in the middle section, as the most significant amount of irrigation water in the middle and south sections comes from the King Talal Dam. In the 2000s, total renewable freshwater was appraised at 705Mm³/year (550Mm³/year of surface runoff and 155Mm³/year of groundwater recharge (Van-Aken et al., 2009). Total water withdrawals in the basin reached 585Mm³/year (for instance, 83% of the renewable surface water and groundwater), including 275Mm³/year in groundwater abstraction (e.g., a gross overdraft of the aquifers of 120Mm³/year), and 310Mm³/year of surface water diversion (including 60Mm³/year of recycled wastewater) (Van-Aken et al., 2009). Besides, the basin also imports 30Mm³/year of groundwater and 45Mm³/year of surface water from outer basins. Free flows to the Dead Sea are low and amount to 315Mm³/year (Courcier et al., 2005).

¹⁵ Such as the projects in Northern Badia in Mafraq governorate and in Middle Badia in East and South Amman.

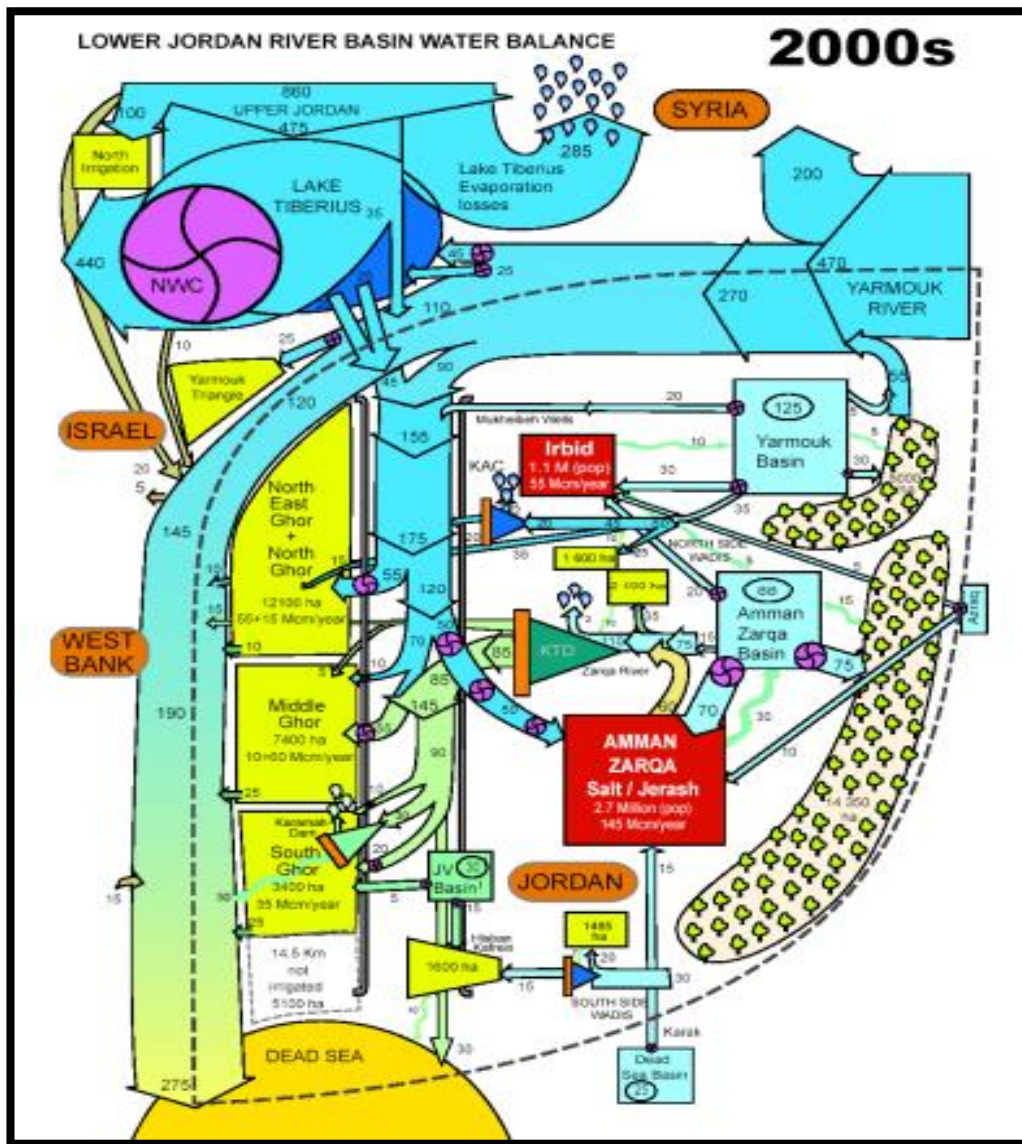


Figure 5.5: Water resources and uses in the Lower Jordan River Basin in the 2000s.

Source: (Courcier et al., 2005).

5.4.2 Changing components of the water accounting in the Lower Jordan River Basin

The qualitative information on the change in the Lower Jordan River Basin can be paralleled by quantitative information on the inequality between water supply and demand (Gunkel & Lange, 2012). This water accounting draws on the categories of water balance suggested by Molden (1997). These levels include a category of application such as an irrigated field or household, a service category such as irrigation or water supply system, and a water basin level that may involve several uses. The historical changes in the components of the water balance and water accounting of the water flows is discussed in the following sections.

There are no legal or ethical responsibilities regarding sustaining the quantity and quality of the water entering the Dead Sea, which is, therefore, deemed as a sink (Venot et al., 2008). Accounting for the water flow needed to maintain the level of the Dead Sea as a 'duty' would change water balances to the point of making this duty senseless, as carrying it out would amount to an extreme over-commitment, since the basin has been suffering a shortage of around 540Mm³/year since the early 1950s (Suleiman, 2003). Water depletion is defined as the use or elimination of water from a water basin that renders it unavailable for further purposes (Molden, 1997) On the basis of this definition, the Lower Jordan River Basin used 86% of its net inflow (for instance, rainfall, inter-basin, transfers and lateral groundwater flows) through evaporation and evapotranspiration in the 2000s (Venot et al., 2008). The only water reaching the Dead Sea comes (uncontrolled) from the Upper Yarmouk River Basin (110Mm³), the Upper Jordan River (10Mm³), return flows from irrigated areas (70Mm³), and excess or free flows from canals and side-*wadis* (125Mm³) (Venot et al., 2008; Van-Aken et al., 2009). Moreover, beneficial depletion (irrigation, rain-fed agriculture, and industrial and drinking uses) accounts for 33% of the net inflow, low useful depletion (natural vegetation) for 15%, and nonbeneficial depletion (through open land evaporation) for 38% of it. The remaining 14% flows go into the Dead Sea (Courcier et al., 2005).

Most of the water depletion takes place in desert areas (44% of the total water depleted in the Lower Jordan River Basin). Evaporation in irrigated areas accounts for 18% of the complete depletion, as much as the depleted amounts through either rain-fed farming or natural vegetation, despite their much smaller areas. Finally, despite all the allocation disputes between municipalities and agriculture, the share taken for domestic and industrial purposes is negligible, representing only 3% of the entire depleted portion in the Lower Jordan River Basin (Venot et al., 2008; Van-Aken et al., 2009). There is, therefore, a need for adequately treated wastewater to save groundwater and as a substitute for freshwater for irrigation (Bajjali & Al-Hadidi, 2017).

The water balance has changed markedly, moving from a situation in the 1950s, when few surface water and groundwater resources were used, to the current position of over-exploitation (Courcier et al., 2005; Van-Aken et al., 2009). Figure 4.5 summarises main indicators of water mobilisation and uses in the Lower Jordan River Basin and their growth during the 1950s-2000s period, including some

projections for 2025. Figures indicate that total depletion has increased since the 1950s and amounted to 2290Mm³ in the 2000s. The first significant evolution is that of land use. Irrigated areas expanded more than fourfold between the 1950s and the 2000s. This total area (including both schemes in the Jordan River Valley and groundwater-based agriculture in the uplands) is projected to decline by 10% in the next quarter century. Rain-fed cropping regions increased significantly in the 1950-1975 period when cereals provided work and food to increasing population (Van-Aken et al., 2009). This extensive type of farming later declined, with the increasing influence of urban regions and a transformation towards nonagricultural activities (Suleiman, 2003)

In 2000, with only 315Mm³ reaching the Dead Sea every year, the shortage in inflow resulted in a regular and constant drop in the water level of the inland sea. Deducting rainfall evaporated from crop and exposed soils, the renewable freshwater shows a reduction of 56%, with a slump at 705Mm³ in 2000 and a subsequent projected rise of 23% projected for 2025 due to water imports (Courcier et al., 2005). The controllable renewable freshwater is significantly lower (545Mm³), since free and brackish flows from the Yarmouk River, side-*wadis* or Israel¹⁶ are discounted (Courcier et al., 2005; Van-Aken et al., 2009). The anticipated increase in 2025 reflects the water imports and the more significant share of flow of the Yarmouk River stored in the Al-Wehda Dam on the border between Syria and Jordan. The withdrawals of water amount to 121% of the controlled renewable freshwater (for instance, 660Mm³/year) because of groundwater over-exploitation and multiple diversions (Return flows from *wadi*-irrigation or Amman are reused downstream in the south of the Jordan River Valley) (Venot et al., 2008).

The most significant changes occurred in the 1950-1975 period when total beneficial depletion rose dramatically from 391Mm³ to 756Mm³/year and the total depletion from 58% to 78% of the net inflow (Van-Aken et al., 2009). This situation occurred because of the increased planted areas and because the net inflow was

¹⁶ Water is dealt with rather extensively in the Israeli-Jordanian Peace treaty. The treaty outlines the water allocations that both countries are entitled to from the Jordan River, including its tributary the Yarmouk River, and the shared groundwater in the Jordan Valley. The treaty also provides for the storing of Jordanian 'winter water' in the Lake Tiberius inside of Israel when they do have a relative excess of water flow. Israel subsequently releases the water in the dry summer period when Jordan needs it.

reduced by the diversion of the Upper Jordan River by Israel. This trend lasted into the last quarter century and took the beneficial depleted fraction to 39% of the total depleted in the basin in the 2000s (867Mm³/year; partly due to the over-abstraction of the groundwater). At the same time, the total depleted fraction grew to 86% of the net inflow and will proceed to rise to 92% in the next 25 years; only 8% of the inflow will reach the Dead Sea (Venot et al., 2008).

Nonbeneficial and low-beneficial depleted portions remained approximately constant since the 1950s, while their relative share continuously reduced due to the expansion of the cultivated region (both rain-fed and irrigated) contributed to increasing the beneficial depleted fraction. Furthermore, irrigation depletion dramatically rose from 2% of the net inflow in the 1950s to around 18% in the 2000s (making up 45% of the beneficial depleted fraction) (see Figure 5.6). These values are anticipated to mainly decrease under the assumption that irrigated agriculture of the uplands is to be reduced and that more water is to be imported into municipalities. Finally, the overall efficiency of water uses in the basin, deemed as a system and expressed both in the percentage of renewable freshwater or in the percentage of controlled renewable water, has reached 67% and 87%, respectively. These values are predicted to reach 82% and 87% in 2025 (Courcier et al., 2005).

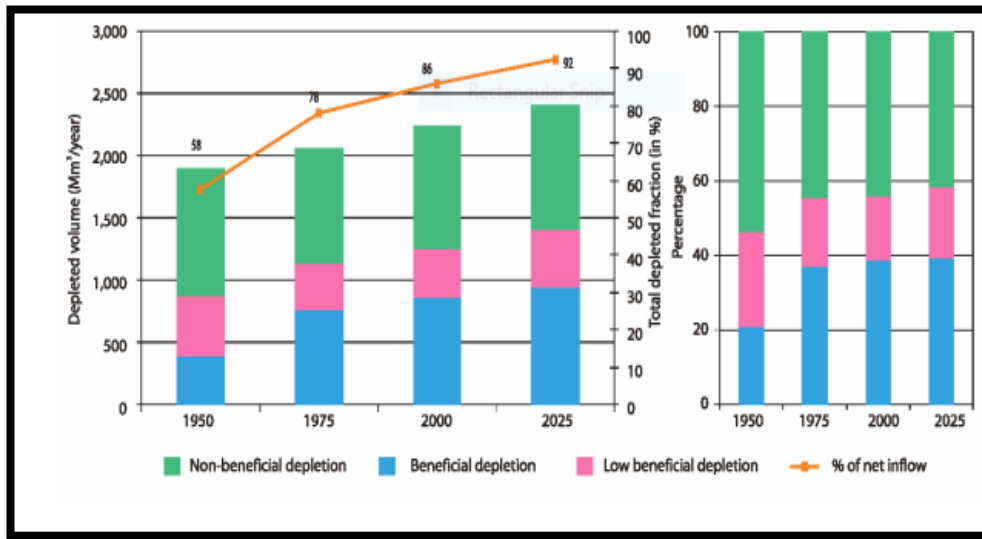


Figure 5.6: Evolution of depleted fractions in the Lower Jordan River Basin (nominal and percentage).

Source: (Courcier et al., 2005).

The values in Figure 5.6 underline the fact that the Lower Jordan River Basin is a closed basin where nearly no water is left to be gathered and used. In other words, there are few possibilities to mitigate the Jordanian water crisis through technical improvement aimed at raising freshwater use efficiency (where the ratio of depleted water to water withdrawals reaches 72%, according to Venot et al., 2008). Several factors affect the water situation in Jordan. Some are related to institutional factors and the others to Jordanian water policies.

5.5 Water Policies in Jordan

The Jordanian government is engaged in a critical reorientation of its water policy (Yorke, 2013). The publication of Jordan's water strategy and policies, the creation of the Ministry of Water and Irrigation, and the official issuance of a national water master plan called for the implementing of useful demand management options (notably through a drop in agricultural water consumption and a better management of urban water supplies). The Ministry of Water and Irrigation has begun to depend on publications targeting local communities in order to save water, as shown in Figure 5.7. The ministry has introduced Islamic materials encouraging people to take care of the limited water resources (Ministry of Water and Irrigation, 2010a). This approach may help focus on water demand management rather than water

domestic water in the Amman-Zarqa Basin. The project finished in 2013 (Schyns et al., 2015). Before to that project, the Disi water had been used during the previous three decades for agricultural purposes, as the groundwater in the Disi represents the only strategic freshwater reserve in Jordan (Salameh, Alraggad, & Tarawneh, 2014; Schyns et al., 2015). After many years of abstraction for agricultural purposes in the south of Jordan, groundwater levels of the Disi reduced approximately 25m. The Disi aquifer receives an average water renewal of 50Mm³/year, but this amount is lost as natural outflow (Salameh et al., 2014).

The Jordanian government decided not to renew the licences for the Disi irrigation projects in the south of the country. This decision was strongly supported by cooperation partners such as the German Technical Cooperation Agency (GTZ) and the United States Agency for International Development (USAID) (Magiera, Taha, & Nolte, 2006).

In order to augment the supply of domestic water in Amman, the Jordanian government has considered several grand projects such as the Disi aquifer and building the Red Sea-Dead Sea Canal. The Canal would link the Red Sea and the Dead Sea as well as an associated hydroelectric plant and desalination facilities. The length of the suggested Red Sea-Dead Sea Canal is about 180km and it would provide 850Mm³/year of freshwater to Jordan, Israel, and Palestine (Denny et al., 2008). Theoretically, this canal would also revive the Dead Sea's water level to around 400m below sea level (Al-Omari, Salman, & Karablieh, 2014). It is now 430.5m below sea level (Israel Oceanographic and Limnological Research, 2018).

The main benefit of this project is to create renewable water resource, which would give a long-term solution to water problems in Jordan. Additionally, the project may be able to conserve the Dead Sea by using seawater to compensate for present water loss (Hussein, 2018b). Some have also argued that this canal could offer a platform for regional peace and cooperation with Israel (Ferragina & Greco, 2008).

In addition to the Disi project and the Red Sea-Dead Sea Canal, the government of Jordan takes into account the desalination of seawater. The central principle of a desalination plant is to turn seawater into freshwater fit for human consumption or irrigation (Hadadin et al., 2010). Since the signing of the peace agreement with Israel in 1994, the building of a desalination plant in Aqaba city has been discussed.

Denny et al., (2008) indicated significant growth in this city is, therefore, anticipated and the desalination plant would aim to meet the water demand for the area's increasing population as well as the needs of the industrial and the tourist sectors.

Desalination is also a technology that is already exploited in the Middle East, particularly in Israel and Saudi Arabia. As the effectiveness of desalination plants improves, this technology can help augment existing water supplies (Denny et al., 2008). Politically, this technology does not require regional cooperation, so its implementation is much more manageable (Alqadi & Kumar, 2014).

5.5.2 Community-based water projects

In addition to grand projects and national reforms, it is essential that the demand side water levels take into consideration the potential for change at the local level through community-based initiatives (Denny et al., 2008). For instance, Jordanian NGOs and international aid agencies are financing community-based organisation to promote household water-conservation projects (Denny et al., 2008). Such projects cover switching to more efficient irrigation techniques, installing rainwater harvesting containers for collecting drinking water, and helping breeders of sheep and goats to use water efficiently (Hadadin et al., 2010).

A useful variation of such projects is microloan programmes that grant qualifying societies a small amount of money to perform water projects deemed necessary by the community itself (Denny et al., 2008). The fact that communities themselves have information about the kinds of projects that they would find most beneficial is a crucial element in making such initiatives sustainable in the long term (Denny et al., 2008).

In order to promote society initiatives, the Jordanian government can consolidate local projects with comprehensive institutional support and cooperation. Doing so can fill the gaps in communication and resource sharing that traditionally exist between national government, donor agencies, NGOs, and local societies (Denny et al., 2008a; Salman, Al-Karablieh, Regner, Wolff, & Haddadin, 2008).

5.5.3 Enforcing water regulations

At the institutional level, Jordan, like other water-poor countries, has strict statutes regulating weekly household water consumption and illegal drilling for groundwater (Abu-Sharar, 2006). As stated previously, groundwater in Jordan is deemed government property. In practice, however, compliance with water laws is imperfect, especially in rural areas in the south and east of the country. The power of some tribes has led the Ministry of Water and Irrigation enforcement officers to avoid patrolling these communities for fear of physical attack (Denny et al., 2008). The government could create a stronger enforcement mechanism in the case of abusers of water by transferring these responsibilities to the military or police instead of the Ministry of Water and Irrigation and making an example of particular offending communities (Denny et al., 2008; Yorke, 2013).

A significant problem with strict enforcement of regulations is that it could reveal underlying tribal conflict and create social disturbance in rural regions, negating the positive impact of law enforcement of water usage (Mustafa, Altz-Stamm, & Scott, 2016). However, making an example by enforcing the law against some offenders could have a deterrent influence on neighbouring populations and eventually lead to higher compliance with aquifer drilling laws across the kingdom (Mustafa et al., 2016).

In the short term, continued policing to stop the digging of aquifers would increase the water table, decrease demand, and improve the rule of law (Denny et al., 2008). A drawback, however, is that transferring legal enforcement responsibilities from the Ministry of Water and Irrigation to the police or military without increasing their financial allocation would turn officers away from other tasks that are within their traditional domain (Denny et al., 2008).

The first step to manage the actual demand for water was taken in with an embargo on the authorisation of well drilling. However, digging of wells continued, indicating breaching of the current laws and the dominance of nepotism within the Jordanian community (Bin-Tareef, 2013). The second step involved implementing a tax for any water pumped or sold/used for industrial or aesthetic uses. The third introduced metering for farming groundwater abstraction. In response to a drop reflecting water availability, the fourth step involved managing the quotas allotted to agricultural uses. Fifth came modernisation of irrigation systems. Sixth came the

recommendation to raise irrigation water charges in the Jordan River Valley. The seventh related to reprocessing of water through increasing use of reclaimed wastewater in the south of the valley and, finally, a growing amount of water was reallocated from agriculture to urban purposes (around the 2000s, 50Mm³/year). The reallocation transferred water from the Jordan River Valley to Amman; this project is estimated to increase the amount to 90Mm³/year by the year 2025 (Van-Aken et al., 2009; Venot et al., 2008).

The moderately high water use efficiency, the limited losses through percolation, and the expense of using high-tech equipment indicate that the scope for water savings both at the regional and basin levels is more restricted than often believed. Reopening the Lower Jordan River Basin through water transfers (freshwater for domestic uses, sufficiently treated wastewater for irrigation, and desalinisation) as also seen in Israel might become a common characteristic of the development of the river basin in the future (Scott et al., 2003).

5.6 Institutional Politics in Jordan

Factors such as policy, culture, belief, the general legal framework, and traditional and local institutions have (purposefully as well as unintentionally) influenced water governance and water institutions. Further, policies and priorities in other policy fields like agriculture, the economy, ecology, or, in countries with transnational water resources, foreign affairs influence the performance of water institutions (Sehring, 2006).

5.6.1 Nepotism (*Wasta*)

To understand nepotism and its effects on the Jordanian community, it is necessary to trace its origins. On the day before of the establishment of the Transjordanian Emirate in 1921, almost the entire population of Jordan was organised along tribal principles and maintained tribal customs. The tribe determined conclusively every aspect of people's lives, forming in most cases their primary frame of reference for decision-making (Brand, 2008). The control over freshwater and land, seasonal migration, the provision of individual safety, conflict resolution, and marriage preparations all happened either within the tribal system or through its conventions (Al-Ramahi, 2008).

King Hussein, just like his grandfather, the founder of Transjordan, King Abdullah I, understood the necessity for strong personal ties with the Bedouins. Thus, he visited them often, socialising in their tents and playing the role of the dominant tribal *sheikh*¹⁷. Although King Hussein became progressively autocratic in the last years of his rule, he continued to owe a debt of gratitude to a small circle within the ruling aristocracy who were tribal men. King Hussein's authority eventually rested on the armed forces and the general intelligence apparatuses, which were mostly dominated by tribal persons. This reliance continued after King Hussein's death. King Abdullah II's inexperience as a leader ensured his need for his late father's closest consultants. However, even after King Abdullah II had established himself, the next generation of counsellors came from the same traditional elite (Al-Ramahi, 2008). Saleh Al-Armouti, a member of parliament, emphasises that there are three existing power centres in Jordan; the first resides in the general intelligence apparatuses, the second in the royal palace, and the third is the official government (Jordan Television, 2018). The first two centres constitute the hidden power centres; these affect the king's opinion and the entire policy of the country (Denny et al., 2008).

The concept of nepotism is rooted in the Jordanian community. It affects the family and leaves a profound influence on how family members think. Jarrar (2017) shows that the most dangerous kind of cronyism is when the victims are children. This preferential treatment habitually happens in schools and sports clubs, when a child is given attention just because his/her father/mother is a staff member in the school or the sports club. This favouritism makes other children hate the society when they grow up and makes them believe that nepotism is a way to keep their right especially in relation to obtaining jobs. Besides, the effects of nepotism stretch beyond the family, to formal relationships among employees in the country. Al-Shawawreh (2016) explains that nepotism is more widespread in the public sector more than in the private sector, as private organisations have profitable aims that need active employees who have the skills to accomplish the final objective, that of maximising profits. However, the case is different in the public sector because often there are no measurable objectives, especially in developing countries where people are forced to accept the government services regardless of their inferiority and

¹⁷ An Arab leader, in particular the chief or head of an Arab tribe, family, or village.

quality. The nepotistic situation in Jordan, especially in the water management sector, is clearly apparent (Yorke, 2013).

The water situation in Jordan is complicated, so it is essential to understand the power dynamics of the country (Denny et al., 2008). Knowledge of where power is centred and who controls decision-making will serve to formulate policy recommendations that are both reasonable and sustainable given political, cultural, and bureaucratic truths (Denny et al., 2008).

Jordan is a monarchy, and decision-making processes usually start, finish or at least pass through the Royal Court (Denny et al., 2008). This statement is correct despite the appearance of democracy that Jordan's three ruling authorities practise. The fact that the three authorities' own members are either directly or indirectly appointed by an influential king means that politics which are not in line with the king's priorities rarely originate from within the government (Denny et al., 2008). Yorke (2013) argues that the relations between the Royal Court and the powerful tribes and landowners have constituted what it is called a 'shadow state' affecting the decision-making in the water governance.

Parliament consists of the Senate and the House of Deputies. Senators are appointed by the king, while deputies are selected by the citizens through direct elections. The king has the constitutional power to dissolve parliament at any time. Generally, the legislative authorities' actual ability is limited because, in many respects, its primary function is to approve or legitimise programmes proposed by the king. More often, it exercises what power it has by denying the king's proposals rather than generating its own initiatives (Denny et al., 2008).

The administration of all national and international Jordanian affairs is entrusted to the prime minister and the Council of Ministers (Government of Jordan, 2013), the members of which are selected by the king and approved by the House of Deputies. The most significant ministries regarding water policy are the Ministry of Water and Irrigation, the Ministry of Planning (which supervises the financial allocation and implementation of many projects), and the Ministry of Agriculture (a key player due to the large percentage of water utilised for irrigation) (Denny et al., 2008).

The question of who exercises influence regarding water policy is much more complicated than merely analysing the governmental structure, however (Yorke,

2013). First, one must judge who the actual individuals are in government. The phenomena of nepotism – a centuries-old custom of assigning weight to tribal and family-related relationships when awarding professional positions – is rife in Jordan, which retains a robust tribal system (Sidani & Thornberry, 2013). Designating state resources, choosing within ministries, and deciding promotions within the country's bureaucracy are all features of Jordanian life that owe much to the practice of preferring nepotism over strict considerations of ability, need, and skill. Unlike outright corruption such as allocating state treasury funds, nepotism does not suffer from negative public opinion and is seen merely as a way of doing business. Favoritism negatively impacts productivity in all Jordan's ministries and the Ministry of Water and Irrigation is no exception (Denny et al., 2008).

Powerful tribes can build and maintain relationships with the government through these connections and thereby actively lobby in the interest of their group (Sidani & Thornberry, 2013). Interestingly, the impact of tribes is historical and cultural rather than economic. This control and its relevance to water policy have also been disclosed in palpable ways on the ground. Government and civil sectors alike cite the recent fire shooting encountered by the Ministry of Water and Irrigation officials who tried to stop illegal tribal well drilling as an example of how tribes oppose unacceptable government policies. A prevailing sentiment on the ground is that the only person the tribes will listen to is the king (Denny et al., 2008).

Ironically, this level of power works in both directions. While the king has a distinguished position of control over the tribes, the king is also reliant on the tribes for continued legitimacy and support (Mustafa et al., 2016). In general, the king must be cautious to maintain favourable public opinion of the monarchy to conserve his authority and control. Doing so is particularly challenging in the field of water due to the resource's insufficient availability, which means that people gain more influence when demanding shifts in water policy (Denny et al., 2008). Both nepotism and the central government administration play a pivotal role that affects the water situation in Jordan.

5.6.2 Bureaucracy

Some Jordanian government entities deal with water in the domestic context and Jordan's relations with riparian countries: These entities are the royal cabinet (the king's staff), the Ministry of Water and Irrigation, the Ministry of Agriculture, the

Ministry of Planning, the Ministry of Environment, and the Ministry of Foreign Affairs (Venot et al., 2008). In contrast the United States' federal government, where strategic resource planning happens within agencies in conjunction with the White House-based planning and budgetary team, long-range strategic planning in Jordan occurs in the Ministry of Planning and so planning is relatively separated from the daily processes in the Ministry of Water and Irrigation itself. Some interagency water panels meet bi-weekly at the level of vice minister to discuss grand projects, near-term reallocation aims, and donor agency coordination, a procedure which reflects the administrative slackness and the centralized nature of decision-making (Denny et al., 2008).

The Ministry of Water and Irrigation is responsible for all of Jordan's centralised freshwater and wastewater systems, as well as for creating national water policy (Tarawneh et al., 2008). In principle, all ministries work under the Ministry of Water and Irrigation's strategic National Water Master Plan. According to the vice minister of the Ministry of Water and Irrigation, strategic plans are updated to describe planning activities that cover the influxes of refugees in its predictions (Denny et al., 2008).

In practice, water allocation across the country can be a random affair, with the Ministry of Water and Irrigation subdirectorates and city councils across the country making personal requests to senior ministry officials asking for the tap to be turned on in their region (Denny et al., 2008). The Ministry of Water and Irrigation officials are also responsible for implementation of water shares, an often-perilous task that pits the prerogatives of the central government against the control of local tribes whose power allows them to tap groundwater with impunity (Mustafa et al., 2016). In addition to nepotism and bureaucracy, the geopolitics of water affects the political will and increases the adverse water situation in Jordan.

5.6.3 Geopolitics of Water in Jordan

The water policy of Jordan and the related decision-making power are dictated by regional geopolitics (Hoff et al., 2011). Most of Jordan's significant freshwater resources are transnational (Schyns et al., 2015). In the case of the Jordan River, Jordan is downstream from Israel and Syria and, therefore, has little bargaining influence with its neighbours in terms of freshwater. Although Jordan is stable, it is influenced by destabilising factors that originate abroad, for example, its unstable

political relations with Israel, Syria, and Saudi Arabia. Therefore, the government is often obliged to respond reactively to external shocks instead of responding proactively to longer-term crises such as lack of water (Denny et al., 2008; Hoff et al., 2011).

As indicated earlier, Jordan obtains more than 36% of its water from sources shared by its neighbours (Kliot, 2005). The Jordan River is utilised by Syria, Israel, Palestine, and Jordan. A long history of competition for limited water resources exists among these countries and at times controversy over water has contributed to more critical regional disputes (Hoff et al., 2011). Syria protested to the United Nations in the 1960s when Israel started building its National Water Carrier, diverting the Jordan River to the Negev Desert (Denny et al., 2008). When the Arab countries decided to divert the Jordan River's headwaters in 1964, border disputes, which later contributed to the outbreak of the 1967 Arab-Israeli War, resulted. An Israeli victory improved Israel's water resources through control of the Golan Heights and the Palestinian aquifer, which in the past decades has led to charges that Israel is keeping water that rightly belongs to the Arab countries (Kliot, 2005).

Over 90% of the Jordan River is diverted for human use (Denny et al., 2008). Israel utilises about 60% of the flow of the Jordan River for domestic use and irrigation. Jordan and Syria share 40% of the river's supply, build dams, and divert water from its most significant tributary, the Yarmouk River (Kliot, 2005). The economies and societies in the Lower Jordan River Basin are vulnerable to any constraints in the supply of water, making the situation highly volatile (Selby, 2005).

Even when the broader political environment did not allow countries in the region to sign formal water agreements, Jordan and Israel continued meeting on an annual basis to review water issues at informal 'picnic table' conversations (Kliot, 2005). The 1994 peace treaty between Israel and Jordan agreed to set a joint Water Committee to develop further water resources, including two new weirs. The current agreement, however, does not discuss the present issue of shrinking groundwater resources or flow into the Dead Sea (Selby, 2005).

5.7 Chapter Summary

The water situation in Jordan is complicated and unsustainable. Jordan experiences rising freshwater demands that exceed availability; in addition, its surface and

groundwater resources are contaminated. The country depends heavily on freshwater resources that are outside its borders through the sharing of rivers and aquifers with adjacent countries. Sharing freshwater resources with Israel and Syria has led to instability in the past. Moreover, Jordan has experienced massive waves of refugees because of the current conflicts in the neighbouring countries, which raises Jordan's struggle to meet domestic freshwater needs.

In the last 50 years, the Lower Jordan River Basin has experienced a rapid and thorough process of development of its limited water resources. This process led to its continuous closure; almost no freshwater is left that can be mobilised and utilised while demand, notably in cities, keeps growing. Despite the need to take into account demand management options to mitigate the Jordanian water crisis, the potential of these opportunities appears insufficient in the mid-term; as a result, the increasing demand of the population and the sustaining of farming are unlikely to be met without supply growth measures, which will reopen the basin.

To preserve the surface water and groundwater resources, there is a need to develop an integrated water management system, including water policies and legislation. Most importantly is the necessity to implement the water policies and environmental regulations correctly. This task can be accomplished through people's awareness, rational water governance, and strong political will on the part of decision-makers. The next chapter deals with the study's methodology and methods.

Chapter 6: Research Methodology and Methods

6.1 Introduction

The chapter discusses the research methodology and methods used in the study. Dhawan (2010) describes research as a systematic process of investigating and analysing materials and situational elements relating to a research question in order to address and resolve it. Identification of the research methodology is a substantial factor in the research process. Research methodology in a social science field refers to the philosophical worldview, including ontological and epistemological assumptions, followed to study a particular social phenomenon. Research methodology is based on the research paradigm adopted by the researcher (Punch, 2013). A research paradigm is a combination of norms, values, beliefs, and the nature of knowledge a researcher holds concerning the world (Denzin & Lincoln, 2011). Newman and Benz (1998) illustrate that research can be conducted using a quantitative, qualitative, or mixed methods approach. In this study, a qualitative approach was adopted to understand the environmental consequences of pollution in the study area, the Jordan River Valley, from the stakeholders' perspectives. The impacts that pollution have on stakeholders are considered to be physical, emotional, and spiritual impacts.

In addition, the chapter discusses how the study was designed to achieve its objective. The first section, research methodology, discusses the selection of the research methodology, Islamic hermeneutics. The second section, research methods, is concerned with humanistic Islamic Hermeneutics and classical Islamic hermeneutics. The section includes data collection methods, primary data, qualitative interviews, conducting qualitative interviews, secondary data, documents, data analysis methods, qualitative content analysis. The chapter concludes with a chapter summary.

6.2 Research Methodology

This section discusses the research methodology adopted in the study. The discussion starts by identifying and explaining the difference between qualitative and quantitative research in order to distinguish between the two approaches. A

section, which discusses the way the qualitative approach adopted in the study was used then as follows.

6.2.1 Selection of research methodology

The research aims to investigate the impacts of pollution in the Jordan River Valley and the Zarqa River Basin. To achieve the research objective, a qualitative approach was adopted.

Creswell (2013b) defines research approaches as “plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation” (p. 3). The selection of a research approach depends on the nature of the research problem or issue being addressed, the audiences for the study, and the researcher’s personal experiences (Kumar, 2011).

Creswell (2013b, p. 4) defines qualitative research as “an approach to exploring and understanding the meaning individuals or groups ascribe to a social or human problem”. The process of the investigation involves emerging procedures and subquestions, data typically collected in the participant’s setting, inductive data analysis building from particulars to general themes, and the researcher, in turn, making interpretations of the meaning of the data (Denscombe, 2014).

In the quantitative approach, researchers set hypotheses to be accepted or rejected using statistical analysis (Teddlie & Tashakkori, 2009). Creswell (2013b, p. 4) describes quantitative research as “an approach for testing objective theories by examining the relationship among variables”. These variables can be measured, typically on instruments, so that numerated data can be analysed using statistical analysis (Creswell, 2013b). Quantitative researchers also have assumptions about testing theories deductively, controlling for alternative explanations, and being able to generalise typically and replicate the findings of their studies (Collis & Hussey, 2009).

One of the most common ways to understand qualitative research is to make a direct comparison between qualitative and quantitative research methods (Tracy, 2012): here, as the quantitative approach employs numbers and closed-ended questions, the qualitative approach draws on data drawn from texts and images and open-ended questions (Collis & Hussey, 2009; Denscombe, 2014). Researchers assert that qualitative research can be distinguished from quantitative research by means

of the many unique characteristics that are inherent in the methodological design (Creswell, 2013b).

Characteristics of qualitative research are appropriate for this study, as it occurs in social settings (Kumar, 2011). In addition, qualitative research is based on philosophical assumptions that are widely different from those underpinning quantitative designs. Hypotheses or theory are not established *a priori* in qualitative research (Creswell, 2013b). Creswell (2013a) describes these philosophical assumptions and shapes them into interpretive frameworks.

Creswell (2013a) proposes that interpretive frameworks can social science theories such as leadership, political influence and control, and attribution shape the theoretical lens that researchers use in their studies. Finally, reliability and objectivity are important and critical to both research traditions. That said, the criteria for judging qualitative research differs from those used for quantitative studies. First and foremost, the qualitative researcher seeks believability that rests upon coherence, insight, and instrumental utility (Lincoln, 1985). Moreover, trustworthiness can be achieved through a process of verification rather than through traditional reliability and validity measures (Creswell, 2013b). The following table shows the difference between qualitative and quantitative research methods.

Table 6-1: *Qualitative and quantitative methods.*

Qualitative Methods	Quantitative Methods
Emerging methods	Predetermined methods
Open-ended questions	Closed-ended questions
Interview data, observation data, document data, and audio-visual data	Performance data, observational data, attitude data, and census data
Text and image analysis	Statistical analysis
Themes, patterns, interpretation	Statistical interpretation

Source: Adapted from (Flick, 2008).

In planning a study, researchers need to think through the philosophical assumptions that they bring to the study, the research design that is related to these assumptions, and the methods of research that translate the approach into practice

(Welman, Kruger, & Mitchell, 2005). Worldviews are preferred ways of understating reality, building knowledge, and collecting information about the world (Tracy, 2012). A researcher's worldview can differ according to ontology (the nature of reality), epistemology (the nature of knowledge), or methodology (strategies for collecting and analysing data) (Tracy, 2012). Guba and Lincoln (1994) define research paradigms as 'the worldviews or belief systems that guide researchers'. Creswell (2013b) describes a paradigm as a general philosophical orientation about the world and the nature of research that is brought to a study.

The interpretive paradigm is typically considered as an approach to qualitative research. Qualitative researchers who adopt an interpretive paradigm believe that individuals attempt to understand the world in which they work and live (Locke, Spirduso, & Silverman, 2013). People develop subjective meanings for experiences directed toward particular observations (Creswell, 2013b). These meanings are varied and multiple, leading the researcher to look for the complexity of the viewpoints rather than narrowing meanings into a few ideas or categories. The aim of the research is to rely as much as possible on the participants' perspectives of the situation being addressed (Creswell, 2013b).

The study adopts a qualitative methodology, because the objective of this research is to understand the effects of pollution in the Jordan River Valley from the viewpoints of stakeholders. The aim of qualitative research is to understand a particular social situation, event, group, role, or interaction (Locke et al., 2013). It is, in general, an investigative process where the researcher gradually makes sense of a social phenomenon by comparing, contrasting, replicating, cataloguing, and classifying the object of the research (Miles & Huberman, 1984). Marshall and Rossman (2010) suggest that this process entails immersion in everyday life of the setting chosen for the research. Researchers use several methods in qualitative research. To the preferred way to select the most appropriate for a study and to understand the differences between them is to compare them.

The ethnographic research method is a method used by researchers in qualitative research. The ethnographic approach emerged from the field of anthropology. Its origins can be traced back to anthropological studies of small, rural societies that were undertaken in the early 1900s when researchers such as Alfred Radcliffe-Brown and Bronislaw Malinowski participated in these communities over extended

periods of time and documented their belief systems and social arrangements (Reeves, Kuper, & Hodges, 2008). The aim of ethnographic research is to obtain a holistic picture of the subject of the research, with an emphasis on portraying the everyday experiences of individuals by interviewing and observing them (Creswell, 2013b). Ethnographic research includes in-depth interviewing and regular and ongoing participant observation of a situation in an attempt to capture a holistic image that reveals how individuals and relevant others describe and structure their world (Reeves et al., 2008). Data collection and data analysis in ethnographic research often happen somewhat simultaneously. Experienced ethnographers admit that it is virtually hard, and possibly not even desirable, to analyse their data with full objectivity. Wolcott (1994) has suggested that the researcher should seek to balance, fairness, completeness, and sensitivity in the final analysis and interpretation of the data.

The number of research approaches summarised under the qualitative research umbrella has grown considerably (Denzin & Lincoln, 2000). Amongst these are grounded theory and hermeneutics. Grounded theory is a method of inquiry originating from sociology in which the researcher tries to derive a general, abstract theory of a process, action, or interaction grounded in the viewpoints of participants (Charmaz, 2014). The following table presents a comparison of ethnography, grounded theory, and Hermeneutics methods.

Table 6-2: *Ethnography, grounded theory and Hermeneutics methods.*

Items	Ethnography	Grounded Theory	Hermeneutics
Source of Method	Anthropology and sociology	Sociology	The theory of knowledge, religious script
Researcher's Role	Studying the shared patterns of actions	Derivation of a general, abstract theory of actions	Understanding the meaning of texts and images
Data Collection Method	Interviews and observations	Multiple stages of data collection and refinement of categories of information	Verbal and nonverbal communication

Source: Adapted from (Berg & Lune, 2004).

Given the researcher's background understandings of Islam, and the politics, customs and culture of the country the study is situated in, this research follows Hermeneutics, first, because of its spiral movement and secondly, because Hermeneutics leads to a better understanding of participants' positions around the study's topic – pollution in the Jordan River Valley. As Arcodia (2005) explains, Hermeneutics acknowledges the contextuality of findings which are located in place, time, and culture and acknowledges that researchers unavoidably bring subjectivity to their research. Moreover, Hermeneutics allows for multiple perspectives in the inquiry and challenges the need to validate research findings only when they can be replicated and generalised.

6.2.2 Hermeneutics

Hermeneutics aims at understanding a participant's views about the situation being addressed (Tracy, 2012). The primary objective of Hermeneutics is to explore and analyse the lifestyle of individuals (Addeo, 2012). Hermeneutics is concerned with the meaning of a text or text-analogue. A text-analogue is anything which can be treated as a text, for example, any human artefacts, culture, action, or organisation (Bleicher, 1980). Bleicher (1980, p. 1) defines Hermeneutics as "the theory or philosophy of the interpretation of meaning". The word 'Hermeneutics' indicates an interpretation of a text, especially in the areas of interpreting religious and legal documents (Addeo, 2012). Schleiermacher (1977) broadened the field of

Hermeneutics theory to encompass not only religious or juridical texts but also all humanitarian texts and procedures of communication. Hermeneutics sees interpretation as a circular process that moves spirally (see Figure 6.2). This process provides interpretation through a sustained and reciprocal interaction between the interpreter's progressive sense of the whole and the interpreter's retrospective understanding of its component fragments (Mohseni, 2014). Schleiermacher (1998) concentrates in his approach on the significance of the interpreter's understanding of a text as a solid phase to interpreting it.

Understanding a text requires iterative spiral movement between the parts and the whole (Ricoeur, 1981). Hence, the notion of an interpretive or hermeneutic circle. Understanding the meaning of a text is not about decoding the meaning intended by the author. It is about building real relationships between text, reader of the text, and context. Heidegger (1994), who improved the notion of the hermeneutic circle, refers to the concept that one's understanding of the text as a whole is constructed by reference to the parts and that one's understandings of each part is constructed by reference to the whole. Gadamer (2008) mentions that Hermeneutics could be applied to all humanitarian activities. In social science, the field of Hermeneutics has been progressively expanded to study every activity involving interpretation, whether it is a verbal or nonverbal communication, as retrospective understandings (Addeo, 2012).

Retrospective understandings from the linguistic and historical perspective are preceding, directing, and achieving every action of next understanding and interpretation. Retrospective understandings are social institutions, for example, the family, civil society, ethics, and law (Hegel, 1971). Dilthey (1976b) expanded the notion of retrospective understandings to include language, habits, traditions, and lifestyle. Husserl (2002) contends that the personal lifestyle is the most significant form of retrospective understandings.

Qualitative researchers using Hermeneutics examine conversation or text by empathically imaging the experience, incentives, and context of the participant and then engaging in a circular understanding that moves between the data text and the situated scene (Schwandt, 2000). This practice proposes that to understand any text, one must also simultaneously consider its historical and cultural context. For example, to understand a religious text hermeneutically, the researcher considers

the time context of the text and also how people of that era would understand its teaching. Likewise, to understand ethnographic texts, researchers have to take into consideration their own subjectivity and life experiences (Berry, 2011).

