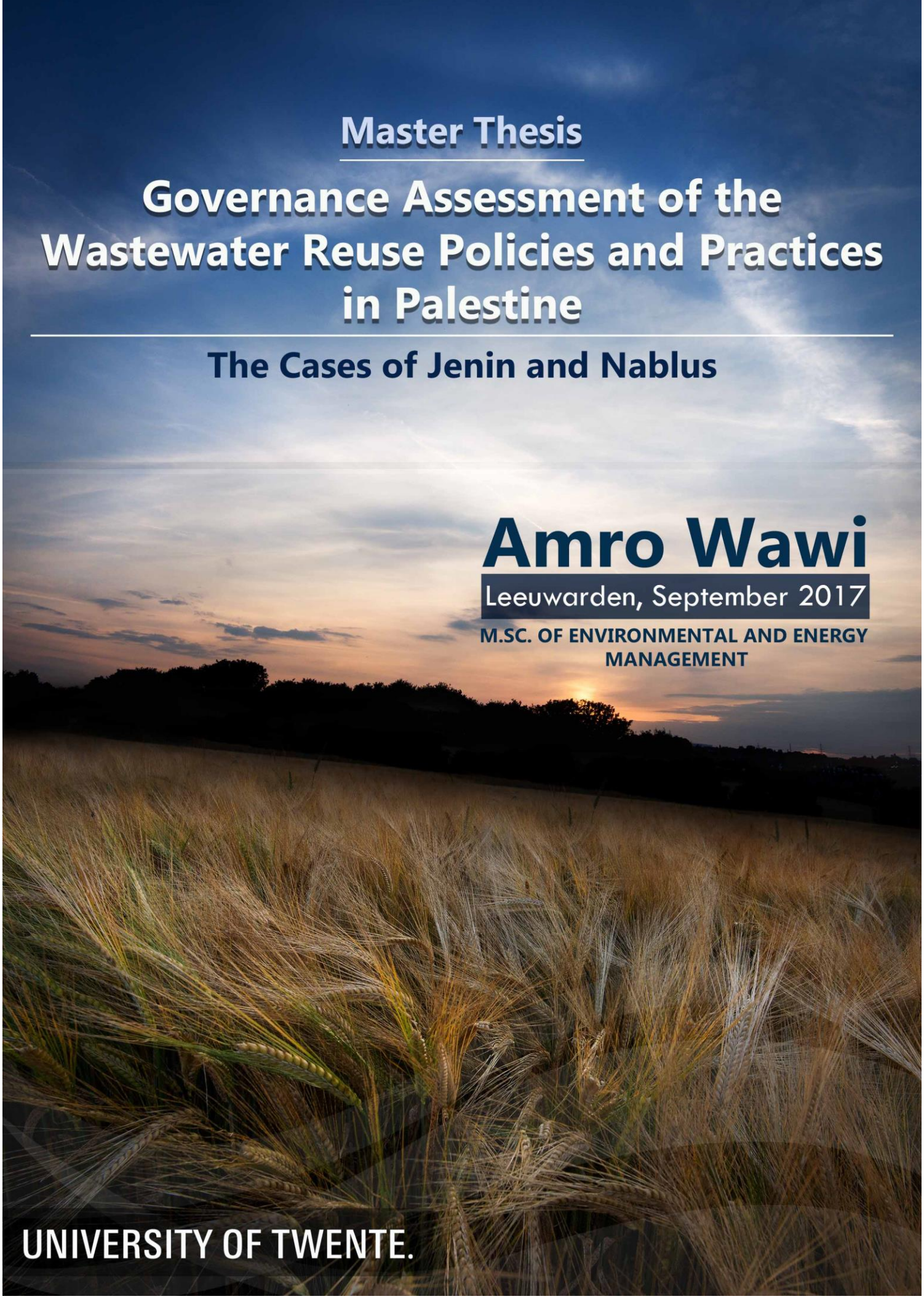

Master Thesis

Governance Assessment of the Wastewater Reuse Policies and Practices in Palestine

The Cases of Jenin and Nablus

Amro Wawi

Leeuwarden, September 2017

M.SC. OF ENVIRONMENTAL AND ENERGY MANAGEMENT

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Governance Assessment of the Wastewater Reuse Policies and Practices in Palestine

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Dedication

To all those who lighten my dark nights with their prayers, stand by my side and encourage me until the end of time, to those I feel unable to express my great gratitude for their precious support,

To both of whom I am indebted to forever and I owe everything that made it all possible, to my parents Salma and Hasan,

To the sweetest heart ever my lovely sister; Forat,

To the solid rock of my life, my brothers; Qais, Abdurrahman, Abdullah and Mohammed

To my love, soul and life, my fiancée Raghad

I dedicate my work…

Acknowledgment

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To each one of the above, I extend my deepest appreciation

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Abbreviations

ANERA	American's Near East Refugee Aid
ARIJ	Applied Research Institute – Jerusalem
CEP	Caribbean Environment Programme
CIT	Contextual Interaction Theory
ECS	EcoConServ Environmental Solutions
ECU	Environmental Control Unit
EIA	Envronmental impact assessment
EQA	Environmental Quality Authority
GAT	Governance Assessment Tool
GWPMed	Global Water Partnership Mediterranean
JWC	Joint Water Committee
KFW	Kreditanstalt für Wiederaufbau
KPR	Kinetics-Passavant Reodiger
L/c/d	Liter Per Capita Per Day
MCM	million Cubic meter
MENA	Middle East and North Africa
MoA	Ministry of Agriculture
MoE	Ministry of Economy
MoH	Ministry of Health
MoLG	Ministry of Local government
NGO	non-governmental organizations
NIS	New Israeli Shekel
NWC	National Water Company
NWWS	National Water and Wastewater Strategy
OECD	Organization for Economic Cooperation and Development
OFID	OPEC Fund for International Development
OPEC	Organization of the Petroleum Exporting Countries
PA	Palestinian Authority
PADICO	Palestinian Development & Investment Company
PARC	Palestinian Agriculture Development Association
PCBS	Palestinian Central Bureau of Statistics
PSI	Palestinian Standards Institution
PWA	Palestinian Water Authority
RVO	Rijksdienst voor Ondernemend
RWU	Regional Water Utilities
SDP	Strategic Development Plan
UG	Universal Group-Gaza
UN	United Nations

UNDP	United Nation Development Program
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan
WAU	Water User Association
WSRC	Water Sector Regulatory Council
WW	Wastewater
WWAP	UN- World Water Assessment Program
WWTP	Wastewater treatment plant

Abstract

Palestine, like most countries in the Middle East and North Africa (MENA), suffers from scarce water resources. However, water scarcity in Palestine is a very complex problem, since it results from not only the unavailability of water, but also the control of Israel on the Palestinian water resources. The problem is becoming even more alarming with population growth, which further increases the water. Therefore, nonconventional resources are explored to augment the water supply. One of such nonconventional water resources is treated wastewater, which is used for irrigating crops and trees, but not for domestic purposes. However, reusing the treated wastewater is not widespread even with building new wastewater treatment plants, mainly due to barriers created by policies and practices, such as financial barriers, and insufficient standards and regulations.

This research investigated the implementation of policies regarding wastewater treatment and reuse in Palestine. Particularly, two main wastewater treatment plants in the West Bank were studied in terms of the design and implementation of wastewater reuse projects. Additionally, the governance assessment tool was applied to assess the supportiveness of the governance dimensions (actors; problem perceptions and goal ambitions; strategies and instruments; responsibilities and resources) using the four qualities (extent, coherence, flexibility and intensity). The assessment results were used to make recommendations for improving the wastewater reuse policies and practices in Palestine. The results show that the most supportive dimension, or the least in need of improvement is the actors, were the strategies and instruments was the most restrictive dimension. specifically, because of the complex political status, absence of guidelines for reusing the treated wastewater and disability to legalize the laws due to nonfunctioning Legislative Council in Palestine. The main recommendations are to issue a guideline about reusing the treated wastewater, and to enact and enforce the necessary legal instruments.