In the Jordan River Valley – the research study area – the researcher took into consideration the relative difference in meaning of some words in the interviews in terms of the different places where the stakeholders live and work. Moreover, the study area is not far from where the researcher lives. Therefore, the researcher lives part of the experience that is lived by the stakeholders. This shared experience enabled the researcher to understand the meaning intended by the various stakeholders.

The development of Hermeneutics has been influenced principally by two philosophical schools, that is, the subjectivist and objectivist schools, and their radically varied conceptions of its scope and purpose. The subjectivist approach is influenced by the thoughts of Heidegger (1996) and Gadamer (1975), while the objectivist approach follows the tradition of Schleiermacher (2002) and Dilthey (1976).

An objectivist approach to Hermeneutics accepts the notion that a text has constant meanings, that is, original meanings intended by the producer of the text (Schleiermacher, Loudon, & Huijs, 2002). The objective of interpretation is to recover the original meaning intended by the producer and to understand the historical context which produced what was written (Prasad, 2002). The process of comprehension is within the context of the historical and social world in which the text was produced, that is, the historical-social world of the producer of the text (Palmer, 1969) and the psychological experience of the producer. During the process of comprehension, empathy sets in and the interpreter of the text employs imagination and intuition to realise the intellectual universe of the author (Alvesson & Skoldberg, 2009). Through a “mysterious process of mental transfer” (Palmer, 1969, p. 104) and through reliving the experience of the producer of the text, the objectivist approach claims that objective knowledge can be achieved (Dilthey, 1976).

Palmer (1969) believes that the experience of the author and the intended meanings become entirely understandable through language. Texts and actions are

expressions of meaning (Croft, 1998) and “lived experience is embodied in language” (Croft, 1998, p. 95). The language is used to express, and the grammar to understand, the meaning intended by their producers. Hence, the objectivist approach to Hermeneutics is driven by strict grammatical rules and procedures for interpretation (Prasad, 2002). Objectivity (i.e., original meanings intended by the author of the text) as presented in objectivist Hermeneutics refers to the presence of a subject-object dichotomy in the process of interpretation (Burrell & Morgan, 1979).

The subjectivist approach emphasises the role and impacts of the interpreter who approaches the text with his/her sphere of tradition and prejudgments. The objective of Hermeneutics, according to the subjectivist approach, is no longer a reenactment of the original meaning intended by the originator of the text (Heidegger, Stambaugh, & Schmidt, 2010). Ontology is produced through the interpreter’s experience or interpreting of a phenomenon (Heidegger, Stambaugh, & Schmidt, 2010). The interpreter of a text is in the action of forming any object as object (Palmer, 1969). The object is not an unchangeable understanding but historically constituted and collected in the experience of confronting the phenomenon. Hermeneutics means showing what is hidden to light (Palmer, 1969), that is, describing unobserved meaning behind a phenomenon.

According to Gadamer (1975), the interpreter’s comprehension of a text can differ from that of the originator of the text. This discrepancy results in a gap between the interpreter and the originator. Gadamer (1975) claims that every age understands a text within the context of the tradition of the period. The original meaning of a text to the interpreter is always partially determined by the historical circumstance of the interpreter. The meaning of a text always goes beyond the originator of the text and, therefore, comprehension is not only reproductive but also always a productive stance (Gadamer, 1975).

The implication of the philosophical assumptions of epistemology and ontology is that the same text can have various meanings for different human subjects (Doolin, 1998). A methodology based on Hermeneutics endeavours to comprehend the subjective experience of persons in the context of the social world and tries to illustrate what is distinctive to the person rather than what is shared and universal (Burrell & Morgan, 1979). The epistemological assumption in hermeneutic

methodology that is the subjectivist does not accept the objectivist perspective of the natural sciences. Rather, the subjectivist methodology depends on a phenomenological approach to identify the kind of knowledge and understanding that is suitable for explaining human phenomenon (Palmer, 1969).

6.2.3 Islamic Hermeneutics

Hermeneutics of Islamic exegesis¹⁸ is a method followed by Quranic scholars to understand The Quran. Allah revealed the Quran to the Prophet Muhammad, peace be upon him (570-632 A.D.), through the angel Gabriel during the 23 years of the divine revelation of The Quran (Mohseni, 2014). The revelation was as a response to the incidents occurred in the everyday life of the Prophet and his Companions¹⁹. The Companions asked the Prophet Muhammad about the meaning of particular words in The Quran. They also asked him for details on specific spiritual or historical issues. Muslims wanted to understand the Islamic religion, and so they attempted to obtain more guidance. The Companions, who had learned The Quran and the Prophetic Traditions and received living interpretations from the Prophet himself, died one by one because of the battles that occurred between Arab Muslims and other Arabs who did not accept Islam as a new religion (Heath, 1989). Therefore, Quranic scholars recognised the importance of creating a methodology to interpret The Quran in any time.

Mohseni (2014) describes interpretation as a term that means clarification, commentary, analysis, explication, and exegesis of written and recorded religious materials. Hermeneutics, in general, describes the interpretation of meanings, clarification, commentary, explication, and analysis. Additionally, hermeneutics includes guided readings and commentary-exegesis on how the interpretation is applied to the written text (Mohseni, 2014).

Birkeland (1955) explains that the matter of scriptural interpretation was of primary significance early in the history of Islam. One of the first issues to preoccupy Islamic scholars was whether it was permissible to explain The Quran. The majority of Islamic scholars considered the matter of Quranic interpretation as not only allowable but unavoidable and, therefore, began to regulate the procedures by which interpretation should proceed (Birkeland, 1955). How to understand the meaning of a given verse was given more attention, for not everything in The Quran was considered obvious, including the essential requirements of Islamic Law (Esack, 1993). It became a tenet of Quranic hermeneutics that, since The Quran is the Word of Allah, the best interpretation must come from within it. One verse

¹⁸ An explanation or critical interpretation of a text.

¹⁹ One who met or accompanied the Prophet and believed in him and who died as a Muslim.

interprets another, a process called self-exegesis. The next best interpretation was provided directly by the Prophet. After the Prophet's interpretation, the Companions' interpretation comes down to us through their teaching which is preserved in the Prophetic Traditions and then through their followers' interpretations. In addition, the interpretation handed down through the subsequent generations of Quranic scholars is a process called an exegetical legacy. Moreover, studying the reasons for the revelation is known as cause-and-effect exegesis²⁰. All of these stages of interpretation must be followed by the interpreter to obtain the intended meaning of a verse (Calder, 1993).

6.2.3.1 Humanistic Islamic Hermeneutics

Nasr Hamid Abu-Zaid was an Egyptian Muslim thinker (1943-2010AD). His approach to interpreting The Quran is distinctive (Sukidi, 2009). Humanistic hermeneutics is a term applied to the art of interpreting The Quran with a humanistic dimension. The hermeneutic work is deemed humanistic in so far as it indicates a human-oriented interpretation of The Quran (Abu-Zaid, 2000). Not only does the human interpreter represent a necessary and invaluable form of agency in the hermeneutic work, The Quran itself includes human dimensions and grants a space for humanistic enquiry (Sukidi, 2009). For example, the humanistic aspect of The Quran and its exegeses is visible in the following verse

Say: people of the Book! Come to a word common between us and you: that we shall serve none but Allah and shall associate none with Him in His divinity and that some of us will not take others as lords beside Allah. And if they turn their backs (from accepting this call), tell them: Bear witness that we are the ones who have submitted ourselves exclusively to Allah (The Quran, 3:64).

This verse calls for a statement of equality or commonness between Muslims and followers of other divine religions. While the majority of ordinary Muslims understood this verse as referring to doctrinal variances between Islam and other divine religions, some Islamic scholars clearly explained that this verse also had social implications like social equality and religious pluralism (Mol, 2010).

²⁰ Analysis of the occasions of the revelation. Allah revealed each verse to the prophet Muhammad, based on an event that had happened at that time.

Defining The Quran as a linguistic text is the justification that Abu-Zaid gives for considering the history of Arab culture as a culture of the text (Sukidi, 2009). Abu-Zaid (2000) describes it as a culture, expanded mainly through the social contestation with reality and the discursive conversation with the text. In a text-centred civilisation, the method of understanding and interpreting would form the primary role in the search for the sound meaning of the text (Zayd, 2004).

If The Quran is a linguistic text, and its understanding is expanded by human discursive conversation with culture and reality, then Abu-Zaid defines The Quran as a human text (Sukidi, 2009). Abu-Zaid's starting point is to understand the original status of The Quran as an explicit and constant religious text based on its spoken form or its literal wording. Its constancy²¹ is part of a characteristic of its being absolute and holy. Abu-Zaid continues, The Quran loses its constancy and alters into an understandable notion or a human text once it has been subjected to human opinion (Biesterfeldt et al., 2012). The subjection of The Quranic text to human opinion began from the moment of divine revelation when the Prophet Muhammad, received the first verses of The Quran, recited them in a human language, and started interpreting them on the basis of his inspired opinion (Zayd, 2004). Abu-Zaid (2000) mentions that the divine text has changed from its authentic manifestation as a holy text and become a humanly understandable text, because it changed from divine revelation to human interpretation. At that moment when The Quran changed into a human text, it became subject to standards of human understanding and explanation (Zayd, 2004).

Sukidi (2009) explains that the manifestation of the Word of Allah into the created²² Quran, i.e., a linguistic text and a human text, is founded in Abu-Zaid's notion that The Quran is personified in human language, culture, and reality. This personification is just one aspect of the emanation of The Quran as a text as being a product of culture that took shape during the journey of divine revelation over a period of more than 23 years in Mecca and Medina²³ (Sukidi, 2009). Another aspect of The Quran is that it can be seen as a producer of culture, acting as a doer in the

²¹ It means that the meaning of The Quran is immutable.

²² If The Quran is a created object, this means that it is subject to humanistic standards, and the meaning of a verse that interpreted was by the Prophet Muhammad can be changeable, according to the new context. However, The Quran is a characteristic of Allah, and its meaning cannot be changed.

²³ A city in Saudi Arabia. It is the first capital in Islam. Its religious significance comes from the presence of the tomb of Prophet Muhammad and the Prophet's mosque, which is the second mosque in Islam after the sacred mosque in Mecca.

formation of the culture as the object (Hoffman, 2001). The debatable relationship between The Quran as a religious text and language, culture, and reality took place in a particular time in history. The 7th century marked a transformation point in the formation of The Quran as an old text subject to historical comprehension and exegesis (Hoffman, 2001). Abu-Zaid uses the term ‘historicity’ to mean the divine revelation of The Quran over the period of revelation. The Quran was, therefore, a reaction to the needs and requirements of the Prophet Muhammad, and the local community in a particular place and time, rather than one journey of complete divine revelation (Sukidi, 2009), in the sense that The Quran and the *Sunnah* were sent down to the Prophet Muhammad according to the events and occasions that occurred in the Arabian Peninsula.

Abu-Zaid’s idea of hermeneutics is depicted as an epistemological process, as the coming together of human comprehension and exegesis in the search for the original meaning of The Quran (Hoffman, 2001). Abu-Zaid conceives hermeneutics as the detection of the hidden meaning that is revealed through the interaction between the rational intellect of the interpreter and the text. Thus, the actual meaning of the text is revealed when the interpreter engages with the text in the hermeneutic process (Zayd, 2004).

Abu-Zaid (2000) asserts that the human interpreter’s first step is to understand the historical meaning of The Quran within the historical, cultural, and social contexts of the first receivers of the text, i.e., the Prophet Muhammad, and his Companions. The meaning of The Quranic text may be valid and constant based on what the Prophet Muhammad, intended in the historical past (Zayd, 2004). The significance of the text in The Quran may, however, be different in the present context as that meaning is shaped by a human interpreter or the person who reads the text in a different place and time (Sukidi, 2009). Abu-Zaid (2000) assigns a subsequent step to the human interpreter, i.e., to discover the changing character of the significance of the text in The Quran in the present context. When decoding The Quranic text, Abu-Zaid asks the human interpreter to discount the historical meaning of the Quranic text, as this meaning does not carry any significance in the present, and to recode the text to uncover its meaning in the current context (Zayd, 2004). Abu-Zaid’s hermeneutics involves productive reading which requires a recurring movement between the two dimensions, moving either between the historical *origin* and the *purpose* or between the *meaning* and the *significance*. An interpreter, who

is inventive, engages in both the meaning of the Quranic text in the past and its significance in the present to reach a valid interpretation (Sukidi, 2009). A valid interpretation is obtained when the human interpreter understands the variation between those two dimensions and then connects the significance in the present to the meaning in the past through the process of interpretation.

Dhahabī (1976) explains that exponents of interpretation by opinion regardless of other interpretations believe in one meaning of a verse and attempt to transform the original meaning so that it becomes appropriate to their beliefs. In contrast to classical Islamic hermeneutics, this kind of Quranic interpretation does not take into account the meaning of the verse within the context of other verses or within the complete *Surah* (Quranic chapter) (Amina, 2013).

6.2.3.2 Classical Islamic Hermeneutics

Most of the fundamental doctrines that are part of Islam, including the basic legal doctrines, developed during the first three periods of the traditional age²⁴ (Afaki, 2009). Contemporary Islamic scholars continue to depend on the materials produced during the formative and traditional periods of Islamic religion. Some significant genres can be found in that considerable library of classical scholarship. The most important genre of the tradition is the literature of Quran interpretation (Freamon, 2006).

Quran interpretation is also not an easily defined notion and there is a scholarly debate surrounding attempts to identify it and mark its field and range (Atwell et al., 2010). The Arabic word for Quranic interpretation is *tafsir*²⁵. This word as a noun comes from the verb *fassara*, which means ‘to explain, explicate, espouse, elucidate, or interpret’. The Quranic *tafsir* literature is an agent of the hermeneutical tradition in Islamic religion (Freamon, 2006). It is the fruit of efforts exerted by scholars and interpreters interested in understanding the meaning of the divine text in The Quran and the Prophetic Traditions and converting that comprehension into interpretation of the Islamic text (Afaki, 2009). These interpretations of religious texts can then constitute the foundation for juridical and liturgical decision-making

²⁴ Refers to the periods traditionally dated from the 8th century to the 13th century when much of the historically Islamic world was experiencing a scientific, economic, and cultural flourishing.

²⁵ A Quranic *tafsir* will often explain content and provide times and places, not included in Quranic verses, as well as giving the various views and opinions of Islamic scholars on the Quranic verse.

by religious actors, including judges, jurists, government officials, political leaders, military commanders, parents, and ordinary Muslims (Afaki, 2009). Traditionally, the opinions of Islamic scholars as presented in the *tafsir* play a significant role in the everyday lives of Muslims, because Muslims try to understand and transform the religious teachings of The Quran into practical guidance for conduct and behaviour (Freamon, 2006).

Wansbrough (1978) allocates five sequential classifications to *tafsir*. These are narrative, legal, textual, rhetorical, and allegorical classifications. Rippin (2008) argues that classifications of (Serjeant et al., 1978) are considered as scientific style, functional, unified, and revealing. Rippin (2008) points out that the first works of *tafsir* that emerged in the 10th century combined all five of these classifications. The first of these works was Abu-Jafar al Tabari's *Jami al-bayan an tawil ay al-Quran*. At that time, the literature flowed in two main streams: interpretation by tradition and interpretation by opinion (Rippin, 2008).

Interpretation through tradition relies mainly on the exegetical legacy of the Prophet Muhammad, his Companions, and the opinions given by the pioneers of Islamic scholarship in the Prophetic Traditions (the *Sunnah*). Interpretation through opinion requires interpretation based on the personal judgement of the Quranic interpreter, more precisely on his theological, rational, or philological analysis as applied to the Quranic text (Freamon, 2006). The Quran interpretation literature, and particularly its dichotomy into these two extensive streams, is affected by the disagreement between the *Asharite*²⁶ and *Mu'tazilite*²⁷ theologians (Freamon, 2006). Because of this ideological disagreement between *Asharite* and *Mu'tazilite*, the literature on the interpretation of The Quran remains at the heart of and is the essence of classical Quranic hermeneutics (Freamon, 2006). Although there were variances of opinion among the different Quranic interpreters, all approached The Quran with the same major goal. This target is to reach a true judgment about the meaning of the Quranic text (Afaki, 2009). The methods used in these Quranic interpretations included grammatical, syntactical, philological, and linguistic analysis based on comparison with other Quranic verses and analysis of the preunderstanding of the divine

²⁶ It is an early theological school of Islam founded by Imam Abu-Hasan al-Ash'ari. The school arose mainly as a response to the Mu'tazilites.

²⁷ It is a school of Islamic theology based on reason and rational thought. The Mu'tazilites believed The Quran was created, whereas the Asharites believed that it was not created.

revelation, including divine revelation from other Abrahamic beliefs (Taji-Farouki & Nafi, 2004). For 500 years, this type of literature exercised control over the comprehension of the meaning of the Quranic text.

Abu-Jafar al-Tabari (839-923 AD) is one of the pioneers in interpreting The Quran. He is a well-known example of interpretation through tradition (Afaki, 2009). Tabari's interpretation of The Quran is characterised by little subjectivism (Heath, 1989). However, one may find particular aspects of objectivism, using exegetical legacy review, in his Quranic interpretation, something which Tabari appears to find inevitable. Tabari's approach to building the Quranic meaning of a verse or any word is entirely traditionalist. The singularity and uniqueness of subjectivism and the inevitability of objectivism both come from his duty towards tradition (Afaki, 2009).

Abu-Jafar al-Tabari's veneration for the privileged status of The Quran or his historical reality makes him unable to approach The Quran's text unmediated. His philosophical methodology provides one central line of mediation. He never tries to interpret The Quran's words directly; he confronts and addresses them by analysing their grammar, semantics, or history (Heath, 1989). Tabari also uses another method to interpret The Quran, that of secondary exegesis. He does not explain his personal beliefs directly. Instead, he studies The Quran's meaning by critically examining copious masses of the common tradition inherited from prestigious predecessors²⁸ (Auliffe & Dammen, 1988). Quoting many exegetic options about any part of The Quran permits Tabari to suggest a considerable range of potentially valid interpretations. This interpretation does not burden Tabari with personal responsibility for an exegesis with which he disagrees, but because of its true origins, does not wish to refute. Simultaneously, the interpretation provides him with confirmatory support for interpretations he espouses, all without requiring him to approach The Quran's text directly (Heath, 1989). In this sense, he introduces several interpretations in order to obtain support from the ones that he agrees with, and at the same time, does not exclude any interpretation that may be correct, even if he disagrees with it.

²⁸ The Companions of the Prophet Muhammad and the followers.

Tabari's hermeneutic methodology is mainly multisubjectivist in that his method juxtaposes traditions of the Prophet Muhammad, his companions, followers, and the followers of the followers, as well as the *Isra'iliyyat*²⁹ which handed down to him over thirty-eight thousand *isnad*³⁰. Along with multi-subjectivism, one can also trace some objectivism in Tabari's Quranic interpretation (Afaki, 2009). It is very common in Quranic exegesis to find references to language to make sure of the meaning of the text in The Quran about the mainstream Arab-Islamic tradition (Freamon, 2006). This tradition itself emerged from the prophetic hermeneutics. Therefore, if somebody returns to that tradition to find the most appropriate meaning of the text in The Quran, one will justifiably follow objectivism in one's methodology (Freamon, 2006). However, Tabari never takes the traditional level of language to be the single meaning context for his Quranic interpretation; rather, his Quranic interpretation relies mainly on his juxtaposing of *isnad*, which means that the objectivism of his hermeneutic methodology is limited. However, a semiobjectivism parallels his multisubjectivism in the Quranic exegesis (Afaki, 2009). This methodology intermixing of multisubjectivism and semiobjectivism is particular to Tabari's Quranic interpretative methodology; rather, this is what the Quranic interpretation through tradition is all about generally (Afaki, 2009).

There are some limitations to Quranic interpretation through tradition, including the multiplicity of Quranic interpretations about a single text. Moreover, the problem of disconnection or omission of one of the narrators in the *isnad* (the chain of narrators) or the refusal to accept one of them based on his honesty leads to the *Hadith*³¹ being's rejected as Prophetic Traditions (Saeed, 2006). Finally, the confusion caused by *Isra'iliyyat* plays a role in the limitations of this approach (Freamon, 2006). These limitations make an interpreter turn to new possibilities of meaning-context to find a relatively more suitable and bigger hermeneutic arena for his Quranic interpretation (Afaki, 2009). The best alternative option that he can find is the sociocultural-historical continuum of tradition handed down to him on the level of language so that his hermeneutical position is also a part of it. To get

²⁹ This is the body of narratives originating from Jewish and Christian traditions. They include information about earlier prophets mentioned in the Bible and The Quran, stories about the ancient Israelites, and fables allegedly, or taken, from Jewish resources.

³⁰ In Islam, it is a list of authorities who have transmitted a report (*sayings and doings of the prophet*), one of his companions, or of a later authority, followers and the followers of the followers; the list's reliability determines the validity of the Prophetic Traditions.

³¹ It is one of the different reports describing the sayings, deeds, and approvals accurately narrated by the Prophet Muhammad, which constitutes the Prophetic Traditions (the *Sunnah*).

benefits from the language as a centre of traditional development, one cannot juxtapose different opinions regarding the meaning of a particular text (Afaki, 2009). One has instead to reflect on one's own on how to reach the most suitable comprehension of the Quranic text in the given field of tradition. The limitations of Quranic interpretation through tradition lead an interpreter turn to Quranic interpretation through opinion, so that the traditions, exegetical legacy, and the life-language historical continuum go hand-in-hand in his Quranic interpretation (Heath, 1989). This is the hidden feature of Tabari's method of interpretation, but with the exception that he concentrates more on the exegetical legacy characterised by multisubjectivism rather than on the life-language historical continuum described by semiobjectivism (Afaki, 2009).

The difference between exegesis through tradition³² and exegesis through opinion is a halfway turn from the tradition as exegetical legacy to tradition as life-language historical continuum (Saeed, 2006). Saeed (2006) explains that in this limited variation between objective and subjective exegesis, the primary duty of the interpreter is to stay with the former rather than the latter. Mohseni (2014) claims that the principles espoused by most interpreters of the Quran are similar to those used by exponents of the classical western hermeneutics approach to comprehending and interpreting the text.

6.2.4 Commonalities between classical western Hermeneutics and classical Islamic Hermeneutics

The history of western classical Hermeneutics is demonstrated by the work of Friedrich Schleiermacher (1768-1834), the father of the modern Hermeneutics, who presented Hermeneutics as a general theory of interpretation (Prasad, 2002). Chenari (2009) explains that Schleiermacher considers that a text has constant meanings, and, therefore, the objective of classical western Hermeneutics is to retrieve the original intended meanings of the author by re-experiencing the author's original intention. In order to accomplish that aim, the interpreter has to enter the world of the author (Osborne, 2009).

³² The body of traditional social and legal custom and practice of the Islamic community. Along with The Quran and the Hadith (recorded sayings of the Prophet Muhammad), it is a major source of Islamic law.

The shared principles of classical Islamic Hermeneutics and classical western Hermeneutics are numerous. The first of these is the possibility of understanding and interpretability (Mohseni, 2014). Most exponents of The Quran believe that understanding the text's details and its implicit meanings is possible for Muslims depending on their levels of knowledge in the sciences of The Quran (Waardenburg, 2002), because the realisation of the chief aims of The Quran requires that its details be understandable, as, otherwise, educating and instructing Muslims towards goodness and cheerfulness will not happen (Freamon, 2006).

Second, both encompass author-based principles (Mohseni, 2014). For Islamic exponents of hermeneutics, one must search for the meaning of The Quran in its revealed wisdom. Therefore, all linguistic, philological, and syntactical tools for understanding the meaning of the verses must be used to obtain these aims (Waardenburg, 2002). Similarly, classical Islamic Hermeneutics seeks to uncover the intended meaning of the author's text (Kirazli, 2003).

The third commonality between classical western Hermeneutics and classical Islamic Hermeneutics is that both adopt the method-based principle (Mohseni, 2014). The issue of method is significant to the extent that some exponents who resort to the tradition know that the standard of soundness of interpretation lies not in arriving at the meaning but on following the proper methodology to understand the Word of Allah (Kirazli, 2003).

Fourth, objectivity and determinacy of meaning are important principles in classical western Hermeneutics and classical Islamic Hermeneutics (Mohseni, 2014). The aim of objectivity is show that an objective meaning of a text is constant, unchangeable, and dependent on the circumstances of comprehension, realisation, and the mode of thinking of the exponent and the historical perspective (Thiselton, 2009). Objectivity is one of the most substantial principles of Quranic exegesis. It is the nature of exegesis of religious text, reproduction, and detection of demands and messages sent by Allah to educate and instruct believers and not to make sense of the text (Waardenburg, 2002).

The fifth commonality is the possibility of overcoming historical comprehension barriers and obstacles (Mohseni, 2014). Exponents believe that in spite of the time gap and distance between the time of divine revelation and the time of exegesis,

objective meaning and understanding is possible (Thiselton, 2009). Mohseni (2014) explains that classical western Hermeneutics believes that researchers can transcend the time gap. Thus, Hermeneutics is recommended as a useful tool to cross the time distance between the time of writing and the time of interpretation (Kirazli, 2003).

Sixth, both styles of Hermeneutics follow the general rules of language (Mohseni, 2014). According to the reasonable standards viewpoint, communication flows are based on general rules of language, including semantics, grammar, aesthetics, rhetoric, and vocabulary (Izutsu, 2002). According to the classical Islamic exponents, Allah has expressed The Quran in the form and structure of human language and made us able to understand it and extract His teachings from it (Kirazli, 2003). Classical western hermeneuticist has also applied general rules of the language for the explanation of texts. The difference between classical Islamic Hermeneutics and classical western Hermeneutics is that classical Islamic Hermeneutics depends on the reasons of the revelation (cause-and-effect exegesis) in the sense that to understand the text, one must understand the rationales behind creating that text (see Table 6-3).

Quranic scholars employ four notions of classical Islamic Hermeneutics because they call for understanding of the author's intended original meaning of the Quranic text. These four notions are legacy review, cause and effect, general language rules, and self-exegesis.

In this study, concepts and procedures adopted by exponents to interpret The Quran have been used in interpreting the qualitative data to understand the speaker's original meaning.

Table 6-3: Summary of classical western Hermeneutics and classical Islamic Hermeneutics.

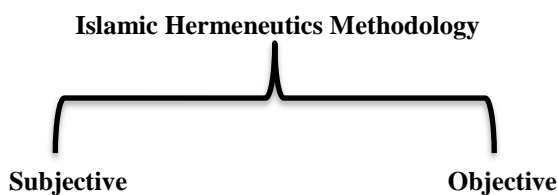
Criteria	Classical western Hermeneutics	Classical Islamic Hermeneutics
Scholars	Friedrich Schleiermacher (1768-1834 AD)	Abu Jafar al-Tabari (839-932 AD)
Objective	To recover the author's original meaning	To recover the author's original meaning
Procedures	<ul style="list-style-type: none"> • Schleiermacher's circle of interpretation that means interpretation based on <ul style="list-style-type: none"> ➤ grammatical ➤ psychological ➤ emphasised on historical-based interpretation 	<ul style="list-style-type: none"> • Self-exegesis that means understanding a verse is in another verse before or after the verse under investigation in the context of the whole text • Linguistic exegesis that means grammatical, syntactical, philological, and linguistic analysis based on comparison with other verses. • (Cause-and-effect exegesis) analysis of the reasons for the revelation
Concept	<ul style="list-style-type: none"> • Historicity • Schleiermacher's circle 	<ul style="list-style-type: none"> • Constancy of the meaning • Cause-and-effect exegesis (the reasons for the revelation) • Linguistic exegesis • Self-exegesis (one verse interpreting another)
Contribution	<ul style="list-style-type: none"> • Creating theories for regulating interpretation 	<ul style="list-style-type: none"> • Creating theories for regulating interpretation

Source: (Author)

6.2.5 Summary of Islamic Hermeneutics methodology

Table 6-4 below depicts the criteria for each category of Islamic hermeneutics, namely humanistic Islamic Hermeneutics and classical Islamic hermeneutics. The criteria in the Table 6-4 also shows the difference between the two categories based on the discussions of Islamic Hermeneutics presented in section 6.2.3. For example, humanistic Islamic Hermeneutics aims to understand the original meaning that pertained at the time when the text was produced (Sukidi, 2009). If the meaning of the text in the past is the same as the meaning in the present, the past meaning is considered valid in the present. Thus, Taji-Farouki and Nafi, (2004) explain that humanistic researchers endeavour to ascertain the validity of the meaning of the text in the present through the difference between its original meaning in the past and the *significance* of the meaning in the present. On the other hand, classical researchers endeavour to ascertain the *purpose* the text had for its author. Moreover, they see that there is a possibility to get new meanings from the text within new cultural and social contexts. Hence, classical researchers believe in the stability of the original meaning in the past and, at the same time, support the concept of getting new meanings without any clashes with the original meaning. Classical hermeneutists also move back and forth between semiobjectivity and multisubjectivity to determine the author's intended meaning. On the other hand, humanistic hermeneutists endeavour to be subjectivist and to dispense with the legacy. They call for a single meaning of the text.

Table 6-4: Summary of Islamic Hermeneutics classifications and criteria.



Criteria	Humanistic Islamic Hermeneutics	Classical Islamic Hermeneutics
Scholars	Nasr Hamid Abu-Zaid (1943-2010 AD)	Abu-Jafar al-Tabari (839-923 AD)
Objective	To get a valid meaning	To recover the author's original meaning
Procedures	<ul style="list-style-type: none"> • Productive reading which requires iterative movement between the original meaning in the past and the significance of the meaning in the present • Interpreting a verse in isolation from the other verses in the <i>Surah</i> (Quranic chapter) 	<ul style="list-style-type: none"> • Understanding a verse lies in another verse before or after the verse under investigation in the context of the whole text (self-exegesis) • Grammatical, syntactical, philological, and linguistic analysis based on comparison with other verses (linguistic exegesis). • Analysis of the reasons for the revelation (cause-and-effect exegesis)
Concept	<ul style="list-style-type: none"> • Validity of the meaning; • Inconstancy of the meaning • Interpretation that is based on treatment of the text as <ul style="list-style-type: none"> ➤ Humanistic text ➤ Linguistic text ➤ Historical text ➤ Cultural text • Independent interpretation 	<ul style="list-style-type: none"> • Constancy of the meaning • Cause-and-effect exegesis (the reasons for the revelation) • Linguistic exegesis • Self-exegesis (one verse interpreting another)
Contribution	<ul style="list-style-type: none"> • Identifying philosophical issues surrounding interpretation 	<ul style="list-style-type: none"> • Creating theories for regulating interpretation

Source: (Author).

6.2.6 The application of classical Islamic hermeneutics

To achieve the objective of this research, that is, to understand the stakeholders' perspectives of the environmental consequences of pollution in the Jordan River Valley and the Zarqa River Basin, classical Islamic Hermeneutics was adopted as a strategy of inquiry. Classical Islamic Hermeneutics leads to a better understanding of participants' experience about the contamination in the Jordan River Valley, given the researcher's background of understandings of Islam, politics, customs, and culture. Classical Islamic Hermeneutics was chosen because the technique offered by this methodology was seen as appropriate for this study's investigation into not only how the institutional determinants of pollution have affected the Jordan River Valley but also, how the local and perceived physical, emotional, and spiritual effect of pollution affected stakeholders in the Jordan River Valley?

The process of building knowledge in the research employed four concepts of classical Islamic hermeneutics, namely constancy of the meaning, cause and effect, linguistic exegesis, and self-exegesis. These four concepts were applied because they call for understanding the original meaning of the text. As a result, the participants in this research, the stakeholders, are the only ones who can express their visions about the environmental consequences of pollution in the study area. The environmental effects of pollution in the past, now, and in the future, will be the same with existence of the same pollutants.

To interpret the results of the interviews about the environmental consequences of pollution in the Jordan Valley, it was necessary to investigate the reasons for the contamination which resulted in the environmental impacts. The language used for the qualitative interviews is Arabic, which is also the mother tongue of the researcher. Having a share language enabled the researcher to understand the contents of the qualitative interviews accurately. The concept of self-exegesis is applied in interpreting The Quran. Classical Islamic Hermeneutics considers this idea as one of the best methods to understand the original meaning of an author (Mohseni, 2014). The researcher applied this concept to understanding the meaning of the interviews. The concepts of classical Islamic Hermeneutics facilitated the mission of the researcher to understand the original meaning. Figure 6.1 shows the ways in which classical Islamic Hermeneutics concepts were applied by the

researcher to develop an understanding of the environmental consequences of pollution in the Jordan River Valley from the perspectives of stakeholders.

Phase 1 aimed to identify the institutional determinants of the pollution in the Jordan River Valley, in addition to identifying the local and perceived physical, emotional, and spiritual effect of pollution on stakeholders in the Jordan River Valley. Moreover, this phase aimed to gain retrospective understanding to the research problem. The researcher gained this understanding through a review of secondary data such as journal articles, newspaper articles, television reports, and online multimedia and government documents. Having this prior knowledge is necessary if the researcher is to understand the viewpoints of the stakeholders, because classical Islamic Hermeneutics calls for understanding of the original meaning of the author (in the case of this research, the interviewees). It was, therefore, necessary to examine studies about the reasons for contamination in the study area in order to obtain preunderstanding of the environmental consequences of pollution in terms of the connection between results of this pollution and reasons for it. Given that the reasons for pollution could be different, the environmental impacts could also differ. Although the knowledge collected at this phase provided only partial understanding of the whole situation, this partial knowledge was then used as a base for deeper understanding in the second phase of understanding, which came from the interviewees.

Phase 2 was designed to obtain deeper understanding of the data gathered in qualitative interviews. This phase aimed to evaluate the institutional determinants of pollution in the Jordan River Valley. In addition, this phase aimed at evaluating the local, emotional, and spiritual effect of pollution on stakeholders in the Basin. This phase was designed to uncover the stakeholders' perspectives about the environmental consequences of pollution in the study area to recover the original meaning. The concepts of classical Islamic Hermeneutics of linguistic exegesis and self-exegesis were applied when analysing the interviews.

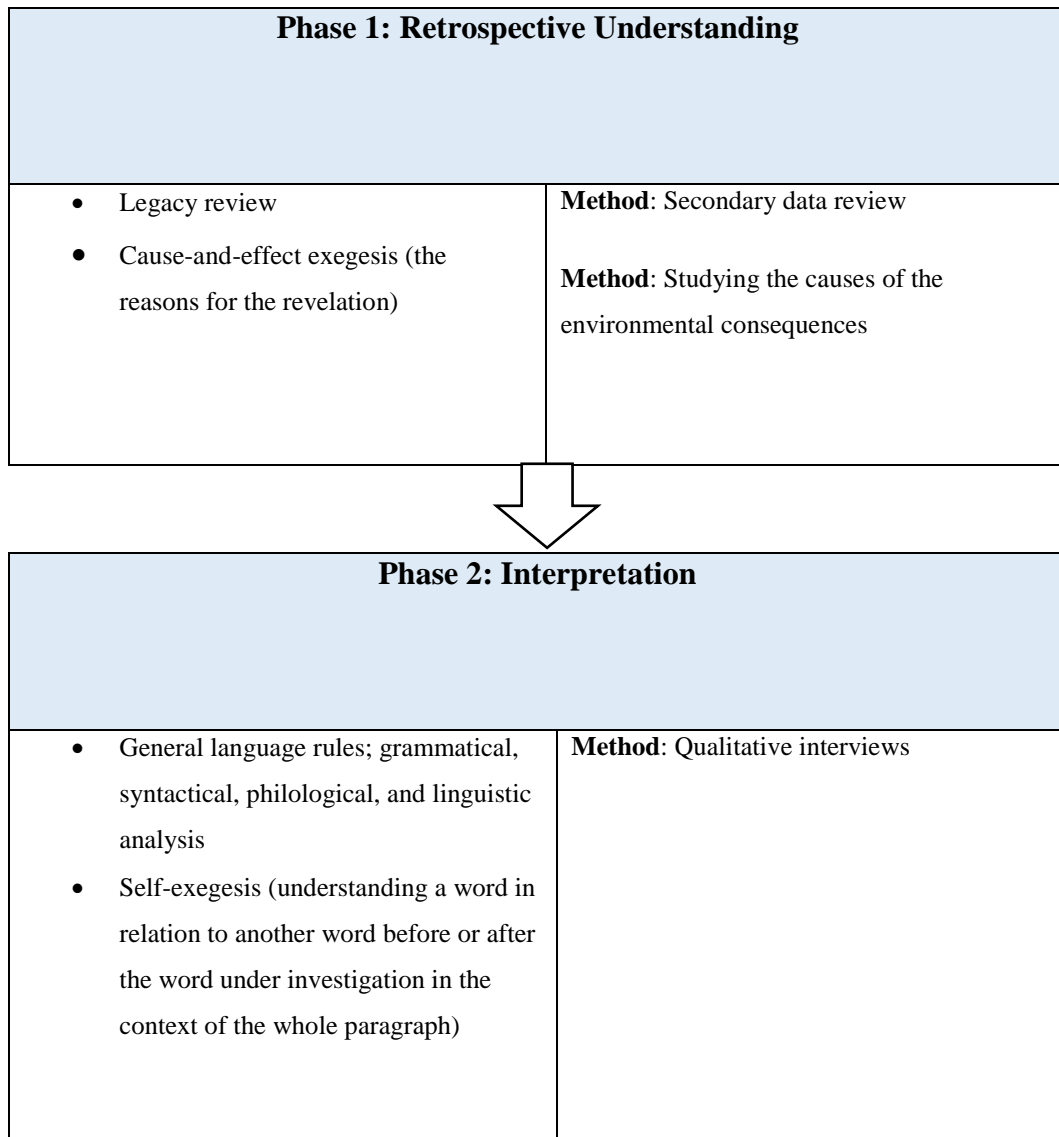


Figure 6.1: The application of classical Islamic Hermeneutics concepts.

Source: (Author).

In reading each document, the researcher attempts to make connections between the different parts of a document (words, sentences, paragraphs, subheadings, and headings) to see if they make sense as a consistent whole and if there is a discrepancy between the different parts and the goal of each document in the research. Mohseni (2014) indicates that it is inevitable to consider retrospective understanding when reading each document. Retrospective understanding comes from the current and influential literature on the causes and effects of pollution in the Jordan River Valley. In addition, understanding is broadened through the agricultural and religious significance of the study area, the sustainability of the situation in Jordan, and the Jordanian environmental legislation applied in the study area. The retrospective understandings give the context for approaching the empirical data. Secondary documentary data sources were read in order to obtain

retrospective understandings. Indicating the retrospective understandings is principally significant, as the primary objective of the interpretation is to understand the stakeholders' perspectives of the impacts of pollution in the Jordan River Valley. Therefore, another aspect to the Hermeneutics approach emerges from alternating between the researcher's retrospective understandings and the understanding attained from the whole-of the hermeneutic spiral process, as presented in Figure 6.2. In applying these circles of comprehension, reference is also made to the retrospective understandings of the researcher. Thus, the hermeneutic process produces multiple spirals of interactions, that is, alternation between the researcher's retrospective understandings and the various documents.

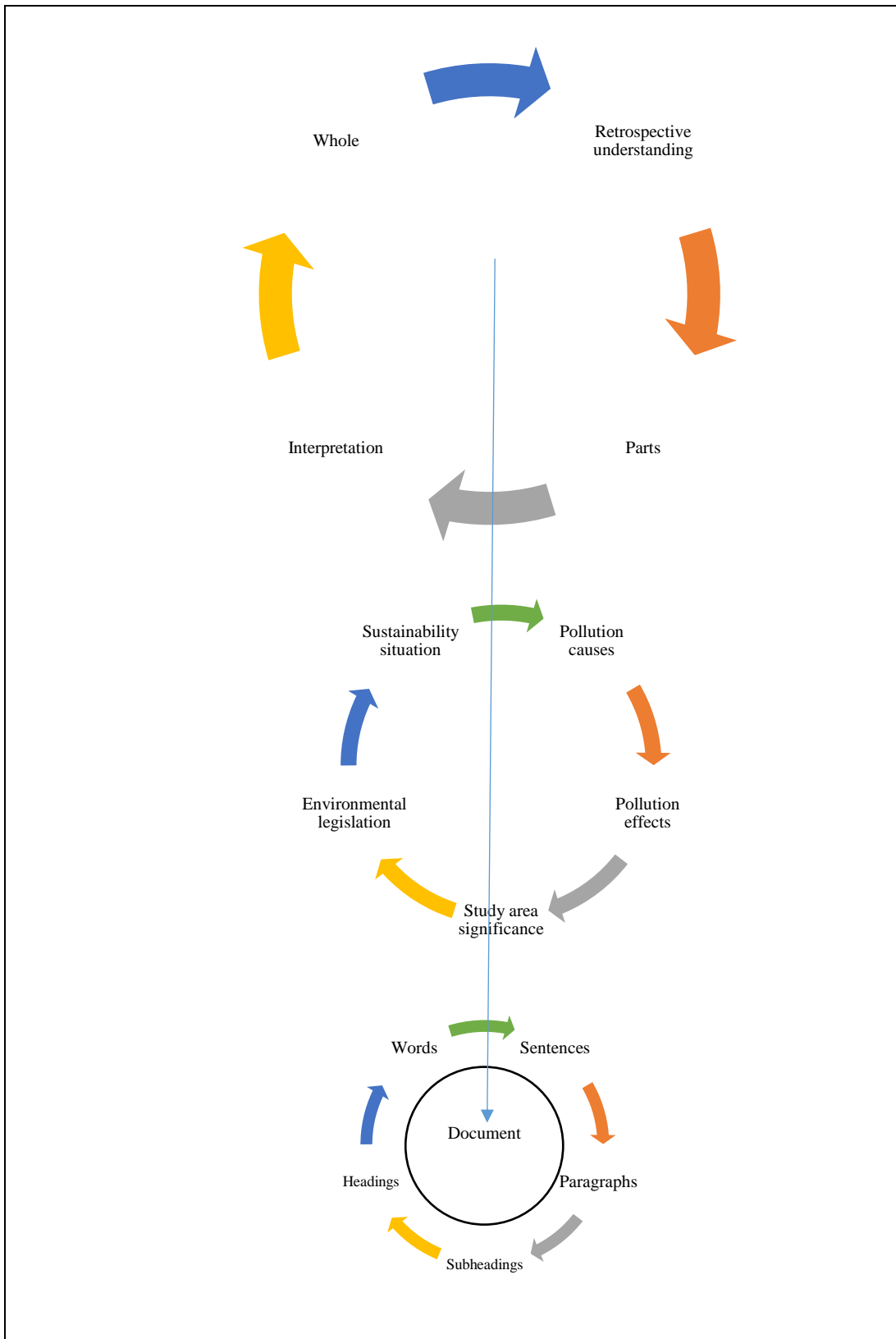


Figure 6.2: The complementary hermeneutic spiral process in the interpretation of a text.

Source: (Author).

6.3 Research Methods

The primary objective of the research is to investigate the stakeholders' perspectives of the impacts of pollution in the Jordan River Valley. At the research

preparation phase (see Figure 6.3 below), the literature review provided an understanding of the research problem and the researcher to define the research questions. The interview results then provided a basis for identifying and evaluating the local and perceived physical, emotional, and spiritual effects of pollution in the Jordan River Valley and so provided a basis for evaluating the impact of contamination on the stakeholder groups. As detailed in Figure 6.3, this research involves four primary phases, namely research preparation, literature review, conducting semistructured interviews, and analysing the interview data. These phases were followed by content analysis using qualitative data analysis software, QSR NVivo, to analyse the data.

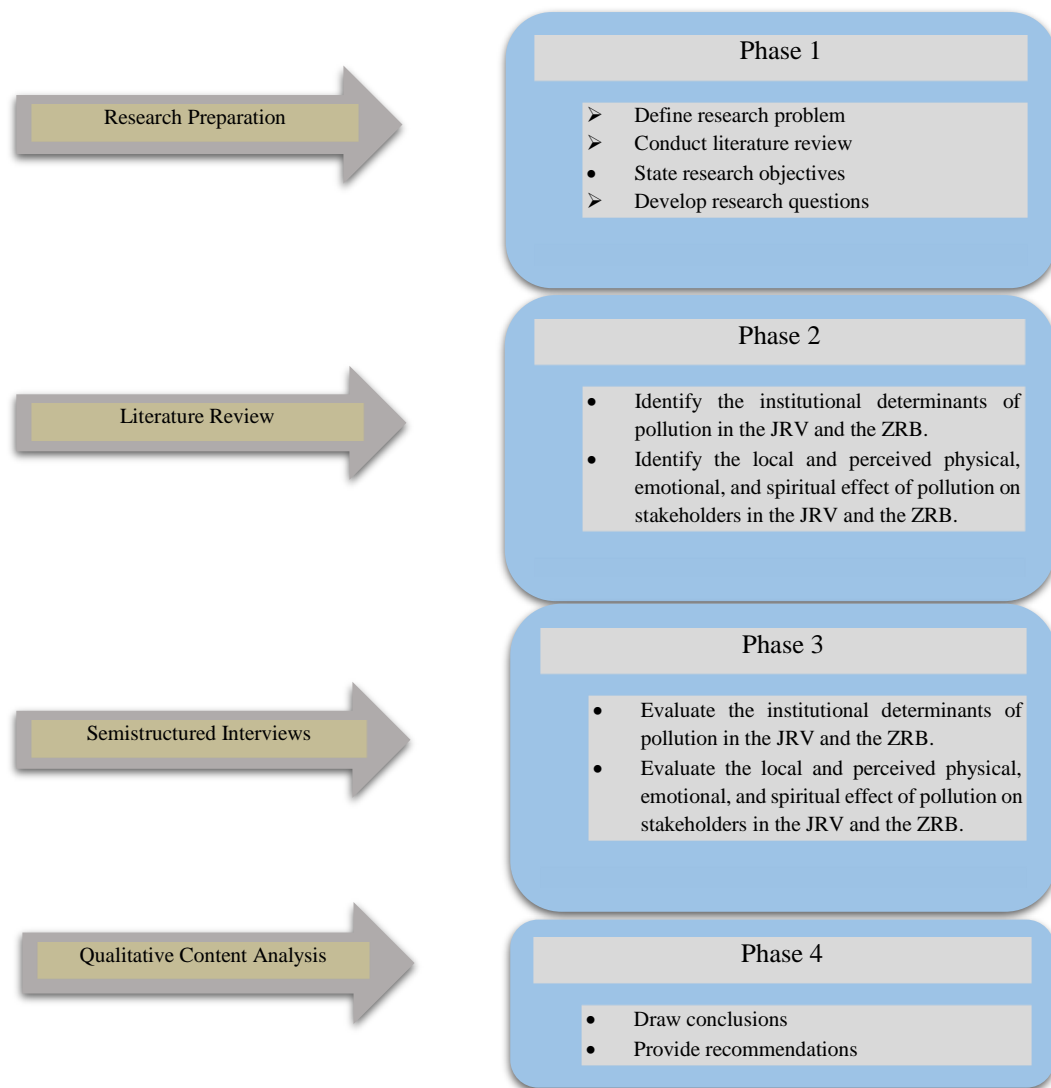


Figure 6.3: Research phases.

Source: (Author).

6.3.1 Research Preparation

A review of water studies (Abu-Sharar, 2006; Al-Wer, 2009) was undertaken to gain a retrospective understanding about the study area, the Jordan River Valley and the Zarqa River Basin. The study's targeted interviewees were all stakeholders and they included government, residents, local farmers, environmental NGOs, religious actors, and environmental experts. They were selected through the snowball sampling technique (Saunders, Saunders, & Lewis, 2011). The first participant came from an environmental experts' group. This participant was the chairperson of the Centre for Water, Energy, and Environment at the University of Jordan. The researcher had previously seen him on television speaking about water contamination in Jordan, particularly in the study area. All the environmental experts who contributed to this study have a long experience in the field of water

and environment, as illustrated in Table 6-6. In addition, the first participant in the second group – those from the government sector – was an engineer in the Ministry of Environment. The researcher visited the Ministry of Environment and asked who was had responsibility for water pollution in the study area. In the third group, environmental NGOs, the participant was introduced to the researcher by one of the researcher’s friends who works in one of the most influential environmental NGOs in Jordan. The first participant chosen to represent the fourth group – religious actors – was a Latin Vicariate clergyman from Madaba city where the researcher lives. As one of the researcher’s friends is a Christian, the researcher asked him to introduce him to one of the clergy and he did. To recruit members of the fifth group – farmers – the researcher visited the Ministry of Agriculture and asked the ministry to provide him with the names of some farmers in the study area.

As noted previously, as little research has been undertaken to examine the impact of pollution in the study area, the Jordan River Valley from a stakeholders’ perspectives, the literature review was used in the development of the study’s research questions.

6.3.1.1 Research Objective

The objective of the research is to investigate the stakeholders’ perspectives of the impacts of pollution in the Jordan River Valley and the Zarqa River Basin.

6.3.1.2 Research Questions

- What is the local and perceived physical, emotional, and spiritual effect of pollution on stakeholders in the Jordan River Valley and the Zarqa River Basin?
- What are the institutional determinants of contamination in the Jordan River Valley and the Zarqa River Basin?

Merriam (1998), as well as Marshall and Rossman (2010), contend that the methods and procedures followed in order to address qualitative research questions must be a simultaneous process. Figure 6.4 presents the methods used to address each research question.

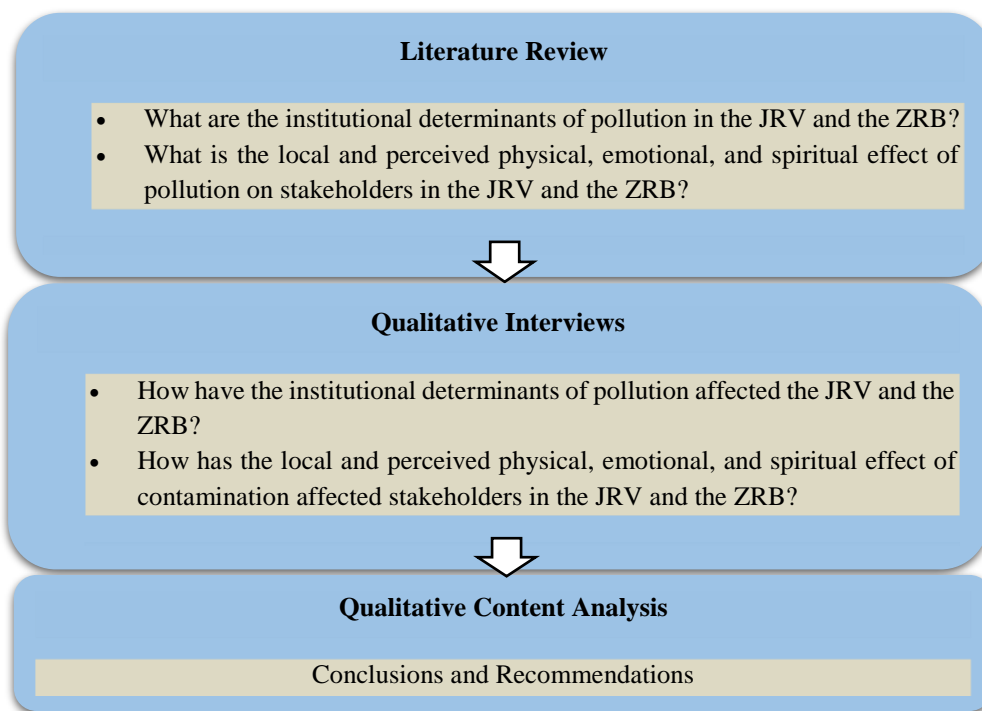


Figure 6.4: Methods used to address research questions.

Source: (Author).

The literature review carried out as a part of the research preparation phase highlights the economic and religious significance of the Jordan River Valley, along with some of the causes of pollution and its environmental, health, and economic consequences in the study area. The literature review and the interviews constitute a basis for addressing the research question.

6.3.2 Data collection methods

There are four primary methods of data collection which researchers in the social sciences can use when conducting research; these are: interview, document, observation, and questionnaire survey. In qualitative interviews, the social researcher can conduct either face-to-face interviews with interviewees or telephone interviews. Qualitative interviews employ unstructured or semistructured and open-ended questions to unveil the visions and viewpoints of the targeted respondents (Creswell, 2013b). This method, qualitative interviewing, is deemed to be the best way to obtain revealing insights from people at the micro level (Bryman, 2015). The following paragraphs discuss the use of semistructured face-to-face interviewing in the research.

6.3.2.1 Primary Data

In order to achieve triangulation, the researcher needs to take more than one type of data into account. For that reason, the current study drew upon both primary and secondary data. As already noted, qualitative interviews provided the primary data for this study.

6.3.2.1.1 Qualitative Interviews

Qualitative interviews provide opportunities for mutual understanding and explanation via a path that is organic, adaptive, and energising (Jenner, Flick, von Kardoff, & Steinke, 2004). Interviews clarify lived experiences and standpoints from the interviewee's perspective (Tracy, 2012). Qualitative interviews are like having "night-vision goggles" (Rubin & Rubin, 2011, p. 7), because interviews enable the researchers to explore complex phenomena that may be hidden (Tracy, 2012). Indeed, interviews are not mere interchanges of questions and answers, but active processes in which the researcher comes to understand the life experience of individuals in the places where they live or work (Fontana & Frey, 2005). Researchers, therefore, must investigate not only what data are gathered in an interview, but also how the interview is accomplished through fruitful negotiated interaction (Holstein & Gubrium, 1995).

The researcher chose semistructured interviews for this study because they allow for new understanding and for the interviewees' complex visions to be heard (Denscombe, 2014). Furthermore, less structured qualitative interviews are likely to make use not only of contents but also emotions (Kumar, 2011). Often the semistructured interview process itself is the site where researchers learn what data are most relevant and interesting by allowing the interview to focus on topics that emerge as most fruitful, meaningful, and interesting (Tracy, 2012). The researcher used an interview schedule when asking questions and recorded the interviewee's answers during the interview. The interview record included a heading (date, place, interviewee), the questions, space between the questions to record responses, and a thank you statement as an appreciation of the time the respondent had spent being interviewed (Creswell, 2013b).

The interview questions in the interview record drew on the tree and branch model suggested by Rubin and Rubin (1995). Their model consists of the main theme that is the trunk; the branches are the questions that emerge from the trunk. Each branch

is explored through questions of less or similar depth. This model is followed when the researcher is aware from the literature review of the primary questions that must be asked to get data that answer the research questions (Rubin & Rubin, 2011). The interview questions are illustrated in Table 6-5.

Table 6-5: Interview questions.

Group name	Interview questions
Government	<ol style="list-style-type: none"> 1. What are the standards for discharge of industrial wastewater in the Zarqa River Basin and the Jordan River Valley? 2. What are the standards for discharge of treated domestic wastewater in the Zarqa River Basin and the Jordan River Valley? 3. What are the standards for treated wastewater used for agricultural purposes in the Zarqa River Basin and the Jordan River Valley? 4. How do the environmental standards contribute to the reduction of pollution in the Zarqa River Basin and the Jordan River Valley? 5. How effective are the environmental standards in reducing pollution in the Zarqa River Basin and the Jordan River Valley? 6. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected the issuing and development of environmental legislation?
Residents	<ol style="list-style-type: none"> 1. Tell me what unfavourable changes you have noticed because of pollution in the Zarqa River Basin and the Jordan River Valley. 2. How has the pollution affected the physical health of residents/farmers in the Zarqa River Basin and the Jordan River Valley? 3. How does the effect of contamination in the Zarqa River Basin and the Jordan River Valley affect an individual's interaction with family, friends, and society? 4. How does the pollution in the Jordan River impact on the spiritual relationship the three divine religions have with the river? 5. How has the pollution affected the future of the farming community/residents of the Zarqa River Basin and the Jordan River Valley? 6. How has the pollution affected the local consumption of fruit and vegetables grown and irrigated from the Zarqa River Basin and the Jordan River Valley? 7. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected local tourism? 8. If you were the authorities, what would you do to reduce the impacts of pollution locally, nationally, and regionally in the Zarqa River Basin and the Jordan River Valley?
Local farmers	<ol style="list-style-type: none"> 1. Tell me what unfavourable changes you have noticed because of contamination in the Zarqa River Basin and the Jordan River Valley. 2. How has the pollution affected the physical health of residents/farmers in the Zarqa River Basin and the Jordan River Valley?

	<p>3. How does the effect of contamination in the Zarqa River Basin and the Jordan River Valley affect an individual interaction with family, friends, and society?</p> <p>4. How does the pollution in the Jordan River impact on the spiritual relationship the three divine religions have with the river?</p> <p>5. How has the pollution affected the future of the farming community/residents of the Zarqa River Basin and the Jordan River Valley?</p> <p>6. How has the pollution affected the quality of agricultural soil in the Zarqa River Basin and the Jordan River Valley?</p> <p>7. How does the effect of contamination in the Zarqa River Basin and the Jordan River Valley affect the exports of fruit and vegetables?</p> <p>8. How has the pollution affected the local consumption of fruit and vegetables grown and irrigated from the Zarqa River Basin and the Jordan River Valley?</p> <p>9. If you were the authorities, what would you do to reduce the impacts of pollution in the Zarqa River Basin and the Jordan River Valley?</p>
Environmental NGOs	<p>1. How important is the role of environmental NGOs in preserving biodiversity in light of increasing pollution in the Zarqa River Basin and the Jordan River Valley?</p> <p>2. How is the role of the environmental NGOs affected in light of increasing pollution in the Zarqa River Basin and the Jordan River Valley?</p> <p>3. How does the effect of pollution in the Zarqa River Basin and the Jordan River Valley affect the interaction of an individual with family, friends, and society?</p> <p>4. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected the relationship with concerned governmental institutions?</p> <p>5. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected the future planning towards reducing the pollution?</p>
Environmental experts	<p>1. How has the pollution affected the future of the farming community/residents of the Zarqa River Basin and the Jordan River Valley?</p> <p>2. How has the pollution affected the quality of agricultural soil in the Zarqa River Basin and the Jordan River Valley?</p> <p>3. How does the effect of contamination in the Zarqa River Basin and the Jordan River Valley affect the exports of fruit and vegetables?</p> <p>4. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected researchers in conducting environmental research?</p> <p>5. Which areas does research need to focus on in the future to better understand and combat the increasing pollution in the Zarqa River Basin and the Jordan River Valley?</p>
Religious actors	<p>1. How does the pollution in the Jordan River impact on the spiritual relationship the three divine religions have with the river?</p> <p>2. How has the pollution in the Jordan River affected the role of religious actors for whom the river has religious significance?</p> <p>3. How has the pollution in the Jordan River affected religious tourism?</p>

**Water
Industry**

4. How does the effect of pollution in the Zarqa River Basin and the Jordan River Valley affect the interaction of an individual with family, friends, and society?
5. How has the pollution in the Zarqa River Basin and the Jordan River Valley affected the future planning towards reducing the pollution?
1. What plans are there for Jordan to implement a formal water accounting programme along the lines of other countries that experience water shortage such as Australia?
2. What obstacles have prevented Jordan from implementing a formal water accounting programme?
3. What issues do you think that a formal water accounting programme can address in Jordan?

Source: (Author).

6.3.2.1.2 *Conducting Qualitative Interviews*

There are several ways to conduct semistructured interviews such as face-to-face, telephonic, and video conferencing. The researcher chose semistructured face-to-face interviews because through face-to-face interviews it would be possible to understand the facial expressions, body language, and emotions of the interviewees. These combinations of gestures; eye, eyebrow, lips, and cheek movements help in gauging the different moods of an individual (e.g., angry, sad, happy, and depressed) (Kumar, 2011). According to Laverly (2003), a qualitative interview should occur in a secure place and in an environment of trust. Table 6-6 presents an overview of the interviewees.

Table 6-6: Interviewees profile.

Participant's Group	Size of the group	Position	Workplace	Experience (years)
Environmental Experts	10			
	1	Chairman	Centre for Water, Energy, and Environment/the University of Jordan	25
	1	Researcher	Department of Civil Engineering/the University of Jordan	10
	1	Chairman	Department of Natural Resources Engineering/German Jordanian University	14
	1	Researcher	Centre for Environment/Royal Scientific Society	8
	3	Researcher	Department of Agricultural Economics and Agribusiness/the University of Jordan	Average 20
	1	Chairman	Department of Geology/the University of Jordan	20
	1	Researcher	Department of Land, Water, and Environment/the University of Jordan	12
	1	Researcher	Department of Water/German Society for International Cooperation (GIZ)	10
Government	7			
	2	Engineers	Jordan Valley Authority/the Ministry of Water and Irrigation	Average 15
	2	Engineer	Water Authority/the Ministry of Water and Irrigation	Average 15
	1	Chairman	Directorate of Agriculture in Jerash/the Ministry of Agriculture	20
Environmental NGOs	8			
	1	Engineer	Royal Scientific Society	15
	1	Engineer	Royal Society for Conservation of Nature (RSCN)	20
	1	Engineer	GOPA/Worldwide Consultants	16
	1	Engineer	International Union for Conservation of Nature (IUCN)	10

Religious Actors	1	Chairman	Friends of the Earth Middle East (FEME)	20
	1	Engineer	Jordan Environment Society (JES)	14
		Engineer	Birdlife International/Amman (BLI)	10
	5			
	1	Churchman	Latin Vicariate in Madaba	5
	2	Churchman	Latin vicariate in Amman	Average 25
	1	Media Coordinator	Latin Vicariate in the Baptism site/the Jordan River Valley	20
Local Farmers	1	Islamic scholar	Ministry of Islamic Affairs	16
	10			
Residents	10	Farmers	JRV and ZRB	Average 10
	10			
Water Industry	10	Residents	JRV and ZRB	
	5			
	2	Officials	Public Water Industry Corporations	Average 20
	3	Managers	Private Water Industry Company	Average 15

Source: (Author).

Saunders (2009) indicates that getting access to information from participants is one of the most challenging missions in qualitative research. The researcher gave the respondents every opportunity to talk freely, while trying to get questions answered and themes fully covered.

The researcher provided an information sheet to each interviewee including information about the research objective. Furthermore, the researcher introduced the study in a face-to-face situation. In the data collection phase of the study, the researcher contacted potential interviewees by telephone or email. When email was used, a copy of the participant information sheet (see Appendix 1), a copy of the consent form for participants (see Appendix 2) were attached.

In this research, the researcher combined the interview data gathered from the 50 stakeholders presented in Table 6-6, with the range of secondary sources such as reports, and newspaper articles shown in Table 6-7. Such triangulation improves trustworthiness (Lincoln, 1985) and makes it easier to see the data in a historical context (Yin, 2014), while at the same time telling about the experiences of the different actors involved and which instances of decision-making took place (Bryman & Bell, 2011). The 50 semistructured interviews were conducted between June 2015 and December 2015.

After contacting and interviewing the first participant from each group, snowballing was used to identify other potential interviewees that person had recommended (Bryman, 2006). According to Laverly (2003, p. 29), qualitative researchers who adopt Hermeneutics should endeavour to select participants “who have lived experience in the context of study’s focus, who are diverse enough from one to another to enhance possibilities of wealthy and unique stories of a particular experience”. This advice notably does not differ from the approach taken in classical Islamic hermeneutics. The Companions would question the Prophet Muhammad on the meaning of specific words in the verses or details on spiritual or historical issues on which Muslims sought more guidance. Most Companions who had learned The Quran and the Prophetic Tradition and their living interpretations from the Prophet himself died one by one. After that, the followers were careful to meet any Companion who was still alive to get the accurate interpretation of any verse (Syafuruddin, 1994).

The interviewees were given the opportunity to talk freely when they were asked questions about their opinions on the following areas:

- The local and perceived physical, emotional, and spiritual effect of pollution on stakeholders in the Jordan River Valley and the Zarqa River Basin.
- The institutional determinants of pollution in the Jordan River Valley and the Zarqa River Basin.

The researcher made prior appointments with the interviewees via telephone and email. The researcher asked permission from the respondents to record the interview.

Table 6-7: Overview of data sources.

Type of Data	Details of Data	Data Analysis
Primary data	Interviews with government, residents, farmers, environmental NGOs, religious actors, environmental experts, and water industry	Transcribed interview material analysed and coded using the QSR NVivo computer programme
Secondary data	Newspaper articles from the Jordanian press, NGO studies, government legislation and documents, and images	Contextual reading. Background for interviews; improved credibility and more validation of interview data interpretations

Source: (Author).

The researcher developed questions for the interview in English. However, all interviewees preferred to conduct the interview in Arabic. Translating the interview questions into Arabic language was required, as was back translating of the interview into English. The research adopted appropriate techniques to ensure an accurate translation. The researcher first translated the Arabic interview into English (Alkharusi, 2013). After translating the interviews, a third party, who is bilingual in English and Arabic, checked the translations. The third party compared the two versions to ensure an accurate translation (Alkharusi, 2013).

6.3.2.1.3 Secondary Data

Secondary data are data that have been gathered and readily obtainable from other sources. In contrast, primary data are compiled by the researcher conducting the study. Secondary data include various forms of documents.

6.3.2.1.4 Documents

Documents are considered ready-made sources of research data; they include visible, digital, written, and physical materials related to what is being studied (Tracy, 2012). Documents are gathered as evidence relating to realities from the past and the present, as well as for the future. Documents take several forms, including books, advertisements, attendance registers, manuals, background papers, minutes of meetings, and different public and private documents (Bowen, 2009). Before conducting the qualitative interviews, the researcher gathered several documents including journal articles, government documents, photos of the study

area, and newspaper articles, which provided extra information for the research problem. These various documents helped the researcher to understand the words and language of the targeted interviewees and gave the researcher preunderstanding of the environmental consequences of pollution in the Jordan River Valley.

The documents play a significant role in triangulation which improves trustworthiness (Lincoln, 1985). Moreover, the secondary materials helped the researcher to reduce the possibility of making inaccurate interpretations, because they are not affected by the research process and are characterised by many features such as constancy, high level of accuracy, and coverage or what Creswell (2013b) terms nonreactive or unobtrusive elements. Thus, written documents have a high degree of consistency, as the existence of the researcher does not change their facts. Thus, documents are appropriate for iterative reviews (Bowen, 2009). The researcher, in this research, reviewed all the documents many times to make sure he really understood them. All the documents in this research, including journal articles and government documents, enjoy a high degree of accuracy value because of the method by which they are published, which, in turn, ensures the accuracy of the information they contain (Bowen, 2009). As a result, the originality and credibility of documents used for this research was high.

6.3.3 Data analysis methods

The aim of analysing a text is to obtain a better understanding of it. Through a detailed analysis of the text that is being investigated the analyst seeks to explain its parts, describe how it works, and interpret what it means (Denscombe, 2014). There are no strongly coded and standardised data gathering and analysis methods. Therefore, considerable significance is attached to the skills and the efficiency of the researcher. For example, the researcher's personal knowledge and his/her capacity for empathic understanding are important (Addeo, 2012). Detailed procedures for data analysis should be prepared before conducting interviews, since data analysis plays a crucial role in influencing the interview guide, the interview process, and the interview transcription process (Kvale & Brinkmann, 2009). Usually, by the time the interview finishes, a part of the data analysis has already begun (Tracy, 2012).

The researcher starts the analysis of the interviews by using the content analysis technique as a way of quantifying the contents of the qualitative interviews

(Denscombe, 2014) and taking advantage of a computer data analysis programme. The researcher in this study used QSR NVivo computer software.

Qualitative software programmes have become widely popular because they help qualitative researchers to sort, organise, and search for information in image or text databases (Guest, MacQueen, & Namey, 2011). Software programmes are particularly useful when dealing with large databases, as the qualitative researcher can speedily locate all text segments that have been coded the same and determine whether interviewees are responding to a coded idea in similar or different methods (Binderkrantz & Andersen, 2011). QSR NVivo is a programme for handling qualitative data. Unlike a computer programme that analyses quantitative data, QSR NVivo does not provide qualitative researchers with unambiguous and clear-cut outcomes for the reason that qualitative analysis is not based on mathematical formulas but, rather, on the interpretive capabilities of the researcher. The programme cannot think for the researcher (Bazeley & Jackson, 2013; Binderkrantz & Andersen, 2011).

QSR NVivo does not support any particular methodology; it is designed to simplify common qualitative techniques for sorting, analysing, and sharing data, no matter what the aim of the research is and what methodology the qualitative researcher uses (Castleberry, 2014). In a study that used Hermeneutics as their research methodology, Rykkje, Eriksson, and Raholm (2013) took advantage of QSR NVivo as a computer programme that could carry out qualitative content analysis. Several other studies (Chang & Horrocks, 2006; Duffy, 2010) have also used QSR NVivo computer programme in hermeneutics-based research. Given that, there are many commonalities between classical western Hermeneutics and classical Islamic Hermeneutics (Mohseni, 2014). Content analysis is explained in more detail next.

6.3.3.1 Qualitative Content Analysis

Interviews, field notes, government documents, and different types of data are often not amenable to analysis until the documents have been compressed and made systematically comparable (Berg & Lune, 2004). An objective coding programme must be applied to the data or notes. This process is commonly called content analysis (Krippendorff, 2012). In a qualitative content analysis, researchers try to examine artefacts that contain social communications. Typically, these are the

transcription of recorded verbal communications or written documents (Jacob, 1987). Holsti (1968) defines content analysis as ‘any technique for making inferences by systematically and objectively identifying unique characteristics of messages’. A discussion of the methods employed in a qualitative research needs to specify the procedures used in analysing the different forms of qualitative data. The aim is to make sense out of text and image data, which includes segmenting the data and taking it apart (Tracy, 2012). Data analysis in a qualitative study will go hand-in-hand with other parts involved in developing it, namely the collection of data and the write-up of findings. For example, researchers may be analysing an earlier interview, writing memos that, in the end, will be included as a narrative in the final report, and arranging and organising the structure of the final report. This process differs from the quantitative research process in which the investigator collects the data, then analyses the information, and, lastly, writes the report (Creswell, 2013b).

Text and image data are very concentrated so that not all of the information can be captured in qualitative research. Thus, in the analysis of the data, researchers need to filter the data (Guest et al., 2011), a process which involves focusing in on some of the data and disregarding and ignoring other parts of it. This process was achieved through the iterative process of reading, thinking, and writing as proposed by the hermeneutic methodology (Tracy, 2012). Figure 6.5 illustrates an overview of the data analysis process.

The interviews and government documents were read many times to get a sense of the whole and their context, thus getting an initial understanding of the environmental consequences of pollution in the study area. Texts were coded into nodes using QSR NVivo computer software and formed the unit of analysis. The substantial characteristics of the text were put into meaningful units, and these were condensed through interpretation of their implicit meaning. In the next procedure, the interpretations were compared, sorted, and categorised into themes and subthemes. The spiral process of hermeneutical comprehension was taken into consideration continually in the process of recognising meaningful units and statements that corresponded to a theme, as shown in Figure 6.5 below. Qualitative validity means that the researcher examines the accuracy of the results by employing particular procedures, while qualitative reliability indicates that the researcher’s approach is consistent across many researchers and various projects

(Gibbs, 2008). Validity is one of the strengths of qualitative research and is based on determining whether the findings are fair from the viewpoints of the researcher, the interviewee, or the readers of an account (Creswell & Miller, 2000).

Figure 6.5 shows how validation of results occurs throughout the procedures in the process of research analysis; there are many valid strategies to assess the accuracy of findings, as well as to persuade readers of that accuracy. The present researcher triangulated various data sources of information such as journal articles, government documents, and newspaper articles by checking evidence from the secondary data sources and using it to construct a coherent justification for themes (Creswell, 2013b). If themes are established based on the convergence of various sources of data or perspectives from interviewees, then this process can be claimed as adding validity to the research (Creswell, 2013b). Gibbs (2008) proposed different qualitative reliability steps, including examining transcription. The researcher examined transcripts to make sure that they did not contain mistakes made during transcription.



Figure 6.5: Overview of the data analysis process

Source: Adapted from Creswell (2013b).

Figure 6.6 shows an example of the analysis process using NVivo software. The researcher was asking the participant how the contamination has affected the future of the farming community/residents of the Zarqa River Basin and the Jordan River Valley. The parent node, the main theme, is ‘Effects on Farming Community’ and one of the child nodes, a subtheme, is ‘Crop Restrictions’ and the related references are as follow: the first participant of the first group mentioned that the pollution restricted farmers to use the polluted waters in irrigating fodder crops. He said:

The contamination in the Zarqa River is the reason beyond the lack of agricultural diversity due to the restrictions imposed on the quality of vegetables planted and irrigated by untreated wastewater which affect the income from farming

The second participant mentioned that the government punishes farmers who break the environmental legislation. The second participant said:

There are various sources of pollution and the government prohibited planting the vegetables that are eaten uncooked

The third participant expanded by showing the effects of pollution on agricultural community saying:

The farmers who used to plant on the riverbanks became unable to grow crops that are usually eaten uncooked like lettuce, tomato, cucumber and others. If you ask any Jordanian about these vegetables, he says it is necessary to see them on the table every day. Because of that, they had to change the agricultural crops according to law that is the river's water became unsuitable for growing crops that are eaten uncooked. The law forces the farmers to grow crops, which are not eaten raw and fodder crops, and any outbreak for these laws, the Ministry of Health will destroy the planted crops on the river's water

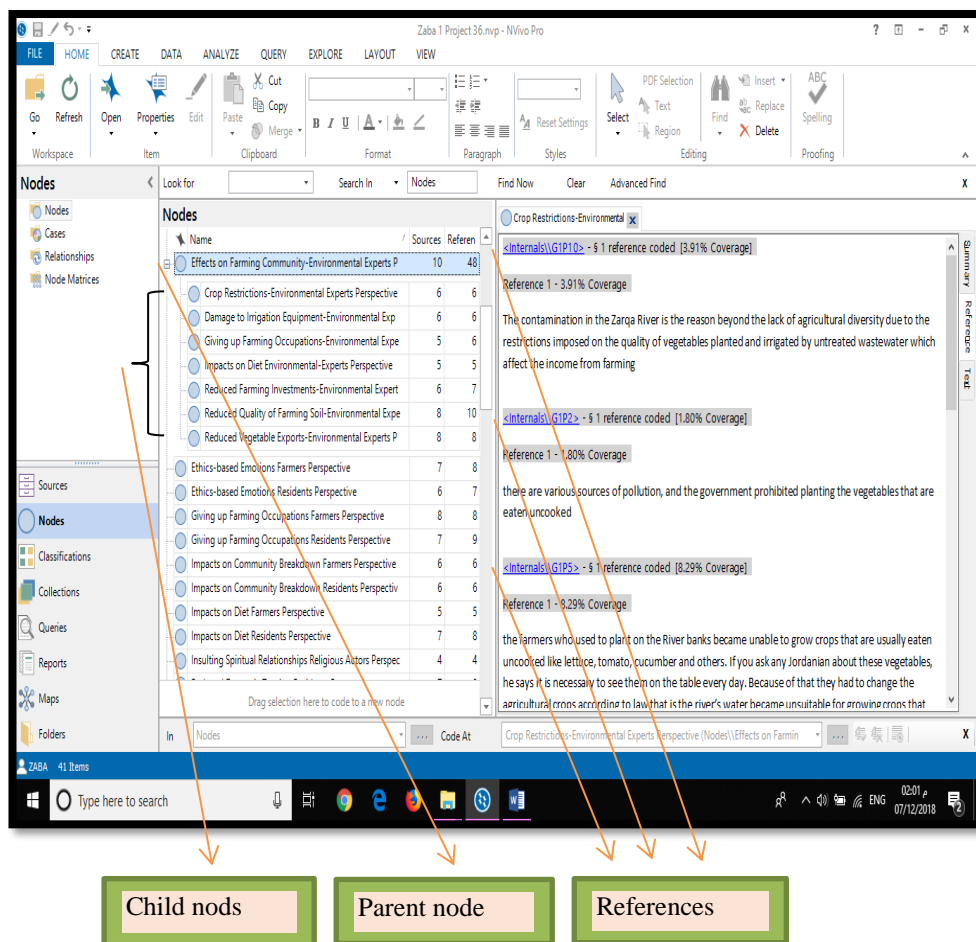


Figure 6.6: Using NVivo software in the analysis process.

Source: (Author).

6.4 Chapter Summary

Chapter 5 explained the research methodology and research methods adopted by the researcher in conducting the research. The study employs a qualitative methodology. The aim of qualitative research is to understand a particular social situation, event, group, role, or interaction (Golden-Biddle & Locke, 2007). To

achieve the study's research objective, that is, to understand the stakeholders' perspectives of the environmental consequences in the Jordan River Valley and the Zarqa River Basin, the researcher adopted classical Islamic Hermeneutics as a strategy of inquiry.

Classical Islamic Hermeneutics was introduced because the notions and procedures offered by this methodology were seen to be appropriate for an investigation into how the local and perceived physical, emotional and spiritual consequences of pollution have affected stakeholders. In addition, the research also sought to understand how the institutional determinants of pollution have also affected the Jordan River Valley. The research used semistructured face-to-face qualitative interviews. Qualitative interviews provide opportunities for mutual understanding and explanation via a path that is organic, adaptive, and energising (Jenner et al., 2004). Interviews explain subjectively lived experiences and standpoints from the interviewees' perspectives (Tracy, 2012). In this research, the researcher combined in the first round interviews with 50 representatives of stakeholders, including Jordanian government, residents, local farmers, environmental experts, NGOs, religious actors, and in the second round 5 extra interviews with water industry actors.

The aim of analysing a text is to gain a better understanding of its meaning. Through detailed analysis of the investigated text, the study sought to explain its parts, describe how it works, and interpret what it means. The researcher gathered qualitative data from semistructured face-to-face interviews. Interviews, field notes, and different types of nonverbal data are often not amenable to analysis until the information they contain has been compressed and made systematically comparable (Berg & Lune, 2004). An objective coding programme must be applied to the data or notes (Krippendorff, 2012). In content analysis, researchers try to examine artefacts of social communications. Electronic content analysis computer software called QSR NVivo was used to analyse the interviews. The following chapter covers the preunderstanding phase, which is required by the classical Islamic Hermeneutics methodology. This understanding was extracted from my own experience and secondary data resources about the causes and effects of water resources pollution in the Jordan River Valley.

Chapter 7: Preunderstanding

7.1 Introduction

Central to classical Islamic Hermeneutics is the concept of preunderstanding. Ricoeur and Thompson (1981, p. 243) explain that preunderstanding is shaped by the researcher's belonging "to a history, to a class, to a nation, to a culture, to one or several traditions." Preconceived visions stem from the tradition, historical, cultural, social and economic background, and lived experience of the exegetist and represent the perspective within which the interpreter approaches and understands text (Gadamer, 1975). As I am a male Muslim living in Jordan, and as most of the Jordanian population are Muslims, my preunderstanding has been affected by my Islamic and Jordanian culture.

A researcher is never free from prejudices, which implies that the explanation of text and its significance is subjective with no guarantee about any specific interpretation. Burnett, Dickey, Chudoba, and Kazmer (2003) explain that there is perhaps considerable variability of opinions from one commentator to another if readers invoke different frames of reference for any given text.

Classical Islamic Hermeneutics requires understanding the reasons behind the revelation of a verse in The Quran to understand the intended meaning of the author (Mohseni, 2014). Besides, an exegetist must understand other interpretations regarding the verse. I will follow the same approach to reasoning in my analysis as a means to understand the intended meaning of the participants in the interviews. Consequently, I must understand the physical and institutional grounds for the pollution of the Jordan River Valley in order to understand its health, economic, social, and spiritual consequences. My preunderstanding originates from both my own experience and reading of secondary data including journal articles, newspaper articles, government reports, and online multimedia on the reasons why there is water pollution in the Jordan River Valley.

From a hermeneutical perspective, it is necessary to understand each cause (the part) and the interrelatedness of the causes as a pollution state (the whole). The causes (parts) give a better understanding of the water pollution process (the whole) and vice versa. In other words, to obtain a holistic understanding of the impacts of

freshwater pollution, it is necessary to understand the parts and the whole of the situation regarding water contamination.

This chapter is structured into four interconnected sections. Section 7.2 explains my preunderstanding of water pollution in the Jordan River Valley from my own experience in the Zarqa River Basin. Section 7.3 describes stewardship towards freshwater in Islam. Islam emphasises the importance of stewardship of natural resources and water. As a Muslim, my understanding is that Islam considers this stewardship as the primary reason for adhering to the teachings of Allah. Section 7.4 explains my own experience. I demonstrate that contamination results from not only different industrial activities, but also institutional policies. Section 7.5 summarises my preunderstanding on the water contamination in the Jordan River Valley.

7.2 My Preunderstanding

My preunderstanding has evolved from my own experience, as I live 30 minutes away from the Zarqa River. I can see the river in its polluted state and frequently talk to people who are permanent residents of Jordan when I go to the capital, Amman. As indicated earlier in chapter 2, Jordan has three rivers: the Jordan River, the Yarmouk River, and the Zarqa River. The first two rivers are shared by Jordan, Israel, Syria, and Lebanon. The Zarqa River is the only river exploited exclusively by Jordan. The river originates in Amman, stretches to Zarqa, then to Jerash, and finally to the Jordan River. I used to see rivers around the world on Jordanian television. The rivers were large and clean. When I was a child, I wanted to see the Jordan River, as it is the most significant river in Jordan. However, before the signing of the peace agreement in 1994 between Jordan and Israel, visitors were not allowed to visit the Jordan River. School trips could not be organised to that border region where the Jordan River is located, even though there was a ceasefire between the two countries between 1967 and 1994. So, I used to go with my family to the Zarqa River and the King Talal Dam instead.

The first time I visited the Zarqa River I was shocked! I asked my father, “Is this a river?” He said, “Sadly, yes.” I said, “What is going on in the river?” He said, “The River was completely different in the past.” He told me that people used to swim and fish in the river. Besides, people from the adjacent regions of the Zarqa River used to breed livestock and come here to collect drinking water for sheep and their

families. The riverbanks were full of vegetation. Many people used to use the river waters for their farms. Residents depended on their crops, as agriculture was a successful occupation. My father added, the Circassians³³ who came to Jordan from Russia around 1900 chose to live on the banks of the Zarqa River due to the availability of freshwater and fertile land. Later, most of them left agriculture and moved to other places. Al-Basheer (2013) confirms that the Zarqa River was attractive to Russian immigrants to Jordan who used to work in agriculture on the riverbanks. Farming was profitable as water for irrigation was free and available at any time. My father said, this region was planted with all kinds of leafy vegetables such as green onions, parsley, spinach, cabbages and lettuces without any restrictions. In addition, other kinds of vegetables such as tomatoes, cucumbers, carrots and radishes were also planted on the Zarqa riverbanks. The river used to be crowded over the weekends. People promenaded and enjoyed the beautiful view and fresh air. All these lovely aspects disappeared with the pollution as a consequence of rapid population growth and urbanisation.

In order to clarify the difference between the situation in the past and the present, my father said that the Grand Amman Municipality was unable to find any solution to avoid the unbearable odours from and visual pollution of the river, although the eventual solution was to cover the river with a roof where it crosses the city centre. In fact, I see the roof daily when I come back from Amman to Madaba where I live. I wait for the bus at the Muhajireen³⁴ Transport Centre. The transport centre itself is built over the Zarqa River. Part of the city centre is built over the river as well. I can see the utility holes in the street near to the city centre. If I go to the city centre on a rainy day, I can see flooding from sewage and street storm water run-off, as both are discharged using the same sewer network. This flooding frequently happens.

One day I was waiting for the bus at the Transport Centre to go to Zarqa city. The seat next to me was vacant. During the journey, the bus stopped and a man joined the bus. He seemed to be an Islamic cleric. During the trip, we could smell and see the river. I said to him, "It seems that it is impossible to solve this problem." He smiled and said, "No, if they want, they can fix it, but it may take a lot of funds." I

³³ The Circassians, who are Muslims, are of Russian origin and have fair hair and skin. They came to Jordan to escape from civil war in Russia.

³⁴ This Arabic word refers to the Circassian immigrants living in Ras-Alain on the Zarqa Riverbanks.

argued that the rapid population growth and lack of money, as Jordan is a developing country, are not the only reasons for the delay in finding a proper solution, as I had heard from a highly positioned government official that procedures to rehabilitate the Zarqa River would harshly affect the industrial sector in Jordan, as most of the country's industrial activities are located in the Amman Zarqa Basin. My interpretation is that the government prefers to favour undertaking several massive projects such as the Disi project. This project will collect water from Aqaba city and, through huge pipes, bring it to Amman – a distance of 350km – because such projects cost less than rehabilitating the river. It appears that rehabilitation of the river is not within the government's priorities.

My Muslim bus companion pointed out that the situation is worsened by the Zarqa River, which contributes to the pollution of the Jordan River. I said, "Yes, you mean the river of life." He said, "It is the dead river now." It seems that the polluters do not know that the Jordan River is mentioned in The Quran where it says:

then when Talut (Saul) set out with the army, he said, "Verily, Allah will try you by a river. So, whoever drinks thereof, he is not of me, and whoever tastes it not, he is of me, except him who takes (thereof) in the hollow of his hand." Yet, they drank thereof, all, except a few of them. So, when he had crossed it (the River Jordan), he and those who believed with him, they said, "We have no power this day against Jalut (Goliath) and his hosts." (The Quran, 2:249).

Islamic scholars conclude that the verse indicates that the Jordan River water was the purest water at that time. In this verse the thirsty soldiers are being tested to see if they can resist thirst when in the presence of clean freshwater. Several Quranic verses call for water preservation and so this subject will be introduced in section 7.3. It is my belief that if there were more environmental responsibility, there would be much less contamination of water. The issue of accountability will be introduced in section 7.5.

7.3 Stewardship of Freshwater in Islam

The cultural aspect of the environment and the variable contexts of water resources make it critical that water management includes components of local cultures and religions (Caponera, 2001). The Quran refers to water and its conservation. For instance, in The Quran, the word 'water' occurs 63 times, and 'rivers' 52 times

(Abdul-Baqi, 1987). Thus, freshwater as a natural source enjoys significance in Islam.