Keywords: wastewater treatment; wastewater reuse; water governance; governance assessment; reclaimed water; West Bank; Nablus; Jenin; Palestine

1. Introduction

1.1 Background

Freshwater is the key resource of living as well as the source of spiritual, social and economic wellbeing and development (Eppel, 2014). However, even though it is essential to sustain life, it is finite and vulnerable (CEP 65, 2012). The twenty-first century has been called the "century of water" (Nakagami, et al., 2016, p.4) due to water scarcity that is becoming an alarming issue in the developing countries as the water demand for agricultural, domestic and industrial purposes is increasing rapidly (WWDP, 2015). The necessity of water makes nonconventional water resources more popular (Arafat, 2015). For example, wastewater is expected to replace freshwater in many uses (Al Masri & Mcneil., 2009).

Palestine, like most Middle East and North Africa (MENA) countries, suffers from scarce water resources. The MENA region is the driest on earth, containing only 1% of the world's water reserves (Qadir, et al., 2007) and majority of the MENA region countries are classified as being semi-arid with dry ecosystems (Zimmo & Imseih, 2010). Moreover, water scarcity in Palestine is intensified due to the political restrictions imposed by Israel's control on the Palestinian natural water resources (Mizyed, 2013). Consequently, water resources are extremely scarce in both West Bank and Gaza Strip. This situation negatively affects the lives and livelihoods of Palestinians living there (PWA, 2012).

In Palestine, treated wastewater can augment irrigation water supply (Afifi, 2006). The agricultural sector is the largest user of water in Palestine since 70% of the total water supply is consumed to irrigate Palestine's agricultural land, which makes up 15% of the total area of Palestine (Arafat, 2015). Treated wastewater is considered as invaluable additional source of water (Al-Khatib, et al., 2017), which could potentially be used by farmers (Qadir, et al., 2010).

1.2 Problem Statement

The insufficient exploitation of treated wastewater is considered to be a problem in Palestine, from both political and social perspectives. The shortage of water supply is threatening for domestic usage, agricultural and industrial sectors. Most importantly, as the population is

increasing, the disparity between water demand and supply is also increasing. If this problem is not solved soon, drinking water will become unaffordable. Moreover, this shortage of water supplies affects agricultural and industrial products. As a result, it negatively affects socio-economic development and food security, and increases poverty. Moreover, the conversion of agricultural land into arid land has negative environmental consequences (Mizyed, 2013).

Despite the need of reusing treated wastewater, it is still not widespread yet mainly due to barriers created by policies and practices, such as financial constraints, insufficient standards and regulations, and lack of public acceptance. In a situation where many actors are involved and have different interests, goals, resources and responsibilities regarding the policies and practices of reusing the treated wastewater; studying two WWTPs and their reuse project will lead to a better understanding of the current barriers that impede the reuse process. Applying the Governance Assessment Tool (GAT) to descript the elements of wastewater governance and to assess the qualities (extent, coherence, flexibility and intensity) of the governance context of the wastewater reuse projects will address the problem in a systematic manner. However, there are few studies that focus on the assessment of wastewater governance in the Palestinian context, such as the study by Al-Khatib et al. (2017), which focuses on the case of Jericho City.

1.3 Research Objectives

In this research, a review is provided about the barriers that stand in front of expanding the utilization of treated wastewater in Palestine in general and specifically in the West Bank. Provided that, in the last decade the West Bank has been relatively politically and technically open to improve reusing this option, in contrast with Israel's punitive land, air and sea blockade over the Gaza Strip. Particularly, this research focuses on Nablus-West wastewater treatment plant (WWTP) and Jenin WWTP. The research assesses the policies and strategies that guide the reuse process and the degree of success of the current projects for reusing the treated wastewater in Palestine.

The specific objectives of this research are threefold:

1) To describe the elements of wastewater governance in terms of the multiple actors, problem perceptions, goal ambitions, strategies, instruments, responsibilities and resources,

2) To assess the governance context of the wastewater reuse projects in terms of the qualities of extent, coherence, flexibility and intensity, and
3) To provide recommendations for the responsible authorities to take the actions towards improving the reuse of treated wastewater.

1.4 Thesis Outline

The first chapter discusses the research motivation, the problem statement and highlighted the main objectives of this thesis. The second chapter points to the barriers against reusing the treated wastewater in Palestine, as well as a literature review on the regional experience of reusing treated wastewater in Israel and Jordan, water and wastewater governance definitions, the governance assessment tool, and the worldwide experience on wastewater management. The third chapter explains the methodology used to conduct this research. The fourth chapter presents the empirical background about Palestine regarding the water scarcity, wastewater situation, water system, and the policies and strategies. The fourth chapter presents the results of the research in two categories. The first is the current practices of reusing the treated wastewater in Jenin and Nablus, and the second is a description of the elements of wastewater governance and an assessment of the governance context of wastewater reuse projects in Palestine. The fifth chapter presents the conclusions, recommendations and further research directions.

2. Literature Review

In this chapter, scientific articles, theses, books, governmental and non-governmental reports and other relevant professional publications were reviewed. These literatures describe the treated wastewater reuse issues in the region, in Israel and Jordan as the closest two countries to Palestine. The reports published in the last five years are considered for reviewing, in addition to the related scientific articles in the last 15 years. The social theme is mostly considered to present a holistic view about the practices of governments and other stakeholders in reusing wastewater.

2.1 Water and Wastewater Governance

It is internationally agreed that the water problems are best seen as governance matters. The solutions are known and the amount of water can be sufficient, but inequality, lack of access and management problems still exist, therefore the implementation of the solutions is the real challenge (Casiano, et al., 2017).

2.1.1 Water Governance

Governance is an important and commonly used concept in the water sector, but there is no common understanding on its use or meaning. (Casiano, et al., 2017) This encourage many researchers to categories those meanings (Casiano & Boer, 2015).

The concept of governance can be found in different forms and characterized in many contexts, but they all deal with the actors and structures of water policy designing and implementation (Keremane, 2017), for instance ‘global governance’ (Keohane, 2003), ‘water governance’ (Rogers & Hall, 2003), ‘distributed governance’ (Townsend & Pooley, 1995), ‘self-governance’ (Ostrom, 1990; Tang, 1992), ‘good water governance’ (Vinke-de Kruijf & Özerol, 2013), ‘improved water governance’ (Casiano, et al., 2017) and ‘modern governance’ (Gaudin, 1998).

International organizations such as the United Nations (UN) and the Organization for Economic Cooperation and Development (OECD) promoted the governance based on normative perspective.

The United Nation Development Program (UNDP) in 2006 defined governance as: *an exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences* (Keremane, 2017, p.23)

OECD published on June 2015 its own principles of water governance. The principals intend to inspire actions leading to better water governance at all levels involved in water policy formulation and implementation based on three main driving goals, namely effectiveness, efficiency and trust and management. (OECD, 2015; Akhmouch, 2016)

In this thesis, water governance is defined as the context that guides and organizes the actions and interactions of actors involved in the management of water resources (Bressers, et al., 2013). When there is equitable, environmentally sustainable and efficient use of water resources, then it can be argued that water governance is effective. However, there is no single model for effective, good or bad governance (UNESCO, 2003).

2.1.2 **Definition of Wastewater Governance**

The term "wastewater governance" has not yet an independent definition. Because it is considered as part of water governance system as the wastewater resources are generated through the use of freshwater resources. Therefore, a clear definition for this term can be derived from the definition of water governance; considering that it is part of the same political, social, economic and administrative systems. In addition, the actors in this sector aim to develop and manage recovering the reusable treated wastewater from the wastewater resources, and to deliver this new resource to users at different levels of society.

Wastewater governance therefore is defined as a context of political, social, economic, and legal structures within which societies manage their wastewater related affairs. It includes governmental and non-governmental mechanisms that steer actors' interactions. It can also be looked as processes of decision-making, involving both formal and informal actors in society at all levels.

2.1.3 **Governance Assessment Tool**

Various researchers call for contextual consideration to solve the governance problems that need context-specific answers (Casiano, et al., 2017). These different points of views contributed in developing new frameworks that are context-sensitive. The Governance Assessment Tool (GAT), is one of those frameworks that is elaborated and used in this research.