Water, like any other natural resource, is sometimes used in an irrational way, a practice which is not in line with the Quranic teachings which speak of the concept of *fassad* (Zouhaili, 1992; Kadouri, Djebbar, and Nehdi 2001). Basically, the word *fassad* may be translated as ‘mischief’ (Ali, 1973); its other meanings comprise the taking of something unfairly and unjustly (Al-Munjid, 1994) or damaging or degrading natural resources. The Quran instructs believers not to make mischief on the earth. According to The Quran, “Mischief has appeared throughout the land and sea by (reason of) what the hands of people have earned, so He may let them taste part of [the] consequence of what they have done [so] that perhaps they will return to righteousness” (The Quran, 30:41). When human-produced mischief damages the natural order, Allah chastises societies with the same kind of harm that they have inflicted on Allah’s creation. However, the word *fassad* is challenging to interpret, as it includes, in addition to its wide translation by Ali (1973), a more exact notion. Tabatabai (1974) explains that the exact concept of *fassad* is damage that afflicts functioning of present (natural) regulations of the terrestrial world irrespective of whether or not the damage was based on the choice of certain individuals. *Fassad* generates an imbalance such as water scarcity in the ecosystem. Moreover, the verses that follow the section concerned with the concept of *fassad* refer to earth and wind and to rewards from Allah’s bounty for those who believe in Allah and work good deeds. It should be noted that *fassad* is not associated with any definite time or place and is thus worldwide and permanent in scope (Amery, 2001). Although *fassad* is introduced in the context of land and sea (The Quran, 30:41), it can also be extended to include all other elements of the ecosystem, for The Quran mentions that the skies and the earth and whatever is between them and what is underneath the ground belongs to Allah (The Quran, 20:6; 30:26) the creator of everything (The Quran, 25:2). There is thus a Quranic disapproval of *fassad* and of excessive exploitation or degradation of ecological resources, including freshwater, despite the position of The Quran that everything in nature is subservient to humans (Amery, 2001; Al-Tabarani 2010; Tayob, Deedat, & Patel, 2015).

My understanding is that the notion of worshipping does not mean that current natural resources can be exploited by the current generations only. Natural

resources that are in our hands are not just ours; some of them are for the next generations and humans are playing the role of their trustees (Annas, 2016). Al-Damkhi (2008) mentions that, although humans are equal collaborators with everything in the natural universe, they have added responsibilities. Humans are not lords and masters of the natural universe. He emphasises that Muslims are custodians and friends of the earth and must take care of it for the next generations. My understanding is that all humans, not only Muslims, must take care of freshwater and are responsible for the Earth's natural resources and water. My interpretation is that any adverse impact on freshwater affects the spiritual feelings of humans toward the water in terms of its being Allah's bounty and the origin of life.

7.4 Daily Zarqa River Observations

The sources of pollution along the river in this study vary significantly from one section to another. The causes of the contamination of the river and its tributaries include pollution from small factories and services and large factories (Al-Kuisi, Mashal, Al-Qinna, Hamad, & Margana, 2014). The Zarqa River Basin is the most densely industrialised region of Jordan. Four major municipal wastewater treatment plants run under the auspices of the Water Authority of Jordan's (WAJ) supervision are found in the basin. These treatment plants are: the As-Samra, Abu-Nusier, Ain Ghazal, and Jerash plants. The As-Samra plant, which has been overloaded, serves the population of Amman, Zarqa, Russeifa and Hashemiyyeh (Bajjali & Al-Hadidi, 2017). These cities are the most populous cities in Jordan. I argue that there is a lack of urban planning in Amman and Zarqa cities. Salama (2016) emphasises that Amman, Irbid, and Zarqa were built randomly. This lack of planning creates pressure on public services and especially on the sewerage network and wastewater treatment plants (Housing and Urban Development Corporation, 2011). I can see swamps of effluent in the riverbed in the summer season. In addition, utility holes frequently overflow in the cities of Amman and Zarqa during rainy seasons, because sewage and stormwater run-off are discharged into the same canals. As a result, the Zarqa River receives these polluted waters from the catchment area during the winter season.

The main springs that flow into the Zarqa River are the Ras-Alain and Sukhneh. Presently, these springs are mainly used for drinking water. However, the amounts

of water from these springs that discharge into the Zarqa River are insufficient for this purpose (Al-Khraisha, 2012). During the summer season, this situation results in a riverbed which is dry except for a quantity of sewerage that comes from the As-Samra plant. The surface water in the Zarqa River is used for irrigating small farms along the river banks and the amount that is left over flows into the King Talal Dam to be used for irrigation in the Jordan River Valley (Aljazeera, 2017). I can see farmers use this contaminated industrial water for irrigating their crops on the riverbanks in Zarqa city, a usage which could threaten the well-being of farmers and consumers (see Figure 7.1).



Figure 7.1: A farm on the bank of the Zarqa River uses polluted irrigation water.

Source: (Author).

The industrial activities that contribute to the contamination of the Zarqa River cover a wide range of sectors, including pharmaceuticals, petrochemicals, steel, and food. Small industrial activities and services also play a significant role in degrading the quality of the water in the Zarqa River (Al-Yarmouk, 2017). For instance, I have seen illegal dumping of liquid and solid waste, debris, and discharge of private septic tankers into the river. In fact, the industrial activities consider the river course as a landfill for their different types of waste (Al-Dhahir, 2011). I understand that the polluters do not care about the impacts of pollution because they do not consider the laws. I do, however, believe that if there were punishments, they would never do that. Local communities call for contamination prevention and invite the government to take strong action against the polluters. The Jordanian government makes promises about the rehabilitation of the Zarqa River, but it does not live up

to any of its obligations. I understand that local societies are marginalised. People who live in close proximity to the river have been suffering for more than 30 years, and if there were real intentions to solve the problem, the government would address it (Abulhawa, 2010). It seems that there are people who have more power than the government and or that the local societies and the environment are not priorities within the government agenda.

7.5 Institutional Grounds of Pollution

Causes of pollution in the Jordan River Valley are not limited to the dumping of industrial and domestic wastewater or solid waste, but include institutional factors such as nepotism (*wasta*) and a lack of enforcement of regulations. These factors are grounded in social and historical motives. *Wasta* is embedded in the Jordanian society. This practice is obvious in how Jordanian families raise their children. Children in any Jordanian family are used to asking their father to buy things for them. If the father refuses to agree to the demand, the children turn to their mother to intercede with their father to obtain their wants. Therefore, children grow up with the notion of playing both ends against the middle. When I was a teacher in Jordan, one of the students that I used to teach was the son of the headmaster. Although the student was naughty, none of the teachers was able to punish him. One day he was very naughty and his classmates were complaining about him, but we decided to keep silent and asked the students to go to the headmaster and explain his son's behaviour to him because it was a bit difficult for the teachers to apply the regulations to the son of someone in a higher position. As a Muslim, I agree with the idea of being a mediator in resolving problems among families or individuals. In addition, I agree with people who play the role of intermediary, in order to help someone obtain his/her right. Islam encourages people to be helpful and supportive. As The Quran states: "whosoever intercedes for a good cause will have the reward thereof..." (The Quran, 4:85). However, if the role of the mediator involves trespassing on another's right, this is injustice and is against the Islamic teachings that we were taught at a young age, a view which is supported in The Quran when it goes on to say: "...and whosoever intercedes for an evil cause will have a share in its burden" (The Quran, 4:85).

Denny, Donnelly, McKay, Ponte, and Uetake (2008) explain that the phenomenon of *wasta* – a centuries-old custom of giving weight to tribal and ethnical connections

when granting professional positions – exists in Jordan, a country which maintains a robust tribal system. Allotting state resources, hiring within ministries, and deciding promotions within the rigid routine of the kingdom are all aspects of Jordanian life that owe much to the practice of favouring *wasta* over stringent considerations of skill, need, and competence. Unlike apparent corruption such as appropriating state treasury funds, *wasta* does not suffer from an overly adverse public perception and is seen merely as a way of doing business. However, *wasta* harmfully affects performance in all government authorities, and the Ministry of Water and Irrigation is no exception.

My understanding is that nepotism in the Jordanian community takes two forms. The first form is favouritism, which is motivated by paying money to the mediator, while the second form is doing a favour for someone in need, when the favour is driven by nonfinancial mutual interests. Bribery as a form of corruption is not predominant in the country. My interpretation is that the tribal structure of Jordanian society diminishes this kind of corruption. Due to its moral system, tribal societies in Jordan consider bribery as shameful behaviour. According to Sameeh Bino, former president of the Jordanian Anti-Corruption Commission, in contrast to nepotism, bribery does not exist as a phenomenon among Jordanians (Russia Today Arabic, 2018), whereas tribal ethical systems deem the second kind of nepotism as doing a favour to someone who is in need. For example, I graduated from university and then remained unemployed for 5 years before I secured work as a teacher. The person who helped me find a job is one of my relatives. As a result, I voted for him when he was nominated to be a member of the Jordanian parliament. He was not the only one eligible to be a member of parliament, but because of his help to me, I wanted to help him gain that position. My understanding is that nepotism based on nonfinancial interests is complicated. It takes multiple shapes in the sense that the motivation of nepotism is that the intermediary who gives help and the person who needs the help are relatives.

In the tribal system, if the intercessor can help but does not help, the tribe considers this to be a shameful act. This kind of nepotism expands the notion of doing a favour to relatives to other types of services such as doing a favour to people who are not relatives. The motivation behind that practice is to obtain help from others. The following examples help to illustrate different types of help. On the one hand, if someone works in the government and someone else works in a private company,

the one who works in the government may help the one who works in the private company to bypass government regulations. On the other hand, the one who works in the government asks the other one to help employ his/her relative in the company as a way to return the favour. Abu-Olwan (2015) maintains that this type of favouritism constitutes a phenomenon in the Jordanian community especially in the public employment segment and in water sector management. My understanding is that these kinds of behaviours may lead to the appointment of unqualified employees and vice versa. The father and grandfather of one of Jordan's prime ministers were also prime ministers; there is no election for obtaining that position, as the King appoints his prime minister.

Jordan suffers from lack of freshwater resources due to climate change and overexploitation of groundwater. Jordan permits farmers and industrialists to dig artesian wells in some regions; however, others are not allowed to drill wells in other regions, even if the wells were previously licensed; this type of behaviour reflects selectivity in enforcing the laws. Therefore, if the government makes a new decision not to dig new wells in a region, people must abide by the new decision and close the old wells. Some people break the law regarding digging artesian wells (RoyaNews, 2014). One of the private investors in Madaba city, where I live, has drilled an artesian well without obtaining permission from the Ministry of Water and Irrigation. The government asked him to close the well, but to no avail. The Ministry of Water and Irrigation notified the Ministry of Interior to take action against the owner of the well. The administrative governor tried to enforce the closure of the well, but he was not able to do so because the owner of the well is from a powerful tribe and he has many relatives who hold high positions in the government. Finally, the governor's only solution was to ask the investor to get the well licensed, as illustrated in RoyaNews (2013).

My understanding is that legislation is applied to people who do not have power or connections to influential tribes. However, this nepotistic behaviour encourages other citizens to break the laws. My understanding is that the government is a crucial factor in the marginalisation of accountability. The government claims that if it enforces the rules strictly, the investors will give up their investments and that this lack of investment, in turn, will affect the Jordanian economy (Daradkah, personal communication, July, 2015). My interpretation is that the government has not solved problems of enforcement of regulations yet. The Jordanian people have,

therefore, become accustomed to breaching the laws due to the lack of accountability. As a result, the government finds difficulties in addressing the consequences of a lack of accountability such as aggravating nepotism and shortage of groundwater. Adnan Al-Zoubi, assistant minister of the Ministry of Water and Irrigation, in an interview on Jordanian television stated:

The reconciliation process is not easy (a state of being unable to enforce the law or to turn a blind eye). We are not talking about who has the right, but we are talking about a very, very, very difficult situation (RoyaNews, 2013).

Local societies, NGOs and the media make verbal and written complaints against offenders to the Ministry of Environment and other governmental parties, but to no avail. The lack of legislative commitment on the part of industries and inadequate enforcement of environmental legislation by the government increase the severe situation of the shortage of freshwater. This situation has resulted in the marginalisation of local societies over a long period of time (Qaqeesh, 2017). In fact, the government does what it wants to do without considering local reactions.

Evidence of the lack of engagement of the local community to address the environmental issues can be seen in the fact that, although the Jordanian parliament, as a group, could place pressure on the government to find a solution to ecological issues through collaboration with the government, it, unfortunately, fails to do so. My understanding is that the regime clearly has control over parliament and that parliament members seem to be sidelined by government agencies, a view which is confirmed by Alfayez (2013) and Alarabialyaoum (2018).

7.6 Chapter Summary

My preunderstanding rests upon what I see and hear daily of pollution in the Jordan River Valley. These causes of contamination seem to be complex. The causes for the pollution are not restricted to physical reasons such as inadequately treated industrial wastewater from industrial activities scattered along the riverbanks and partially treated domestic sewage resulting from poor wastewater treatment plants in the region. The absence of political will to make changes and the lack to enforcement of the law owing to nepotism and apathy, which are embodied in the state culture, are also contributing factors. Solutions are possible, but only if the genuine intention is to create real change. In addition, implementing the

participatory programmes that do not try to marginalise the beneficial role of the local communities to find the difference. Therefore, government authorities, civil society organisations and environmentally concerned parties are all responsible for creating an integrated work environment to not only stop the decline but also improve the river, even if the river may never be able to be restored to its former state. The next chapter, the findings, covers the results of the research that were extracted from analysing the semistructured interviews conducted in the study area.

Chapter 8: Interviews Findings

8.1 Introduction

This research focuses on the effects of the environmental degradation in the Jordan River Valley. The preunderstanding obtained from the secondary data and my preunderstanding in chapters 2 and 7 respectively revealed many effects of pollution on the stakeholders in the region. Although some of the adverse impacts are evident in the Jordan River Valley, others are hidden from the public. The preunderstanding stage provided a rigorous basis for engaging with stakeholder groups when analysing and interpreting their experiences of the impacts of pollution in the Jordan River Valley.

To gain greater understanding, interviews with a wider range of stakeholders were conducted. A series of semistructured interviews was carried out with 55 different participants. The goal of the interviews was to obtain further insights into specific issues from the perspective of their lived experiences. A better understanding of the consequences of pollution can provide new insights into the magnitude of the contamination and focus on the need for accountability for the impacts of that pollution.

Starting from the premise that the stakeholders have particular perspectives of the contamination in the Jordan River Valley, an Islamic hermeneutic methodology was adopted for this research. Stakeholders were encouraged to share their visions and lived experiences in dealing with the impacts of pollution in their own words and based on their experiences. Islamic Hermeneutics theory was selected for this research investigation because of the context within which the pollution takes place, namely Jordan, which is a Muslim country with a conservative Muslim majority population. The methodology led to enquiries about how the local and perceived physical, emotional, and spiritual effects of pollution affected stakeholders in the Jordan River Valley.

The findings in this chapter are grouped into six main sections; first, impacts on the farming community; second, impacts on the tourism sector; third, impacts on institutional politics; fourth, impacts on physical health; fifth, impacts on the emotional relationship with the valley and the basin; and finally, impacts on the

spiritual relationship with the valley. These sections include main themes and subthemes that were identified as of concern across the stakeholders in the Jordan River Valley.

8.2 Impacts of Water Pollution on the Farming Community

Degradation in irrigation water quality has many damaging impacts on the farming community in the Jordan River Valley. These effects include (1) immediate impacts, e.g., (a) damage to irrigation equipment, (b) cropping restriction, (c) reduced vegetable exports, and (d) reduced farming soil quality; (2) economic sustainability of farming, e.g., (a) reduced farming investments, (b) giving up farming occupations; (3) social affects, e.g., (a) impacts on the diet and (b) impacts on the social structure. This section presents clarification on both immediate and long-term effects of pollution on the farming community.

8.2.1 Immediate impacts

Water pollution has assumed alarming proportions worldwide and particularly in Jordan (Mohsen & Jaber, 2003; Zawahri, 2012). It has emerged as one of the main environmental threats in the Jordan River Valley. Both industrial and nonindustrial factors contribute to this problem (Nortcliff et al., 2008). Increased population growth and forced immigration from neighbouring countries have brought about rapid urbanisation (The World Bank, 2001) and have generated enormous pressures on freshwater resources (Ayyash, 2008; Rezeq, 2009; Qadir, Bahri, Sato, & Al-Karadsheh, 2010). Thus, increasing pressure is placed on wastewater treatment plants. Inadequately treated wastewater includes dangerous industrial substances in addition to pathogens which all have long- and short-term effects (Zemann et al., 2014).

8.2.1.1.1 Damage to irrigation equipment: Environmental experts' perspective

Drip irrigation systems became clogged because of suspended solids, algae growth, or mineral deposition resulting from using treated wastewater for irrigation (Whitall et al., 2007; Carr et al., 2011; Myszograj & Qteishat, 2011; Hanjra et al., 2012). Liu and Huang (2009) attribute blockage to mineral precipitation because of the high level of pH of partially treated wastewater, while Duran-Ros, Puig-Bargués, Arbat, Barragán, and de Cartagena (2009) identify the combined impacts of algal growth and mineral precipitation as a common reason for clogging.

The participants from the environmental expert's group were asked about the impacts of pollution on the farming community in the Jordan River Valley. A comment made by G1P1 is a typical one. He states:

In addition to the lousy quality of irrigation water which contains a high content of substances suspended and causes blockage to drippers and sprinklers. (G1P1, environmental expert).

The quality of irrigation water provided by the Jordan Valley Authority is not suitable for farming purposes, because partially treated wastewater clogs sprinklers and drippers. As a result, less water reaches vegetables, which impacts on crop productivity and farming income.

8.2.1.1.2 Damage to irrigation equipment: Farmers' perspective

Alfarra, Sonneveld, and Hoetzl (2013) found that insufficient treated wastewater used for irrigation purposes has no undesirable impacts on irrigation equipment. However, a comment made by G5P9, a farmer in the Jordan River Valley, shows that the farmers who participated in the current study disagree with this position. G5P9 illustrates how the pollution affects the irrigation equipment. He states:

نوعية مياه الري السيئة تتسبب في إغلاق النقاطات والمرشات

...the bad quality of irrigation water causes blockage of drip irrigation systems and sprinklers (G5P9, farmer).

G5P9 provides a reason why partially treated wastewater used in irrigation causes a financial loss for farmers. Many steps are required to alleviate the problem. First, farmers have to replace the damaged drippers. Second, they need additional workers to clean the drippers and sprinklers manually. Finally, they need to use chemical materials to dissolve the suspended solids. All of the options increase maintenance costs, which affects the farming community financially.

8.2.1.2.1 Crop restrictions: Environmental experts' perspective

Environmental experts were asked to provide their overall evaluations of the impacts of contamination on the farming community. Their views are represented by a comment made by G1P5, who works in the Department of Agricultural Economics and Agribusiness at the University of Jordan. G1P5 states:

The farmers who used to plant on the River banks became unable to grow crops that are usually eaten uncooked like lettuce, tomato, cucumber and others. If you ask any Jordanian about these vegetables,

he says it is necessary to see them on the table every day. Because of that, they had to change the agricultural crops according to law that is the river's water became unsuitable for growing crops that are eaten uncooked. The law forces the farmers to grow crops, which are not eaten raw and fodder crops, and any outbreak for these laws, the Ministry of Health will destroy the planted crops on the river's water (G1P5, environmental expert).

Using partially treated wastewater in irrigation requires farmers to plant fodder crops and vegetables that require cooking before consumption (Dreschsel, Blumenthal, & Keraita, 2002). These restrictions are imposed by law (Ammary, 2007). Consequently, farmers are required to plant crops that are not as profitable. There is a high demand for uncooked vegetables in Jordan when compared to fodder crops and vegetables which have to be cooked. If farmers want to plant vegetables that are eaten raw, they need to purchase freshwater for irrigation purposes rather than using water from the Zarqa River.

8.2.1.2.2 Crop restrictions: Farmers' perspective

Alfarra et al. (2013) show that 82% of the farmers they sampled expressed their concerns about using partially treated wastewater for irrigation because of restrictions on what crops can be cultivated. In this study, G5P1, a farmer in the Zarqa River Basin, reveals that the contamination in the Zarqa River has made the irrigation waters unsuitable for all types of crops. He states:

The pollution of the Zarqa River water makes it unsuitable to irrigate all types of crops. As a result, the government has imposed on us (the farmers) to use the Zarqa River and the King Talal Dam only to irrigate fodder crops and the nonraw eaten vegetables, which is not profitable as raw eaten vegetables (G5P1, farmer).

This change in cultivated crops decreases the profitability of agricultural activities. Those farmers who do not adhere to the government requirements risk the destruction for their vegetables if they breach the regulations contained in Agriculture Law No. 44/2002 and use partially treated wastewater for irrigating vegetables that are eaten uncooked.

8.2.1.2.3 Crop restrictions: Residents' perspective

G6P10, who lives in the Jordan River Valley, expresses the effect of pollution in the Jordan River Valley on the farming community, stating that the pollution affects the types of crops grown and irrigated by the Zarqa River waters and the King Talal Dam. He states:

العديد من المزارعين بدأوا بزراعة المحاصيل العلفية مثل البرسيم والشعير بالإضافة الى أشجار الفاكهة والتي هي أقل جدوى بدلا من الخضراوات التي تؤكل غير مطبوخة

Many farmers began growing forage crops such as alfalfa and barley in addition to fruit trees, which are less rewarding, rather than vegetables that are eaten uncooked (G6P10, resident).

Owing to the pollution, the government imposes restrictions on farmers. Residents emphasise that vegetables that are eaten raw such as tomato, cucumber, parsley, lettuce, green onion and capsicum are more financially rewarding than vegetables that are eaten cooked or fodder crops that are used for feeding farm animals.

8.2.1.3.1 Reduced vegetable exports: Environmental experts' perspective

Group1 participants were asked to provide their overall evaluations of the impacts of pollution on the farming community. Their overall evaluation is reflected in a comment made by G1P9, a scholar in the Department of Civil Engineering at the University of Jordan. He states:

The local newspapers have published reports about the pollution of the Zarqa River, which made Saudi Arabia stops vegetable import from Jordan. This lasted for a long period of time and caused damage and loss to farmers because they relied on Saudi as the biggest and largest Arab market. (G1P9, environmental expert).

The crops in the Jordan River Valley are grown and irrigated by partially treated wastewater. This practice made Jordanian vegetables undesirable in foreign markets. As a result, farmers are obliged to sell their crops in the local market at lower prices.

Mourad, Gaese, and Jabarin (2010) explain that, in 1992, the Saudi Government banned Jordanian vegetable exports, citing biological pollution of products and the use of partially treated wastewater as its main reasons. It took the Jordan Government 18 years to convince the Saudi Government to repeal the ban. This prohibition was eventually lifted in 2010. G1P5, who works in the Department of Agricultural Economics and Agribusiness at the University of Jordan, states:

Not only the exports were affected, but the importation became totally forbidden in Jordan as Saudi Arabia issued a Fatwa that prohibits irrigation by treated wastewater; consequently, importing vegetables from Jordan was banned for several years because the King Talal Dam was polluted by wastewater. In addition, other countries stopped importing vegetables from Jordan (G1P5, environmental expert).

G1P5 explains that using partially treated wastewater for irrigation in the Jordan River Valley caused a financial loss for farmers, as happened when Saudi Arabia banned the export of fruit and vegetables from Jordan. It is the largest importer of fruit and vegetables from Jordan. Saudi Arabia considered using partially treated wastewater for irrigation as forbidden by Sharia³⁵(Farooq & Ansari, 1983).

8.2.1.3.2 Reduced vegetable exports: Farmers' perspective

Farmers were asked to evaluate the impact of pollution on vegetable exports. The following extract from G5P9 sums up their thoughts:

In the 1990s of the last century, a catastrophe has occurred regarding importing vegetables between Jordan and adjacent countries importing Jordanian vegetables and the largest country is Saudi Arabia. Saudi Arabia banned importing vegetables from Jordan for a long time. This problem made the reputation of vegetables shocking among importing countries for a long time that weakened the agricultural products and enabled competitors to enter the vegetable market strongly (G5P9, farmer).

G5P9 states that using partially treated wastewater for agricultural purposes may cause problems for Jordanian vegetable exports, as happened in the 1990s when Saudi Arabia prohibited the importing of Jordanian fruit and vegetables. Farmers, therefore, have concerns that the ongoing use of partially treated wastewater for irrigation may see the problem return. Besides, using treated wastewater for irrigation gives Jordanian vegetables a bad reputation that gives competitors power to compete with Jordanian farming produce.

8.2.1.4.1 Reduced quality of farming soil: Environmental experts' perspective

Several studies find that using treated wastewater for irrigation causes a high level of salinity and high content of heavy metals in farming soil that causes reduced plant productivity (Shahalam, Zahra, & Jaradat, 1998; Toze, 2006; Al-Zu'bi, 2007; Ammary, 2007; Carr et al., 2008; Schacht et al., 2011). In addition, the prolonged use of saline and sodium rich wastewater has the potential to cause soil sodicity³⁶ (Lal, 2009), to destroy the soil structure (Ghafoor, Murtaza, Maann, Qadir, & Ahmad, 2011), and to affect productivity, making the land unsuitable for crop

³⁵ Islamic statutory law based on the teachings of the Quran and the traditions of the Prophet (Hadith and Sunnah) prescribes both religious and secular duties and sometimes retributive penalties for lawbreaking. It has been supplemented by legislation adapted to the conditions of the day, though the way it should be applied in modern states is a subject of dispute between Islamic fundamentalists and modernists.

³⁶ Sodicity is a term given to the amount of sodium held in a farming soil.

production in the long term. Although some metals are essential for plant growth, many are toxic. For example, boron which is present in domestic wastewater, because it is added to cleaning products such as laundry products, dishwasher powders, and detergents is highly toxic to some plants (Vidal, Melgar, Lopez, & Santoalla, 2000). Metals such as mercury, cadmium, lead, boron and dioxin³⁷ are also a serious issue if the effluent is derived from industrial plants (Hanjra et al., 2012).

In this research, group1 participants were asked to provide the overall evaluations of the effects of pollution on the agricultural community. Their views on soil quality are represented by G1P5. He states:

Now the percentage of salinity in King Talal Dam is higher than the one in the Yarmouk River. As a result, all the lands irrigated by the King Talal Dam water, which is mixed with the Yarmouk River water, have become salty. (G1P5, environmental expert).

8.2.1.4.2 Reduced quality of farming soil: Farmers' perspective

Carr et al. (2008) conducted research into the effects of treated wastewater reuse for irrigation on soil sustainability. The study emphasises that the accumulation of salts in the plant root zone endangers plant health and productivity and it may decrease the quality of the soil structure and lead to reduced soil fertility. The proper management of saline waters is required to stop high levels of salts accumulating that threaten the sustainability of the soil system (Rusan, Hinnawi, & Rousan, 2007; Qadir et al., 2010). Farmers were asked to evaluate of the impacts of pollution on the farming community. Their responses are represented by G5P5. He states:

أصبحت التربة الزراعية مالحة بسبب الاعتماد الكلي على مياه السمره للري وعدم استخدام المياه العذبة التي تساعد في غسيل التربة وتصفيتها من الأملاح.

The farming soil has become saline due to the entire reliance on As-Samra's water for irrigation, and nonuse of freshwater that helps to leach the soil and free it from salts (G5P5, farmer).

G5P5 indicates that soil management through using freshwater to leach salts in the soil keeps the soil's productivity high.

³⁷ Dioxin is a highly toxic compound produced as a by-product of some manufacturing processes, particularly herbicide production and paper bleaching. It is a severe and persistent environmental contaminant.

8.2.2 Impacts on economic sustainability of farming

The effects of irrigation water pollution on the agricultural community in the Jordan River Valley is not limited to the immediate impacts. It extends to the longer-term impacts on the economic sustainability of agriculture, which means that farmers and other farming assets, particularly farming soils, are affected by the contamination.

8.2.2.1.1 Reduced farming investments: Environmental experts' perspective

Group1 participants were asked to provide their evaluations of the impacts of contamination on the farming community. The extract taken from the interview with G1P10, who works in the Department of Civil Engineering at the University of Jordan, reflects the views expressed by a number of experts. He states:

The contamination in the Zarqa River is the reason beyond the lack of agricultural diversity due to the restrictions imposed on the quality of vegetables irrigated by untreated wastewater which affect the income from farming. (G1P10, environmental expert).

The impacts of contamination on farming community include the stopping of agricultural investments, which, in turns, limits the contribution of the farming sector in solving unemployment.

8.2.2.1.2 Reduced farming investments: Farmers' perspective

Group 5 participants were asked to provide their evaluations regarding the effects of pollution on the farming community. The opinions of five residents are represented by G5P5 who states:

Many farmers, particularly large ones, consider agriculture is riskier than other fields. There were around 30 farms here in the past, but none of them exists at the present due to the restrictions imposed on farmers (G5P5, farmer).

G5P5 mentions that effects of irrigation water pollution are not only limited to the short term but also extend to the long term. Increasing areas of cultivated lands which are dependent on the poor quality of the irrigation water is considered to be a risky investment, especially land planted vegetables that will not be cooked. Farmers do not like investing much in a risky venture (Abu-Madi, 2004; Al-Atoom, 2007).

8.2.2.1.3 Reduced farming investments: Residents' perspective

Residents in the Jordan River Valley were asked to provide their evaluations regarding the effects of pollution on the farming community. G6P2 sums up the opinions of six of the residents when he says:

There is no longer the Zarqa river water used in free farming activities because it is not appropriate for this purpose. Besides, the Ministry of Health prevents its use and destroys any infringing crops which are considered a big loss for farmers and prevents them from depending on agriculture as a future occupation (G6P2, resident).

G6P2 states that, in spite of restrictions imposed by the Ministry of Agriculture, some farmers breach the laws. This breaching of statutes makes the Ministry of Health take action against the farmers who violate the regulations. These penalties raise concerns regarding the feasibility of agriculture future.

G6P6, who is a resident of the Jordan River Valley, emphasises that using partially treated wastewater for irrigation causes adverse impacts on the farming community. He states:

لم تعد الزراعة مصدرا جيدا للدخل. بصراحة المهنة لا تبني مستقبلا والتوسع فيها خطر وخصوصا للمزارعين الصغار الذين لا يستطيعون شراء المياه النظيفة للري و لزراعة كل أنواع الخضراوات

Agriculture is no longer a good income source. Frankly, it does not build a future, and its expansion is a big risk, especially for young farmers who cannot buy clean water for irrigation and cultivation of all types of crops (G6P6, resident).

G6P6 states that these limitations involve planting only vegetables that are eaten cooked. In addition, farmers cannot expand their investments in agriculture because of high risks such as having their crops destroyed if they use treated wastewater for irrigation. In addition, farmers who insist on planting vegetables that are eaten raw because they are financially rewarding must buy freshwater for irrigation. This purchase means added financial burdens.

8.2.2.2.1 Giving up farming occupations: Environmental experts' perspective

The Jordan River Valley is deemed the food basket of Jordan (Duqqah, 2002; Qdais, 2008) and so environmental experts were asked to provide their overall opinions of the impacts of pollution there. G1P6, who works in the Department of Natural Resources Engineering at German Jordanian University, states:

Some farmers changed their jobs as farmers to other professions because of the low income when being farmers. (G1P6, environmental expert).

The restrictions imposed by the government on farmers are the reasons why they stop working in agricultural occupations. Thus, farmers, particularly small ones, do not have any option except to look for another occupation which is less risky.

8.2.2.2.2 Giving up farming occupations: Farmers' perspective

The farming sector is one of the areas affected by the pollution in the Jordan River Valley (Duqqah, 2002; Mohsen, 2007). The researcher started the dialogue with group 5, farmers, by asking them to provide their evaluations of the effects of pollution on the farming community. The views of seven of the farmers are represented by G5P7 when he states:

نحن لا نستطيع شراء مياه الصحاريج لري المحاصيل. اذا البعض منا يستطيع الحصول على مياه الصحاريج فإنها لن تكون مربحة على المدى البعيد. أيضا غير مسموح زراعة كل انواع المحاصيل. نحن نفضل زراعة البندورة والخيار والبصل كونها مطلوبة بشكل عالي في السوق الاردني

We (farmers) cannot buy tankers' water to irrigate crops. If some of us can obtain tankers' water, it will not be profitable in the long term. In addition, it is not permitted to plant all types of crops. We (farmers) prefer planting tomatoes, cucumbers and onions as they are highly demanded in the Jordanian market (G5P7, farmer).

Jordanian farmers make money only if they can use treated wastewater for irrigating vegetables that are eaten raw. In addition, they need to use adequately treated wastewater for irrigation to avoid the side effects represented by blockage of drippers and sprinklers in irrigation systems. Having high quality irrigation water contributes to reducing extra maintenance costs. Consequently, the farmers' income will not be affected, and they will keep working in agricultural occupations. Poor quality irrigation water in the Jordan River Valley causes reducing numbers of those who are dependent on agriculture (Al-Atoom, 2007).

8.2.2.2.3 Giving up farming occupations: Residents' perspective

Locals in the Jordan River Valley rely extensively on agriculture as a primary income source. The researcher started the conversation with group 6, residents, by asking them to provide their opinions on the impacts of pollution on the farming community. G6P2's statement captures a view shared by five other residents:

The pollution in irrigation water has caused decrease in farmers numbers in the region and made them turn to other professions such as industrial ones (G6P2, resident).

G6P2, who lives in the Zarqa River Basin, used to be a farmer, but now he owns a supermarket. G6P4, who is a resident of the Jordan River Valley, emphasises that the number of farms used to be greater than it is now. He mentions:

The farming occupation is no longer economically viable because the Ministry of Health is destroying the vegetables planted near the river, and, consequently, many farmers began to leave the occupation of agriculture and turn to other occupations (G6P4, resident).

Traditionally, most vegetable farms in the Zarqa River Basin and the Jordan River Valley are small to medium sized (Venot, 2003). The owners of these farms cannot bear the impacts of pollution in the long term so that they are giving up farming and turning to other occupations. Only large farms can resist the impacts of pollution. They can purchase freshwater for irrigation, so they can plant any type of crops without any concerns. Farmers who have large farms can also control the prices of agricultural products and so affect income of small farmers.

8.2.3 Social impact

The effects of contamination in the Jordan River Valley are not restricted to immediate impacts or impacts on the economic sustainability of the farming in the region. The effects extend to social impacts. The social effects are the impacts on diet and on community breakdown.

8.2.3.1.1 Impacts on diet: Environmental experts' perspective

The views of environmental experts were investigated to provide an overall evaluation of the impacts of pollution on the farming community. The views of G1P2, G1P4, G1P5, and G1P6 are captured by G1P10, who works in the Department of Civil Engineering at the University of Jordan, when he states:

The contamination in the Zarqa River is the reason for the lack of agricultural diversity due to the restrictions imposed on the quality of vegetables planted and irrigated by untreated wastewater which affect the income from farming. This is because most families highly depend on tomato and cucumber in their daily meals. It is hard not to use tomato as one of our Jordanian cuisine ingredients (G1P10, environmental expert).

GIP10 illustrates different aspects of the impacts of contamination. The Jordanian government acts against pollution through prohibiting farmers from planting all kinds of crops which are eaten uncooked. These restrictions affect the diet of Jordanian community, as this type of vegetables is preferred, especially at Ramadan.

8.2.3.1.2 Impacts on diet: Farmers' perspective

The following comment made by G5P10, who has a farm in the Jordan River Valley, represents the opinions of the farmers who took part in the study. He states:

Most people ask about irrigation water source for leafy vegetables. If that source is the contaminated Zarqa River water, they will not buy and not advise others to purchase. In addition, the contamination has affected the level of demand for vegetables that are eaten uncooked. These types of vegetables are strongly preferred by Jordanians. As a result, farmers have resorted to transporting vegetables to the Central Market of Fruit and Vegetables in Amman, where they are distributed to the cities and nobody knows their origin. The vegetable transfer to Amman increases the cost for the farmers and the final consumers, but it is a right way to ignore answering the question by inhabitants about the source of irrigation water (G5P10, farmer).

The demand for plants such as tomato, cucumber, lettuce, parsley, green onion, and fruit is higher than for other kinds of crops in Jordan. These types of vegetables and fruit constitute the primary ingredients of Jordanian cuisine. Farming in Islam is based on diversity in plants to get a balanced diet (Mohammad & Zaid, 2010), as is obvious in the following verses:

And We have sent down rain from the sky in a measured amount and settled it in the earth. And indeed, We are able to take it away. And We brought forth for you thereby gardens of palm trees and grapevines in which for you are abundant fruits and from which you eat (The Quran, 23:18-19).

In addition to the previous verses, Allah assures the meaning of diversity in planting crops. He says:

It is He who sends down rain from the sky; from it is drink and from it is foliage in which you pasture [animals]. He causes to grow for you thereby the food crops, olives, palm trees, grapevines, and from all the fruits. Indeed, in that is a sign for a people who give thought (The Quran, 16:10-11).

8.2.3.1.3 Impacts on diet: Residents' perspective

The residents' opinions on the impacts of pollution on their diet are represented by G6P3 who lives in the Jordan River Valley. He states:

Many farmers turned to the transfer and sale of their crops in Amman because of the questions from the local population in the cities of Jerash and Zarqa about the source of irrigation water. The bad reputation of the irrigation water affects the demand for vegetables by locals in the region. (G6P3, resident).

G6P3 states that using partially treated wastewater for irrigation causes a significant risk for farmers. This risk is not limited to destroying the infringing crops, but it extends to diet, as the Jordanian diet is imbalanced; 27% of Jordanian families do not get enough food and suffer from malnutrition, especially low-income people in rural areas (Ministry of Agriculture, 2006).

8.2.3.2.1 Impacts on community breakdown: Residents' perspective

G6P9, who lives in the Jordan River Valley, represents the views of the residents. He states:

Many of the rich families moved from the city of Zarqa to other cities in a search for a clean environment away from areas where industry pollutes it day after day (G6P9, resident).

Leaving farming occupations leads to agricultural lands being left and not utilised because of the impacts of pollution on agriculture that makes young people think that farming is no longer financially rewarding (Doppler, Salman, Al-Karablieh, & Wolff, 2002). Reduced farmer numbers and turning to working in industrial activities in the cities causes changes in the demographics of villages and towns, as most industrial activities are located in the major cities (Al-Atoom, 2007). Rural-urban migration is not encouraged by Islam. Khouri, Kalbermatten, and Bartone (1994) explain that Islam emphasises the significance of sustaining the earth and highly values agricultural occupations. This position is clear in the *Sunnah*. Prophet Mohammad says: 'there is none amongst the Muslims who plants a tree or sows seeds, and then a bird, or a person or an animal eats from it but is regarded as a charitable deed for him.' (Mohammad & Zaid, 2010). Besides, he says 'even if Doomsday is coming, go ahead and plant that tree.' (Mohammad & Zaid, 2010).

8.2.3.2.2 Impacts on community breakdown: Farmers' perspective

The opinions of most of the farmers in group 5 are represented by G5P2. He states:

Some of the local population, who used to live near the river, have moved to other areas that are far away from the river to avoid the spread of insects and the emission of unpleasant smells. Honestly, we feel embarrassed due to living nearby the river (G5P2, farmer).

8.3 Impacts of Water Pollution on Tourism Sector

Impacts of contamination in the Jordan River Valley are not limited to the agricultural sector but extend to the tourism industry. The tourism sector constitutes one of the main pillars of the Jordanian economy (Al-Kheder, Haddad, Jaber, Al-Shawabkeh, & Fakhoury, 2010). It contributes 14% to Jordan's GDP (Ministry of Tourism, 2017), which also includes religious and domestic travel.

8.3.1 Impacts on religious tourism

The Jordan River Valley enjoys religious significance in the three divine religions: Judaism, Christianity, and Islam, as most of the prophets such as Moses, Jesus, and Mohammad lived in the Jordan River Valley. Consequently, the followers of the monotheistic religions believe in the necessity to protect it from any threat.

8.3.1.1.1 Fewer religious tourists: Religious actors' perspective

External religious tourism is one of the primary supports of the tourism industry in Jordan. In 2005, Jordan received approximately six million tourists; one million out of these six million visited the sacred places in the country mainly the Baptism site and the shrines of Prophet Muhammad's Companions (Bader & Hopfinger, 2012). Jordan is blessed with the existence of the holy sites that represent the three divine religions. Jordan is part of the Sacred Land in the Middle East which links the life stories of many messengers and prophets (Tadros, 2015). G2P5 represents the opinions of four of the five religious actors who were interviewed. He states:

There is no Christians' permanent presence in the baptism site around the year. Visitors come on 1 June and 1 September every year to the Jordan River. These days of the pilgrimage present religious events wherein people pray and meet (G2P5, religious actor).

Gorguis (2006) indicates that overexploitation of groundwater by the public and private sectors in Jordan and converting a significant amount of the river water annually to Israel have been contributing to increasing pollutant concentrations in the river, which change water colour and smell. This contamination has led visitors from inside and outside Jordan to reconsider the Jordan River as the tourist destination.

G2P2, who is an Islamic scholar and works at the Ministry of Islamic Affairs, adds:

The pollution in the Jordan River Valley does not affect only Christian pilgrimage but also affects Muslim visitors to the shrines of Prophet Muhammad's Companions. Many shrines that should be visited by Muslims from inside and outside Jordan exist there. Muslims need to visit these shrines to contemplate how much effort was exerted by the Companions to bring Islam from Arabia to these far regions (G2P2, religious actor).

Ayashr (2014) mentions that the shrines of the prophet Mohammad's Companions are no longer deemed the favourite destination for school and university trips. G2P2 explains that the adverse effect of the pollution is not limited to Christians visitors but affects Muslims as well.

8.3.2 Impacts on local tourism

Domestic tourism has also been affected by the contamination of the Zarqa River (Chatel, 2014). The river receives all kinds of pollutants including liquid and solid wastes. This pollution affects visitors coming to the rivers, especially the Zarqa River, negatively.

8.3.2.1.1 Fewer domestic tourists: Residents' perspective

The Zarqa River currently suffers from a lack of domestic tourists compared to the past, including school and university students and families from inside and outside Zarqa (Abu-Zaina, 2011; Toaimat, 2015). The views of many of the residents who were interviewed are represented by the following statement from G6P8:

The river was formerly a popular destination for visitors from inside and outside the city of Zarqa due to the abundance of water, the presence of fish of all kinds and sizes, the cleanliness of its water, and the presence of the beautiful vegetation on the banks of the river (G6P8, resident).

Here, G6P8 shows a comparison between the past and the present state of the Zarqa River regarding local tourism.

8.4 Impacts of Water Pollution on Physical Health

The use of treated wastewater for irrigation has advantages, as it can be used as an alternative resource rather than discarding it into watercourses. Using treated wastewater also decreases the pressures on the environment by reducing the use of

freshwater (De-Freitas, 2003). Some issues associated with using treated wastewater for agriculture need to be considered, including the existence of pathogens and chemical pollutants that affect human health (Toze, 2006; Kim et al., 2014).

8.4.1 Digestive system problems

Using treated wastewater for agricultural purposes can affect human health, particularly human digestive systems. Inadequately treated wastewater contains high ratios of chemical pollutants and pathogens that pose a risk to human health and the environment (Abu-Ashour & Lee, 2000).

8.4.1.1 Digestive system problems: Farmers' perspective

Pathogens such as bacteria, viruses, helminth, and intestinal nematodes can pose a risk to everybody who handles fruit and vegetables irrigated by untreated wastewater (Abu-Ashour & Lee, 2000). This danger includes catching infectious sicknesses such as typhoid fever and cholera (Hillel, Shuval, Lampert, & Fattal, 1997; Shuval, 2000). G5P9 represents the opinions of G5P2, G5P3, G5P4, G5P6, G5P7, G5P8, and G5P10. He states:

The flies that spread heavily in summer and end up in our food sometimes cause food poisoning. Also, children do not realise the seriousness of approaching the polluted river waters (G5P9, farmer).

G5P9 explains how discharging untreated wastewater into the streams causes health problems such as food poisoning from eating uncooked fruit and vegetables. Doctor Abdul Rahman Agha, who works near the river in a government-run hospital in Zarqa city, said that disease is spreading among citizens who live on the banks of the river because they eat food grown in nearby farms (Integrated Regional Information Networks, 2006). In addition, children do not have enough awareness to realise the dangers of swimming in the polluted river.

8.4.1.2 Digestive system problems: Residents' perspective

Using inadequately treated wastewater for irrigation poses a greater risk to children and elderly than to others (Vicheth, & Dalgaard, 2005). For example, using inadequately treated wastewater for agricultural purposes causes a higher prevalence of ascariasis (Hanjra et al., 2012) and hookworm infections among children (Qadir et al., 2010). An equivalent rise in faecal coliforms causing

pollution of water sources poses a considerable risk of diarrhoea in children (Hanjra et al., 2012). Epidemiological studies (Van-der-Hoek, Anh, Cam, Vicheth, & Dalsgaard, 2005; Trang et al., 2007; Qadir et al., 2010) in different countries around the world have established that the greatest hazard to human health from using ineffectively treated wastewater for agricultural purposes is posed by worm infections. The following comment from G6P1 represents not only his own views, but also those of seven other residents. He states:

لعب الأطفال بمياه النهر تسبب لهم بعض المشكلات الصحية مثل الإسهال والتسمم ونحو ذلك

The playing of the children with the river water causes them some health problems like diarrhoea, poisoning, and so forth (G6P1, resident).

G6P1 expresses some concerns regarding sickness occurring in children due to swimming in the polluted water or eating unwashed vegetables and fruit irrigated with treated wastewater.

8.4.2 Respiratory system problems

Respiratory system problems are one of the principal health issues caused by the polluting of the Zarqa River. Pathogens are not limited to viruses, bacteria, and parasites. Bad smells also emanate from the polluted waters (Laitinen et al., 1994).

8.4.2.1 Respiratory system problems: Farmers' perspective

The views of many from group 5, farmers, are represented by G5P4. He states:

Emission of bad smells because of the high concentration of chemical and organic contaminants, especially in summer, causes diffusion of diseases such as difficulty breathing, allergies, and sometimes increases the severity of existing conditions such as asthma and migraine headache (G5P4, farmer).

G5P4 explains how bad air which come from inadequately treated wastewater, especially in summer, cause respiratory problems and other problems associated with the respiratory system such as a headache. Some residents have allergies to this air so that they cannot tolerate it. Most of them stay in their home, especially those who have difficulty in breathing.

8.4.2.2 Respiratory system problems: Residents' perspective

Interviews were conducted with 10 river basin residents. Seven share the view expressed by G6P6, who lives in the Zarqa River Basin. He states:

ضيق التنفس والربو هي معظم الأشياء المشتركة التي نعاني منها بسبب الروائح الكريهة

Difficulty of breathing and asthma are the most common things we suffer from because of bad smells (G6P6, resident).

G6P6 shows that the polluted air that people breathe in increases the magnitude of the problem for those who already had difficulty in breathing. Continuous exposing to toxic air can lead to chronic diseases in the future due to the airborne materials contained in it. The Agency for Toxic Substances and Disease Registry (2017) explains that environmental smells can come from several sources such as oil refineries, wastewater treatment plants, and landfills. People react to smells differently. Some people are more sensitive to bad odours than others are. One's symptoms vary according to the level of one's sensitivity to the odour. Symptoms also depend on the nature of the chemical materials, their concentration in the air, the frequency of one's exposure, the duration of the exposure, and the person's age and state of health. The most common symptoms that people experience are a headache, chest tightness, shortness of breath, and mental depression.

8.4.3 Skin problems

Health problems caused by pollution in the Jordan River Valley are not only limited to the digestive and respiratory systems, but also include skin problems, due to the harmful insects which come to the polluted river and are into direct contact with river water which contains risky industrial substances.

8.4.3.1 Skin problems: Farmers' perspective

A study in Vietnam shows that exposure to inadequately treated wastewater is a major risk factor for skin diseases among farmers. Dealing with sewage causes dermatitis such as eczema in farmers (Trang et al., 2007). G5P7 summarises the opinions of six farmer interviewees when he states:

Honestly, the diffusion of harmful insects such as mosquitoes causes bites, itching and may result in the transfer of other skin diseases. Also, direct contact with wastewater polluted with chemical substances affects the skin. (G5P7, farmer).

Partially treated wastewater contains chemical substances that react on skin. Vidal et al. (2000) emphasise that these chemical materials, for example, boron, cadmium, lead and dioxin are generated by the pharmaceutical and petrochemical industries in the Zarqa River Basin.

8.4.3.2 Skin problems: Residents' perspective

Inhabitants who live close to the polluted river suffer from many health problems. Skin diseases are one of the main dangers residents in the Jordan River Valley encounter. G6P5 summarises many of the residents' opinions on this issue when he states:

The pollution causes skin diseases such as itching caused by mosquitoes. Also, children who are unaware are exposed to skin problems due to swimming in the river, and the river is polluted with industrial substances. (G6P5, resident).

Some of these problems are caused by mosquitoes' bites and other problems from the direct contact with the contaminated river waters.

8.5 Impacts of Water Pollution on Emotions

The environment plays a significant role in people's lives. Experiencing pollution of the environment can lead to negative feelings such as anger, anxiety, sadness, regret, guilt, shock, and loss (Böhm, 2003). Emotions can be categorised into two groups: ethics-based emotions and loss-based emotions (Xie, Wang, Zhang, Li, & Yu, 2011). Böhm (2003) argues that the two judgmental aspects evoke specifically differently types of emotion. Whereas emotions such as fear, worry, and despair are relevant when evaluating consequences, ethical evaluation entails emotions such as anger, outrage, and guilt. In this study, these two kinds will be called consequence- and ethics- based emotions respectively.

8.5.1 Ethics-based emotions

Contamination negatively impacts on the quality of people's lives and so affects their lifestyle (Böhm, 2003; Nancarrow, Leviston, Po, Porter, & Tucker, 2008; Wester et al., 2015). Ethics-based emotions such as anger, outrage, annoyance, irritation, offence, shame, insult, trespass, tension, and anger emerge from environmental pollution (Xie et al., 2011).

8.5.1.1 Ethics-based emotions: Farmers' perspective

Ecological corruption such as water pollution aggravates ethics-based feelings (Böhm, 2003; Crom & Oberholzer, 2012). G5P7 represents the farmers' opinions and explains the impact of pollution on farmers' emotions. The pollution causes an extremely strong reaction of anger, shock, or indignation. He states:

All these aspects of pollution will negatively reflect on the public human mood and make him in a state of constant tension especially with those who communicate with every day from the family members or co-workers. (G5P7, farmer).

8.5.1.2 Ethics-based emotions: Residents' perspective

The views of the majority of the 10 residents who were interviewed can be summarised in a comment made by G6P7, who lives in the Jordan River Valley. He said:

In fact, when I sit down with my family or with friends, and someone starts talking about the problem of the Zarqa River, about which there are new promises of the government to solve the problem, I ask him not to continue talking about the topic, because we are likely to talk for a long time but to no avail (G6P7, resident).

G6P7 explains the effect that contamination in the Jordan River Valley has on residents. The pollution degrades the mood of the locals and puts them under pressure and makes them feel nervous most of the time, because of the continuing promises made to rehabilitate the river that never eventuate. Residents have realised that they are not a priority for the government.

8.5.2 Consequence-based emotions

Environmental contamination affects loss-based emotions (Czap, Czap, Khachaturyan, Burbach, and Lynne (2011). These feelings include fear, risk, worry, anxiety, despair, depression, and loss.

8.5.2.1 Consequence-based emotions: NGOs' perspective

G3P4 illustrates the views of another eight of the interviewees in the NGOs group when he states:

would like to mention that one of my family members lived in the 1970s and 1980s, I mean before the current pollution in the Zarqa River. He always describes to me how the Zarqa River was as an outlet for the people of Amman and Zarqa. He showed me some beautiful old

pictures of the river. Now I feel sorry for the reality of the river as it is getting worse from day to day. Add to that, if you walk on the banks of the river, you will see a very sad scene, foam floating above the river every now and then. Besides, you may ask yourself how long we will remain suffering from the impact of pollution in the food we eat, the water we drink and the air we breathe. (G3P4, NGO).

G3P4 explains the effect of pollution on loss-based emotions. Loss-based emotions such as sadness and regret come from losing the Jordan River as an invaluable natural resource and as one of the economic assets and religious symbols.

8.5.2.2 Consequence-based emotions: Religious actors' perspective

The Jordan River is the only place in the Holy Land that was touched by Abraham, Jacob, Moses Joshua, Elisha, Elijah, John the Baptist, and Jesus Christ, and where their shared legacies still exist (Gafny et al., 2010). Interviews were conducted with five religious actors and G2P3 summarises their opinions in the extract below:

I feel like I am watching a living thing dying in front of me and can do nothing, while it has given us before a reason to exist. I find it obligatory to save it from death. We (Jordanians) should consider the river for Jordan a mother who had sought to provide you a decent life during our childhood and early adulthood, but now we (Jordanians) have grown up and our mother (the river) has become ill and in need for care. It is time to pay her back! What is happening in the Jordan River must be stopped and must be stopped and must be stopped (G2P3, religious actor).

G2P3 explains how much regret the religious actors express about the saddening state of the Jordan River. The river constitutes a great legacy to the followers of the Abrahamic faith. The current situation of the river makes the Jordanians feel as if they are losing hope of ever seeing the river in a better condition, because, despite hearing repeated promises to save the river, nothing has been done.

8.6 Impacts of Water Pollution on Spiritual Relationship

The holiness of the Jordan River Valley means that any degradation of any part of it impacts significantly on the spiritual relationship between the followers of the Abrahamic faith and the valley (Larson, 2011).

8.6.1.1 Reduced practice of religious rites: Farmers' perspective

There is a spiritual nexus between the Jordan River Valley and the followers of the three monotheistic religions: Judaism, Christianity, and Islam (Ministry of Tourism, 2018). This relationship is supposed to be a motivation to protect the Jordan River

from the pollution (Waheeb et al., 2013). G5P1 represents the perspective of most of the farmers' group regarding the pollution of the river. He states:

The Christ was baptised in the Jordan River, and the river is being visited by Christian pilgrims every year. So, the pollution accompanied by the diffusion of insects and the emission of smells as well as the brown colour of the river water will prevent them from visiting the river or will discourage anyone from visiting it, even if it was blessed, because preserving human psyche is superior (G5P1, farmer).

Sustaining the environment for future generations is worship per se. Therefore, this act leads to a strengthening of the spiritual relationship between people who endeavour to protect that environment and God. More than a thousand years before the Geneva Conventions, Muslim soldiers were ordered in a military campaign “not to kill a child, a woman or an old person, not to cut a tree for no need, not to burn an orchard, not to hurt a priest, and not to destroy a church” (Al-Hussein, 2015, p. 4). These are the same values of Islam Muslims were taught in schools as children: not to ruin or desecrate a place where God is worshipped; not a mosque, not a church, and not a synagogue. These values aim not to hurt spiritual feelings of the believers (Al-Hussein, 2015).

8.6.1.2 Reduced practice of religious rites: Religious actors' perspective

The extract below from G2P5 represents the perspective of the four religious actors, both Christian and Muslim on the pollution in the Jordan River Valley. G2P5 states:

Bearing the issue of pollution in mind, we (religious actors) now see some people who refuse to use its water (the Jordan River). (G2P5, religious actor).

Despoiling this sacred water runs contrary to the teachings of both The Quran and the Christian Gospels. Contamination of the Jordan prevents Christians from visiting the baptism site and discourages Muslims from visiting the shrines of the Companions of the Prophet Mohammad, and prevents them from thanking Allah for this grace.

8.6.1.3 Reduced practice of religious rites: Residents' perspective

Local residents are one of the affected categories of those who suffer from the pollution in the Jordan River Valley. G6P5's comment represents their opinion on the ways that river pollution affects religious rites. He states:

The pollution prevents the visitors coming to the whole region from visiting the river, as they suffer from flies and bad smells. Therefore, Christians will be prevented from getting baptised, and Muslims will be prevented from recalling and remembering of efforts done by the Companions of the Prophet Mohammad and thanking Allah for his grace, as water is grace (G6P5, resident).

The existence of pollution, the associated bad smells, the harmful insects, and fears of disease being transmitted to the visitors are reducing the number of both Muslim and Christian's visitors to the river, which, in turn, affects the spiritual relationship between the visitors and the place in a negative way.

8.6.2.1 Insulting spiritual relationships: Religious actors' perspective

G2P1 represents the perspective of the four participants from the religious actors group regarding the spiritual impact of the pollution in the Jordan River Valley. G2P1 states:

Unfortunately, interest in the river (the Jordan River) does not rise to the level of holiness and greatness of the river. (G2P1, religious actor).

It can be concluded from the body language and voice tone that the participants hide some feelings, as they do not want to get in trouble with the government and the Muslim majority. Participants feel, due to the continuing pollution, that their spiritual relationships with the holy River are disregarded. Thus, their feelings are disrespected and exposed to be insulted. Chryssavgis (2014) emphasises that water represents the origin. This holy river can never be regarded or treated as private equity or become the means and end of personal interest. Apathy and negligence towards the spirituality of the Jordan River waters form both ingratitude to God the Creator and a crime against humanity.

8.7 Impacts of Water Pollution on Institutional Policies

Jordan implemented legislation in support of sustainability, including the laws for environmental protection in 2003. Jordan is now faced with challenges related to their implementation (Saed, 2006).

8.7.1.1 Lack of environmental legislation enforcement: Farmers' perspective

The actual value of environmental laws to support sustainability depends primarily on its real enforcement. Hence, it is not simply important to develop laws, policies, and standards in support of sustainability; the practical implementation of

environmental laws should also be accorded equal importance (Saed, 2006). The Jordanian government has not accomplished total success in applying its wastewater reuse policies and regulations (Qadir et al., 2010). G5P9 represents standpoint of most farmers on the issue of law enforcement in this area. He states:

I think that the most successful solution is to activate the application of laws in the region and prevent the factories from releasing liquid and solid waste into the river and penalising all who do not apply the laws. (G5P9, farmer).

G5P9 explains that it is necessary for government punish factories that discharge industrial wastewater into the Zarqa River through the enforcement of the environmental laws and regulations issued by the Ministry of Environment and the Ministry of Agriculture.

8.7.1.2 Lack of environmental legislation enforcement: Residents' perspective

The Ministry of Environment should be the leading authority in the field of environmental protection in terms of providing the necessary environmental laws, supervision, and implementation of the laws issued for environmental preservation. Mustafa et al. (2016) emphasise a lack of governmental accountability as a reason for the lack of environmental laws enforcement. G6P9 represents the resident's opinion here. He states:

I would activate the instructions strictly in order to get rid of the sources of pollution. Doing this would help us gradually get rid of pollution sources and minimising the effects of pollution on the most affected local population (G6P9, resident).

Working to strengthen the supervisory role of the Ministry of Environment, the possibility of creating environmental police, and increased cooperation among different environment-concerned parties would enable Jordan to trigger the application of environmental laws and regulations.

8.7.2.1 Uncovering nepotism: Farmers' perspective

In addition to the revealing the fact that environmental legislation is not applied sufficiently in the Jordan River Valley, the existence of nepotism has been uncovered. The pollution of the valley has played a significant role in the demonstrating not only the weakness of enforcing regulations, but also, as confirmed by Van-Aken et al. (2009) the fact that some people have more power

than the government in the Jordan River Valley. G5P6 represents the opinion here of a number of the farmers who were interviewed. He states:

معاقبة المصانع المخالفة لا يمكن أن يتم ما لم نتخلص من الوساطة والمحسوبية قبل كل شيء

Punishing offending factories cannot be done unless [there is] getting rid of *wasta* (contacts and nepotism) (G5P6, farmer).

If environmental laws are to be enforced, nepotism needs to be rooted out. In addition, the pollution in the Jordan River Valley revealed that favouritism is one of the institutional policies applied in the government.

8.7.2.2 Uncovering nepotism: Residents' perspective

Most employees in water management sector are appointed on the basis of their tribal link to the Jordan Valley Authority president and, therefore, the accountability of those staff is expected to be minimal (Mustafa et al., 2016). G6P3 speaks for the majority of the residents group when he states:

One of the main obstacles facing activating the laws is mutual interest, so we must get rid of it in order to reduce the pollution (G6P3, resident).

When an officer starts to apply environmental legislation, he will come up against what is called 'nepotism-favouritism through intermediary', which is the presence of people who greater authority than the government's authority and who care about collecting money at the expense of the greater national good (Loewe, Blume, & Speer, 2008). Loewe, Blume, & Speer (2008) explain that favouritism, which is referred to as '*wasta*' (connections), contributes considerably to the business environment in Jordan. People with good '*wasta*' can accelerate procedures and get privileged access to services and information. They can even influence regulations to their advantage. Jordanians are aware of this problem. Notwithstanding, they keep using '*wasta*' for at least four reasons. First, they do not see any other way of achieving their aims. Second, people continue to use their '*wasta*' as long as everybody else does the same. Third, many Jordanians link the use of *wasta* with cherished values such as loyalty or solidarity. For instance, they believe that the use of '*wasta*' is part of their culture. Fourth, the Jordanian governmental administrative and political system lacks transparency and accountability at all levels.

8.7.3 Issuing standards of domestic wastewater

Before 1995, specialists in the WAJ relied on WHO standards for wastewater treatment plant design and wastewater control. The standard practice was to obtain total suspended solids of 30mg/l for effluent from treatment plants. By 1995, it was realised that a comprehensive national standard was required (Nazzal et al., 2000).

8.7.3.1.1 Standard 893/2006: Government's perspective

The construction of sewerage facilities has quickly increased since 1984. With the establishment of the Water Authority of Jordan, 20 wastewater treatment plants were built, with more plants planned and designed for urban and rural regions. It is estimated that the amount of treated wastewater which can be produced for irrigation will reach 245 MCM per year in 2020 (Al-Kharabsheh & Taany, 2005). G4P1, G4P2, G4P3, G4P4, G4P5, G4P6 are participants from the government. G4P1 represents government officials. The extract from G4P1 reflects the information provided by the seven government officials in this study. He states:

We (Jordan) have the Jordanian Standard No. 893/2006 concerning treated domestic wastewater which is discharged into the river. This standard specifies the criteria and characteristics as well as the maximum limits of discharge that are permitted to the legitimate intended use. (G4P1, government).

Treatment of wastewater is a necessary component of the water resources management in Jordan where the water supply is insufficient and demand for water is rapidly rising. A prerequisite for the active management of the treated wastewater and the enhancement of public confidence is the establishment of a practical framework of regulations and standards that help ensure public health and low environmental consequences (Nazzal et al., 2000).

8.7.4 Development of environmental legislation

The existing water laws are concentrated on defining institutional responsibilities rather than providing a full insight into national water resources management. Currently, overlapping duties appear concerning various water sector institutions (Tarawneh et al., 2008).

8.7.4.1.1 Modification of the standards: Government's perspective

Laws and standards for wastewater treatment must be able to evolve in line with varying physical, social, economic, and environmental circumstances (Angelakis,

Do Monte, Bontoux, and Asano, 1999; Nazzal et al., 2000). G4P2 represents the four government officials' position when he says:

The Jordanian standard specifications are modified and developed from time to time based on the change in pollution and the requirements for protecting the environment and the environmental elements from pollution. (G4P2, government official).

The environmental threats and different sources of contamination have increased with time, forcing governments to issue control programmes combined with the standards and, thus, amend the environmental standards in force.

8.8 Water Management: Comments from Institutional Level Actors

Since the 1970s, the challenges facing water governance have attracted increased international attention. This interest mirrors and extends the issue of the conflicts that are flaring up as a result of the extensive social inequalities around access to water for fundamental human uses. Inequalities, inefficiency in water, and the ineffectiveness that stems from these characterise water governance in the emerging states (Castro, 2007). Information is central to the good governance and management of water resources. In keeping with changes in society, decision-making for water resources is progressively being devolved downwards from national to state or local governments and local stakeholders (Burton & Molden, 2005). Connected with this changing trend is a growing awareness amongst the general public regarding water-related matters and people's rights and duties in relation to the use and management of progressively scarce water resources (Mitchell, 2005). Experience in many nations is displaying how the sharing of information by government bodies with the broader public enables management to move on to advanced performance levels through enlisting support and cooperation from water users. Societies and government agencies that seek to hold on to authority by restricting the sharing of and access to water resources data will find that they are limiting their ability to make the most productive use of the available water resources (Burton & Molden, 2005).

Water institutions have been less effective in managing water in this relatively new era of water shortage, and this lack of effectiveness results in a drop in per capita water availability in different water-stressed regions that are often located in arid and semiarid climates (Alcamo, Flörke, & Märker, 2007; Molden et al., 2007;

Savenije & Van-Der-Zaag, 2008; Wester et al., 2015). While the emphasis in the 20th century was on water resources development, there needs to be a shift to better water management practices to satisfy the demands of a diverse world in the 21st century. A healthy environment, food security, adequate livelihoods and high well-being are require effective water resources management. One obstacle standing in the way of enhanced water management is the lack of standard data collection processes. Interpretation of water resources information and communication to a various group of water professionals is generally also insufficient (Savenije & Van-der-Zaag, 2008).

Investment in water resources management can be more effective with good and suitable programmes being available and if the management choices are commonly understood, obtainable, acceptable and agreed upon by different stakeholders. The data sources underpinning the presentation of water resources, circumstances, and management should be labelled. This water resources management calls for a suitable framework for planning, operation, monitoring, and assessment for water resources in water-scarce regions (Karimi, Bastiaanssen, & Molden, 2013). Water accounting is the basis for successful water resources management (Escriva-Bou et al., 2016).

Water accounting integrates the fields of hydrology, water allocations, water and environmental management, reporting and communication, and policy decisions. It eases a) identification of fundamental problems in the water-scarce region, b) constraints and opportunities for better climate resilience, and c) helps with decisions concerning carbon sequestration and safeguarding adequate water resources for a good quality life, particularly during periods of protracted drought (Karimi et al., 2013). There are no global water accounting standards. Some countries such as Australia and the UK have designed programmes suited to their own context. Others, however, have no standards at all.

8.8.1 Presence of water accounting

Where water is scarce, accountability and transparency through the provision of data and information enable management to achieve the consensus and support needed from water users to solve issues related to scarcity. Formulation, agreement, compliance, and application of measures to manage resources within the context of

water shortage are empowered by the achievement and sharing of data and information among stakeholders (Burton & Molden, 2005).

8.8.1.1.1 Absence of a sophisticated water accounting programme: Water industry's perspective

Coping with water scarcity and increasing competition for water among different sectors requires water accounting programmes and decision processes (Karimi et al., 2013). The findings of this study demonstrate that there is an absence of water accounting programmes in Jordan. Alcamo et al. (2007) point out that one difficulty facing advanced water management in arid and semiarid regions is the lack of water accounting programmes. G7P2 who represents the five water industry participants when he says:

Water accounting programmes like what you are talking about (advanced water accounting) do not exist. Frankly, what exists is what I have told you about (unsophisticated water accounting). (G7P2, water industry).

There are no water accounting standards in Jordan. The only data concerns water inflow, which comes from precipitation, and outflow amounts exploited by households, agricultural, and industrial sectors.

8.8.2 Obstacles to implementation

Globally, there is much concern about water shortage. However, experts have concluded that the problem is not just water scarcity, but, rather, poor water management that exacerbates the pollution (Biswas & Tortajada, 2010; Biswas & Tortajada, 2011; Chan, 2012).

8.8.2.1.1 Lack of awareness: Water industry's perspective

Despite recent global concern over water issues, few governments have highlighted water conservation or services as pivotal elements for improving livelihoods in their strategy plans. This fact highlights a lack of awareness among decision-makers about the significance of water resources. In addition, it points to the need for water accounting as a tool for collecting appropriate data in order to produce effective, well-organised results in sufficient and consistent decision-making and to ensure sustainable service delivery (Black & Hall, 2004). These findings display a lack of awareness about water accounting programmes. Christ and Burritt (2017b) confirm that businesses remain unaware of the benefits of water management activities and

the need for relevant accounting data to support and encourage better decision-making. Interviews were conducted with Water Industry group. G7P2 who represents the group's views, saying:

Water accounting is new; if someone is a specialist in it, nobody appreciates him or knows how to benefit from him (G7P2, water industry).

He adds:

لو طرح هذا البرنامج على مجلس النواب فماذا تعتقد يكون الرد؟ رفضا شديدا لأنهم كلهم تجار خردة. هذا اللي بتحكيه (المحاسبة المائية) لو تيجي تحكيه في مجلس الوزراء بيقولك هذا ساحر وأبصر شو بحكي هذا! هذا ساحر وأعوذ بالله من الشيطان الرجيم

If this programme (water accounting) is presented to the parliament, what do you think the response is? Rejection, because they are all ignorant. This, what you are talking about (water accounting), if you tell the Council of Ministers, they will say this is a magician! We do not know what he is talking about; this is magic! I seek refuge in Allah from the cursed Satan!

Most officials in Jordan believe that they have their own suitable tools to manage water resources and that they do not need programmes from outside. They believe they just need to augment water supply to address the shortage.

8.8.2.2.1 Lack of expertise: Water industry's perspective

Water organisations have been less effective in managing water in this era of scarcity (Gleick, 2014b). Such ineffectiveness has resulted in a drop in per capita water availability in water-stressed regions that are often located in arid and semiarid climates (Alcamo et al., 2007). While the focus in the 20th century was on water resources development, there now needs to be a move to improve water management practices to meet the demands of a changing world. Schulte, Morrison, and Gleick (2012) suggest that water mismanagement in water-scarce countries is due to a lack of experience in water management accounting. Interviewed participants were asked to offer their evaluations of water accounting programmes in Jordan. G7P3 who represents the water industry group's response says:

The private sector is still immature and lacking knowledge. Therefore, it has not been forming high skills, and always the government gives it opportunities to work (G7P3, water industry).

He elaborates further:

People who are responsible for the water sector are unskilled to the degree [needed] to be open to the outside world.

G7P1 adds:

There are no competencies. The competencies have not been sustained in the water sector in the companies owned by government. Water sector is collapsing. The experts have escaped from water sector. There are no specialised studies from specialist people. Policies (water policies) have to be drawn by specialists (G7P1).

Pahl-Wostl et al. (2008) acknowledge this lack of knowledge and attribute it to a tradition rooted in the hydrological and engineering sciences; water managers have methods and tools with which to address ecological and quantifiable uncertainties. The knowledge and experience required to address uncertainties in decision-making processes are, however, lacking. So, expertise in water-management accounting is needed for good decision-making.

8.8.2.3.1 Inconsistent application by governments: Water industry's perspective

The determination and selection of the means to pursue the purposes and values in relation to water management do not take place in a social vacuum. Parkes et al. (2010) comment that rather than being the outcomes of a balanced partnership, the process of water governance looks like an asymmetric and evolving structure where the actors tend to have various portions of political power and knowledge.

In practice, water policies that have a significant political content are designed and applied with disregard to the values, options, and preferences of the people and in the absence of democratic governance arrangements. In practice, water governance comprises the interaction between government authorities, large corporations, political parties, civil and other organisations representing sectoral interests (e.g., workers' unions, religious actors, and peasant groups), international agencies (e.g., international fund institutions and other agents of the process of 'global governance'), NGOs, and other relevant power holders (Castro, 2007). These actors are engaged in ongoing debates and in social and political confrontations around how water and primary water services should be governed, by whom, and for whom (Castro, 2007).

Participants from the water industry were interviewed to provide views about water accounting. The findings for the interviews with them demonstrate that poor water governance is prevalent in Jordan. G7P2 who represents the water industry group's position when he says:

خمسين بالمئة الفساد والفساد يتعدى الفساد المالي الى فساد جماعة البيئة اللي ما يعملوا تطبيق شديد على الملوث. أنا ليش تركت؟ من كثر ما شفت! أنا شفت القضاة ما بدهم يحكموا السراقين. شفت! أنا زهقت وكل المنظومة زباله واللي هي الحاكمة. احنا عندنا حاكمة فقيرة. لا نملك حاكمة جيدة. هذه ليس لها دخل بالحكم. هذه لها علاقة بالأنظمة والقوانين اللي تحكم عمل المؤسسات.

Fifty per cent is corruption. The corruption exceeds [to be] financial corruption to corrupt environmentalists who do not strictly apply the law against the polluters. Why did I leave? Because I witnessed a lot. I saw that the judges do not want to judge the thieves (of water). Have you seen it? I got bored. The whole system is weak, which is governance. We (Jordan) have poor governance. We do not have good governance. This is not related to the ruling regime, but it is related to the laws and instructions that govern the institutions (G7P2, water industry).

He adds:

حاولت أعدل قانون سلطة المياه وأدخل مبدأ (الملوث يدفع) لكن تعرف مجلس نواب متخلفين وحكومات متخلفة وما قدرت أمشي القانون. أنا تركت الحكومة وزهقت لأنني زي اللي بيباطح في الحيط... ما في هناك اشراك للمجتمع المحلي في الاهتمام ومراقبة كمية المياه المفقودة في مناطقهم.

I tried to amend the law of the Water Authority of Jordan and to enter the principle of 'polluter pays', but as you know, the parliament and the government are ignorant. I could not enact the law. I left the government and got bored because all my efforts to make a change against corruption were fruitless... There is no more significant role for the local communities than in taking care and control of the lost amount of water in their regions.

G7P4 extrapolates:

The problem of water in Jordan is political due to water basins being shared. Israel does not meet the treaties with Jordan concerning Jordan's right to water (G7P4, water industry).

G7P1 adds:

There is mismanagement (in water sector). They (the government) do not leave an employee to work properly because of nepotism. This is to protect their positions (G7P1).

According to the Global Water Partnership, water governance refers to the range of economic, social, political, and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at diverse levels of the community (Black & Hall, 2004).

8.8.3 Benefits of implementation

During the past century, water use has risen twice as fast as the world's population, a rise which has led to 1.2 billion people living in water-scarce areas. Scarcity and competition for water are issues of growing concern, ones that will contribute to potential deficiencies of food. These matters intersect both within the farming sector and across all water-using sectors (Berger, Van-der-Ent, Eisner, Bach, & Finkbeiner, 2014).

8.8.3.1.1 Sustainability of farming activities: Water industry's perspective

Irrigation is by far the most significant user of water in most water-scarce countries and is under pressure to minimise its utilisation (to release water to other sectors, including the environment) and to use water more productively to satisfy demands for food and fibre (Perry, 2011). Karimi, Molden, Bastiaanssen, and Cai (2012) point out that water accounting is used to sustain agricultural activities. General strategies for improving agricultural water productivity can be identified; first, increasing productivity per unit transpiration³⁸; second, reducing nonbeneficial depletion; third, reduction of flows to sinks through interventions that decrease deep percolation and surface runoff where this water presently flows to sinks; fourth, pollution control; fifth, tapping uncommitted outflows; and, finally, reallocating water between uses (Karimi et al., 2012). Sonder, Astatke, El-Wakeel, Molden, & Peden (2003) suggest introducing livestock water accounting as a system to improve water productivity, enhance sustainability, and reduce environmental impact.

Participants were interviewed to provide their evaluation concerning water accounting. G7P2 who represents the water industry group says:

They are going to provide farmers with clean water, but farmers also should meet some requirements represented in high environmental standards on the level of the farm. This is related to using pesticides, using fertilisers, and disposal of agricultural residues scientifically to conserve the environment. On the other hand, the agricultural product is going to be free from environmental polluters. We can reach a particular stage that the product is entirely organic if we properly follow all steps (G7P2, water industry).

³⁸ Transpiration is the loss of water from a plant in the form of water vapour. Water is absorbed by roots from the soil and transported as a liquid to the leaves via xylem. In the leaves, small pores permit water to get out as a vapour. Of all the water absorbed by plants, less than 5% stays in the plant for growth (Sterling, 2005).

G7P5 adds:

In terms of agriculture, you are going (by a sophisticated water accounting programme) to make the quantity and quality of water discharged from factories matching to the standards. Therefore, free and high quality of water is going to be provided to farmers with no harm to the environment (G7P5).

G7P1 illustrates:

This (advanced water accounting programme) should benefit the agricultural sector through farmers' awareness raising (G7P1).

The challenges facing agricultural water management today are different from those faced a few decades ago. People demand more agricultural goods. Also, the type of food they need is shifting towards more meat, dairy, fish and sugar – products that typically need more water than traditional staple foods such as cereals and tuberous crops (Falkenmark & Molden, 2008). As a result, agricultural water use has increased considerably and is still increasing. At the same time, cities and industrial development claim a growing share of available water resources. Over-utilisation and poor governance of water resources threaten the resource base on which agriculture relies (Falkenmark & Lannerstad, 2010). Therefore, there is a necessity for water accounting to improve the productivity of water in agriculture and to sustain agriculture (Onda, LoBuglio, & Bartram, 2012a). Treated wastewater constitutes an alternative source of irrigation water due to its inexpensiveness compared to the cost of freshwater (Jiménez, 2006).

8.8.3.2.1 Improving public health conditions: Water industry's perspective

Water is a crucial factor in sustaining life, maintaining public health, and ensuring sustainable livelihoods (Pruss-Ustun, 2008). The United Nations General Comment on the Right to Water identifies access to clean water as a human right. As a result, requirements are placed on governments to ensure that action is taken to achieve this right (Howard & Obika, 2004).

In poor societies farming households especially often live in polluted and degraded environments where pathogens and toxic substances are abundant and are frequently present in high levels in the water, air, and soil (Cameron, Jagals, Hunter, & Pond, 2011). Such environments also frequently support the development of habitats that allow organisms that transmit ailments such as malaria and dengue fever to breed. At the same time, services such as water supply, sanitation networks,

and drainage that protect public health are often less well-developed, have a lesser quality of service, or are of high cost or poor reliability (Howard & Obika, 2004).

Impoverished communities and households tend to be more undernourished as a result of low incomes that prevent their having foods of higher nutritional value. In addition, those suffering from malnutrition in countryside areas often lack access to good quality land, and frequently water, to support improved farming practices. Children, specifically infants, are at particular risk of infectious illnesses because their immune systems are not fully developed. Within the group at greatest danger, considerable protection procedures against diarrhoea can be attained through the breastfeeding of infants. This practice not only provides benefits in terms of nutrition and the child's immune system, but also lessens exposure to infectious agents contained in polluted water used to make formula preparations (Hunter, MacDonald, & Carter, 2010). As a result, good food for mothers leads to better immunity in children.

The poor are also commonly prone to higher rates of noncommunicable ailment. Rates of depression, heart problems, and other sicknesses are often higher in poorer societies than in those of their more affluent neighbours; this phenomenon appears to hold true in both developed and developing countries. In addition to exerting a substantial health effect in their own right, noncommunicable ailments also often raise susceptibility to communicable diseases through suppression of the immune system (Bartram & Cairncross, 2010).

Water, limited income, and health are closely linked. Poor access to domestic water and sanitation networks results in growing levels of sickness and contributes toward ongoing poverty. Access to more abundant water resources and effective water management of those resources are necessary to reduce health burdens and promote sustainable livelihoods. Reducing water and sanitation-related health burdens is possible at a relatively low cost and will contribute to reducing poverty. To accomplish increases in access to water, more flexible and innovative water accounting systems are needed to promote uptake of services and to develop incremental improvements (Howard & Obika, 2004).

Interviews were conducted with a group from the water industry to provide their opinions about water accounting in Jordan. G7P2 who represents them says:

It (water accounting) impacts on health considerably as insecticides and polluters such as gases, minerals and heavy metals are reduced (G7P2, water industry).

G7P5 confirms:

This (applying comprehensive water accounting system) reflects on improving water service performance. As a result, it is positively reflected on the environment and human health. This means applying the law and accounting standards related to water discharged from factories that it is then matching to specifications (G7P5).

The participants indicate that a water accounting programme in Jordan will improve the human health conditions in the workplace and for the public because water accounting encourages the business sector to disclose its social and environmental responsibilities.

G7P1 adds:

This (water accounting) encourages farmers to have farms (vegetables and fruit) and animal farms as well so that increases, for instance, consumption of children's milk. This improves their health and reduces costs of medical insurance. Eventually, this makes the children think innovatively (G7P1, water industry).

Using water accounting programmes improve water service performance reflects positively on physical and mental human health, animal health, and, finally, the whole environment.

8.8.3.3.1 Improving tourism conditions: Water industry's perspective

Water scarcity is aggravated by climate change. In its targeted report on the issue of water scarcity and climate change, the Pacific Institute analysed water demand by sector and examined the implications of climate change on water reliability (Becken, Rajan, Moore, Watt, & McLennan, 2013). Higher temperatures and its effect on increased water needs for industrial and institutional cooling and increased water for hydration is one instance. Pressures on nonconsumptive and recreational water uses are another (Becken et al., 2013).

Saline water intrusion from excessive groundwater exhaustion and rising seawater levels is of particular significance to tourist destinations (Becken et al., 2013). Increased public health risks due to the mobilisation of pathogens and polluters from severe weather and water-borne diseases from reduced water quality are progressively relevant to tourism (Clift & Page, 2015). Water risks cannot just be

managed internally within a business entity or property, but need strong engagement with other stakeholders in the water-scarce area. Sustainable tourism cannot hope to be accomplished without a more extensive commitment to and understanding of sustainable development results across the broader society and gathering thorough data concerning all users of water and their impacts of the use of water in order to make decisions at the tourism sector level (Becken et al., 2013).

The study interviewed three participants from the water industry and they were asked to provide their evaluations of water accounting. The results demonstrate that applying water accounting in Jordan will contribute to promoting tourism in Jordan. G7P3 represents the water industry group. He says:

We (Jordanians) are going to swim in the Zarqa River, see fish, and the river is going to stop being a contamination centre. Namely it (water accounting) is going to address the environmental problems (G7P3, water industry).

G7P2 adds:

This programme (comprehensive water accounting) will address many things such as reducing water loss, reducing water pollution as well as sustaining water, encouraging industries that lead to wastewater recycling, reviving ecosystems, which reactivate tourism sector on the inside and outside levels (G7P2).

Enhancing the quality of water service in water-scarce regions improves health conditions, regenerates ecosystems, and refreshes the area and so makes it attractive for tourism.

8.9 Summary

This study aimed to understand the stakeholders' perspectives of the impacts of the contamination in the Jordan River Valley. The effects of the pollution have different consequences; these are physical, emotional, and spiritual consequences.

The study showed that water pollution in the Jordan River Valley has affected the economic side of the agricultural community. The contamination has affected the level of income resulting from agriculture by preventing farmers from using wastewater for irrigating all kinds of crops. Moreover, using partially treated wastewater for irrigation causes additional maintenance costs due to blockage of irrigation systems.

It is not only the agricultural sector which is affected by the pollution, but also the tourism sector. The pollution has affected local tourism and religious tourism from inside and outside the country, because of many fauna and flora have disappeared in the region.

Contamination effects are not limited to economic aspects, but also impact human health and the emotional and spiritual life of the local community in the Jordan River Valley. The contamination is experienced in the form of noxious emissions and the spread of harmful insects such as flies and mosquitoes (Ijumba, Mosha, and Lindsay, 2002).

It was seen that institutional policies in conjunction with nepotism and a lack of environmental laws enforcement which in turn led to a lack of accountability, play a significant role in the problem of increasing levels of pollution in the valley. The next chapter covers the results which were derived from analysing secondary data resources such as online multimedia, governmental reports and newspaper articles regarding the impacts of water contamination on stakeholders in the study area.

Chapter 9: Documents Findings

9.1 Introduction

This research focused on the effects of the environmental degradation in the Jordan River Valley. The preunderstanding obtained from the secondary data revealed the impacts of pollution on the stakeholders in the region. Although some of the adverse effects are evident in the Jordan River Valley, others remain hidden from the public. The preunderstanding stage provides a rigorous basis for engaging with documents in order to analyse and interpret their perceptions of the impacts of pollution in the region.

Documents analysis is a form of qualitative research in which multimedia data and other materials are analysed to give voice to and meaning around a topic under study (Bowen, 2009). In this study, government reports obtained from the Ministry of Environment and the Ministry of Water and Irrigation were analysed. In addition, local and international newspaper articles related to the impact of pollution in the Jordan River Valley were analysed. Analysing texts consists of coding content into themes in the same way focus group or interview transcripts are coded (Bowen, 2009; O'Leary, 2017). Document analysis is a social science research method. It is a valuable research tool in its own right and is a significant element in most schemes of triangulation, the mixture of methodologies in the study of the same phenomenon (O'Leary, 2017). The aim of triangulating is to present a confluence of evidence that engenders credibility. In order to obtain convergence and corroboration, qualitative researchers frequently use secondary and primary resources that draw upon various data sources and methods (Bowen, 2009).

This chapter represents the second phase of the research findings on understanding the impacts of water contamination in the Jordan River Valley. The findings in this chapter are grouped into four main sections; first, impacts on human health; second, impacts on the farming community; third, impacts on institutional politics; and, finally, effects on tourism. These sections include central themes and subthemes. These themes were identified as being of concern across the stakeholders in the Jordan River Valley.

9.2 Document Analysis

A researcher can use a wide range of texts for research, although by far the most common is the use of written documents (O’Leary, 2017). In terms of how much material the researcher should select, Bowen (2009) suggests that an extensive collection of documents is better, although the question should be more about the quality of the documents rather than the quantity. There is a number of documents illustrate the size of pollution in the valley. A list of 54 relevant texts (see Table 9-1) were gathered to be explored. The table includes the type, title and source of the document. The table sets out four groups of documents: newspaper articles, websites, reports, and online multimedia. The process of document analysis was carried out through careful, focused reading and rereading of data, as well as coding and category construction, taking into account the Islamic Hermeneutics applied in this research.

Hermeneutics can be treated as both an underlying philosophy and a specific method of analysis (Bleicher & Bleicher, 1980). As a philosophical approach, it provides a philosophical basis for interpretivism. As a method of analysis, it proposes a technique of understanding textual data and is primarily concerned with textual analysis. The patterns of analysis refer to the interpretation and analysis of qualitative empirical data. The fundamental question in Hermeneutics is: “What is the meaning of this text?” (Radnitzky, 1970, p. 20). According to Taylor (1976):

Interpretation, in the sense relevant to hermeneutics, is an attempt to make clear, to make sense of an object of study. This object must, therefore, be a text, or a text-analogue, which in some way is confused, incomplete, cloudy, seemingly contradictory – in one way or another, unclear. The interpretation aims to bring to light an underlying coherence or sense. (p. 153)

Interpretation begins with reading and understanding the words, sentences, paragraphs, subsections, and sections included in the document. The words that constitute a sentence give it meaning. A paragraph is comprehended by reading and understanding the single sentences that form the paragraph. Paragraphs provide meaning for a subsection that consists of the paragraphs, and subsections, in turn, give comprehension of sections. Understanding acquired from different levels contribute to the meaning of the document as a whole. Alternatively, the whole also provides meaning to the parts. For example, the meaning of sentences becomes evident when the researcher understands the aim of the paragraph and its principal

focus. Likewise, this alternating whole/part relationship also operates between a subsection and its paragraphs, subsections and sections, and a document and its sections. While alternating between the whole and parts, the researcher is also affected by preunderstanding. In this case, preunderstanding of the Islamic culture of Jordan as an Islamic country means that when reading each document the researcher regularly refers to Islamic hermeneutics. The documents were read and reread to identify the primary events, parties, metaphors, idiomatic expressions, and themes in the text that are similar to and distinct from the preunderstanding of the interpreter. The themes that arose from reading a document were then used in the reading of other documents. The emergent codes and themes assisted in integrating data gathered by different sources. The information was then organised into what is related to the central topics addressed in the research questions, that is, the effect of pollution on human health, the effect of pollution on the farming community, and the impact of pollution on institutional policies.