GAT is part of those frameworks that consider governance from a natural perspective also it is a part of the 25 assessment tools compiled by OECD (Casiano, et al., 2017).The GAT is based on the Contextual Interaction Theory (Bressers, 2009). The theory views policy implementation process as a multi-actor interaction and driven by the actors. The actors have three characteristics; motivation (targeted goal), cognition (information), and resource (power) that are core to the policy process. These core factors influence each other and in so doing drive the policy process. A strong combination of motivations, cognitions and resources among actors enable a process to succeed, (Bressers, 2009). This complex interaction is illustrated in Figure 1.

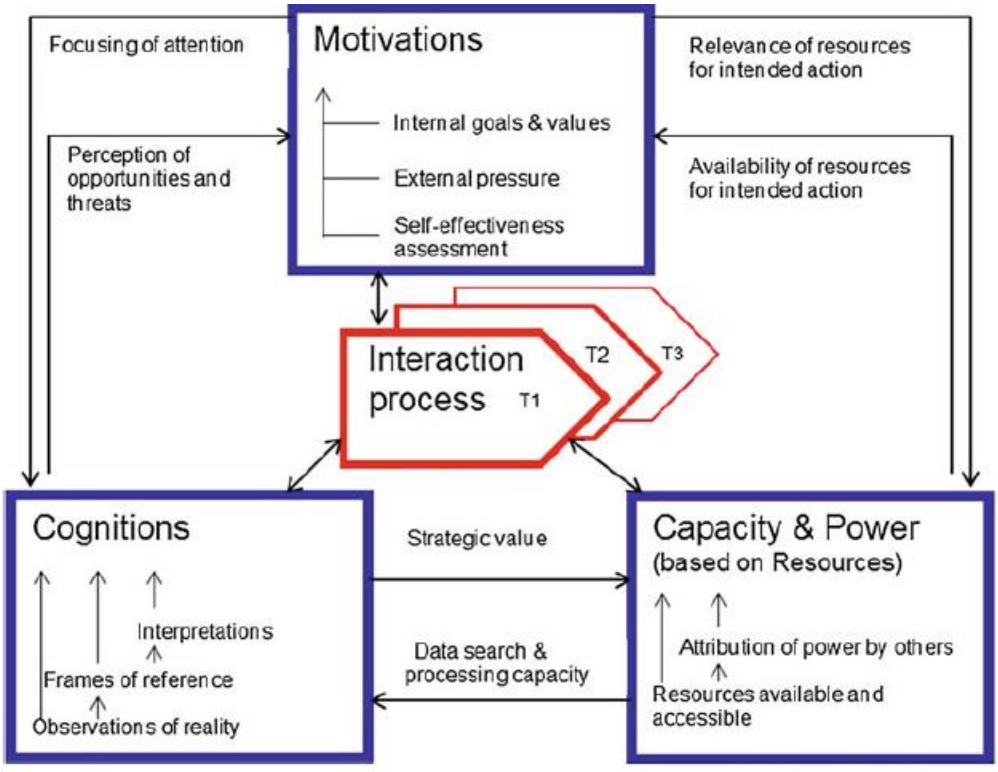

Figure 1: Actor-related factors of the policy implementation interaction process

Source: (Bressers, et al., 2016)

The core characteristics are also influenced by external factors during the policy process. The first level of influence is the specific context which relates to prevailing circumstances, the next level of influence is the structural context which entails the governance dimensions and the third level of influence is the wider context that includes political and cultural contexts among others (Bressers, 2009). For the purpose of this research, the second level, i.e. the structural or governance context, will be considered. The governance context has five dimensions (Bressers, et al., 2016):

1- **Levels and scales:** governance assumes the general multi-level character of policy implementation.
2- **Actors and networks:** governance assumes the multi-actor character of policy implementation.
3- **Problem perspectives and goal ambitions:** governance assumes the multi-faceted character of the problem perceptions and resulting goal ambitions of policy implementation.
4- **Strategies and instruments:** governance assumes the multi-instrumental character of policy strategies for policy implementation.
5- **Responsibilities and resources for implementation:** governance assumes a complex multi-resource basis for policy implementation.

These dimensions are assessed using four governance qualities, namely extent, coherence, flexibility and intensity (Bressers, et al., 2013), result in the GAT. The four quality criteria are defined by the following questions:

- **Extent**: are all elements in the five dimensions that are relevant to the reusing matter taken into account?
- **Coherence:** are the elements in the dimension of governance reinforcing rather that contradicting each other?
- **Flexibility:** are multiple paths to the goals permitted and supported?
- **Intensity:** how strongly do elements in the dimensions of governance urge changes in status quo?

The GAT has been applied in the analysis of different water projects implementation in Palestine (Judeh, et al., 2017; Al-Khatib, et al., 2017), the Netherlands (Boer de & Bressers, 2011), Canada (de Boer, 2012), Turkey and Romania (Boer, et al., 2016), north-west Europe (Germany, United Kingdom, France, Belgium and The Netherlands) (Bressers, et al., 2016) and Mexico (Casiano & Boer, 2015; Casiano, et al., 2017).

2.2 Wastewater Management and Reuse Practices

2.2.1 Wastewater Management

The global point of view about wastewater has recently changed from being a mere waste stream to a recognized source of water and energy (Connor & Winpenny, 2014) but others see it as a problem also (Hanjra, et al., 2012). To enhance wastewater management, adopting a strategic approach to all stages of wastewater cycle shall be implemented from production to reuse (UN Water, WW Management, 2015). The United Nations Environmental Program (UNEP) and the Caribbean Environment Program (CEP) published a report about best practices in wastewater management (CEP 65, 2012), the following principles of wastewater management are considered in this research.

Prevent pollution rather than treating symptoms of pollution: The most logical approach is to prevent the production of wastes that require treatment. This approach should be given priority over end-of-pipe treatments since applying measures to prevent pollution is cheaper from actions to clean up polluted sites and water bodies

Use the precautionary principle: A precautionary action must be taken if there is a probability to harm the environment. If not, substantial environmental damage may occur while waiting to approve that probability.

Apply the polluter pays principle: This principle is not a new concept but has not yet been fully implemented, where the costs of pollution prevention, control and reduction measures are paid by the polluter, this principle is an economic instrument that is aimed at affecting behavior, by encouraging and inducing behavior that puts less strain on the environment.

Apply realistic standards and regulations: For efficient water pollution control, the formulation of realistic standards and regulations is important. The standards must be achievable and the regulations enforceable. Unrealistic standards and non-enforceable regulations may do more harm than having no standards and regulations, because they create an attitude of indifference towards rules and regulations.

Give open access to information on water pollution: Open access to information helps to stimulate understanding, discussions and suggestions for solutions of water problems. This principle is related to the involvement of general public in the decision-making process.

2.2.2 Reuse Options of Wastewater

Reuse of wastewater is a sustainable and renewable source of water, that is used mainly in the agricultural sector, but it is not the only sector especially in regions where the water scarcity is continuously aggravating, while the renewable water resources decrease. The options of reusing the treated wastewater mainly include agricultural, industrial, landscape irrigation, groundwater recharge, direct and indirect potable reuse and urban application (Chenini, 2011).

Agricultural and landscape irrigation: The idea of reusing the treated wastewater for agriculture purposes considered to be very risky method because of the nature of sewage. when examining the pollutants inside sewage, the health consideration took the most priority due to the pathogenic organisms that could be present in the effluent and create toxic materials. That might reach the human food chain by soil or by animals that feed on these plants. therefore, these plants could be affected by dissolved substances which may in turn affect the growth of the plants. However, we cannot ignore the advantages of using wastewater for agricultural purposes as the treated wastewater considered as reliable, constant and low-cost source of additional irrigation water. This treated wastewater saves the high quality water for other beneficial uses while disposing it in economical way that; preventing pollution and sanitary problems, get use of plant nutrients contained in wastewater and providing additional treatment before recharging the wastewater to ground water. In contrast, wastewater that not properly treated can create potential public health problems and chemical contamination in the groundwater. By this method, it should be kept in mind that wastewater is produced within the whole year but the irrigation is seasonal. (Chenini, 2011)

The agriculture is the sector in closest contact with humans, either for human's food or animal's feed. Thus, many regulations, guidelines and criteria are based on parameters to ensure the safety of use for agricultural use (Levine & Asano, 2004)

Groundwater recharge: Three methods are used for groundwater recharge utilizing treated wastewater. First of all, surface spreading or percolation and infiltration. Secondly by direct injection and the last by river bank or stream infiltration. These methods aim to augment potable or non-potable aquifers after providing further treatment for future reuse. In some cases, it provides a storage that may control or prevent the ground subsidence (Chenini, 2011).