Table 9-1: List of documents.

Document Type/Newspaper Article	Source
Hashemiyeh residents mull suing factories for polluting district	The Jordan Times
The environment in Jordan. The challenges facing the significant weakness of the possibilities to address	Addustour Newspaper
Plants irrigated by Zarqa River are polluted	Alghad Newspaper
Baptism by mire? in lower Jordan River, sewage mucks up Christian rite	The Times of Israel
Jordan will witness a steady increase in temperatures, more dry spells	The Jordan Times
The wastes of factories and sewage have changed the Zarqa River nature and polluted its water. The Zarqa River is a model of pollution and a source of inconvenience for citizens and officials alike	Addustour Newspaper
River Jordan baptism site could be closed due to pollution	The Telegraph
Environmentalists say pollution makes baptism at a sacred spot in Jordan River unsafe	The Washington Post
Jordan River still polluted, as three-year-old Rehab plan gets bogged down	Haaretz Newspaper
Exhibition of the Zarqa river, monitoring the transformation of the place visually	Alrai Newspaper
Archaeologists trace history through water resources	The Jordan Times
Germany to finance water, sewage projects in Zarqa, Amman	The Jordan Times
1.7 million people in Jordan are water vulnerable	The Jordan Times
High salinity levels in southern, central Jordan Valley prevent citrus farming	The Jordan Times
Duleil residents complain of 'salty water' as authorities say mineral levels normal	The Jordan Times
Jordan lacks proper facilities for olive waste treatment	The Jordan Times
All septic tankers to be equipped with an electronic tracking system	The Jordan Times
A project to recharge groundwater along the Zarqa River	Alrai
Brave procedures to preserve water resource	Addustour
Jerash Health Directorate confirm that the directorate remove the violating crops on the two river banks	Alghad
Pollution fears at River Jordan pilgrimage spot	The Guardian
Jordan River called 'too polluted' for baptism pilgrims	HuffPost
Document Type/Website	Source
Zarqa Governorate, environmental problems need practical solutions	Ammonnews.com
Clean-up operations tackle polluted Zarqa River	Ammonnews.com
Al Rusaifa: environmental problems irritate half million people	Jefranews.com

The integrated environmental management of the Zarqa River in Jordan	The Mediterranean Wetlands Initiatives
Environmentalists warn of rising pollution in Zarqa River	Humanitarian News and Analysis
Environmental pollution caused by the Zarqa River is waiting for a radical solution	Yarmouknews.com
'Zarqa River' 77 km starts from Amman and ends at King Talal dam	Ain.jo
Save agriculture; the solution is economic policies enabling the sector to get out of marginalisation	National Agricultural Information System
Water left over from the olive pressing processes includes life-threatening materials that spoil the environment, pollute groundwater, and control is absent.	Arij.net
Droughts and farmers' screams	National Agricultural Information System
Director of the Zarqa River Basin project: The degradation of the ecosystem components of the basin is one of the most significant environmental challenges	Almadenahnews.com
Where is the Zarqa River flowing?	Mawdoo3.com
A message from a young Jordanian man to the queen and the Jordan River Foundation	Sarayanews.com
Environmental catastrophe may occur in the Jordan River. What is it?	Sarayanews.com
Water quality	Fanack.com
The Zarqa River from a river to a dump	Al-sjill.com
We need a <i>wasta</i> with the minister of agriculture	National Agricultural Information System
A journey of environmental pollution and no real solution on the horizon	JORDANZAD.com
The river's insects irritate Zarqa residents	Honazarqa.com
Energy, water, transport and agriculture	Sarayanews.com
The Zarqa River pollution is waiting for the illusion	Albaladnews.net
The Dead River? How the waters of the Jordan run foul?	Middle East Eye
Jordan River too polluted for baptisms	Seeker.com
The dirty River Jordan	Maclean
Document Type/Report	Source
Annual report of the national project for monitoring water by remote	Government
The water of King Talal dam	Government
Quality of treated industrial wastewater	Government
Disposal report	Government
Disposal report	Government

The monthly report on water quality	Government
A major deterioration in quality in lower part of Jordan River	Government

Document Type/Online Multimedia	Source
Pollution of the Zarqa River	Youtube.com

Source: (Author).

9.3 Impacts of Water Contamination on Human Health

Many of the critical problems that humanity is facing in the 21st century are related to water quantity and water quality matters. These problems are going to be more severe in the future as a result of climate change, higher temperatures, and an increasing demand for water for domestic, agricultural, and industrial purposes (Vörösmarty et al., 2010). Human health is affected by the lack of enhanced sanitation and the related issue of the lack of safe potable water that presently affects more than 30% of the world's population (Vörösmarty et al., 2010). A failure for the sanitation systems to function in a standard or satisfactory manner may cause wastewater to leak into surface water and groundwater sources or, in some cases, into household drinking water networks (Schwarzenbach et al., 2010). Further threats include, for instance, exposure to pathogens or chemical contaminants via the food chain (e.g., the result of irrigating with partly treated wastewater and of bioaccumulation of poisonous chemicals by aquatic organisms, including seafood and fish) or during recreation (e.g., swimming in contaminated rivers and lakes) (Schwarzenbach et al., 2010). Several documents (Matas, 2006; Al-Otoom, 2007; Namrouqa, 2009, 2014b; Ammonnews, 2010; Zacharia, 2010; Sudilovsky, 2010; Raja & Shirokov, 2010; Al-Qhuari, 2011; Al-Atyat, 2012; Addustour, 2013; Al-Emam, 2014; Lidman, 2015; Jfranews, 2016; Ministry of Environment, 2016; Arsenault, 2017; and Yarmouknews, 2017) mention that the pollution in the Jordan River causes physical health problems. A report published in the Jordan Times by Namrouqa (2014b) represents the opinions stated above. She says,

If the water is not well treated, it could increase the risk of transmission of several pathogens through crop contamination, which could cause outbreaks like typhoid fever or hepatitis A (Namrouqa, the Jordan Times).

Al-Emam (2014) adds:

Instead of addressing the roots of the problem, the government has been dealing with its consequences, MP Zyoud said, noting that the

government pays for the medical treatment of those affected by the pollution (Al-Emam, The Jordan Times).

In an interview conducted by Al-Shareef (2013), Ahmad Alshawabka, dean of Islamic Community College says:

Some students were taken to the hospital after being unconscious because of bad smells emitted from the river (Al-Shareef, website).

Dr Isa Al-Omari, a physician, confirms that foul smells are a problem, saying:

Most residents who live close to the Zarqa River are exposed to asthma and allergies because of foul odours (Al-Shareef, website).

Dr Malik Haddadin, a professor at the University of Jordan, comments about the adverse effects of wastewater on human health, animals, and plants. He says,

The effect of toxicity of these compounds (phenolic compounds) is directly on the oversensitive organs and tissues in the human body, animals and plants. The most organs affected are the lungs, liver, and the urinary and reproductive system (Ennab, website).

The Zarqa River water is unsuitable for drinking, swimming, washing hands and plates or watering plants that are eaten fresh. Direct contact with this contaminated water, primarily by children, causes health problems in the short and long term.

9.4 Impacts of Water Contamination on Farming Community

Environmental contamination occurs when the rate at which any substance (liquid, solid, or gas) is added to the environment at a faster rate than it can be dispersed, diluted, decomposed, reused, or stored in some simple form. The main kinds of environmental pollution are water, air, and land contamination (Nathanson, 2018).

Although pollution can be caused by natural events such as wildfires and active volcanoes, the use of the word pollution commonly implies that the pollutants have an anthropogenic source created by human activities. Pollution has accompanied humankind ever since groups of people first congregated and remained for a long time in any one place. Indeed, early human settlements are frequently recognised by their pollutants and middens. However, with the establishment of permanent settlements by significant numbers of people, contamination became a problem for human welfare, and it has remained one ever since (Nathanson, 2018).

9.4.1 Crop restrictions

The treatment of wastewater has been extensively adopted as the primary control measure in controlled effluent use schemes. A more integrated approach to the planning of wastewater reuse for agricultural purposes will take advantage of the optimal combination of the health protection standards available and accord with the domestic, sociocultural, and institutional conditions. However, ill-suited recycling of wastewater causes adverse impacts on the farming community through, for example, crop restrictions (Mara & Cairncross, 1989). Several documents (Ministry of Water and Irrigation, 2011; Ministry of Environment, 2013a, 2013b; Ministry of Health, 2015a; and Rinat, 2016) show that treated wastewater coming from the As-Samra plant into the Zarqa River is unsuitable for all kinds of crops growing in the Jordan River Valley. An extract from one Ministry of Health (2015a) report represents the documents above:

The farm of Mr Ali Al-Kulaibi. The farm is planted with clover in a 5 acre-wide area, parsley in a half acre-wide area, and beets in a half acre-wide area. All crops are irrigated from a pool that is 30m away from the riverbed. He has been warned to remove the parsley and beet crop within 48 hours as of the date of examination; yet, he refused to sign on the report (Report, government).

Toaimat (2015) mentions:

Al-Saad (the director of Jerash Health Directorate) shows that the Health Directorate regularly works to monitor the crops grown on the two river banks and eliminate them (crops eaten raw) (Al-Toaimat, Alghad newspaper).

Raja and Al-Otoom (2007) added:

The governor of Jerash city indicates that due to the unsuitability of this water (the Zarqa River) for irrigating crops eaten raw, the intensive monitoring on the two river banks is applied by the specialised panels (Raja & Al-Otoom, Addustour newspaper).

Raja and Al-Otoom (2007) show the effect of wastewater in the Zarqa River on farmers. They say:

The commission (health and safety in Jerash city) spoiled many crops in this region (Jerash) frequently, mentioning that irrigation from the river is restricted to trees and plant nurseries (Raja & Al-Otoom, Addustour newspaper).

Ain.jo (2011) adds:

Al-Faysal's plant nurseries are located on the two river banks, where the water's colour mostly is yellow to brown. One of the employees, who preferred to be anonymous, said: we do not have lack of water. This is because of the river water. We mainly depend on the river water, but for example, lettuce is not allowed to be planted and irrigated by the river (Ain.jo, website).

The contaminated irrigation water obliges farmers to grow plants that are financially unrewarding. However, any attempt to use the wastewater for irrigating tomatoes, cucumbers, leafy vegetables, and so on will lead to farmers being punished.

9.4.2 Decreased vegetable exports

Treated effluent can be used for irrigation under controlled conditions to reduce risks from pathogenic pollutants and mitigate harm to the soils, surface water, and groundwater caused by industrial toxic substances (Seder & Abdel-Jaber, 2011). Additionally, by using recycled wastewater for agricultural purposes the problems such as wastewater disposal and the shortage of freshwater availability in arid zones could be controlled. The presence of a broad spectrum of pathogens increases the adverse impacts of using untreated wastewater, including human health risks and vegetable export ban (Al-Lahham, El-Assi, & Fayyad, 2003). Several documents (Raja & Al-Otoom, 2007; Ain.jo, 2011; Ministry of Environment, 2016; Al-Habashna, 2016 and Al-Rubai, 2017) show that water contamination negatively affects the quality and quantity of the agricultural production, which, in turn, affect vegetable exports. Al-Rubai (2017) represents the documents above. He says:

It seems that agricultural concern is continuing even after we have succeeded in entering and opening other markets after a long boycott of the Jordanian products and receding markets. Significant efforts have been exerted to convince Arab Gulf countries and others to reimport Jordanian fruit and vegetables due to using contaminated irrigation water from the Zarqa River (Al-Rubai, website).

Adnan Al-Zubi, assistant to the Deputy at the Minister of Water and Irrigation, commented:

Opening this topic (using the Zarqa River for irrigation) is basically wrong because it disrupts the Jordanian exports of vegetables (Ain.jo, website).

Al-Rubai (2017) confirms that view saying:

Strenuous efforts were exerted to convince the Arab Gulf states and others to reimport Jordanian fruit and vegetables after the press reports of 10 years ago, which indicated polluted crops, especially from the Zarqa River, and black water from As-Samra (Al-Rubai, website).

A number of delegations from these countries visited Jordan to check the irrigation process and standards applied in irrigating vegetables. Because of these visits, the commissions recommended strict criteria to permit reimporting vegetables from Jordan. In 1991, the Saudi Arabia government banned importing vegetables from Jordan, citing chemical and biological pollutants as a result of using treated wastewater and overusing of pesticides (Mourad et al., 2010). In May 2017, the UAE also banned importation of seven of Jordan's primary types of vegetables. Neither the UAE nor any other Arab Gulf state has returned shipments of Jordanian fruit and vegetables, because, to avoid losses, farmers are not exporting the types of products banned under the new decision. The forbidden plants comprise all kinds of lettuce, cauliflower, green beans, cabbage, sweet pepper, zucchini, and eggplant. The UAE is one of Jordan's biggest importers of fruit and vegetables, with over 150,000 tonnes of farming produce being exported annually (Namrouqa, 2017b).

In an attempt to deal with its water challenges, the Council of Leading Scholars (*Hay'at kibār al-'ulamā'*) in Saudi Arabia issued a *fatwā* (legal viewpoint) in 1978 on the reuse of effluent. Impure effluent can be deemed as pure water and similar to the authentic pure water if its treatment uses improved technical procedures that are capable of eliminating its impurities with regard to taste, colour, and smell and if it meets the standards approved by honest, specialised, and well-acknowledged experts. Then it can be used to eliminate body impurities and for cleansing, even for drinking. If there are adverse effects on human health from its direct use, even minor ones, then its use for agricultural purposes has to be avoided, not only because it is impure (unacceptable for ablution and other domestic uses), but also to avoid harming the human beings (Tayob, Deedat, & Patel, 2015).

9.4.3 Impacts on community breakdown

The continuing use of inadequately treated wastewater for agricultural purposes endangers local rural communities that are heavily dependent on agriculture as a primary source of rural livelihoods (Shatanawi & Fayyad, 1996; Scott, Faruqui, & Raschid-Sally, 2004). Increasing farming soil salinity would lessen soil quality, limit crop choice and growth, reduce the quality of fruit and vegetables, constrain

agricultural productivity, and in severe cases, result in the abandonment of farming lands (Ammari et al., 2013). Some of these societies have turned to other sources of income such as commercial and industrial occupations. Many documents (Al-Jarah, 2007; Masarwa, 2013; National Agricultural Information System, 2014; Namrouqa, 2014b, 2015; Al-Habashna, 2016; Ennab, 2016; and Goussous, 2016) show that the contamination in the Zarqa River contributes to local farmers' giving up agricultural lands and looking for other occupations, which leads to community breakdown. Ennab (2016) represents the opinions above. She says:

The suffering is continuing, and nobody buys houses, and the pollution threatens [the] citizen's life and the environment (Ennab, website).

Namrouqa (2015) adds:

Hydro-insecurity does not occur in isolation but is accompanied by one or more issues such as poverty, war and conflict, low women's development, and environmental degradation (Reporter, The Jordan Times).

Al-Dhahir (2011) demonstrates the effects of pollution:

But the environmental contamination has weakened and damaged the quality of local communities' life and adversely affected the social and economic development in that region. Furthermore, the pollution has impacted on the biodiversity, livestock, and health of populations (Al-Dhahir, website).

Al-Jarah (2007) confirms that view, saying:

And revealing the current situation of the river, which adversely affects the quality of life and the surrounding community and has become a black environmental spot in Jordan (Al-Jarah, website).

The pollution in the Zarqa River has created a poor environment for livelihoods and so adversely affected the community's well-being and its stability.

9.4.4 Decreased quality of farming soil

As early as 1940, Jordan began its irrigation development by establishing irrigation systems along the side-*wadis* and around significant springs through the construction of hydraulic structures such as weirs and concrete canals (Suleiman, 2003). Water is the determining element for boosting the size and the productivity of the irrigated areas in Jordan. Historically, and in particular up until 1940, farming production in Jordan relied primarily on rainwater for agricultural purposes. However, scattered irrigated farming lands were found around springs (Al-Zu'bi,

2007). The significant development in irrigation started in the early 1950s. The Jordanian government endeavoured to achieve the integrated rural development of the Jordan River Valley to utilise Jordan's share of the fresh surface water resources of the River Jordan Water Basin Regime. The irrigation system in the valley has been suffering from the bad quality of irrigation water owing to the mixing of the Jordan River's water with partially treated wastewater from the As-Samra wastewater treatment plant. The poor quality of irrigation water increases the salinity of farming soil, which affects farming productivity (Ammari et al., 2013). Several documents (Abulhawa, 2010; Addustour, 2013; Freij, 2014; Obeidat, 2014; The Jordan Times, 2014; Namrouqa, 2015; Al-Zaboon, 2015; Al-Zyood, 2015; Ennab, 2016; Cooke, 2017; Ministry of Environment, 2017 and Sarayanews, 2017) demonstrate the impacts of wastewater reuse for irrigation on farming soil. The following extract from the Ministry of Environment (2017) represents the documents above. The report explains:

Salinity levels in the lower part of the river are high, which indicates that the ecosystem of the Jordan River Basin is threatened and needs rehabilitation actions (Report, Ministry of Environment).

Freij (2014) adds:

Shihab (head of the Jordan Valley Agriculture Directorate) said farmers do not cultivate their lands with citrus trees in the southern and central Jordan Valley because of the high levels of salinity in the soil; moreover, salinity levels are high in the water that they receive from the King Talal Dam (Freij, The Jordan Times).

A report published by The Jordan Times (2018) states:

The ministry (the Ministry of Water and Irrigation) banned the drilling of wells in 1998 to limit random pumping of water, in order to preserve aquifers from depletion and salinity (Report, The Jordan Times).

Cooke (2017) shows how bad the situation in the Jordan River is when he says:

Flow has been reduced to about one-tenth of the historic value and water quality has sharply deteriorated, with raw sewage, saline flows, and agricultural run-off polluting the remaining water (Cooke, website).

A study published by The Jordan Times (2014) warns:

If it spreads on soil or is dumped in side-*wadis*, zibar (the wastewater remaining after pressing olives) can cause serious environmental problems and reduce soil fertility as it contains many chemicals (Report, The Jordan Times).

People in Jordan can see zibar dumped in side-*wadis* in the Amman Zarqa Basin, especially in Jerash city. The zibar pollutes the soil, and through runoff reaches the Zarqa River from where it reaches the King Talal Dam. Surface water contamination contributes to increasing the levels of salts in the surface water, affecting farming soil fertility. In addition, salty surface water affects the quality of groundwater.

Abdullatif (2017) adds:

Citrus farmers in the northern Jordan Valley have blamed the Ministry of Agriculture and the Ministry of Water and Irrigation because of the reduced yield of their farms compared to the previous years. They mention that irrigation water is drawn from the King Talal Dam, which has high salinity and adversely affected the quality of crops especially vegetables such as cucumber, eggplants, and zucchini (Abdullatif, website).

Al-Odwan (2014) confirms:

Many farmers who are interested in planting citrus in the central and southern Jordan Valley confirm that there is a decline in planting citrus because of the lack of irrigation water and its reduced quality. They mention that reduced quality and quantity of their farming yield is due to the irrigation water coming from the King Talal Dam, which is unsuitable for irrigating citrus because of its high salinity.

In Jordan, the farming land is limited to 8% of the total land area and is heavily reliant on irrigation because of the arid climate conditions. The Jordan River Valley is the main agricultural area, with a cultivated area of about 35,000ha (Abu-Aisha, 2001). Over 60% of Jordan's farming produce is planted in the Jordan River Valley. The Jordan Valley varies in soil taxonomies, annual rainfall, cropping patterns, and farming operations. The salinity of farming soils along the Jordan River Valley is dramatically altering since natural floods are no longer occurring to flush the irrigated agricultural land and leach salts. In addition, high evaporative conditions and insufficient precipitation for appropriate leaching contribute to further salt accumulation (Ammari et al., 2013).

9.4.5 Degraded quality of groundwater

Joint industrial investments are being planned for the Jordan River Valley. These projects rely on the availability of relatively large amounts of high-quality water which, as of yet, are unavailable (Hötzl et al., 2008). Large shares of groundwater

resources which form the primary source of water in the region are of a relatively high salinity, which makes them inappropriate for domestic and for most traditional agricultural purposes (Hötzl et al., 2008). Several documents (Salamah, 2009; Namrouqa, 2009; Abulhawa, 2010; Alrai, 2014; Al-Zaboon, 2015; Al-Zyood, 2015; Fanack, 2016, 2014a, 2014b, 2017a and Sarayanews, 2017) demonstrate the impacts of contamination in the Zarqa River on groundwater. Namrouqa (2014a) represents the opinions above. She indicates:

The project seeks to improve environmental conditions in the As-Samra plant area, protect water aquifers from contamination, and turn materials generated from the wastewater treatment process into fertilisers or bio-fuel for industrial purposes (Namrouqa, The Jordan Times).

Significant over-exploitation of the groundwater feeding the Zarqa River has caused reduction of the Zarqa River level and, in the process, contributed to the extremely poor quality of surface water and increasing salinity of the groundwater feeding the river.

A report published by Namrouqa (2017a) states:

A database of owners of septic tankers, their locations, and routes has been created, according to ministry (the Ministry of Environment) spokesperson Isa Shboul, who noted that the step seeks to protect the environment from pollution, particularly underground water (Namrouqa, The Jordan Times).

Several owners of septic tankers were seen unloading wastewater at undesignated locations in order to avoid paying fees for using the authorised areas. This type of illegal dumping, in the long term, leads to infiltration of sewage into the groundwater.

As Al-Dhahir (2011) points out:

The quality of surface water and groundwater has deteriorated because of depleting aquifers for agricultural and domestic purposes. The extracted amounts have exceeded the safe limits, which has resulted in reduced groundwater and increased salinity (Al-Dhahir, website).

Groundwater resources are indispensable in Jordan and so need management in order to preserve human socioeconomic development and diverse ecosystems. However, these essential resources are at risk of degradation through both mismanagement and overuse that results in pollution and decline of water levels

(El-Naqa & Al-Shayeb, 2009). Jordan is over-exploiting its groundwater resources. The current impacts on the aquifers themselves are demonstrated in the decline in groundwater levels, decrease in or stopping of springs discharges, saline water intrusions, and reducing water quality. The socioeconomic effects result in lower water quality and quantity. The negative effects, both on the groundwater and on socioeconomics are projected to increase with the passage of time. Reconsidering the management of the water sector has become crucial and essential changes towards a balanced resources/demand equation have become unavoidable if there is to be a continuous yield of water resources to guarantee future generations equity in these valuable resources (Salameh, 2008).

9.5 Impacts of Water Contamination on Tourism

Tourism in Jordan has grown for the past 30 years and represents one of the country's primary sources of foreign currency. The primary goals of the Ministry of Tourism and Antiquities have, for a long time, been the development of heritage tourism (Neveu, 2010). There are many strengths that contribute to the rapid growth of tourism in Jordan; these are the broad range of tourism sites in urban, rural, and border areas (Neveu, 2010). Several documents (Raja & Al-Otoom, 2007; Abulhawa, 2010; Zacharia, 2010; DNEWS, 2010; Sherwood, 2010; Sudilovsky, 2010; Ward, 2010; Al-Dhahir, 2011; Al-Atyat, 2012; Al-Shareef, 2013; Lidman, 2015; Toaimat, 2015; Adnan, 2016; Jfranews, 2016; Yarmouknews, 2017 and Cooke, 2017) show the effect of contamination on tourism in the Jordan River Valley. DNEWS (2010) represents the documents above. The DNEWS explains:

Friends of the Earth Middle East call on regional authorities to halt baptism in the lower Jordan River until water quality standards for tourism activities there are met, said a statement from the group (DNEWS, website).

Cooke (2017) demonstrates how the religious tourism in the Jordan River is affected. He says:

Tourists flock to see the River Jordan, one of the world's most celebrated and holiest of rivers. It is said to be the body of water which the Israelites crossed to reach their promised land and in which Jesus was baptised. However, there is little that is holy about the river now (Cooke, website).

The state of the river goes against religious tourism, as visitors who come to the Jordan River for baptism need to see the river clean every time. The pollution forces the local authorities responsible for human health to ask the Ministry of Tourism to prevent people from coming and baptising in the river until get the river water clean.

The DNEWS adds:

The group issued the call following media reports that Israel's Health Ministry had urged the Tourism Ministry to stop people (visitors for baptism) bathing in the river, saying it posed a health risk (DNEWS, website).

Al-Shareef (2013) interviewed Hyatt Al-Musaymi, a former MP in the Jordanian parliament. Al-Musaymi states:

People of Zarqa city have lost the river known for trees and water, which has mostly converted to the dry swamp. In the case where water exists, water is wastewater, which makes people exposed to many contaminants (Al-Shareef, website).

Al-Dhahir (2011) met Dr Monther Haddadin, a former minister of the Ministry of Water and Irrigation. He mentions:

It has become, what is running in the Zarqa River of water, unsuitable for hiking, swimming, or drinking (Al-Dhahir, website).

The freshwater scarcity has resulted an unsuitable environment for both domestic and international tourism to the Jordan River Valley. This situation adversely impacts on the country's economy (Dobricic, 2013).

9.6 Impacts of Water Contamination on Institutional Policies

The contamination of irrigation water in the Jordan River Valley has contributed to revealing some institutional policies which lead to catastrophic consequences for the environment and its natural resources. Nepotism is one of these policies that has aggravated the dangerous situation of the Jordan River Valley.

9.6.1 Uncovering nepotism

Despite the diversity of the Arab states, the predominant culture in these countries appear similar in many of their practices, especially since most of the Arab states are ruled by tribal custom (Sidani & Thornberry, 2013). As a result, nepotism has become a dangerous phenomenon because of its involvement in various areas such

as the employment of people who lack the scientific and practical competence in the positions. Nepotistic policies may be both a sensitive and significant issue, particularly in the public-sector institutions. The reasons for the spread of this phenomenon in the public sector more than in the private sector lies, perhaps, in the fact that private-sector administrations have profitable objectives that need well-educated and trained workforces who can achieve the enterprise's final goal, which is maximising the owner's profit (Al-Shawawreh, 2016). Several documents (Al-Jarah, 2007; Al-Emam, 2014; Shaker, 2014; Al-Qaisi, 2015; Al-Zyood, 2015 and Ennab, 2016) show that nepotism (*wasta*) plays a significant role in the contamination of irrigation water in the Lower Jordan River Valley. Al-Emam (2014) represents the opinions above. She says:

Zyoud (MP) said: several complaints have been presented to the government against the district's 'very bad' environmental conditions, but in vain, charging that the government provides owners of these establishments with privileges because they are 'well connected' (Al-Emam, The Jordan Times).

Ennab (2016) confirms that the septic tankers discard wastewater in the side-*wadis* at night, and that this effluent is, in turn, transferred to the Zarqa River, impunity. She says:

Septic tankers have been doing that (dumping wastewater) for 10 years in the light of the absence of monitoring of the Ministry of Agriculture and the Ministry of Environment. Some MPs intercede to release a driver caught while dumping his load in the reserve (Dibeen natural reserve in Jerash next to the Zarqa River) (Ennab, website).

Al-Zyood (2009), directing his speech to the queen regarding the pollution in Zarqa city and its effects on the community, says:

And they (officials) have to serve the Jordanian citizen without nepotism or default (Al-Zyood, website).

The officials must serve citizens without nepotism or curtailments and the leadership should not rely on unqualified officials who just care about obtaining money and privileges at the expense of the higher interest of the country.

9.6.2 Lack of enforcement of environmental laws

Corruption has many meanings and interpretations that vary by time and place and encompass bribery, extortion, exchange of favours, nepotism, cronyism, conflicts

of interests, and, finally, lack of law enforcement (Rose-Ackerman & Palifka, 2016). Several documents (Al-Atyat, 2012; Al-Shareef, 2013; Addustour, 2013; Al-Emam, 2014; Shaker, 2014 and Ennab, 2016) show that the environment and its natural resources are not of the government's priorities. Al-Emam (2014) represents the documents above. She says:

The governor agreed with [the] lawmaker that the government is 'going easy' on violators, who are harming some 100,000 individuals residing in the district (Al-Emam, The Jordan Times).

She adds:

The lawmaker added that several factories were closed down in the past due to environmental violations, but were reopened 'two hours after closure, with claims that the violations were addressed'.

Ennab (2016) shows how bad the situation is in Jerash city, where the Zarqa River crosses the town on its way to the King Talal Dam. She says:

It (zibar) is mixed with drinking water and pollutes it and then converts it to waste harming the environment and humans. It has been discharged on the main roads as a toxin deteriorating the soil, the trees, and causes spreading of insects and emitting bad smells while the government does not care (Ennab, website).

The continuous pollution indicates that the government does not take action against offenders. This inaction has aggravated the pollution problem.

9.6.3 Lack of political will

Governments and other organisations can assist in reducing levels of pollution through waste management by minimising the quantity of waste they generate, both in their operations and through the materials they purchase. Moreover, coordinated efforts by different levels of government to include applying environmental criteria, with a focus on waste reduction (Callway, 2012) could be implemented. In the Jordanian context, doing these things needs strong will (Qadiret al., 2010; Abboud, 2010). Several documents (Al-Dhahir, 2011; Kharsat, 2013; Al-Shareef, 2013; Badran, 2014; Gharayba, 2014; Jfranews, 2016; Adnan, 2016 and Al-Rabea, 2018) demonstrate the absence of political will to deal with pollution in the Jordan River Valley. Al-Shareef (2013) represents the documents above. She says:

The Ministry of Environment announced that, in cooperation with the International Union for the Protection of Nature, it had developed a

long-term rehabilitation strategy for the Zarqa River basin in the period 2007-2020 with a budget of about 10 million. However, the people of Zarqa have not seen any change in the status of the river since the announcement of this strategy, and the situation is even getting worse (Al-Shareef, website).

Jfranews (2016) shows the long period of pollution in Zarqa city and the weak efforts exerted by the successive governments to address it. It says:

The environmental problems with its heavy loads still exist on the Rusaifa in Zarqa in spite of the many governmental promises to solve it but in vain (Jefranews, website).

Khrasat (2013) indicates:

Some of these projects (rehabilitation projects) were said to be funded by external donors in the form of environmental aid and the others in the way of provisions allotted from the state treasury every year to end the case of pollution in the Zarqa River, but funds have been spent on items that are not related to environmental protection (Khrasat, website).

People in the Jordan River Valley think that their voice has not been heard by the government and that agriculture itself is a less significant sector among the economic sectors in the country.

9.7 Chapter Summary

This chapter aimed to present a set of documentary evidence that supports the credibility of the impacts of the contamination in the Jordan River Valley. The effects of the pollution have different consequences; these are physical, emotional, and spiritual consequences.

The study showed that water pollution in the Jordan River Valley has affected the economic side of the agricultural community. The contamination has changed the sources of peoples' livelihoods and the level of well-being the rural community enjoys.

It is not only the agricultural sector that is affected by the pollution, but also the tourism sector. The pollution has affected local tourism, because many of the region's fauna and flora have disappeared.

Contamination effects are not limited to economic aspects but also extend to the human health of the local community in the Jordan River Valley, due to the

emission of bad smells and the spread of harmful insects such as flies and mosquitoes.

Investigation of the pollution revealed that nepotism plays a significant role in institutional policies and in the lack of environmental laws enforcement, both of which, in turn, lead to a lack of accountability. These policies contribute to increasing the level of the pollution in the region. The next chapter provides the discussion.

Chapter 10: Discussion

10.1 Introduction

This chapter focuses on the main results of the study and is structured according to the questions that guided the research. Sections 10.2, 10.3, 10.4, 10.5, and 10.6 address research question 1: What is the local and perceived physical, emotional, and spiritual impact of pollution on stakeholders in the Jordan River Valley and the Zarqa River Basin? Sections 10.7 and 10.8 address research question 2: What are the institutional determinants of pollution in the Jordan River Valley and the Zarqa River Basin?

The purpose of the study was to investigate, from the perspectives of those stakeholders who are often neglected in research, the impacts of contamination in the Jordan River Valley and the Zarqa River Basin. In order to achieve the research objective, a classical Islamic Hermeneutics approach was adopted (see chapter 6).

Culture, including religion, affects how people perceive and manage a resource such as water. Although culture was frequently neglected in development projects in the Middle East and North Africa, development authorities are gradually acknowledging the significance of local culture and values in their policies (Faruqui, Biswas, & Bino, 2001).

Examining fundamental values according to classical Islamic Hermeneutics is particularly important in the Middle East and North Africa, which are home to over three hundred million Muslims (The Guardian, 2016). As with some other faiths, Islam is much more than worship; rather, a code of personal behaviour is implied by the word 'religion' (Bankowski, Barzelatto, & Capron, 1989). Islam affects all facets of individual and collective human life. For instance, it regulates matters such as buying and vending, contracts, inheritance, marriage, family and intimate relations, and even basic matters such as eating and personal hygiene and sanitation (Faruqui et al., 2001). Jordan is a relatively secular country when compared to Saudi Arabia or Iran and has significant religious minorities. In Jordan, the Ministry of Water and Irrigation uses Islamic sources combined with secular slogans to promote water preservation (Faruqui et al., 2001).

Coupled with water preservation is the impact of water contamination and the use of partially treated wastewater. Understanding the impacts of contamination can provide new insights into the extent of adverse effects on the population and help to focus on the need for accountability extensively. Preunderstanding as a first stage to reach better understanding evolves from secondary data reviews such as reviewing journal articles, websites, government reports, television programmes, and newspaper articles and studying the causes of the environmental effects. Here two problems can be seen: lack of clean drinking water and the use of partially treated wastewater. The following sections address the research questions.

10.2 Institutional Actors' Perspectives

Research question 1 addresses the way in which stakeholders perceived the physical, emotional, and spiritual impacts of pollution in the Jordan River Valley and the Zarqa River Basin. The perceptions are henceforth discussed as impacts on the farming community (section 10.2.1), impacts on the tourism sector (section 10.2.2), impacts on physical health (section 10.2.3), impacts on emotional relationships (section 10.2.4), and lastly spiritual relationships (section 10.2.5). Section 10.3 addresses research question 2: What are the institutional determinants of pollution in the Jordan River Valley and the Zarqa River Basin?

10.2.1 Impacts on the farming community

Freshwater is a public commodity in Islam (Faruqui et al., 2001). It is a gift from Allah and a significant component of life and it is necessary for sustaining all ecosystems. Freshwater is owned by the public as a whole; everyone has the right to use the source of water in his/her land, and when he/she is satisfied, others are entitled to use the same source. In fact, the recognition of water as a vital source, to which everybody has the right, is emphasised by the following *hadith*, which makes water a commodity source to which all, rich or poor, have a right: 'Muslims have common share in three things: grass (pasture), water and fir (fuel)' (Bin-Ashath, 2008). The third Muslim Caliph bought the well of Ruma (a settlement in Arabia) and made its water obtainable free to the Muslim community – the well was actually

made into a *waqf*³⁹, a usufruct or a collective property for religious goals and public utility (Faruqi et al., 2001).

Kadouri, Djebbar, and Nehdi (2001) explain that most Islamic scholars have concluded that individuals or groups have the right to utilise, vend, and recover value-added costs of most categories of water. These judgments are based mainly on two *hadiths*. First, 'It is better ... to go to the woods and cut and sell lumber to feed himself ... than to beg people for help', which suggests that common property resources such as wood (as a source of fuel) and water can be vended and traded (Zouhaili, 1992). Second, the previously cited *hadith* about Othman's purchase of the well at Ruma demonstrates that wells can be held and traded. On the basis of these and other sources, water is classified in Islam as follows:

(a) Private property (water in private containers, treatment plants, distribution networks and basins): This is water in which work, infrastructure, and knowledge have been invested to attain it. The 'owner' of the 'container' has the right to utilise it, trade it or vend it. (b) Limited private property (lakes, brooks and springs located in private lands): The proprietor of the land has special rights over others, but also has certain duties to them. Within these limits, the proprietor can trade water like any other commodity. (c) Public property (water in rivers, lakes and groundwater): Clearly, freshwater in its natural state cannot be purchased or vended (Sabeq, 1981; Zouhaili, 1992).

Among the main ecological problems at local and regional level in Jordan are those related to a shortage of freshwater. Al-Ansari et al. (2013) identified that shortage of surface water and groundwater could be partially overcome by new water sources such as treated wastewater. Treated sewage water can be used for agricultural purposes under controlled conditions to reduce human health dangers arising from pathogenic and toxic contamination of the farming produce, soils, surface water, and aquifers. The degradation of irrigation water quality has, however, affected the farming community in a number of ways. These include first, immediate impacts, second, economic sustainability of farming, and third, the social impacts. The following sections draw from and discuss the main results presented in chapter 8.

³⁹ An endowment of money or property: The return or yield is typically dedicated toward a certain end, for instance, to the maintenance of the poor, a family, a village or a mosque.

10.2.1.1 *Impacts on agriculture*

The survey conducted identified four main impacts of pollution on agriculture. These are grouped as the effect on irrigation equipment, crop restrictions, vegetable exports, and quality of farming soil.

10.2.1.1.1 *Irrigation equipment*

Rapid population growth and an expanding agricultural sector make the demand for substitute freshwater resources pressing. The Jordanian government has adopted a water strategy that meets the agricultural sector water demand for producing more treated wastewater suitable for irrigation purposes (Myszograj & Qteishat, 2011). However, several studies (Whitall et al., 2007; Carr et al., 2011; Hanjra, Blackwell, Carr, Zhang, & Jackson, 2012) indicate that the high levels of suspended solids, algae growth in King Talal Dam, and mineral sedimentation resulting from using partially treated wastewater reduce the efficiency of the drip irrigation network.

The interviews confirmed that farmers predominantly depend on treated wastewater for irrigation purposes. However, the farmers interviewed all believed the treatment of the wastewater was inadequate for irrigation purposes. During the interviews, farmers claimed that the inadequately treated wastewater caused clogging and corrosion to parts of their dripper and sprinkler irrigation systems. As one farmer said:

It (inadequately treated wastewater) affects [the] irrigation network because it will be damaged. It has salts and sedimentation. It will be clogged, as it (irrigation network) is unsuitable to use this kind of water (see section 8.2.1.1.2).

Local farmers stated that they required freshwater to dilute the polluting materials in the irrigation water to mitigate the mineral sedimentation on the internal surfaces of the irrigation systems. This practice results in additional costs. These findings are consistent with the preventive procedures and remedial actions to overcome blockage of irrigation systems that increase the costs of the water and reduce the farmers' agricultural income, as echoed by Ammary (2007) and Hanjra et al. (2012).

The views of the farmers were supported by environmental experts who advised that the partially treated wastewater used for irrigation purposes still contained a high level of chemical and organic substances, as clarified by an expert:

No good outputs without good inputs. It is right, prices of irrigation water [are] less than freshwater but irrigation water causes extra maintenance of irrigation systems (see section 8.2.1.1.1).

These findings are in line with several studies that highlight how inadequately treated wastewater used for irrigation water damages irrigation infrastructure (Ammary, 2007; Whitall et al., 2007; Carr et al., 2011).

10.2.1.1.2 Crop restrictions

Irrigation is a significant element in securing food supplies in many developing nations. Poor quality of irrigation water has negative effects on agriculture and the local community (Jiménez, 2006). Dreschsel, Blumenthal, and Keraita (2002) emphasise that the demand for vegetables that are eaten uncooked is high in cities and that only certain cash crops provide the level of profits farmers need to secure their necessities of life. However, the interviews confirmed that farmers are not allowed to use inadequately treated wastewater for irrigating crops that are eaten raw, a point illustrated by a farmer:

It is not allowed to irrigate from the river. From time to time, they (the government) come to inspect (see section 8.2.1.2.2).

Jordanian Standard No. 1145/1996 (see section 5.3) which deals with the use of wastewater for irrigation purposes requires farmers to plant and irrigate fodder crops such as alfalfa and vegetables that require cooking before consumption. Tomatoes are the number one crop in Jordan, as illustrated by Al-Lahham, El-Assi, and Fayyad (2003). However, these restrictions mean that farmers do not have the freedom to plant crops considered profitable.

If the farmers breach the laws and use partially treated wastewater for irrigating restricted crops, the government will destroy their crops (Ministry of Health, 2015b). As a result, local farmers seek refuge by buying freshwater for irrigation rather than using inadequately treated wastewater, which places additional financial burdens on them. As one farmer said:

I have a well for the farms. I pay to the government. Every year, they (the government) harden the procedures. There is a gauge on the well. Every year, the government bring new gauges and we have to pay the price of the new ones. In this year, the licence of the well must be renewed yearly.

These financial losses cause social concerns and threats to farmers' livelihoods and their households (see section 4.2.3). It was clear during the interviews that there is a consensus between the farmers and the experts regarding the perception of the use of inadequately treated wastewater for irrigation and crop restrictions. As one expert mentioned:

The farmers who used to plant on the river banks became unable to grow crops that are usually eaten uncooked like lettuce, tomato, cucumber and others. If you ask any Jordanian about these vegetables, he says it is necessary to see them on the table every day. Because of that, they had to change the agricultural crops according to law that is the river's water became unsuitable for growing crops that are eaten uncooked. The law forces the farmers to grow crops, which are not eaten raw and fodder crops, and any outbreak for these laws, the Ministry of Health will destroy the planted crops on the river's water (see section 8.2.1.2.1).

It was also clear during the interviews that farmers' views were also supported by the residents, as illustrated by a resident who said:

There were farms of leafy vegetables, eggplants, lettuce and cabbage. They were using water from the river without any problems (restrictions). Now, it is not allowed for agriculture (leafy vegetables) to use this water in summer (irrigated agriculture) (see section 8.2.1.2.3).

The reason why farmers and residents agree on the crop restrictions issue is that residents may have worked in the past as farmers. They live in a rural area. As a result, it is reasonable to assume that they have opportunities to discuss their daily life issues. Farmers improve household revenue by producing perishable crops such as leafy vegetables for sale in domestic markets, as illustrated by Qadir et al. (2010).

10.2.1.1.3 *Reduced vegetable exports*

In Islamic laws, water is categorised into the three categories of *tahūr*⁴⁰, *tāhir*⁴¹, and *mutanajjis*⁴². The last two classes can be converted into *tahūr* water and, therefore, may be used for all ordinary as well as religious purposes if they are assimilated into the overall supply of *tahūr* water. This conversion would be legal from the

⁴⁰ *Tahūr* is pure and natural water that may be used for mundane and religious purposes without any treatment.

⁴¹ *Tahūr* water becomes *tāhir* after religious washing and may be used for mundane purposes without any treatment but cannot be utilised again for religious purposes.

⁴² The *tahūr* and *tāhir* categories of water are liable to become *mutanajjis* if they are defiled with contaminations such as urine, faeces, and blood, rendering them unfit for the religious and mundane washing. This last category of water may still be used for irrigation, etc., which involves no washing.

Islamic standpoint even without treating the water. To make use of innovative technology to recycle household and industrial wastewater after treatment, therefore, appears in keeping with the spirit and letter of the Islamic teachings (Farooq & Ansari, 1983).

Jordan agricultural exports depend on the Jordan River Valley as a primary source of agricultural production (see section 2.3). However, Mourad, Gaese, and Jabarin (2010) explain that, in 1992, Saudi Arabia banned Jordanian vegetable exports, citing biological contamination of products and the use of inadequately treated wastewater as its main reasons. In the discussion during the interviews with experts, it was revealed that pollution has an adverse effect on the reputation of Jordanian vegetables. As one expert mentioned:

Several years ago, a professor from the University of Jordan [has] submitted a research paper in a conference in Turkey mentioning that the crops of the Jordan River Valley are irrigated by treated wastewater. Officials in Arab Gulf Countries [have] heard this news and they stopped importation of vegetables from Jordan (see section 8.2.1.3.1).

This use of treated water means that consumers have increased health concerns, which in turn makes it hard to export vegetables. The interviewees recognised that they were still able to export, but also that with the increased pollution of the river, this trade has been curtailed, as illustrated by a farmer:

This river sufficed the Arab Gulf States in the seventies of vegetables and fruit. The river was less harmful than now. Now algae exist (see section 8.2.1.3.2).

As a result, farmers are obliged to sell their crops in the local market at lower prices. However, continuing to use inadequately treated wastewater for agricultural purposes means that there is a possibility that the problem over vegetable exportation may appear again (Mourad et al., 2010). It is clear that some local farmers have anxieties concerning the return of the prohibition, as the United Arab Emirates decided in 2017 to impose a ban on Jordanian fruit and vegetables due to the existence of industrial residues as a result of using chemicals and partially treated wastewater for agriculture (Gerasanews, 2017).

10.2.1.1.4 Reduced quality of farming soil

Using partially treated wastewater for irrigation causes a high level of salinity and high content of heavy metals in agricultural soil that cause reduced plant

productivity (Toze, 2006; Al-Zu'bi, 2007; Ammary, 2007; Carr, Nortcliff, & Potter, 2008; Schacht et al., 2011). A high level of salinity comes from the use of insufficient freshwater for leaching⁴³ the soil (Shahalam, Zahra, & Jaradat, 1998; Mohammad & Mazahreh, 2003; Jiménez, 2006; Giordano, 2009; Al-Hamaiedeh & Bino, 2010; Pedrero, Kalavrouziotis, Alarcón, Koukoulakis, & Asano, 2010). The interviews confirmed that farmers believed that the river waters are salty, as clarified by a farmer:

The river in summer gets dry and its water becomes very salty (see section 8.2.1.4.2).

This lack of freshwater is due to the unsustainable strategies which depend on augmenting water supplies applied by the government to meet the increasing demand for freshwater (see section 5.5.1). The prolonged use of saline and sodium-rich wastewater has the potential to cause soil sodicity⁴⁴ (Lal, 2009) and to damage the soil structure (Ghafoor et al., 2011).

It was clear during the interviews that experts supported the farmers' views. The experts believed that reduced quality of farming soil is due to the long-term accumulation of a high level of salinity and heavy metals. As one expert said:

I think that the quality of the soil was severely affected such as the high degree of salinity and the heavy metals contained in the soil (see section 8.2.1.4.1).

The increasing use of inadequately treated wastewater affects productivity, making the land unsuitable for long-term crop production.

10.2.1.2 *Impacts on economic sustainability of farming*

The effect of contaminated irrigation water in the Jordan River Valley encompasses the economic sustainability of agriculture. Two aspects are highlighted: reduced farming investment and giving up farming as an occupation.

10.2.1.2.1 *Reduced farming investments*

Administrative regulations and restrictions for using partially treated wastewater for irrigation purposes restrict farming alternatives. This restriction has led to a

⁴³ With reference to a soluble chemical or mineral drain away from soil by the action of percolating liquid, especially rainwater.

⁴⁴ Sodicity is a term given to the amount of sodium held in farming soil.

decrease in the number of farms in the Jordan River Valley, which reduces the agricultural significance of the valley (see section 2.3). Likewise, it was clear during the interviews that experts believed that pollution has played a dominant role in reduced reliance on agriculture as an investment, a view elucidated by an expert from the University of Jordan:

Irrigation water arrives (from the King Talal Dam) to irrigate plants (in the Jordan River Valley) through [a] drip irrigation system; [while] it (irrigation water) lacks a lot of oxygen, and it arrives [at] the root of the plant without oxygen; that in turn has led to the death of crops irrigated by this water (see section 8.2.2.1.1).

As noted by Hanjra et al. (2012), Jordan is no longer an agricultural community. Jordan has a high level of urbanisation at 70 per cent, and the agricultural contribution to Jordan's Gross National Product (GNP) is almost 7 per cent (Mohsen, 2007).

Similarly, it was clear during the interviews with farmers that experts' views were supported by farmers. Local farmers believed that reduced investment in agriculture is due to government's failure in treated wastewater management as an alternative source for irrigation, as clarified by a farmer:

It is possible to address the problem if the river gets rid of the wastewater. In addition, factories must be connected with the wastewater network. They (factories) must not discharge wastewater into the river. It has also to be monitored and the wastewater network has to be able to contain the wastewater. In western countries, vehicles can enter the wastewater network (this refers to the physical size of the scheme, pipes etc.). The country plays a role in this topic (the pollution). In the past, there were major springs, but the water authority of Jordan has drawn water to the regions where it wants (urban regions). This has caused the river to stop running in summer (see section 8.2.2.1.2).

The farmers interviewed referred to several procedures that contributed to wastewater mismanagement. The farmers believed that the government is responsible for poor wastewater governance.

Similarly, residents supported the farmers' views. The residents who were interviewed believed that pollution has affected the number of farms. According to one resident:

Its future (agriculture) is very bad and the number of farmers was more (the number of farmers was more in the past than it is now). Every

farmer is looking for his livelihood and his family. The number of farms has reduced. Most of the farming lands have become residential compounds (see section 8.2.2.1.3).

10.2.1.2.2 Giving up farming

The pollution in the Jordan River Valley is a major ecological problem (see section 2.3). It was clear during the interviews that experts believed that pollution has forced farmers to look for other sources of income. As one expert explained:

The restrictions imposed by the government, such as planting vegetables that are eaten cooked using wastewater and planting fruit trees and fodder crops only – of low profits – made the farmers leave farming activities (see section 8.2.2.2.1).

Qadir et al. (2010) contend that restrictions imposed on vegetables that are eaten uncooked and infringement penalties against crops irrigated by partially treated wastewater contribute to farmers' giving up agriculture. As a result, farmers claimed during the interviews that if they want to cope with this problem by using freshwater, they face the high costs of freshwater. As one farmer said:

We (farmers) have wells and pay [for] the government. Every year they complicate the procedures in addition to increased prices of production inputs (see section 8.2.2.2.2).

High freshwater prices decrease farmers' incomes, making agriculture less profitable. Small farmers, who cannot afford this additional financial burden, give up agriculture for other occupations in the industrial sectors (see section 4.2.3). As a result, the country has started to depend on the services sector rather than on agriculture (Bdour & Hadadin, 2005; Hanjra et al., 2012).

Similarly, during the interviews with residents, it was clear that they believed that contamination has made people shift from their authentic farming occupations to working in the industrial and military services sectors, as mentioned by a resident:

The number of farms has reduced. A little forward, you can find some farms but surely [they] have reduced compared to the past. Definitely, the number of farmers has reduced, and they [have] turned to other occupations (see section 8.2.2.2.3).

In 1990s, the public authorities introduced a system of restrictions on freshwater supply for irrigation in the Jordan River Valley, and these restrictions resulted in reduced production and vulnerability of crops during periods of drought. According

to Doppler, Salman, Al-Karablieh, and Wolff (2002) small farmers were also made to work in harsh conditions as a result.

10.2.1.2.3 Degraded quality of groundwater

On the basis of their Islamic culture, Jordanians have the right to obtain clean water from rivers and reservoirs (see section 7.5). The findings of this research from the secondary data demonstrate that the pollution in the Jordan River Valley affects the quality of groundwater, as illustrated by Al-Dhahir (2011):

The quality of surface water and groundwater has deteriorated because of depleting aquifers for agricultural and domestic purposes. The extracted amounts have exceeded the safe limits, which has resulted in reduced groundwater and increased salinity (see section 9.4.5).

The increasing salinity is the major reason for the poor quality of groundwater. This salinity is attributed primarily to the poor wastewater quality from the As-Samra WWTP, to over-exploitation of the aquifers, and to the agricultural activities within the region (Al-Kuisi et al., 2009; Al-Kuisi & Abdel-Fattah, 2010).

There is another explanation for why people in Jordan think that freshwater is available for all and why they believe that the government has to provide water for people without their being required to pay for it. It is seen as the responsibility of the government to punish the polluters and find accountability. As one interviewee said, “To address pollution, officials must fear Allah, perfect their jobs and work hard.” The interviewees believed that commitment to Islamic teachings is an essential part of the Muslim faith. Islam recommends implementing laws and sustaining water. Al-Tabarani (2010) mentions that the Prophet Muhammad said in the *hadith* ‘Allah loves people who try to do perfectly their works’. Consequently, reduced quality of groundwater is due to a lack of accountability.

10.2.1.3 Social impact

The results of contamination in the Jordan River Valley are not limited to immediate effects or to impacts on the economic sustainability of farming in the region. They extend to social impacts. The social results include the impacts on diet and on community breakdown. The effects of irrigation water pollution extend beyond the physical ailments affecting the livelihoods of farmers and the welfare of rural societies (see section 4.2.3). The impacts that can be seen on people’s diets and on the community are discussed next.

10.2.1.3.1 Impacts on diet

Limiting water pollutants is crucial because they find their way into the food chain through fruit and leafy vegetables. In addition, consumer attitudes toward purchasing fruit and vegetables change, as illustrated in the literature (Doppler et al., 2002; Keraita, Drechsel, Huibers, & Raschid-Sally, 2002; Jiménez, 2006; Hanjra et al., 2012). Qadir et al. (2010) explain that the Jordanian government takes action against pollution by prohibiting farmers from using partially treated wastewater to irrigate vegetables that are eaten uncooked. However, it was clear during the interviews with experts that the public demand for vegetables and fruit that are eaten raw is higher than the demand for other crops in Jordan. One expert said:

Most families highly depend on tomato and cucumber in their daily meals. It is hard not to use tomato as one of our Jordanian cuisine ingredients (see section 8.2.3.1.1).

Government procedures may contribute to reducing health problems from pollution on the one hand, but on the other hand, these procedures affect the farming community, as farmers are not allowed to plant vegetables that will be eaten raw, even though, as Carr et al. (2008) point out, these are highly preferred in the local market.

During the interviews, the experts' opinions were supported by those of farmers. The farmers confirmed that people do not buy vegetables grown and irrigated using partially treated wastewater. As one farmer said:

Most people do not buy [polluted produce] and prefer to know the source of irrigation water if it is freshwater or polluted. A person asks me to swear by Allah to tell him about the source of water if it is freshwater or the river (see section 8.2.3.1.2).

Similarly, residents support the farmers' views. The residents confirmed that consumers check the source of water to see if it is wastewater or freshwater. Because of the reduced availability of unpolluted produce, people's choice has also been reduced and, consequently, they are not having the same balance in their diet that they traditionally had. As one resident put it:

People currently, if they know the source of water, they do not buy. Currently, our neighbour says he has a well, but the well does not last for a long time, so definitely he irrigates using the river waters (see section 8.2.3.1.3).

10.2.1.3.2 Impacts on community breakdown

Some industries around the world dispose of their waste in rivers, lakes, ponds, and streams in an attempt to hide residues from environmental inspectors (Mohsen & Jaber, 2003). These water sources feed essential crops and food becomes polluted with a variety of chemicals and bacteria, causing epidemic health problems and leading to the breakdown of the stability of the society (EarthEclipse, 2017). Bdour and Hadadin (2005) state that laws, regulations, and restrictions for wastewater irrigation use restrict agriculture alternatives. It was clear during the interviews with residents that the scarcity of freshwater in the Jordan River Valley has led to a poor quality of life. As one resident explained:

Farming [as an] occupation is not being inherited because it is financially unrewarding. They (parents) try to direct their sons away from agriculture to military services (see section 8.2.3.2.1).

As a result, the total size of cultivated lands has reduced in the Jordan River Valley. Furthermore, the magnitude of the local labour force has diminished due to lower labour requirements in agriculture. In addition, impacts on the market supply of specific types of produce has led to reduced livelihoods from agriculture (Abu-Madi, 2004; Bdour & Hadadin, 2005; Hanjra et al., 2012).

Similarly, residents' viewpoints were supported by those of farmers. The farmers during the interviews revealed that they believed that contamination has worsened the situation in agriculture, so people have started changing agricultural occupations. One farmer said:

There is no future for agriculture. Now, it (agricultural land) has been sold and turned to commercial shops. Seventy-five per cent of it has gone (see section 8.2.3.2.2).

In the end, people find that they have no choice but to leave the region. In addition, the youth think that agriculture is no longer a rewarding occupation, an attitude which makes them move to less risky jobs such as jobs in the services sector.

10.2.2 Impacts of water pollution on the tourism sector

Undesirable effects of pollution in the Jordan River Valley have threatened several economic sectors. In addition to the agricultural sector, the tourism industry is one of the affected sectors. Tourism constitutes one of the main pillars of Jordan's economy and water pollution affects both religious and domestic tourism.

10.2.2.1 Impacts on religious tourism

The Jordan River Valley enjoys unique features. One of these features is the religious significance of the Jordan River to the three monotheistic religions: Judaism, Christianity, and Islam (see section 2.4). Most prophets such as Moses, Jesus, and Mohammad lived their entire or part of their lives in the Jordan River Valley. As a result, followers of the monotheistic religions have religious ties with the valley.

10.2.2.1.1 Reduced numbers of religious tourists

Religious tourism is one of the key pillars of the tourism industry in Jordan. The country receives local and international visitors who come to visit the country's sacred places, particularly the Baptism site and the shrines of the Prophet Muhammad's companions (Ministry of Tourism, 2018). However, the findings of this study highlight that religious actors emphasise that the number of religious tourists has reduced due to the pollution in the Jordan River Valley. As one religious actor said:

We (religious actors) also seek to encourage people to visit this sacred place so that everyone will know the real extent of care given to the river by the followers of the three monotheistic religions (see section 8.3.1.1.1).

Although the relative change in the number of international religious tourists during the years 2016, 2017, and 2018 demonstrated an increase (Ministry of Tourism, 2018), the religious actors during the interviews confirmed that local visitors have stopped visiting sacred sites. Information from the Ministry of Tourism (2018) shows the relative change in the number of local religious tourists during the same period, showing a decline in their numbers. This reduction may indicate that local tourists are aware of the pollution to a greater extent than international tourists are. According to one religious actor:

Not all those coming to the river, especially the Christians coming from outside Jordan, would expect the sacred river be extremely polluted

However, the interviews confirmed that religious actors have concerns about the number of tourists coming to the site in the future, irrespective of whether they are local or international tourists. As one religious actor said:

Moreover, the negative perception of a visit would be reported by a tourist to discourage his/her relatives and friends to visit [from visiting] the river. Despite the pollution, the river remains sacred; yet, pollution remains an impediment for more tourists to come over.

It was clear during the interviews with religious actors that the emitting of bad smells, the spread of harmful insects, and the change in the river's water colour to a dark colour make tourists reluctant to come to the area, as illustrated by a religious actor:

The pollution in the Jordan River Valley does not affect only Christian pilgrimage but also affects Muslim visitors to the shrines of Prophet Muhammad's companions. Many shrines that should be visited by Muslims from inside and outside Jordan exist there. Muslims need to visit these shrines to contemplate how much effort[s] [was] exerted by the companions to deliver Islam from Arabia to these far regions.

10.2.2.2 *Impacts on domestic tourism (entertainment tourism)*

Domestic tourism is also affected by the contamination in the Jordan River Valley (Toaimat, 2015). The Jordan and the Zarqa rivers receive all types of wastes including liquid and solid wastes (see section 8.5).

10.2.2.2.1 *Reduced numbers of domestic tourists*

The Zarqa River was a tourist destination in the past, but because of the pollution, it has become a landfill (Abu-Zaina, 2011). The Zarqa River is not listed on the domestic tourist destinations, so there is no official data related to the number of domestic tourists who visit it (Ministry of Tourism, 2018). During the interviews with residents, it was, however, clear that the Zarqa River suffers from a lack of domestic tourists compared to the past. As one resident mentioned:

There is no domestic tourism except small children. They go for hanging out (see section 8.3.2.1.1).

Data about the Jordan River and the Zarqa River are unavailable for people who want to visit the rivers. Chatel (2014) confirmed that data are also unavailable for stakeholders; consequently, decision making is adversely affected by this lack of information.

The interviews confirmed that the residents ascribed the reduced number of domestic tourists to the disappearing of fauna and flora and tourist services, as illustrated by a resident:

Tourism [has] reduced because there is nothing attractive. First, if there are clean pure water, vegetation, and good smells, people can come, bringing teapot and sit, breathing fresh air, but now where can we sit? Nothing, the situation is different and there are no[t] many parks, seats, and services around the river.

This situation means that the valley lacks essential services that are needed by visitors and to attract people from inside and outside of Jordan to visit the region. Al-Kheder, Haddad, Jaber, Al-Shawabkeh, and Fakhoury (2010) explain that tourism planning strategy has to focus on the discipline of regional tourism planning and tourism master plans, including environmental management of the place. The advantages of this work can be displayed in two ways: i.e., while better urban layouts and reduction in water contamination in the valley make the region appealing to tourism, tourism leads to domestic economic development and environmental enhancement.

10.2.3 Impacts of water pollution on physical health

The use of recycled wastewater for agricultural purposes constitutes an alternative resource for irrigation as it can be used in place of freshwater. Recycling also helps prevent watercourses pollution. Using treated effluent also reduces pressure on the environment by decreasing the use of groundwater. Nevertheless, some issues related to partially treated wastewater for irrigation need to be considered, including the existence of pathogens and industrial pollutants that affect physical human health (see section 4.2.1).

10.2.3.1 *Digestive system problems*

There are negative health and environmental threats from using inadequately treated wastewater for irrigation that need to be addressed. Pathogens (Tyagi, Kazmi, & Chopra, 2008), excess nutrients (Kalavrouziotis et al., 2015), saline salts, and heavy metals (Li, Wang, Allinson, Li, & Xiong, 2009) can adversely affect human health. During the interviews, farmers confirmed that the river water is risky. They explained that swimming in the polluted waters causes food poisoning in children as they inadvertently ingest the water from the river. Children are also at risk if they eat food without washing their hands. As one farmer mentioned:

The water may cause diseases, germs, harm[s] on humans like malaria, intestinal germ[s], dysentery, cholera, and children may be afflicted by diarrhea if they swim and drink from the river (see section 8.4.1.1).

Moreover, several studies (Pettersson, Ashbolt, & Sharma, 2001; Qadir et al., 2010; Becerra-Castro et al., 2015) confirm the interview findings that people believe that polluted river water causes chronic and fatal diseases. It was clear during the interviews that the farmers' opinions were supported by those of residents. As one resident said:

The river now is a landfill because of wastes and residues discharged in it. The polluted water causes cancers and several illnesses such as renal failure (see section 8.4.1.2).

The residents believed that eating fruit and vegetables polluted with partially treated wastewater was another source of threats to residents' digestive system, if the produce was not washed before eating it. This point is highlighted by one resident:

Our neighbour says, he has a well for irrigation, but the well does not last for a long time, so surely, he irrigates using the river waters. During my life, I did not know diseases. Now, spiral germ, colon diseases.

10.2.3.2 *Respiratory system problems*

Pharmaceuticals and personal care products are present in partially treated wastewater (Kim et al., 2014). One of the most prevalent symptoms that result from dealing with wastewater are those relating to the respiratory system (Laitinen et al., 1994). During the interviews, residents confirmed that bad smells from the river mean there is a high concentration of organic and industrial contaminants in the river water. This high concentration of pollutants comes from inadequate treatment of sewage water by wastewater treatment plants. As one resident said:

Now, the river has become a landfill for factories. Bad smells come from it. This surely affects health. There are many people [who] are very close to the river. They are like this tree. Definitely, the river has become a landfill, and the accumulated chemicals have harmful smells. Definitely, when the chemicals accumulate, the bad smells emit. It is known that stagnant water, which has domestic wastewater and industrial wastewater, is risky. Bad smells affect human health (see section 8.4.2.2).

There is a need in the Jordan River Valley for monitoring programmes to ensure the discontinuance of any violations against the regulations on groundwater and surface water resources protection, as highlighted by Ammary (2007). It was clear during the interviews that residents' opinions were supported by those of farmers. Farmers confirmed that the effect of pollution on the respiratory system is because of the lack of groundwater that feeds surface water, which, in turn, contributes to

increasing the level of chemicals and organic substances in the water, as elucidated by a farmer:

Emission of bad smells which are unbearable, especially in summer (this refers to dry riverbed due to lack of groundwater), causing difficulty breathing. Moreover, bad smells cause headaches (see section 8.4.2.1).

Wastewater comprises a considerable variety of organic compounds and some chemicals that emit bad smells. Many of these materials are resistant to traditional wastewater treatment and may persist in the environment for a long time, which reflects the inability of wastewater treatment plants to adequately treat wastewater as cautioned by Jiménez (2006).

10.2.3.3 *Skin problems*

A study in Vietnam (Trang et al., 2007) shows that exposure to inadequately treated wastewater is a major hazard factor for skin ailments among farmers. Dealing with wastewater by farmers causes dermatitis, for instance, eczema. The findings of this study show that farmers confirmed that using partially treated wastewater for irrigation causes skin problems for those who make direct contact with partially treated wastewater. Skin may become red, swollen, and sore, sometimes with small blisters. These symptoms come from either direct contact with an irritant chemical substance or from an external agent such as mosquitoes or an allergic reaction to their bites. One farmer illustrated this point:

There is the diffusion of the mosquitoes that increase intensively in summer due to the swamps made of wastewater in the river stream. These insects bite inhabitants and cause skin problems and itching (see section 8.4.3.1).

Ijumba, Mosha, and Lindsay (2002) indicate that using partially treated sewage water for irrigation purposes increases the numbers of harmful insects such as mosquitoes which cause skin problems for farmers and residents. Here, the discussions with residents supported the opinions of the farmers regarding the effect of mosquitoes breeding in polluted waters. As one resident said:

The diffusion of mosquitoes and flies is heavy, especially in summer, causing problems. Large-sized mosquitoes bite [which] causes itching (see section 8.4.3.2).

On the other hand, the problems caused by chemical pollutants go beyond skin and nail problems, especially in those countries where industrial development has begun and where untreated industrial wastewater enters the household sewage system and natural watercourses, an outcome which reflects mismanagement of wastewater, as emphasised by Van-der-Hoek, Anh, Cam, Vicheth, and Dalsgaard (2005).

10.2.4 Impacts of water pollution on emotional relationships

The international law principles are in agreement with Islam because they are based on worldwide values (Faruqui et al., 2001). Amery (2001) explains the reward and penalty principle is designed to induce far more righteous deeds than bad ones. For instance, a 'bad deed' counts as one 'against' an individual who is rewarded 10 times to 700 times for each good deed (Al-Bukhari, 1978). Nonbelievers are described as having profitlessly 'bartered guidance for fault' and thus having 'lost true direction' (Mjah, 2000). As a result, only by 'living' or applying the teachings of Islam, those that comprise its ecological ethic, can people expect replenishment of their shrinking water supplies. This idea perhaps clarifies why, when struck by a natural (or human-induced) disaster, many Muslims commonly attribute it to impiety at the individual or societal levels (Amery & Haddad, 2016).

Islam places robust emphasis on the achievement of perfect harmony between physical and spiritual purification. Physical purification cannot be accomplished except by bathing and ablution, which both require clean freshwater. Therefore, purity and cleanliness of water receive a considerable amount of attention in both The Quran and the *Sunnah* and Muslims are urged not to contaminate water. The Messenger of Allah prohibited people from urinating in stagnant water: 'Let no one of you bathe in stagnant water to remove the state of ceremonial impurity' (Mjah, 2000), and 'Guard against the three practices which invite people's curses: evacuating one's bowels near water sources, by the roadside and in the shade' (Bin-Ashath, 2008). A clean environment performs a fundamental function in developing the lives of individuals. Contamination of the environment can lead to negative feelings such as anger, anxiety, sadness, regret, guilt, shock, and loss (Crom & Oberholzer, 2012). Emotions are categorised into two groups: ethics-based emotions and consequence-based emotions (Xie, Wang, Zhang, Li, & Yu, 2011).

10.2.4.1 Ethics-based emotions

Pollution harmfully affects the quality of life of individuals and so affects their lifestyle (Crom & Oberholzer, 2012). Ethics-based emotions such as annoyance, tension, and anger emerge from environmental contamination (Böhm, 2003; Xie et al., 2011). Ecological corruption such as water and air contamination aggravate ethics-based feelings (Crom & Oberholzer, 2012). During the interviews, it became clear that residents confirmed that contamination causes a reaction of anger, shock, or annoyance. One resident showed his anger about the loss of tasty vegetables, which had been available before the problem of pollution. His anger was clear through his body language and the tone of his voice during the interview.

Tomato and cucumber were tasty in the past. Now, they are tasteless. We used to eat red carrot but now it is tasteless. Parsley is tasteless (see section 8.5.1.2).

People demand that the government finds solutions to keep the water clean, yet there is no response from the responsible ministries such as the Ministry of Water and Irrigation and the Ministry of Environment. The government's lack of response suggests that the people are marginalised and have no voice, a point supported by some authors (e.g., Nancarrow, Leviston, Po, Porter, & Tucker, 2008; Wester et al., 2015).

The discussions with interviewees confirmed that residents and farmers were in agreement concerning this issue. One farmer said:

It is something unbearable when talking with family and friends about the problem of the Zarqa River and the promises of governments to solve the problem radically, but all these continuous promises turned false promises (see section 8.5.1.1).

10.2.4.2 Consequence-based emotions

The results of environmental pollution are not limited to ethics-based emotions but also include loss-based emotions, as illustrated by Czap, Czap, Khachaturyan, Burbach, and Lynne (2011). These feelings include anxiety, sadness, regret, guilt, shock, depression, and loss. During the interviews, it was clear that representatives from NGOs expressed emotions such as unhappiness, pity, hopelessness, and gloom. According to an NGO representative:

When NGOs expect a lot from the government and we (NGOs) do not see any promises achieved, which means more losses (environmental

losses) are going to incur, it turns into an unfortunate and sad case (see section 8.5.2.1).

Religious actors shared similar viewpoints about losing the Jordan River as a natural resource due to the pollution. Like the NGO representatives, they expressed their feelings at losing a significant natural asset because of the failure of repeated appeals to government to rehabilitate the Jordan River Valley. As one religious actor said:

I can say that having the river in this state of pollution is a big loss; however, it does not preclude being considered a sacred place. Really, I am completely sad to see the holy river in this situation (see section 8.5.2.2).

Comair, Gupta, Ingenloff, Shin, and McKinney (2013) explain that riparians⁴⁵ of the Jordan River cannot achieve their own needs from the waters of the river and its tributaries without hurting their feelings due to the receding quantity and quality of the water supply. The basin is confronting an issue of continuous mismanagement of its water resources (quantity and quality), a problem similar to that being faced in various other parts of the world today (Biswas, 2010). How bad is the situation of the Jordan River? Hillel (1994, p. 155) answers this question, saying,

After traversing the Sea of Galilee (known as Lake Kinneret in Israel), the river twists its way in an incredibly sinuous manner through the grey chalky marls of the lower valley. Squirring madly as if trying to escape its fate, the Jordan finally completes the journey from its cool-crystal clear origin to its literally bitter end, where it dies a tired death in the warm, murky brine of the Dead Sea.

Similarly, Havrelock describes the significant loss of the river, saying:

While a diminished, torpid river (the lower portion of which carries wastewater, agricultural runoff and saline waters) presents a disappointment, most tourists are unaware of the Jordan's ecologic status and the imminent danger of its disappearance (2011, p. 283).

Another explanation is that the people of Jordan feel that they have lost a valued gift from Allah and so they are unhappy, a view that is supported by an NGO representative,

Now you see just the destruction that the humankind caused against their natural heritage. Because of that destruction, I feel very sorry and

⁴⁵ Of, relating to, or situated on the banks of a river.

sad for what the man did with what Allah has given him; it is water, which is one of the rarest natural resources in Jordan.

10.2.5 Impacts of water pollution on spiritual relationships

In addition to the emotional relationship, the spiritual relationship is affected by the pollution in the Jordan River Valley. Islam cares for water conservation (see section 6.3), as do others: “The more deeply I search for the roots of the global environmental crisis, the more I’m convinced that it is the outer manifestation of an inner crisis that is, for the lack of a better word, spiritual” (Gore, 1992, p. 98).

10.2.5.1 *Reduced practice of religious rites*

There is a spiritual link between the Jordan River Valley and the followers of the three divine religions (see section 2.4). It is understood that this relationship has to be an incentive to protect the Jordan River Valley. However, during the interviews, it was clear that religious actors believed that pollution affects religious rites. Some of them do not use the water directly. As one religious actor said:

The practice of religious rites is adversely affected by the pollution of the river. To clarify this point, what usually happens is that Christian people practise their religious rituals by taking some water from the river to be used as filtered water in [a] baptism ceremony. This means that they do not immerse themselves in the river as happened with Jesus (see section 8.6.1.2).

Similarly, during the interviews with residents, they confirmed that the changing aspects of the river waters affect religious rites. As one resident questioned:

Do you expect from people to come to water with this colour and smell?
Of course, not. The water is not used for drinking, ablution or bathing (see section 8.6.1.3).

It was clear during the interviews that residents’ opinions were supported by those of farmers. They confirmed that the river water is unsuitable for religious rites, as one farmer illustrated:

If you want to swim in the river and then need to pray, you must have a bath, since this water is unclean for ablution before the prayers. I seek refuge in Allah (see section 8.6.1.1).

The contamination which has resulted from partially reclaimed wastewater causes psychological aversion, which, as Abu-Madi (2004) notes, can be a result of health concerns, religious beliefs, and cultural values.

A further explanation is that polluted water is abhorred. This abhorrence means that for religious reasons the residents are advised not to approach or touch polluted water. The residents during the interviews confirmed that polluted water could not be used for ablution before prayers. This point was demonstrated by one resident:

This water is not used for drinking, ablution, or bathing.

Mara and Cairncross (1989) demonstrate that in Islamic societies, direct contact with excreta discharged from the body, especially faeces and urine, is prohibited, since by The Quran edict, these are regarded as containing impurities. To be accepted in Islam, wastewater must be adequately treated and converted so that it has no visual or odorous connection with the original material. The impact of religion on the feasibility of reuse in Islamic communities is often cited as an example of sociocultural factors that limit the use of treated effluent, as illustrated by Khouri, Kalbermatten, and Bartone (1994).

10.2.5.2 *Insulting spiritual relationships*

Rivers brim with historical and metaphorical power (Peppard, 2013). To name particular iconic rivers, the Colorado, the Yamuna and Ganga, the Nile, and the Jordan, is to recall strong symbolic associations of power and turbidity of flow (Peppard, 2013). Such evocations are based on cultural memory and, in some cases, religious texts and value regimes. However, in the early 21st century, religious and cultural narratives have become slowly disassembled from the environmental actuality of riparian regimes (Peppard, 2013).

In the discussions with interviewees it emerged that the religious actors believed that polluters do not respect the spiritual feelings of people who believe in the religious significance of the valley, a view supported by Shrestha (2017). It became clear during the interviews that water in general and the Jordan River in particular are not seen as just a private physical good, but are of and public spiritual interest. As one religious actor said:

The Christians are undoubtedly affected by the contamination of water, which should never be neglected and polluted despite its holiness (see section 8.6.2.1).

During the interviews, it was clear that the interviewees felt shy to talk about pollution. Some of them talked angrily because of the feeling of insult. One religious actor said:

Some visitors refuse even to touch the water after watching the extent of pollution and the murky smelly water.

Chryssavgis (2014) confirms that water symbolises the origin of life and the calling to acknowledge a spiritual existence which affects our physical presence. Surface water, in the form of rivers and lakes, can never be considered or treated as private assets or become the means and end of individual interest. Apathy towards the spirituality of water forms both an ingratitude against Allah, the Creator, and a crime against humankind (Chryssavgis, 2014). To persist in the present path of environmental destruction is not only irrational, but also a sin, which shows disdain and ingratitude towards Allah and creation (Chryssavgis, 2014).

10.3 Institutional Determinants

Now that research question 1 has been answered through an examination of the impacts of pollution on physical, emotional and spiritual well-being, the second research question will be addressed. The following section provides stakeholders' perspectives of the institutional determinants of pollution in the Jordan River Valley by, first, focusing on institutional policies (see section 10.3.1) and then on water management (see section 10.3.2).

10.3.1 Impacts of water pollution on institutional policies

People believe that enforcing the law is the responsibility of governments, as they are responsible for securing basic needs such as clean water for their people (Abderrahman, 2001). The *hadith* narrated by Abdullah bin Omar says:

I heard Allah's Apostle saying, all of you are guardians and responsible for your wards and the things under your care. The Imam (that is, ruler) is the guardian of his subjects and responsible for them and a man is the guardian of his family and is responsible for them. (Al-Bukhari, 1978)

Al-Jayyousi (2001) illustrates that Islamic law is applied either directly by supervised application or by judicial remedy. Consequently, waters that fall under the general category of public ownership are directly controlled by the government and all provisions relating to them are applied by government officials. The penalty for contravening these provisions is through either a prison term or a fine – but more

frequently through a fine. Governments are careless in terms of the enforcement of the laws. As a result, pollution persists for a long time.

Institutional policies are one of the factors affecting the pollution in the Jordan River Valley. They represent the commitment of institutions to the laws, standards, and other policy mechanisms concerning environmental issues. These issues generally include water and air pollution, ecosystem management, waste management, sustaining biodiversity, and the protection of natural resources, wildlife and threatened species. Jordan has enacted environmental laws and regulations (see section 5.3) in support of sustainability, including the Law for Environmental Protection in 2006 (Alqadi & Kumar, 2014; Ministry of Environment, 2006). Jordan is, therefore, now faced with difficulties related to the enforcement of the legislation, particularly Jordanian Standard No. 202/1991 Treated Industrial Wastewater, Jordanian Standard No. 893/1995 Treated Domestic Wastewater, and Jordanian Standard No. 1145/1996 Reuse of Treated Wastewater (Saed, 2006; Madmoun, 2011; Jordan Television, 2018).

10.3.1.1 Lack of environmental legislation enforcement

It is not only required to develop laws and regulations to support sustainability development that matters; the actual enforcement of these statutes (Jordan Television, 2011; Al-Hamad, 2014) should be accorded equal importance (Saed, 2006). However, during the interviews, farmers confirmed that government officials turn a blind eye to some people; as one farmer said:

Laws exist, but the implementation is limited unless there is a complaint. If there is a complaint, inspectors come. Implementation is only on the poor (see section 8.7.1.1).

Participants in this study emphasise the necessity of seeing the laws enforced on the ground. It became clear during the interviews that farmers confirmed that failure to do so is due to the nepotism that has led to the absence of governmental follow-up against offending activities and the achievement of accountability. As one farmer mentioned:

The more considerable evidence is a yeast factory. Nobody (a government official) can approach (punish) it or remove it. This [is] because there are powerful people (nepotism) and when you (a citizen) make a complaint, they (the government) need a month to inspect (without taking action).

Similarly, during the interviews, farmers' opinions were supported by those of residents. They agreed that the government does not implement actual monitoring schemes on activities that violate or do not strictly follow the environmental laws. This situation arises because some people have more power than the government has.

The lack of government commitment to the enforcement of environmental laws and the absence of political will to solve the problem are the reasons for the ongoing pollution in the Jordan River Valley, a point also made by Abboud (2010). This finding is consistent with several other studies that indicate that water sector management in the Jordan River Valley lacks sufficient power to enforce the legislation (Caponera, 2001; Hagan, 2008; Van-Aken et al., 2009; Qadir et al., 2010; Mustafa, Altz-Stamm, & Scott 2016).

Another interpretation is that the interviewees believed that the implementation of environmental laws is part of the governmental duties towards the environment and its natural resources. During the interviews, the farmers confirmed that Islam recommends that people do their works perfectly and are committed to instructions; as one farmer mentioned:

Everybody wants to corrupt, there is no fear of Allah, so everything has finished. If we want the interest of people, we have to work for people.

Similarly, during the interviews, the discussions with residents revealed that residents believed that accountability is part of Islamic teachings. One resident said:

I hope that people who are responsible for the environment [to be to] bear their duties [in] honest[ly]. They have to fear Allah because we [are] all going to be accounted for by Allah. The closer to Allah is not who has more worship but [been] the more beneficial to the people (see section 8.7.1.2).

10.3.1.2 *Nepotism (wasta)*

As already noted, the pollution in the Jordan River Valley leads to several dangers such as health and economic risks (Carr et al., 2011). Public authorities often do not have either enough knowledge of the technical and management options available for reducing environmental hazards or the capacity to enforce laws (Qadir et al., 2010; Mustafa et al., 2016). During the interviews with farmers, they confirmed that nepotism has dominated the Jordanian community, with farmers claiming that

nepotism is the reason for the lack of implementation of laws. One farmer commented:

Factories have caused pollution because of lack of implementation of laws, inspections on us and on the poor because we are not powerful people (do not have connection), inspections on the poor class of the community (see section 8.7.2.1).

Similarly, during the interviews, farmers' viewpoints were supported by the residents' perspectives. The residents confirmed that nepotism in the Jordanian community has led to a lack of implementation of regulations, as illustrated in the comment of one resident:

The government has failed in facing the factories. There are no deterrent laws. If the law does not apply, what is the purpose of it? There is no deter on all people especially [those] who ha[ve] nepotism (see section 8.7.2.2).

This finding is in line with the studies of Sidani and Thornberry (2013) and Mustafa et al. (2016) that indicate there are elites in the water sector who have more power than the government officials. As a result, they can violate the laws without facing any kind of accountability. It is clear that nepotism leads to employing unskillful officials, who, because they rest on the powerful status of their families in the country, are unable and unwilling to enforce the laws (see sections 5.6.1 and 7.5).

The pollution in the Jordan River Valley will continue unless nepotism is ended. A possible explanation for this finding is that government apathy may lead to the lack of governmental accountability. Most laws are not implemented by the minor officials or elected representatives unless they are pushed to enforce them by senior state officials. This situation, eventually, exacerbates nepotism. This lack of accountability is due to the inability in the administrative system of the government, which enables people, who have power, to connect with the decision makers to overcome all laws (see section 5.6.2).

10.3.1.3 *Lack of political will*

The findings of this research from the secondary data demonstrate that pollution in the Jordan River Valley reveal a lack of political will on the part of the government (see section 5.6.2). As a result, the public are marginalised and their voice is not heard, as illustrated by Shoshan (2016) who writes:

The river was clean at the time of previous governments, but the river now is polluted because there is nobody (of governmental authorities responsible) to take care of us (see section 9.6.3)

Residents require the public authorities to take care of them and to find solutions, but they get no response from these bodies. As Wester et al. (2015) point out, this lack of response from the public agencies makes the inhabitants feel that they are neglected.

10.3.1.4 *Standard 893/2006*

According to Shuval et al. (1985), 80 per cent of the towns in developing countries are allowed to use partially treated effluent for unregulated irrigation of vegetables. The weak regulatory and enforcement process in the Middle East and the North African region exacerbates the environmental contamination effects, as demonstrated by Abu-Madi (2004). During the interviews, the government confirmed that there is a standard related to the discharge of domestic wastewater. As one government official said:

There is the Jordanian Standard number 893 of 2006, which controls the characteristics of the domestic wastewater emerging from treatment plants into the *Wadies* (see section 8.7.3.1.1).

However, it became clear that there is a lack of implementation of these standards and regulations, a situation which exacerbates the environmental problems in the region (Aukour & Al-Qinna, 2008). Although the region has made advances by establishing public authorities responsible for the environment, and by issuing environmental standards, the institutions are underfunded and lack credibility and political will (Abu-Madi, 2004). Cross-sectoral linkages between government and public institutions are inconsistent. The statutory framework depends too much on a command-and-control approach and their productiveness is further endangered by weak monitoring and enforcement (Aukour & Al-Qinna, 2008). Thus, if there is no pressure and follow-up from the senior employees, minor ones will not enforce the instructions. In addition, the role of the public in environmental management remains limited. Participatory action from stakeholders is needed in order for people to commit to the regulations and help the government to enforce the laws.

10.3.1.5 *Modification of the standards*

More conservative and stringent standards are frequently adopted without proper study of a site and of locally specific conditions, as demonstrated by Abu-Madi (2004). Consequently, in Jordan, there is a considerable need for quality regulations and standards with minimal quality restrictions that can, in effect, enhance reuse of treated wastewater. At the same time, these need to be compatible with local conditions without threatening human health (see section 5.3.1).

Recycling wastewater is a significant element of water resources management in Jordan where the supply of water is scarce and the demand is rapidly growing, as shown by Nazzal et al. (2000). However, wastewater reclamation poses some dangers to human health, agriculture, and the environment and it is perceived adversely by the community. A prerequisite to the productive management of the reused effluent and the improvement of public confidence is the creation of a practical framework of laws and regulations that help ensure human health and decrease negative environmental consequences (see Table 5-2). The legal framework also has to be flexible enough to adjust to domestic conditions and the economic fundamentals of the situation. Standards for treated wastewater reuse must also be able to adapt to changing physical, economic, social, and ecological conditions, as explained by Abu-Rizaiza (1999) and Nazzal et al. (2000).

The discussions with the government officials revealed that there was a modification of the standards for discharge and treatment of wastewater. As one government official said:

Proceeding from here, it has become vital to develop the environmental standards in light of the evolution of the knowledge due to the evolution of the technical information. For example, it was frequently said that there is a risk of a certain element in the treated wastewater, but modern scientific research proves the accuracy of this piece of information or the opposite happens. Based on this information, the environmental standards should be reformulated in order to develop the treatment plants (see section 8.7.4.1.1).

However, it became clear from the interviews that, although there was a modification of the standards, pollution resulting from using inadequately treated wastewater for irrigation still exists due to the unsuitability of the standards for the Jordanian context. During the interviews with the government officials, the

discussions exposed that the Jordanian standards are not consistent with the Jordanian context; as one government official mentioned:

I feel that despite their relative effectiveness, the Jordanian standard specifications suffer from specific problems. There are some specifications that are really exaggerated; for instance, they are based on rigorous technical specifications. They are too strict. I am with intensive specifications but not to the limit that prevents me from using treated wastewater in areas such as agriculture. Proceeding from this, the specifications must be reasonable and viable.

Angelakis, Do Monte, Bontoux, and Asano (1999) elucidate that the considerable number of components in treated effluent need monitoring and regulation of its use for the intended application. However, concern for human health has dominated most of the development of quality standards and guidelines in the 20th century. In 1973, the World Health Organisation (WHO) suggested strict guidelines. These guidelines were based on the notion of ‘zero risk’, which, however, would compel most emerging countries to employ extensive and expensive treatments which would be out of their reach. Abu-Madi (2004) highlights that many countries around the world copied the WHO standards. Jordan is one of them. However, few countries could, in practice, satisfy these their high technological standards and managerial requirements; nor could they afford the expense involved, especially for upgrading wastewater treatment plants.

10.3.2 Water management

In Islam, The Quran suggests that decisions have to be made by a person who is qualified and has enough and accurate information to make them. Otherwise, the decision will be irrational, and the decision maker will be blamed (The Quran, 27: 20-37). The Quran also highlights that decision making must be proceeded by data collection (The Quran, 6:49).

A broad variety of forces, however, is driving a shift away from the augmentation of new water resources. Most important is the improved understanding of the true economic, social, and environmental costs for that augmented water supply. As a result, water decision makers worldwide are on the verge of a central change in thinking about the water – a change from a concentration on the new water supply to a focus on assessing how best to satisfy human needs (Berger et al., 2014).