Direct and indirect potable reuse: People are not accepting the direct use of treated wastewater unless it loos its identity through mixing it with water of rivers, lake or aquifer, in this case people are becoming more acceptable, however water quality should be monitored and appropriate measures should be performed before distribution (Chenini, 2011)

Industrial reuse: In many countries, the industrial sector comes after the agriculture in terms of water consumption levels, and therefore it represents an important potential for reusing the treated wastewater. Specifically, the factories generating wastewater can recycle their wastewater within the plant, depending on the availability of water and the industry's discharge requirements that may vary from industry to another, cooling water is the biggest application that using this treated wastewater (Levine & Asano, 2004),

Fout! Verwijzingsbron niet gevonden. summarizes these options, the possible barriers and categories of use for treated wastewater

Table 1: Summary of Options for the Reuse of Treated Wastewater

Option	Category of Use	Potential barriers
Agricultural and Landscape	Agricultural and landscape irrigation include: crop irrigation, commercial nurseries, parks, school yards, freeway medians, golf courses, cemeteries, greenbelts, and residential areas	Effects of salts on soils and crops, Public health concerns, surface and groundwater pollution, marketability of crops, and public acceptance
Groundwater Recharge	Aquifer recharge categories of treated wastewater reuse can be considered as following: groundwater replenishment, salt water intrusion, and subsidence control.	Potential barriers are limited to potential toxicity of chemicals and pathogens.
Direct and Indirect Potable Reuse	Blending in water supply and pipe-to-pipe water supply are the two categories of treated wastewater reuse for potable water.	Potentially toxic chemicals, public health, and public acceptance are the potential barriers for using treated wastewater for potable purposes.
Non-Potable Urban Reuse	Fire protection, air conditioning and toilet flushing can be considered as the main treated wastewater for non-potable urban purposes	Potential barriers are: Public health, fouling, scaling, corrosion, and biological growth
Industrial Reuse	cooling, boiler feed, process water, and heavy construction	Scaling, corrosion, biological growth, and fouling and public health concerns are the main barriers facing the reuse of treated wastewater

2.3 Factors That Affect the Reuse of Treated Wastewater

Projects of reusing treated wastewater needs good construction management and monitoring in order to go forward (Arafat, 2015), along the timeframe of these projects the barriers that stand in front of it need to be overcome. Several barriers affect the wastewater treatment and reuse in the Mediterranean countries, including Palestine (Özerol, 2013). These include financial barriers, standards and regulation, technical issues, institutional managerial aspects, monitoring and evaluation, policy and political, health impacts and environmental safety and public acceptance. These barriers are categorized under three main titles: social, economic and political factors. An elaboration of each barrier is provided below.

2.3.1 Political Barriers

Conflict and occupation: There is a lack of political commitment and of a national policy and/or strategy to support wastewater reuse. All of the reuse projects are connected with political obstacles due to the occupation and the conflict with Israel about the Palestinian rights of water (Kampa, et al., 2010). Moreover, lack of legal instruments and enforcement of these polices is considered as political obstacle for reusing the treated wastewater. The enforcement of these regulations often is weak and ineffective because of the political division of Palestine into Areas A, B, and C as a result of Oslo agreement on 1995 (ARIJ, 2015). Based on the Oslo agreement, Area A is under full control of the Palestinian Authority (PA) and consists primarily of urban Palestinian areas where Area B is under Palestinian civil control and shared Palestinian and Israeli security control and includes the vast majority of the Palestinian rural areas. Area C is under full Israeli control, but PA is responsible for education and healthcare (OCHA, 2009). As a result, the PA has no control to enforce the legal instruments in Area C where most of the WWTPs are located. In addition, the presence of Israeli occupation produces poor governance, these polices and laws could not be monitored in Areas B and C. But this is not the only cause; Corruption, political and tribal nepotism and favoritism in providing water services prevent the implementations of these laws (ARIJ, 2015).

Institutional capacity: The distribution of the responsibilities of (planning, design, implementation, operation and maintenance of wastewater treatment and reuse facilities) among the governmental departments is lacking coordination, cooperation, exchange information and

networking (Kampa, et al., 2010). But after the publishing water law 2014 the responsibilities become clearer and assigned to one institution to avoid overlapping. However, weak institutions and lack of trained persons, made most of monitoring and evaluation programs in Palestine irregular, insufficient and not well-developed (Kampa, et al., 2010)

Technical resources are important to assess, operate, design and develop any wastewater or reuse project (Arafat, 2015). In Palestine, the responsible institutions are not equipped with new technologies for treating wastewater. In addition, these new technologies have high operation cost and lack of qualified human resources (Özerol, 2013).

Standards and regulations: One of the main elements in the sustainable treatment and reuse of wastewater is to formulate realistic standards that must be achievable and regulations that should be enforceable (Kampa, et al., 2010), the standards and the regulations in Palestine are mostly based on either United States Environmental Protection Agency or on the WHO guidelines that sometimes do not respond to the country-specific needs (Özerol, 2013). Moreover, there is a draft standard for the treatment and reuse issues, but no clear mechanism to enforce the regulations (Arafat, 2015).

2.3.2 Economic Barriers

The investment and the operation cost (facility construction, collecting lines and reuse project … etc.) of these projects is very high especially for small and medium communities that suffer from the lack of funding resources (Özerol, 2013). Many WWTPs are waiting the fund to be constructed while others are construed but not operating. All of these costs cannot be handled by the municipalities, the Palestinian Water Authority (PWA) or the research centers unless the people pay for the service (Arafat, 2015). To resolve this issue encouraging people to use this water may occur if the cost of freshwater increased to be higher than the treated wastewater (PWA, 2013a). However, it is still considered that the water and wastewater services are social services that should be provided at the lowest prices; therefore, if any increment on the bill will be occurred it will be rejected by the community (ARIJ, 2015).

2.3.3 Social Barriers

Health impacts and environmental safety: The unregulated and continuous irrigation with insufficient treated wastewater will cause soil structural deterioration and livestock infection (Kampa, et al., 2010) and negative impact on humans and animals (Özerol, 2013). Mostly the problem of insufficient treatment is not lie on the WWTP but in many cases on incapable technicians who operating it (Kampa, et al., 2010).

Public acceptance and awareness: (Mizyed, 2013) stated that treated wastewater reuse faces socio-economic challenges and these challenges could be overcome through public participation in policy and decision-making in early stages which will make them committed to the new sector (Arafat, 2015), by which all of the stakeholders present their views and concerns for successful implementation of treated wastewater reuse projects (Mizyed, 2013). The limited involvement of public such as (local farmers, civil society, citizen and private sector) reduces the awareness and knowledge of public on health risks and economic benefits of reuse (Özerol, 2013). A recently survey by Arafat (Arafat, 2015) revealed that the barriers in Palestine against reusing treated wastewater were mainly economic and social factors. In addition, the acceptance of the public is not affected by age, sex or education level its only affected by location of living and material state (Arafat, 2015) which requiring a complete awareness campaign about the treated wastewater reuse that should be accomplished on all public scales.

To conclude, overcoming these barriers requires the cooperation of all stakeholders on all levels, requiring experts from all fields, policy-makers and the public sector to work together using innovations, sustainable tools and strategies to solve today the problem of tomorrow (Shomar & Dare, 2015).

2.4 Wastewater Treatment and Reuse in Jordan and Israel

Jordan and Israel are selected as the two countries for comparison. Jordan is selected since the stakeholders and practices in Jordan are close to the one in Palestine, as well as the cultural, economic, technical and water resources. Therefore, finding out the successful practices on reusing treated wastewater and the barriers of implementing the reuse approach can be useful for improving the Palestinian experience, too. Regarding the choice of Israel, the nature of the conflict between Palestine and Israel on land, resources and rights is considered as the main factor to study the situation in Israel. As the occupying power, Israel has control over resources, which deeply influences water, wastewater and environmental management practices in Palestine. However, there are also differences between Palestine and Israel in terms of economic and political systems, technological developments and the legal instruments used.

2.4.1 Wastewater Reuse in Jordan

"Wastewater shall not be managed as "waste". It shall be collected and treated to standards that allow its reuse in unrestricted agriculture and other non-domestic purposes, including groundwater recharge" (Water Strategy of Jordan, 1997). This statement was considered as the official governmental recognition of the importance of reusing wastewater in Jordan. since that time, the main focus was on technical development rather than other issues such as political, social and cultural were these aspects neglected by the planners (Albakkar, 2014).

Currently, more than 27 centralized wastewater treatment plants in Jordan are collecting and treating 121 MCM of wastewater (WAJ, 2013). And about 61% of the population are connected to the collection and treatment system (Abdulla, et al., 2016). Even though, this quantity is 10% of total national water consumption and 20% of the agricultural water need (USAID, 2012).

The treated wastewater in Jordan is mainly reused for agricultural purposes for both restricted and unrestricted irrigation, which will increase the freshwater that used for domestic purposes such as drinking, cooking and washing (Albakkar, 2014). the reused water for irrigation of agricultural land accounts for 14.7% of the current total water used for agriculture This percentage will be increased as the number of WWTPs increases (Abdulla, et al., 2016).

Forage crops, olive trees, date palm, fruit trees, steppe trees and nurseries are the crop patterns irrigated with treated wastewater in Jordan with a consumption exceeding 32 MCM per year covering 14,758 dunums (UG & ECS, 2013). Unrestricted irrigation is allowed if the effluent is diluted with freshwater, then it could be used for vegetables and fruits. But if it is not blended with freshwater the restricted irrigation is applied, fodder crops as an example (Albakkar, 2014).

The financer of 45% of wastewater collection and treating costs is the Jordanian government in addition to international grants and loans, while the householders covers the rest by the water bills (Ghneim, 2010).

2.4.1.1 Standards and Laws in Jordan

Reusing the treated wastewater in Jordan have been in developing process since 1955 when the government adopting the Law No. 29/1955 that gives the greater municipalities such as Amman the rights of deciding fees of water service, constructing and managing sewer networks and set standards for constructing water facilities. And its ends up with Law No. 893/2002 that has been approved in 2006 which detailed the standards of reusing wastewater. Currently there are three main standards used to regulate and managing the reuse of wastewater (Albakkar, 2014);

1) Standard 893/1995 – Discharge Standards for Treated Domestic Wastewater amended by Jordanian Standard 893/2006, The standards establish a variable standard for wastewater quality for 7 categories of discharge or direct reuse such as (UG & ECS, 2013):
    - Recycling of water for irrigation of vegetables that are normally cooked,
    - Recycling of water used for tree crops, forestry and industrial processes,
    - Discharges to receiving water such as valleys and catchment areas,
    - Use in artificial recharge to aquifers,
    - Discharge to water bodies containing fish,
    - Discharge to public parks or recreational areas, and
    - Use in irrigation of animal fodders.
2) Jordanian Standard 202/1991 for Industrial Wastewater amended by the Jordan Standard No. 202/2007 this standard *"entails specification and qualities of industrial wastewater that might be disposed or reused for irrigation purposes"* (Ghneim, 2010)

3) Jordanian Standard No. 1145/1996 - the Uses of Sludge in Agriculture amended by Jordanian Standard No. 1145/2006, that specified the requirements of using bio-solids in agricultural. The standards provide rigorous control on the process of sludge conversion to organic soil conditioner for agricultural use and it limits the places that such converted sludge can be used for soil enrichment (UG & ECS, 2013).

In 2009, the new national water strategy was published aiming to achieve its goals by 2022 and to support the wastewater in irrigation. It has put forward the following approaches (Kampa, et al., 2010):

1) Introduction of appropriate water tariffs and incentives to promote water efficiency in irrigation,
2) Ensuring that health standards for farm workers and consumer and that all wastewater from will be treated to meet the relevant national standard.
3) Periodical analysis and monitoring of all crops irrigated with treated wastewater or mixed waters.
4) promoting the reuse of treated wastewater by designing and conducting programs on public and farmer's awareness.

2.4.1.2 Stakeholders of the Water Sector and barriers

The stakeholders of reusing treated wastewater in Jordan are divided into two categories; governmental and non-governmental authorities (Ghneim, 2010). The governmental actors are the Ministry of Water and Irrigation, Water Authority Jordan, Jordan Valley Authority, Ministry of Health, Ministry of Agriculture, Ministry of Environment and Institute of Standards and Metrology. On the other hand, the non-governmental actors are Urban Water Users, Farmers, Donors and Lenders, Donors/Lenders Committee and Informal Interest Groups.

The technical issues in the policies of reusing treating wastewater in Jordan have been addressed in many studies. For instance, (Albakkar, 2014) analyzed these polices from a social perspective. She highlighted three main challenges, namely 1) stakeholder engagement, 2) enforcement of laws and 3) implementation and public awareness by education and behavioral change. Stakeholders engagement is necessary to obtain sustainable wastewater management system. By improving the management practice, and stockholders succeeded in addressing the

social, political and cultural the sustainability will occur (Albakkar, 2014). To enhance the stakeholder's engagement, cooperation is needed on three levels:

1- **Cooperation between donors, government and farmers**: Farmers should participate in decision-making, while the donors need to fund such projects to enhance farmers' participation in controlling actions, the government has to facilitate this (Albakkar, 2014).
2- **Cooperation between governmental institutions:** An overlap of responsibilities and duties between the governmental actors mentioned before, this overlapping between these institutions is not only about issues of monitoring but also over fresh and wastewater resources (distribution, collection and treatment), a recommendation to avoid this overlapping is to handling the responsibilities of wastewater managements and reuse to one single agency (Albakkar, 2014; Ghneim, 2010)
3- **Cooperation between government, donors, and educational institutions:** The necessity of this cooperation comes from the consideration of the educational institutions' role of engaging public and making them aware of water issues. Moreover, the government need to stop ignoring the academic institution and involve them in the researches needed. It must be mentioned, the government in Jordan do not trust the academic institutions to conduct researches on their behalf because of some cultural aspect about the power of who owns the information (Albakkar, 2014).

The second issue that has been addressed is policymaking in Jordan. As (Albakkar, 2014) stated, the water sector policy and law creation in Jordan is usually affected and shaped by politics. In other cases, some influential stakeholders shape the policy in the way they want. Most importantly, the policymaking is tied up with culture, since the Jordanian are less likely to follow the regulation If they are not engaged as stakeholder in developing the importance of these policies in protecting their lifestyle.

2.4.1.3 Conclusions regarding Wastewater Reuse in Jordan

1- Reusing reclaimed water has become already an integral effective component of long-term water resources management in Jordan.

2- The existence of the prerequisites for a sound legal framework in Jordan for safe use reclaimed water are in place. However, it was not sufficient. Such action needs to be complemented by awareness campaigns.
3- The involvement of all stakeholder proven that efficient and successful to initiate national interdisciplinary working groups with specialists of the involved authorities for the elaboration of guidelines and monitoring programs.

2.4.2 Wastewater Reuse in Israel

Israel has a pioneering experience in wastewater treatment and reuse, and stands as an idealistic model for other countries (UG & ECS, 2013). In 1948, Israel had a mixture of laws that were legislated by the Ottoman Empire and Britain. Both were used for some time and gradually replaced or updated. Most laws that were legislated during the fifties, sixties and seventies depend on two concepts: 1) Abatement of nuisance and protection of public health. 2) All-encompassing legislation for a particular natural resource, such as water, nature reserves and forests. The evolution process of wastewater management system in Israel passes through three phases as shown in **Fout! Verwijzingsbron niet gevonden.** (Hophmayer, 2010).

Wastewater reuse is an integral component of the national water management strategy in Israel, where many projects expanding the areas irrigated with treated wastewater. Agricultural reusing option remains the largest potential market, followed by recreational and landscape uses (Afifi, 2006) , where it accounts for 31% of the demand for irrigation (Becker, 2013).

Almost 98% of generated wastewater in Israel is collected and 90% is treated (UG & ECS, 2013), yearly more than 530 MCM (Becker, 2013) and up to 80% is reused, mainly for agricultural purposes which considered to be one of the highest percentages in the world (UG & ECS, 2013). The treatment of the wastewater is processed by 135 WWTPs that are spread around the country. By 2020, 95% of the wastewater will be used for different purposes which will allow the high-quality water for domestic use. The target for 2020 is to reach 600MCM of treated wastewater. The wastewater qualities used for irrigation are divided into five levels, whereas most of the treated wastewater used for irrigation is of high quality (Becker, 2013).

Table 2: Summary of the Evolution of the Israeli Water Management System,

Regime phases	Description	Results
Phase one simple regime (1948–1970)	wastewater management is dominated by one main user/actor: agriculture, with focus on use-driven policies.	continuous discharge of untreated or partially treated wastewater to the environment and pollution of water resources.
Phase two Simple to complex: failed regime shift (1970- end of 1980s)	Following the cholera outbreak more uses are formally restricted/protected and the public policy system slightly expands with the appearance of new instruments (new legislation) and resources (separate budgets).	Mainly unchanged
Phase three complex but fragmented (end of 1980s/beginning of 1990s <)	As a response to pressures from different fields, more uses are acknowledged, public policy system shifts to a multiple-element system, a shift to decentralized decision-making approach. A shift to protection-driven policies is observed. While the regime becomes complex, coordination among the different elements remains insufficient.	Advanced WWTPs are constructed throughout the country; the authority of the municipalities is restored and it became very difficult for them to continue neglecting wastewater.

Source: (Hophmayer, 2010)

2.4.2.1 Standards and Laws in Israel

1- **Licensing of Businesses Law, 1968, amended in 1972, 1974, 1994:** This law affects the construction of WWTPs and treated effluent-reuse structures. (UG & ECS, 2013).

2- **Discharge of Industrial Wastes into the Sewage System, 1981:** The law declares that the owner or holder of an industrial plant shall not discharge industrial wastes into the sewage system and shall not allow any other person to discharge from his plant into the sewage system (UG & ECS, 2013).

3- **Israeli regulations on use and disposal of sludge, 2004**: Regulations on the use of sludge require WWTPs to stabilize and treat the sludge they generate as a condition for agricultural use or soil improvement (UG & ECS, 2013).

2.4.2.2 Stakeholders of Water Sector in Israel

1- **Ministry of National Infrastructure** is responsible to the Parliament for the management of the water resources of the country, the proposal of a national water policy for Cabinet approval and its subsequent implementation, as well as for Israel's external water relations. Additionally, the primary governmental organization responsible for the planning, regulating,

and policy creation relating to water is the **Israeli Water Authority,** which is a department of the Ministry of Infrastructure.

2- **The Governmental Authority of Water and Sewerage**: By 2006 Law many of responsibilities with respect to the water sector were transferred to the directorate of the governmental authority of water and sewerage, also known as "Water Commissioner".
3- **The Water Board** is an institutionalized forum of public participation, composed of representatives of the Government and the public, whose advice must be obtained for various measures taken by the Council of the Authority and the Director of the Authority in the implementation of water legislation.
4- **The National Water Company "Mekorot"** is Israel's bulk water supplier which is a corporate entity owned and controlled by the Government. Its main statutory functions are to establish and manage the National Water System.
5- **Regional Water Authorities** are entities that operate regional water systems for the production and supply of water on a regional basis.

2.4.2.3 Conclusions regarding Wastewater Reuse in Israel

1- In Israel, the water is publicly owned and the polluters (people, cities, urban centres, etc.) are responsible for cleaning and treating their wastewater, as an application of "the polluters pay" principle.
2- The responsibility of operating the treatment facilities is the local council issue and monitored by the regional authority.
3- The quality of treated wastewater should be suitable for un-restricted reuse in agriculture since they using the Tertiary treatment.

3. Research Design

This chapter presents the methodology, activities and the steps followed in order to achieve the research objectives.

3.1 Research Framework

To achieve the research objective a clear approach followed for efficient preforming during the research period based on (Verschuren & Doorewaard, 2010). Giving schematic presentation of the research objectives was applied. Its include a step-by-step approach to approach the research objectives. The research framework consisted of the following steps

Step 1: Characterizing the objective of the research project

The objectives of this research are threefold as mentioned in section 1.3:

1) To describe the elements of wastewater governance in terms of multiple actors, levels, problem perceptions, goal ambitions, strategies, instruments, responsibilities and resources.
2) To assess the qualities (extent, coherence, flexibility and intensity) of the governance context of the wastewater reuse projects, and
3) To provide recommendations to the responsible governmental authorities to take the actions towards improving the reuse of treated wastewater.

Step 2: Determining the research object

This research focusing on the policies and practices of treating and reusing wastewater processes. investigating on two main objects; West-Nablus and Jenin WWTPs.

Step 3: Establishing the nature of research perspective

This research assesses the current governance system of water sector in Palestine based on the two objects of the study mentioned above, through the qualities of extent, coherence, flexibility and intensity given by GAT within the context of the governance elements of actors, problem perception and goal ambitions, strategies and instruments, and responsibilities and resources for implementation (Bressers & de Boer, 2013). The analysis of the Palestinian's wastewater sector

governance will result in better understanding of how well the governance regime is placed (Al-Khatib, et al., 2017) and the actor's interrelations within the governance system.

The possibility to increase the usage of treated wastewater will be assessed by analyzing the current wastewater reuse projects. This will provide a deep insight and updated information regarding the barriers that limit the effective implementation of treated wastewater reuse.

Step 4: Determining the sources of the research perspective

The conceptual model is developed by studying documents related to 1. policies and practices, 2. policy-makers, practitioners and experts and 3. scientific literature (thesis, articles and books).

Key concepts	Theories and documentation
• Actors interactions • Wastewater governance • Reusing treated wastewater • Influence of the water governance on reusing treated wastewater • Potential of increasing utilization of reusing treated wastewater services	• Governance Assessment Tool - based on Contextual Interaction Theory • Literature on the current reusing projects. • Documentation on reusing treated wastewater policies and standards in the surrounding countries

Step 5: Making a schematic presentation of the research framework

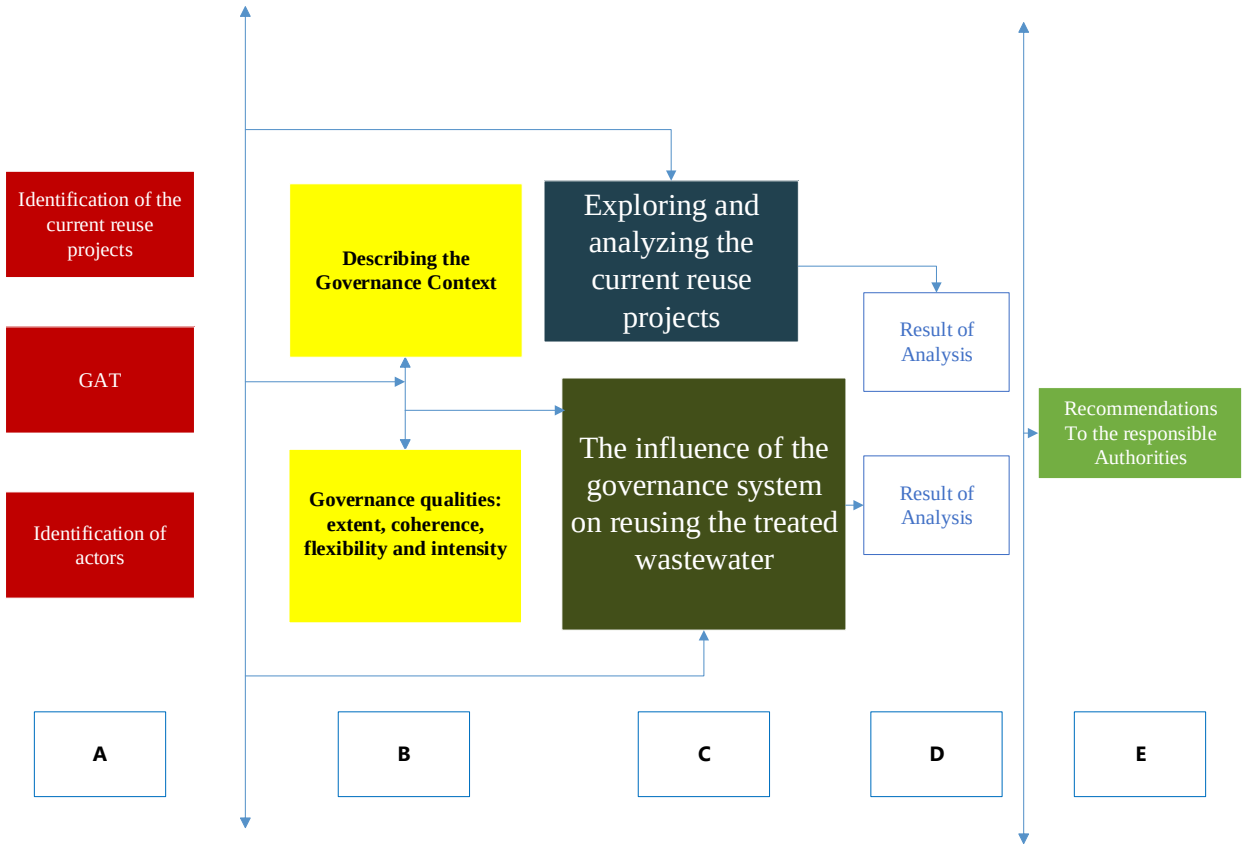

Figure 2: Schematic Sketch of the Research Framework

Step 6: Formulating the research framework in the form of arguments

The steps to be taken in this research project are formulated as following:

a. A study of documents regarding the actors of the Palestinian water and wastewater sector, wastewater reuse laws and standards, and the current wastewater reuse projects.
b. Application of GAT and preliminary research to describe the elements of the wastewater governance context.
c. Assessment of the qualities of the governance context of reusing treated wastewater and their influence on the current reuse projects.
d. A comparison and evaluation of the results and literature review
e. Recommendations to the responsible authorities for improving the reuse of treated wastewater.

Step 7: Checking whether the model requires any change

The research is an iterative process and as more data is collected about the research object, changes may be made to the framework

3.2 Definitions of Key Concepts

Wastewater: wastewater is defined as "a combination of one or more of:

- domestic effluent consisting of Blackwater (excreta, urine and fecal sludge) and greywater (kitchen and bathing wastewater);
- water from commercial establishments and institutions, including hospitals;
- industrial effluent, storm water and other urban run-off;
- agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter" (Corcoran, et al., 2010)

Wastewater treatment is a process used to convert wastewater which is water no longer needed or suitable for its most recent use into an effluent that can be either returned to the water cycle with minimal environmental issues or reused (Hammer, 1975).

Stakeholder: is a member of the "groups without whose support the organization would cease to exist (Freeman, et al., 1983).

Policy effectiveness: the effect of the policy in terms of is accessibility, utility, quality, and competitiveness that are eventually able to satisfy the setting in terms of legal, technical, marketing and economic aspects of the related topic (Baporikar, 2014).

Policy success: A policy is successful if it achieves the goals that proponents set out to achieve and attracts no criticism of any significance and/or support is virtually universal (McConnell, 2010).

Governance: as the combination of the relevant multiplicity of responsibilities and resources, instruments, strategies, goals, actors and scales that forms a context that, to some degree, restricts and, to some degree, enables actions and interactions (Bressers, et al., 2016).

Water Governance: the context that guides and organizes the actions and interactions of actors involved in the management of water resources (Bressers, et al., 2013).

3.3 Research Questions

The Main Research Question:

How can the implementation of policies regarding wastewater treatment and reuse in Palestine be improved?

Sub-Research Questions

1- How can the governance context of wastewater treatment and reuse in Palestine be described in terms of the following dimensions? a) actors b) problem perceptions and goal ambitions c) strategies and instruments d) responsibilities and resources.
2- Based on the assessment of four governance dimensions using the four qualities (extent, coherence, flexibility and intensity), how supportive is the governance context of wastewater treatment and reuse in Palestine?

3.4 Research Strategy

The research strategy is case study approach, which is an in-depth examination of two main research object using various methods for generating data.

3.4.1 Research Unit

Nablus and Jenin WWTPs have been selected as research units to assess the influence of the water governance system on reusing the treated wastewater. Nablus and Jenin are both in the northern region of the West Bank, with agricultural characteristics. Moreover, they are similar in the economic properties. Both WWTPs are described in section 4.2.1 and 4.2.2 with focus on the influence of the governance context on the current reuse projects.

3.4.2 Research Boundary

In order to finish the research with the specific time, this project is limited to only two WWTPs with different performances in reusing treated wastewater. Both WWTPs were studied under the mentioned framework. The following boundaries are used in this research:

- GAT covered the qualities of the governance context for the four dimensions, actors, problem perceptions and goal ambitions, strategies and instruments, and responsibilities and resources.
- The reuse projects currently operated have been analyzed and identified from the point of providing quantities, types of crops irrigated and operator.

3.5 Data Sources and Collection Methods

Data required to answer the research questions was collected using several tools including documents, observations, media and interviews. The interview method as source of data is elaborated in the next section in terms of which organizations were represented by the participants and when the interviews took place, how long they lasted and the selection criteria.

The information required and its accessing method identified through the set of research question in Table 3.

Table 3: Research Material Matrix

Research Question	**Data/Information Required to Answer the Question**	**Sources of Data**	**Accessing Data**
How can the governance context of wastewater treatment and reuse in Palestine be described in terms of the following dimensions? a) actors b) problem perceptions and goal ambitions, c)strategies and instruments, d)responsibilities and resources.	- who are the actors of water sector, their responsibilities, goals, strategies and/or polices used, policies' or strategies' instruments and the resources allocated. - Data about current reuse projects, (land area, crops, operators, water consumptions)	Secondary Data: Publicly available documents, Policies, articles, and reports	Content Analysis Search method
		Primary Data; People: WWTPs', WUA, WSRC, ANERA, MOA, PSI, PARC, Municipalities, Farmers and Expert	Questioning Observation Interview
Based on the assessment of four governance dimensions a) actors b) problem perceptions and goal ambitions c) strategies and instruments d) responsibilities and resources. using the four qualities (extent, coherence, flexibility and intensity), how supportive is the governance context of wastewater treatment and reuse in Palestine?	- Results of the Governance assessment of the wastewater treatment and reuse in Palestine	Secondary Data: Publicly available official governmental documents and articles.	content analysis Search Method
		Primary Data; People: WWTPs', WUA, WSRC, ANERA, MOA, PSI, PARC, Municipalities, Farmers and Expert	Questioning Observation Interview Content Analysis

3.5.1 Interviews

Based on the GAT, an interview guide was designed to ensure the boundary of the research and to facilitate collection and analysis of data. The questions asked to the participants were based of the GAT matrix (see Appendix 1).

12 interviews have been conducted with the key stakeholders of wastewater reuse sector, namely with the policy maker; Water Sector Regulatory Council (WSRC), Ministry of Agriculture (MoA), Palestinian Standards Institution (PSI) in addition to local government representative from Nablus Municipality and Jenin Municipality specifically the treating department. Moreover, we interviewed a representative of West Nablus WWTP as well as the Environmental Control Unit (ECU) and agricultural academic expert. Form the non-governmental organizations NGO; the Palestinian Agriculture Development Association (PARC) and American's Near East Refugee Aid (ANERA) were interviewed. Further, Water User Associations' (WUA) representative and farmers as potential treated wastewater users were interviewed.

The interviews were conducted by the researcher through an audio call using skype or WhatsApp. Ten interviews lasted for an average of 45-60 minutes, and the other 2 between 30-45 minutes, between 10-25 of August 2017. Before the interview a full insight about the research and its goal was provided to the interviewees. The interviews were recorded electronically and saved confidentially to ensure privacy after permission by the participants, except one from the Environmental Control Unit (ECU), who asked not to record it. During the interviews, extensive notes were taken.

3.5.2 Documents Reviews

During the literature review process, qualitative data was collected through relevant policy documents, scholarly articles and reports. Water, Agricultural and wastewater development strategies and policies for short and long-term periods (PWA-2013, MoA-2014, PWA-2014, PWA-2016, PWA-2017), laws (3/2002, 14/2014), by-laws (34/2012, 16/2013, Tariff-Forthcoming, WUA-Forthcoming), plans and action plans (SDP-2013, SCP/2016), issued in Palestine were reviewed. Further, reports on water and wastewater statistics in Palestine that were issued by the governmental bodies (PWA-2011, PWA-2013, PCBS-2016), NGOs (PARC-2015,

ARIJ-2015, ANERA-2016) were examined. In addition, to the operational reports of the WWTPs. Finally, international, regional and local scientific articles, reports and books about reusing of treated wastewater and the governance assessment of wastewater in different countries were reviewed.

3.6 Data Analysis

3.6.1 Analytical Framework

The purpose of analyzing data is to obtain usable and useful information. In this research, a qualitative analysis was performed as follows:

First step is reviewing the documents, WWTP operational data, the current reuse projects and describing the context of the governance system in terms of the governance dimensions; actors; problem perceptions and goal ambitions; strategies and instruments; and responsibilities and resources. This step answered the first sub-question.

Second step is assessing the wastewater governance context in terms of the qualities (extent, coherence, flexibility and intensity) in Palestine by analyzing the polices, standards and the interviews answers on the GAT matrix and set of questions which describe the influence of the governance system on reusing treated wastewater (Appendix 1).

Further, a manual was developed for evaluating the answers to the questions in the GAT matrix. The manual was developed based on the GAT questions according to the research case. Based on the assessment of all dimensions, the degree of supportiveness was measured as follows for each quality criterion:

- The context is assessed as “supportive”, when at least two dimensions support the implementation, and there are no restrictive dimensions.
- The context is assessed as “moderate”, when at least three dimensions moderately support implementation, there is at most one restrictive dimension.
- The context is assessed as “restrictive”, when at least two dimensions restrict the implementation.

The dimension of “levels and scales” was not included in the assessment process in this research since insufficient data were gathered and specifically this dimension was not notable among the interviews. Additionally, the term “actors” was used rather than “networks” and that refers to the political system in Palestine, which involves stakeholders that often act as individual actors, and not as networks. This step answered the second sub-question.

Third Step: Gathering the analysis results from the previous two steps will provide solid knowledge to build recommendations for the responsible public authorities. and by this step the main research question was answered.

3.6.2 Validation of Data Analysis

Different and multiple sources of data were used in order to assure the validity of the information obtained. In addition, a combination of multiple research methods was used to investigate the same concept. As a result, a validation of the data through cross verification from two or more will be managed and by bringing the data obtained through interviews, literature reviews and sources; a triangulation of sources will be applied to avoid the one-sided vision regarding any point.

4. Results

4.1 Empirical Background about Palestine

4.1.1 Water Resources of Palestine

West Bank, with an area of 5655 km^2 and a population of 2.9 million, consumes 139.6 million cubic meters (MCM), 63% of it is for domestic use while the rest is for agriculture purposes. On the other side, Gaza Strip is 365 km^2 area with population of 1.9 million consumes 183.7 MCM, 53% used for domestic purposes and 47% for agricultural (PWA, 2011); (PCBS, 2016) As a result, the Palestinian domestic water consumption is limited to an average of 70 liters per capita per day below the 'absolute minimum' of 100 liters recommended by World Health Organization (Özerol, 2013).

As mentioned in the introduction chapter, the restrictions on the water resources result from not only the environmental factors, but also mainly to the discriminatory water policies and practices that Israel has instituted across the occupied Palestinian territory since 1967. Without access to and control over their rightful share of the trans-boundary freshwater resources located in the occupied West Bank (PWA, 2012). However, these practices affect the Palestinian only and expanding badly over the time as a result of the discriminatory allocation of the shared freshwater resources located in the West Bank. Basically, the Palestinian are prevented from accessing their rightful share of water from the underground mountain aquifer, and have no access to the Jordan River (PWA, 2012) .

Al-Ghour area separated by Jordan River, the east side is belonging to Jordan and the west for the Palestinian. To the Palestinians its considered to be their vegetables and fruit basket, this area now becoming more and more thirsty.

Therefore, the government realized the importance of reusing the treated wastewater to alleviate the shortage in water supply. Palestine generated 114.36 MCM of wastewater in 2015, and the produced wastewater is from 53.9% of the connected users to the sewage network (ARIJ, 2015). At the moment 6 main central WWTPs are operating in north and middle of West Bank

(see **Fout! Verwijzingsbron niet gevonden.**). Table 4 shows these central WWTPs and their capacities (PWA, 2011; ARIJ, 2015).

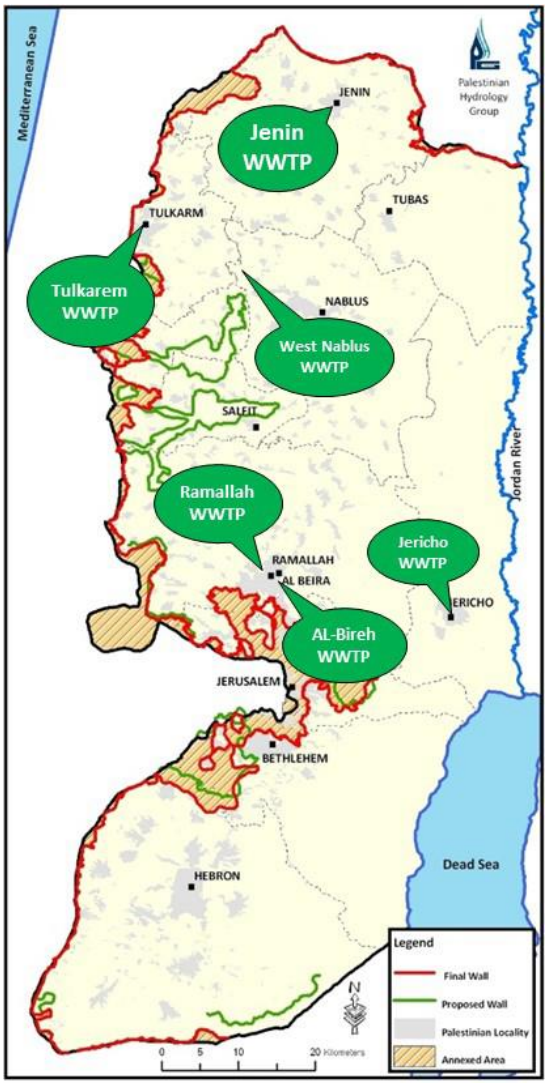

Figure 3: Central WWTPs in the West Bank

Source: (PWA, 2011)

Table 4: Central WWTPs and Their Capacities

City	Operational Year	Design Flow for Dry Weather (m_3/day)	Actual Flow (m^3/day)
Al-Bireh	2000	6,000	5,000
Ramallah	1975, rehabilitated in 2002/2003	1,400	2,400
Tulkarm	1972, rehabilitated in 2004	15,000	7120
Jenin	2012	9,250	3,000
West Nablus	2013	14,000 by (2020)	10,500
Jericho	2013	9600	300

Source (ARIJ, 2015; PWA, 2011)

4.1.2 Policies and Strategies in Palestine

The Palestinian National Authority was founded in 1994, it has issued several laws, regulations, strategies and polices for managing the water and wastewater sector, Table 5 summarizes the laws polices, strategies and work plans that had been established for that purpose.

Table 5: Timeline of Palestinian Water and Wastewater Laws and Polices

Law	Year	Description
Palestinian National Water Policy (NWP)	1995	addresses the important issues of water management and planning such as the structure, legislation, and the tasks of water sector institutions
Water Resources Management Strategy	1998	highlights the necessary aspects of water resources and sector development, and outlines a focus on securing sustainable water management.
Palestinian Environmental Law No. 7	1999