Water accounting is the basis of effective water management (Escriva-Bou et al., 2016). It includes means, tools, and practices to evaluate the capacities of water available and used throughout a water system. Water accounting is critical to water management at all levels, from large river basins to local irrigation districts or municipal water utilities (Escriva-Bou et al., 2016). Although some formulas for water measurement and tracking have long traditions, the use of the term ‘water accounting’ is relatively new. It mirrors recent efforts in Australia and internationally to draw parallels to financial accounting and to develop comparable standards for tracking water (Vardon, Lenzen, Peevor, & Creaser, 2007; Escriva-Bou et al., 2016).

10.3.2.1 Absence of a sophisticated water accounting system

With growing competition for limited and frequently scarce water resources, there are strong demands to obtain the best use from water. An increasing population and growing urbanisation mean increased water demand (Perry, 2011). The discussions with the water industry actors revealed that they agreed that Jordan has no advanced water accounting system (see section 8.4). However, while the Jordanian water authorities do provide limited information in the form of annual reports (Water Authority of Jordan, 2017), there is insufficient data on which to make rational decisions, a point demonstrated by one water industry actor:

In general, there are no plans in this area (water accounting), and this term is unknown in the water sector (see section 8.8.1.1.1).

Faruqui et al. (2001) stress that controlling side effects related to extractions, consumption, changes in water quality and quantity and so forth requires very sophisticated legal and monitoring systems that do not yet exist in the Middle East and North African countries and it became clear during the interviews that inconsistent application of regulations by governments has played a pivotal role in preventing Jordan from adopting or designing a sophisticated water accounting programme. As one water industry actor said:

I tried to amend the law of Water Authority of Jordan and to enter the principle of ‘polluter pays’, but as you know, the parliament and the government are ignorant. I could not enact the law. I left the government and got bored because all my efforts to make a change against corruption were fruitless... There is no more significant role of the local communities in taking care and control of the lost amount of water in their regions.

Abu-Madi (2004) emphasises this finding, saying that the poor regulatory and implementation mechanisms in the Middle East and North African countries worsen the water scarcity. Although the area has made advancement by forming ministries of the environment and by preparing and enacting environmental regulations, the government institutions are underfunded and lack integrity and political power.

10.3.2.2 *Lack of public awareness*

In addition to mosques, all levels of formal and informal education are necessary to raise public awareness (see section 5.5). The topic of water scarcity and the need for effective water resources management can be addressed in the course of teaching subjects such as religion, Arabic, science and geography, as elucidated by Atallah, Khan, and Malkawi (2001). During the interviews, the discussions with water industry actors revealed that water accounting is unknown at the level of both government and the public. As one water industry actor said:

If this programme (water accounting) is presented to the parliament, what do you think the response is? Rejection because they are all ignorant. This, what you are talking about (water accounting), if you tell the Council of Ministers, they will say this is a magician! We do not know what he is talking about; this is magic! I seek refuge in Allah from the cursed Satan (see section 8.8.2.1.1).

It became clear from the interviews that Jordanian curricula lack water management as a part of sustainability education. As one water industry actor mentioned:

Now, I have been working on this topic, taking advantage of students like you to spread awareness. Every day, students, Arabs and foreigners, come to my house. My house is open to all people.

Atallah et al. (2001) suggest upgrading curricula in the Middle East in the subjects mentioned to include sustainability education which should address all the priority issues including water management. Improving sustainability education enhances environmental awareness, which creates generations interested in environment-related issues and disciplines, as shown by Al-Akra, Ali, and Marashdeh (2009) and Belal, Cooper, and Roberts (2013).

10.3.2.3 *Lack of expertise*

The theory and practice of the management of natural resources has changed (Faruqui et al., 2001). In research centres, academics have started to analyse natural

resources from multidisciplinary perspectives. Resource managers are being urged to take into consideration the concerns of the full range of stakeholders. Decision makers have recognised the importance of bringing overseas expertise and institutions into the domestic arena (Faruqui et al., 2001).

Jordan has statistics about inflows and outflows of water. Data are produced by the Water Authority of Jordan and the Jordan Valley Authority (see section 5.4.1). However, during the interviews, the discussions revealed that water industry actors believed that there are no specialists to design a sophisticated water accounting system in Jordan. According to one water industry actor:

There is a lack of application tools. Namely, if the Ministry of Water and Irrigation knows about the subject (water accounting) and wants to apply the programme, how to use it? We need tools. How is the programme going to be implemented? How to enter the data and get the information? I mean how to apply the programme on the ground (see section 8.8.2.2.1).

It became clear from the interviews that there is no one body responsible for managing and preserving water resources; as one water industry actor said:

Now, we are in Jordan working on this topic (water accounting). We are not advanced in this topic... we have three companies (private distribution companies) responsible for water in Jordan: Jordan Water Company – Miyahuna, Al-Yarmouk Company, Aqaba Company in addition to the Ministry of Water and Irrigation.

Caponera (2001) explains that the Middle East countries suffer from inconsistent water management and inefficient water institutions. In Jordan, the Ministry of Water and Irrigation and its affiliated authorities (see section 5.2), the Ministry of Environment, the Ministry of Agriculture, the Ministry of Municipalities, and the Ministry of Health and Healthcare are all responsible for water resources pollution and management.

10.3.2.4 *Inconsistent application by governments*

There is little evidence to demonstrate that present institutional arrangements for management of water resources have been adequately able to treat issues of water-scarce regions. Managing a water-scarce region requires systems analysis, dealing with the region as a complex sociocultural-political-natural resource system. In addition, understanding how a change in water and land use in one part of the area

affects others in the area and involving different groups of users in informed decision-making processes is illustrated by Falkenmark and Molden (2008).

During the interviews, the water industry actors confirmed that Jordan needs a consistent application of laws; as one water industry actor stated:

We are not Australia or America. Therefore, it is not easy to let private firms audit the business of the public sector. We (Jordanians) are a tribal community; we need to breach the law. We have distribution (of water) according to the tribal base. Sometimes we need to violate the law; thus, we do not apply the regulations 100 per cent (see section 8.8.2.3.1).

Caponera (2001) shows that in the Middle East countries' fragmented water laws and ineffective water organisations have been responsible for the poor governance of water resources, because thorough legislation and actual authorities to force the regulations are lacking. It was clear during the interviews that this situation is due to the water authorities' being governed by nepotism, which results in selectivity in enforcing the laws (see section 5.5.3). The water industry actors confirmed that nepotism is the reason for the selective application of laws, as demonstrated by one water industry actor:

There are [a] lack of management, lobbying. They do not let a person work properly. In addition, nepotism to keep their positions.

As explained by Faruqi et al. (2001), the rich are liable to have an extreme effect on government policies. Large farmers, in particular, as well as the upper class in urban regions, tend to have very robust lobbies for their interests (see section 2.2).

Signori and Bodino (2013) state that as water is public property everybody shares its use, hazard, right, and responsibility. A complex combination of social, political, environmental, and religious values is involved and strong stakeholder management is central to encounter these issues. Engaging with stakeholders can, in fact, be a robust way of understanding primary water-related issues from various viewpoints. There must, however, be a will coming from the top management not only to dialogue with stakeholders, but also to respond to their concerns and to find, where possible, a shared ground. This type of helpful exchange of information and rational water decision making is supported by Rached and Brooks (2010) and Hübschen (2011).

10.3.2.5 *Sustainability of farming activities*

The concentration of water planning and management is slowly moving from the development of water-supply schemes to more integrated analysis of how humans use water. Through better understanding of water needs, progress in the overall productivity of human activities can be identified and completed and so will lessen water use and the adverse implications of that usage (Molden, 2013). There is mounting evidence and experience that show how progress in water-use efficiency can offer the fastest and cleanest sources of new supply by decreasing overall demands for water in every sector, especially the agricultural sector as it is the largest water-consuming sector (see section 5.5.2). A far more important determinant of water use is the level to which nations use their water resources for the production of food, especially irrigated farming, as shown by Parkes et al. (2010).

The interviews confirmed that a sophisticated water accounting system may help sustain farming activities. As one interviewee from water industry mentioned:

This (water accounting) leads to sustaining agricultural activities. This sustainability means maintaining jobs and introducing jobs that need high training. As a result, the export market becomes more open for farming products that adopt principles and standards of sustainability (see section 8.8.3.1.1).

Livestock water accounting helps improve water productivity, sustainability, and reduces environmental impact, as Sonder et al. (2003) suggested.

Moreover, it became clear during the discussion with the interviewees that water accounting improves the productivity of water use for crop farming. As one water industry actor said:

You (after using water accounting) are going to make the quantity and quality of the industrial wastewater meet the standards. As a result, this will increase the amount of water (irrigation water) available for farmers. This means that you provide them with free alternative water resources for agriculture. As a result, production inputs are going to be cheaper, which reflects on increasing production and decreasing the cost.

Perry (2011) suggests applying water accounting to improve irrigation water productivity. On the other hand, water accounting in the form of data is required by the managers of the irrigation systems to facilitate the management, operation, and

maintenance of the farming water system (Burton & Molden, 2005). It was clear during the interviews with water industry actors that improved water productivity results in saving water, which may lead to increasing farmers' incomes. As a result, water accounting is a prerequisite for the concerted efforts of water resource agencies and agricultural guidance services working in close cooperation with irrigation water users to reduce total evapotranspiration and nonrecoverable seepage to maintain or improve farmer incomes (Foster & Perry, 2010; Perry, 2011; Karimi et al., 2012).

10.3.2.6 *Improving public health conditions*

Water is an essential requirement for health. It is needed to maintain physiological functioning, to grow and cook food, and to maintain personal and domestic hygiene (Pruss-Ustun, 2008). The lack of access to water for household use is clearly linked to disease, both directly (e.g., poor domestic water supply) and indirectly (e.g., poor nutrition resulting from lack of access to water for irrigation) (see section 4.2.1). The effective use of water in activities that promote good health and are protective against diseases is, therefore, essential to the improvement of public health (Howard & Obika, 2004).

During the interviews with participants from the water industry sector, they confirmed that applying a sophisticated water accounting system may provide information on which decisions on ways to improve public health conditions can be made; as one interviewee said:

Farmers take clean irrigation water; as a result, the agricultural produce is polluter-free produce. We may reach a level of very organic produce if we go further in this programme (see section 8.8.3.2.1).

It was clear during the interviews that the programme will reduce diseases that result from polluted water, enhance social well-being, and force the economic sectors to abide by the environmental regulations. As one interviewee said:

The impact on health is considerable because reduced use of chemicals and pollutants. This positively reflects on humans, animals, sheep and poultry. This is the meaning of sustainability; everything is being improved.

Overall, the interviews confirmed that water accounting programmes would help in making rational water decisions. These will reduce externalities that result from using water in production processes. As one water industry actor mentioned:

The impact will be by saving clean water, but there will be production requirements in the form of high environmental level through the rational use of insecticide, rational use of fertilisers, and stop[ping] discharging residues. In addition, wastes must be discharged in an environmentally friendly way.

Therefore, access to wider clean resources and effective water resources management is vital to lessening health burdens and promoting sustainable livelihoods. To attain increases in access to clean water, more flexible and innovative programmes such as water management accounting are required to promote uptake of services and to develop gradual improvements, a point emphasised by Howard and Obika (2004) and by Molden et al. (2010).

10.3.2.7 *Improving tourism conditions*

Jordan is a small nation with one of the highest focuses on archaeological, cultural, and religious sites in the world (see section 2.4). Religious visitors can visit sites connected directly to holy texts and to the lives of Mohammed, Jesus, and the prophets; these sites are all concentrated along a narrow zone in the Jordan River Valley (Bar & Cohen-Hattab, 2003). Christian religious tourism enjoys significance on a global level. Americans, Europeans and other ethnic groups are attracted in great numbers to sites of religious significance, whether connected with the Old and New Testaments, the lives of the saints, or other sacred people (Becken et al., 2013). Jordan offers Muslims a number of sites linked to the life and mission of the Prophet Mohammad during Islam's foundational years in the 7th century CE and the events of earlier prophets (such as Abraham, Moses, David, Elijah, Jesus, and John the Baptist) whose lives touched the land of Jordan and whose missions are stated in the Bible and The Quran (Neveu, 2010).

During the interviews, the interviewees confirmed that an advanced water accounting system might provide information on which decisions as to ways in which to improve tourism conditions can be made. As one interviewee said:

We (Jordanians) are going to swim in the Zarqa River, see fish, and the river is going to stop being a contamination centre. Namely, it (water

accounting) is going to address the environmental problems (see section 8.8.3.3.1).

The emphasis of participants in this research on the significance of water accounting in the tourism industry stem from its being a tool for communicating information for decision making. An interviewee mentioned:

This echoes improving the water service so reflects positively on the environment and health conditions

Enhancing the quality of water service in water-scarce regions improves health conditions, regenerates ecosystems, and refreshes the area and makes it attractive for tourism (De-Freitas, 2003). De-Freitas (2003) proposes that a fundamental driver of water accounting in the form of data is the identification and evaluation of environmental information for business planning and rational decision making in the recreation and tourism industry.

10.4 Chapter Summary

Given agriculture's high demand for water, as well as a growth in the population that demands food and generates wastewater, water reuse for irrigation is bound to increase. In developing economies there are several examples of the use of treated wastewater for irrigation and, as long as wastewater production rises along with demand for food, the public authorities of such nations will progressively have to adopt planned approaches rather than unplanned ones (Jiménez, 2006). The governmental agencies need to take control of the situation in order to gradually but constantly put in place water management measures to protect human health, economic activities, and the environment. The government needs to accept that the volume of treated effluent used for irrigation is and will be one of the most sustainable ways to save water worldwide.

The primary challenge in marginal-quality water for agricultural activities is to increase the benefits for farm households and local society, while lessening negative environmental and human health effects. In addition, since treated effluent is a cheap source of irrigation water, and in many places the only possible source of water for agriculture, it will continue to be utilised to irrigate plants. Improving this water is thus essential in meeting goals to enhance food security and ecological quality in the future.

Water management needs to be approached in a novel way, in order to include farming demands, socioeconomic and institutional facts, the significance of helping nature to close ecological cycles, and, most of all, to contain the notion that to enhance the quality of life does not essentially mean the same thing in various areas. This integral approach suggests amending some of the more traditional sanitation notions in order to achieve a balance between long- and short-term environmental risks and societies' pressing needs. In Jordan, to stop using treated wastewater for irrigation would mean removing booming micro-economies based on increasing treated-wastewater-irrigated crops and growing surface water contamination, and in the process, adversely affecting the livelihoods and well-being of downstream water users in the Jordan River Valley. Consequently, instead of promoting impractical policies, it would be best to learn lessons from unplanned water reuse for agriculture and try to progressively improve existing practices to reduce the risks.

Water accounting is a tool needed to achieve effective water resources management. It also enhances the level of corporate, social, and environmental disclosure. Moreover, water accounting may provide information on which decisions regarding ways to enhance human health and tourism conditions can be made. Policy responses also need to include measures to reduce water losses in sectors such as agriculture and industry and to find a high level of accountability through improving the level of enforcing laws in a country that suffers from water scarcity as a result of climate change and human-made pollution. Water supports society's livelihoods and preserves ecosystems. Water is, therefore, deemed a public commodity and requires a public interest and, accordingly, public accountability for its use, management, and protection, as argued by Signori and Bodino (2013). Following this line of reasoning, attention should be drawn to the necessity for accountability to be 'public' or at least shared by diverse stakeholders (government at national and global levels, water industries, societies, ecologists, and NGOs). The next chapter presents the conclusions, recommendations and future research drawn from the discussion.

Chapter 11: Conclusions and Recommendations

11.1 Introduction

This chapter concludes the research project by discussing the findings, in order to gain a better understanding of the environmental consequences of pollution in the Jordan River Valley and the Zarqa River Basin. The following research questions were addressed to answer the central research question:

- What are the local and perceived physical, emotional, and spiritual impacts of pollution on stakeholders in the Jordan River Valley and the Zarqa River Basin?
- What are the institutional determinants of pollution in the Jordan River Valley and the Zarqa River Basin?

The overall water situation in Jordan is difficult and unsustainable. Jordan experiences growing water demands that exceed sustainable supply. The country relies heavily on freshwater resources outside its borders through the sharing of the Jordan and the Yarmouk Rivers and aquifers with neighboring nations. Sharing freshwater resources with the state of Israel and Syrian Arab Republic has resulted in instability in the past. Furthermore, Jordan has experienced considerable waves of refugees because of the current conflicts in the adjacent nations, a situation which increases Jordan's struggle to satisfy domestic water needs.

The causes of contamination are not restricted to physical grounds such as partially treated industrial wastewater from factories scattered along the banks of the Zarqa River and inadequately treated domestic sewage water from poor wastewater treatment plants in the region. The absence of political will to make changes and the lack of implementing the law owing to nepotism and apathy, which are embodied in the state culture, are also contributing factors. Solutions are likely, but only if the genuine intention is to make real change. In addition, participatory programmes that do not try to marginalise the useful role of the local societies are needed to create the difference. Therefore, public agencies, civil society organisations, and ecologically concerned parties are all responsible for finding an

integrated work environment not only to stop the decline, but also to improve the river, even if the river may never be able to be reformed to its previous state.

The study is derived from the need to understand the environmental consequences of pollution in the Jordan River Valley and to emphasise the views of stakeholders who do not usually have a voice that is heard. The findings are expected to enhance an understanding of the way stakeholders view the impacts of contamination in the study area. The research should contribute to practice by not just creating awareness but by persuading the Jordanian government to take action against the polluters and enforce existing laws. Moreover, consultation with stakeholders may be a first step that helps to set a new and different way for the government to work in the future.

It is essential to understand the stakeholders' views of the impacts of contamination in the study area, as water contamination affects all facets of life. The contamination affects the right of the coming generations to utilise natural resources and to benefit from a healthy environment. The matter of people's lives and livelihoods is crucial. This final chapter provides the major conclusions of the findings presented in this study. In addition, it covers the recommendations section, methodology, methods and limitations, research contribution, and, finally, presents directions for future research.

11.2 Major Conclusions

Clean drinking water is insufficient in many parts of the world (Gleick, 2014). Water is the source of life and, in many beliefs, it is described as something holy, a gift from Allah. For instance, in The Quran, the words 'water' and 'rivers' occur many times, which reflects how important water is in Islam. Water is necessary for almost all individuals' activities not only for the obvious ones of washing, cleansing, and cooking, but also in less apparent fields such as food safety.

This study found that water scarcity from climate change, human-made contamination, and a failure to implement environmental regulations has adversely affected agriculture. Crop production is also linked with irrigation water quality and agricultural soil fertility. Kang, Khan, and Ma (2009) who summarise the impacts of climate change on water availability, crop yield, crop water productivity and food security explain that the climate change will affect temperature and rainfall averages, which will directly have influences on the soil moisture and aquifer

recharge. The interviews confirmed that intensive use of inadequately treated sewage water for irrigation, accompanied by a lack of freshwater because of increasing population growth, leads to salty farming soil. Availability of freshwater helps leach salts and maintains soil fertility. Therefore, this study concludes that continued lack of freshwater, intensified use of partially treated sewage water, lack of agricultural guidance which guides farmers on how to use partially treated wastewater for irrigation in the light of freshwater scarcity, and a lack of accountability because of the environmental violations lead to decreased quality and quantity of agricultural production.

In addition, as temperatures continue to increase and precipitation falls, water availability and crop yield are likely to decrease in the future. Evaporation of water in farming soil and plant transpiration will be different with climate change; thus, water use efficiency is likely to decrease in the future, reducing food and environmental quality.

Socially, the study found that there is evidence that farmers and residents saw a clear connection between freshwater scarcity and its negative influences on job opportunities, agricultural incomes, credibility, and reliability of agrarian exports. Economically, the negative impact is shown by declined quality of agricultural production. In addition, the loss of agricultural investments resulted from difficulties a community encounters because of water scarcity. Water scarcity threatens the future of the agricultural sector and the rights of the current and future generations to make use of water resources in the Jordan River Valley.

This study aimed to understand the stakeholders' views of the effects of pollution in the study area. The impacts of the contamination create different physical, emotional, and spiritual results. The interviewees advised that water pollution in the Jordan River Valley has affected the level of agricultural income by preventing farmers from using adequately treated wastewater for irrigation of all kinds of crops. In addition, using partially treated sewage water for farming purposes causes additional maintenance costs due to clogging of irrigation networks.

Drawing on the perspectives of the interviewees as well as the literature, the study concluded that the significance of the Jordan River Valley is not restricted to agricultural activities, but also includes religious and local tourism. The Kingdom of Jordan is a small country, but it has cultural, archaeological, and religious sites

which are known worldwide. Religious tourists can visit many sites connected directly to sacred texts and the lives of the prophets, including Moses, Jesus, and Muhammad (peace be upon them). The study confirmed that reduced numbers of religious tourists are coming to the Jordan River Valley. However, the Ministry of Tourism's statistics emphasised increased international religious tourists, while the statistics themselves indicated reduced religious tourists from inside Jordan. Although the participants have concerns regarding potential reduction of international tourists in the future, religious tourism has the potential to be an important business in the Jordan River Valley and is one that fits well with the cultural and natural assets in the region.

This study found that the tourism sector is also adversely affected by the contamination. The pollution has affected domestic tourism (entertainment tourism) and religious tourism from inside and outside of the country, because various fauna and flora have disappeared in the region. In addition, bad smells, harmful insects, and the muddy colour of the river affect tourism. Some religious tourists feel uncomfortable about pollution. Therefore, they do not come or advise their relatives or friends to come. The lack of political will and lack of accountability dominate the religious tourism sector in Jordan.

In addition, the study found that pollution effects include economic facets in addition to the effects on the human health and emotional and spiritual life of the local societies in the Jordan River Valley. The lack of awareness among farmers and residents plays a role in increasing the size of the health problem. The lack of agricultural guidance, which contributes to educating farmers on how to use partially treated wastewater for irrigation, also contributes to increasing the problem. This study concluded that a lack of accountability from the government was one of the primary reasons for these effects.

The challenge in using sewage water for agricultural purposes is to exploit its benefits for farmers and the local community, while reducing adverse environmental and human health effects. In addition, since sewage water is an inexpensive source of water and nutrients, and in many areas the only likely sources of water, it will continue to be utilised to grow crops. Enhancing wastewater management is thus necessary to improve food security and environmental quality into the future.

This study employs a qualitative methodology. To achieve the research objective of understanding the stakeholders' views of the environmental consequences of pollution in the Jordan River Valley, classical Islamic Hermeneutics was adopted as a strategy of inquiry. This research is the first that uses classical Islamic Hermeneutics as a methodological approach in accounting. Preunderstanding was used as a first stage to understand stakeholders' views. This preunderstanding drew on what was seen and heard daily about pollution in the study area. The reasons for the pollution appear to be complex.

The contamination impacts also play a principal role in uncovering institutional policies. These policies include nepotism, the lack of enforcing regulations, and the lack of political will, which, in turn, lead to a lack of accountability, contributing to increasing the level of pollution in the region.

The refugee problem has resulted in the need to develop further water resources. These water resources have been over-exploited, leading water scarcity crisis while demand, markedly in municipalities, keeps growing. It is necessary to take into consideration water demand management options to help alleviate the water problem of Jordan. However, the potential of these choices seems insufficient in the mid-term, as the growing demand from the populous and the ability to sustain agricultural activities are unlikely to be satisfied without augmenting the country's water supply, which, in turn, will increase the size of the water shortage if water demand management is ignored. To preserve water resources, it is necessary to develop or apply an integrated water resources management system, including water policies and law. Most important is the need to implement the current laws properly. Good water management can be fulfilled through public awareness, improved water governance, and robust political will on the part of decision makers.

Due to the increasing waves of refugees from unstable neighbouring countries, as well as an increase in the Jordanian population, there will be increased demand for food and greater generation of sewage water; water reuse for irrigation is, therefore, bound to rise. Public authorities need to take control of the situation in order to put in place efficient management measures to protect human health, livelihoods, and the environment, while also providing a useful function for sewage water. Public authorities need to accept that adequately treated sewage water utilised for irrigation is the most significant alternative source of irrigation water in Jordan.

Finally, this study has concluded that there is a lack of environmental accountability in Jordan and that, in order to mitigate the environmental consequences of pollution and climate change in the country, integrated water resources management is needed. The foundation for this effective water management is adopting a sophisticated water accounting programme. This programme may help enhance accountability and alleviate some of the physical, emotional, and spiritual effects that result from water pollution in Jordan. Based on the conclusions, the final four sections of this chapter provide the study's recommendations and deal with its methodology, methods and limitation, research contribution and future research respectively.

11.3 Recommendations

Based on the findings of this study, recommendations are made for decision makers in the Jordanian government. The findings regarding accountability for environmental consequences of pollution in the Jordan River Valley have implications for water contamination and management.

This study recommends some practices, which fall under the responsibility of the government, in order to address the environmental consequences of pollution in the Jordan River Valley. The interviews suggested that sewage water discharged into the Zarqa River is inadequately treated, contributing to adverse impacts on the farming community, tourism sector, physical health, emotional relationships, spiritual relationships, and institutional determinants. Therefore, the study recommends consistent application of regulations by public agencies. Mara (2013) suggests that, wherever possible, adequate wastewater treatment used for agriculture is needed to lessen pollutants. This adequate treatment requires the government to enforce the law, regulations, and polices unselectively in order to enhance accountability and water governance.

11.3.1 Farming community

Farmers confirmed that using partially treated wastewater for irrigation leads to adverse effects on the farming community. Therefore, it is recommended that the Ministry of Agriculture establish guidance campaigns for farmers in order to educate farmers how to avoid adverse effects on the farming community from using inadequately treated wastewater for agriculture.

The Ministry of Agriculture has to play a prominent role in advising farmers to follow this farming guidance. The agricultural guidance programmes need to be regularly implemented. First, the interviews confirmed that using partially treated wastewater for irrigation causes crop restrictions, because using partially treated wastewater for irrigating crops that are eaten uncooked creates health risks. In addition, using partially treated wastewater for irrigation increases salinity levels in the farming soil, which affects the productivity of the agricultural soil. Therefore, it is recommended that high salt tolerant crops and profitable industrial crops are used. Mara (2013) states that crops are vastly varied in tolerance of salinity and drought. Therefore, an appropriate selection of crops can lessen the different hazards faced from the use of inadequately treated wastewater.

Second, the views of the interviewees confirmed that using partially treated wastewater for irrigation causes damage to drip irrigation and sprinklers systems. Therefore, the study recommends appropriate irrigation methods that lessen health hazards and financial burdens, for example, furrow irrigation, as it has few human health effects when compared to flood and sprinklers systems.

Third, appropriate crop management is needed. Appropriate crop management is aimed at stopping damage to crops caused by salt accumulation in the farming soil surrounding the seeds. Appropriate crop management can be attained by planting on the shoulder of the ridge, using sloping beds with seeds planted on the sloping side but above the irrigation water line, and watering alternate rows so that the salts can be moved beyond the single seed row, as illustrated by Jiménez (2006). Fourth, appropriate agricultural soil management, including levelling of land to a given grade, establishing suitable drainage (both open and subsurface systems), deep ploughing, and leaching to decrease farming soil salinity are recommended. Sewage water irrigation is not profitable in the long term, as confirmed by Abu-Madi (2004). Therefore, control of soil salinisation through leaching and drainage with freshwater from time to time is needed in order to avoid reduced crop yield.

The interviews revealed that pollution caused by inadequately treated wastewater and inconsistent application of the law has affected the agricultural income of farmers. As a result, the Ministry of Agriculture has to focus on small farmers, as they have limited income. The study recommends enhancing agricultural labour requirements in order to improve the livelihoods of farmers from the agricultural occupations and, ultimately, the well-being of the farm households.

11.3.2 Institutional determinants

Jordan claims it has a set of water policies and legislation. However, these policies and laws have little impact, and steps could be taken to address this problem. First, it is recommended that public agencies build the capacity to enforce the law. This process will need more than just ‘capacity building’; the political will to see the legislation enforced will also need to be promoted. Therefore, it is recommended that the Ministry of Environment expands its capacity to oversee and enforce laws. The Ministry must also work to improve its links with the judicial system to confirm effective compliance. Second, the interviews confirmed that Jordan has unsophisticated water accounting. Therefore, Jordan needs to design or adopt a sophisticated water accounting programme in order to achieve effective water resources management. Escrivá-Bou et al. (2016) make clear that water accounting is significant for water management at all scales in water-scarce countries. Third, it is recommended that experts in water accounting programmes are employed in order to establish an advanced water accounting system in Jordan.

The interviews also confirmed that there is a link between the lack of awareness and introducing a sophisticated water accounting programme. The study recommends that sustainability accounting education is a prerequisite for raising awareness of the environment in general and water in particular. Tilbury and Cooke (2005) suggest that sustainability accounting plays a critical role in developing students’ knowledge and their critical thinking skills regarding ecological issues. Saed (2006) emphasises that sustainability education is a tool that can be used by government agencies and other organisations as a strategy to promote behavioural changes to reinforce sustainable environmental management in the long term.

The study findings showed that Jordanian environmental standards need to be amended. However, realistic standards must be adopted to protect public health as well as to provide protection from adverse environmental effects. It is recommended that the standards must be appropriate for the Jordanian context. The situation in Jordan has to change, not just by introducing new standards, but also by treating water demand management as a chief component of water governance. It is necessary to make a shift from augmenting water supply to reducing water demand, an approach confirmed by Brooks and Wolfe (2007) and Al-Mashaqbeh, Ghrair, and Megdal (2012).

In Jordan, bureaucracies are a main obstacle to applying the law. They do not move easily, particularly when the essential change will reverse long-standing policies. However, they will move when they are given strong instructions and when they are sure that those instructions are backed by senior administrators and not just by planners in a section far removed from daily operations.

11.3.3 Health awareness campaigns

This study found that using partially treated wastewater for agriculture affects human health. Therefore, it is recommended that the Ministry of Health takes a stronger role in terms of awareness raising campaigns concerning using inadequately treated wastewater for irrigation. When using sewage water, it is important to inform people of risks connected with the water quality and measures that can be used to lessen or control such dangers. To that end, planned awareness campaigns need to be carried out on a continuing basis. In particular, the use of protective clothing, and how to correctly wash and disinfect vegetables and fruits grown in inadequately treated wastewater, should be addressed. The Ministry of Health should undertake ongoing campaigns to observe the effects on public health and, subsequently, supply farmers and their households with drugs. Good management practices and suitable use of anthelmintic products need to be followed to have an effective parasite control programme. In addition, it is recommended that the Ministry of Municipalities conducts control campaigns against harmful insects such as flies and mosquitoes which are the result of discharging partially treated wastewater into the river.

11.3.4 Tourism sector

The interviews confirmed that the Jordan River Valley pollution has affected the tourism sector. Therefore, improving services that are needed by visitors and attracting them from inside and outside of Jordan to visit the region are recommended. The study also recommends that tourism planning strategy has to concentrate on the discipline of regional tourism planning and tourism master plans, including ecological management of the region. In addition, the Ministry of Tourism has to cooperate with other governmental authorities in order to reinstate the lost aspects of fauna, flora, and pure river water to the region. The Ministry of Tourism also has to establish continuous campaigns to spread awareness regarding the religious and cultural significance of the Jordan River Valley. These ongoing

campaigns should include students, residents, government officers, and industrialists. In addition, it is recommended that awareness is raised about the significance of water in Islam, stressing that water is a public commodity. Furthermore, the people of Jordan are affected by Islamic culture, so one further recommendation is to demonstrate how important it is that Islam encourages the preservation of the environment and its natural resources.

11.4 Methodology, Methods, and Limitations

This study uses classical Islamic Hermeneutics as a methodology, in order to gain a comprehensive understanding of stakeholders' views of the impacts of pollution in the Jordan River Valley. Classical Islamic Hermeneutics helps the researcher to better understand the interviewees' views. The approach enables the researcher to understand the speaker's intended meaning by taking advantage of the preunderstanding of the researcher, in addition to studying the reasons for pollution. The interviews were conducted with 50 participants and included residents, local farmers, environmental experts, NGOs, religious actors, and the government. This research recommends water accounting as a method to address water scarcity. In order to make sure whether Jordan uses a sophisticated water accounting or not, as well as what the obstacles and the benefits of the implementation, five further interviews were conducted with water industry actors after analysing the 50 interviews. This is an ethnographic study which uses the Hermeneutics approach. Although Hermeneutics is not a statistical method, it is a way to gain a better understanding of a topic. There is the problem of generalisation, but, with 55 interviews, recurring themes were obtained. Therefore, it is believed that the sample is fairly representative. In addition, it was hard to increase the number of certain interviewees such as religious actors and those from the government due to the sensitivity of the research topic for some participants.

11.5 Research Contribution

The contribution of this research is to make the stakeholders' voice heard and to encourage the government to take action against the polluters. In addition, it helps to illuminate the issue of water scarcity in the Middle East and North African countries which have experienced similar issues to those that Jordan faces. The Hermeneutics approach may be a beneficial approach that can be applied to understand similar situations in other countries. The institutional determinants in

Jordan, the Middle East, and North Africa, when compared to those in western countries, are about more issues than managing water, because of the existing rights and relationships that govern people with the state. It is a quite different situation. It is also much more than a technical issue. Freshwater scarcity is also related to political will. Therefore, the senior officers in the state have to contribute to solving the problem and try to find a real intention to apply the law.

11.6 Future Research

This study provided empirical insights into how environmental consequences of pollution are understood in the Jordan River Valley. There are a number of suggested potential areas to extend this study. For instance, research could be carried out to compare accountability for environmental consequences of pollution in other similar nations. For example, there are commonalities between Jordan and Israel. Israel has shared borders with Jordan on the Jordan River and has the same climate. In addition, both Islam and Judaism, the states' religions, are divine religions, even though the two nations respond to public management in a different way. Therefore, it would be interesting to understand Israeli stakeholders' perspectives on the impacts of pollution in the Jordan River Valley.

The health impact associated with reclaimed wastewater can be severe. Therefore, public health must not be compromised by maximising reuse rates. The findings of the research show that there are health impacts from using partially treated wastewater for irrigation. More research is needed to study the long-term effects on users of partially reclaimed wastewater and related crops, as well as beneficiaries of the affected water resources. It would be interesting to consider physicians working in the hospitals in the study area as participants in such a study.

Population growth, increasing influxes of refugees due to unstable political situations, and climate change constitute high pressure on freshwater resources in Jordan. These also encourage Jordan to make use of treated wastewater for agricultural purposes as an alternative source of irrigation water. Further future research may be possible on how farmers make use of wastewater in a case study on individual farms in the Lower Jordan River Basin. It is also possible to conduct a feasibility study to see if using partially treated wastewater on the farms is beneficial or not and to compare the findings with other findings from other farms using freshwater for irrigation.

Based on the evidence from this study, as Hanak (2011) suggests, water accounting should be a basis for effective water resources management in water-scarce regions. A case study on the implementation of an advanced water accounting system in Jordan could be undertaken. The merits of whether the system should be newly designed or adopted from developed nations should be debated especially given the specific cultural context of Jordan discussed in chapter 2.

As a final statement, this study has been conducted at a critical time when Jordan is facing significant freshwater scarcity caused by climate change, population growth, and human-made contamination which are all threatening Jordan's water security and the well-being of its people. The recommendations presented in this research can effectively make a difference in mitigating severe freshwater scarcity in Jordan by improving water management and enhancing accountability.

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Appendix 1

Waikato Management School

Te Raupapa



Water Availability and Quality in the Jordan River Valley and the Zarqa River Basin: Stakeholders' Perspectives

What is the purpose of this research?

This research is part of a doctoral thesis at the University of Waikato that seeks to understand the impact of pollution in the Jordan River Valley (JRV) and the Zarqa River Basin (ZRB) from stakeholders' perspectives. The Zarqa River is the major artery flow over King Talal Dam (KTD). The flow's characteristics have been changed by the discharge of treated wastewater to the river which represents nearly all of the summer flow and significantly degrade the quality of water. Quality of water from KTD is deteriorating considerably after building the largest wastewater treatment plants in 1985 at As-Samra, which is about 42 km upstream from the reservoir. The treated wastewater is discharged through the Zarqa River to KTD and spilled out downstream until it reaches in the JRV, is primarily used for irrigation purposes. Therefore, any pollution of the river will lead to pollution in the dam waters, which, in turns, may impact the quality of agricultural production in the JRV and the ZRB.

Who is associated with this research?

The following people are associated with this research:

Researcher:

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What will my participation in the study involve?

You have been invited to participate in this study, entirely voluntary and anonymously, as someone who would be able to provide the researcher with valuable opinions about the issue under study. This research uses semi structured interviews. Through the interview process, as a participant, you will be asked to provide your opinion on issues and requirements to understand the impact of pollution in the Jordan River Valley and the Zarqa River Basin. The interview will last around an hour.

Will my taking part in the research be kept confidential?

The information you provide will be used to understand the impact of pollution in the Jordan River Valley and the Zarqa River Basin. All the information you give the researcher during the course of the research will be kept completely confidential and used for the objective of this study only. All of the data will be analysed and published anonymously. The data will be stored securely during the research and read-access will only be available to the researcher and his supervision panel. Upon completion of the research, data will be destroyed.

Do I have to take part in this research? Can I withdraw?

Participation in this research is completely voluntary. If you don't want to participate, you do not have to give a reason and no pressure will be out on you to change your mind. If you decide that you will participate and later change your mind, you are free to withdraw from the research project at any phase and there will be no adverse consequences. You may also decline to answer particular questions without giving a reason.

Do I need to give written consent?

If you are interested in participation, the researcher will then ask you to sign a consent form.

What if I require further information?

If you require more information or clarification on any aspect of this research, you can contact the researcher or the supervisors using the contact details provided in this information sheet.

What will happen to the results of the research study?

The results will be published in a doctoral thesis. It is likely that the research results will also be published in peer-reviewed journal articles, presented at seminars, and academic conferences.

Will I have access to the results of the research?

As a participant you will be provided with a copy of the data analysis findings. This will enable you as well to express your comment, offer suggestions or withdraw your information.

توافر المياه وجودتها في وادي نهر الأردن وحوض نهر الزرقاء: وجهات نظر أصحاب المصلحة

نموذج معلومات المشارك

ما هو الغرض من هذا البحث؟

هذا البحث جزء من أطروحة الدكتوراه في جامعة واكاتو التي تسعى إلى فهم تأثير التلوث في وادي نهر الأردن وحوض نهر الزرقاء من وجهة نظر أصحاب المصلحة. نهر الزرقاء هو التدفق الرئيسي للشريان فوق سد الملك طلال. تم تغيير خصائص التدفق من خلال تصريف المياه العادمة المعالجة إلى النهر الذي يمثل تقريباً كل تدفق الصيف وتؤدي إلى تدهور كبير في نوعية المياه. تدهورت نوعية المياه من سد الملك طلال بشكل كبير بعد بناء أكبر محطات معالجة مياه الصرف الصحي في عام 1985 في السمرة، على بعد حوالي 42 كم من المنبع. يتم تصريف المياه العادمة المعالجة عبر نهر الزرقاء إلى سد الملك طلال وينسكب في اتجاه مجرى النهر حتى يصل إلى وادي نهر الأردن، ويستخدم في المقام الأول لأغراض الري. لذلك، فإن أي تلوث في النهر سيؤدي إلى تلوث في مياه السد، والذي بدوره قد يؤثر على جودة الإنتاج الزراعي في وادي نهر الأردن.

ماذا ستشمل مشاركتي في الدراسة؟

لقد تمت دعوتك للمشاركة في هذه الدراسة، طوعية تماماً ومجهولة الهوية، كشخص قادر على تزويد الباحث بأراء قيمة حول القضية قيد الدراسة. يستخدم هذا البحث مقابلات شبه منظمة. من خلال عملية المقابلة، بصفتك مشاركاً، سيطلب منك تقديم رأيك في القضايا والمتطلبات لفهم تأثير التلوث في وادي نهر الأردن وحوض نهر الزرقاء. سوف تستمر المقابلة حوالي ساعة.

هل تبقى مشاركتي في البحث سرية؟

سيتم استخدام المعلومات التي تقدمها لفهم تأثير التلوث في وادي نهر الأردن وحوض نهر الزرقاء. سيتم الاحتفاظ بجميع المعلومات التي تقدمها للباحث أثناء البحث في سرية تامة ويتم استخدامها لغرض هذه الدراسة فقط. سيتم تحليل جميع البيانات ونشرها بشكل مجهول. سيتم تخزين البيانات بشكل آمن أثناء البحث ولن يكون الوصول للقراءة متاحاً إلا للباحث ولجنة الإشراف الخاصة به. عند الانتهاء من البحث، سيتم تدمير البيانات.

هل يجب علي المشاركة في هذا البحث؟ هل يمكنني الانسحاب؟

المشاركة في هذا البحث طوعية تماماً. إذا كنت لا ترغب في المشاركة، فلا يتعين عليك إعطاء سبب ولن يتم الضغط عليك لتغيير رأيك. إذا قررت أنك ستشارك وتغير رأيك لاحقاً، فأنت حر في الانسحاب من المشروع البحثي في أي مرحلة ولن تكون هناك عواقب سلبية. يمكنك أيضاً رفض الإجابة عن أسئلة معينة دون إبداء سبب.

هل أحتاج إلى إعطاء موافقة خطية؟

إذا كنت مهتمًا بالمشاركة، سيطلب منك الباحث بعد ذلك توقيع نموذج موافقة.

ماذا لو كنت بحاجة إلى مزيد من المعلومات؟

إذا كنت بحاجة إلى مزيد من المعلومات أو التوضيح بشأن أي جانب من جوانب هذا البحث، يمكنك الاتصال بالباحث أو المشرفين باستخدام تفاصيل الاتصال الواردة في ورقة المعلومات هذه.

ماذا سيحدث لنتائج الدراسة البحثية؟

سيتم نشر النتائج في رسالة الدكتوراه. من المحتمل أن يتم نشر نتائج البحث في مقالات تتم مراجعتها من قبل النظراء، ويتم تقديمها في الندوات والمؤتمرات الأكاديمية.

هل يمكنني الوصول إلى نتائج البحث؟

كمشارك، سيتم تزويدك بنسخة من نتائج تحليل البيانات. سيمكّنك هذا أيضًا من التعبير عن تعليقك أو تقديم اقتراحات أو سحب معلوماتك

Appendix 2

Waikato Management School
Te Raupapa



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Water Availability and Quality in the Jordan River Valley and the Zarqa River Basin: Stakeholders' Perspectives

Consent Form for Participants

I have read the **Information Sheet for Participants** for this study and have had the details of the study explained to me. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the study at any time, or to decline to answer any particular questions in the study. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Information Sheet**.

I agree to participate in this study under the conditions set out in the **Information Sheet** form.

Signed: _____

Name: _____

Date: _____

Researcher's Name and contact information:

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توافر المياه وجودتها في وادي نهر الأردن وحوض نهر الزرقاء: وجهات نظر أصحاب المصلحة

نموذج الموافقة للمشاركين

لقد قرأت ورقة المعلومات للمشاركين في هذه الدراسة، وقد أوضحت لي تفاصيل الدراسة. تم الرد على أسئلتني حول الدراسة بما يرضي، وأنا أفهم أنني قد أطرح أسئلة أخرى في أي وقت.

أفهم أيضاً أنني حر في الانسحاب من الدراسة في أي وقت، أو رفض الإجابة عن أي أسئلة معينة في الدراسة. أوافق على تقديم المعلومات للباحثين بموجب شروط السرية الواردة في ورقة المعلومات.

أوافق على المشاركة في هذه الدراسة وفقاً للشروط المنصوص عليها في نموذج ورقة المعلومات.

وقعت:

اسم:

تاريخ:
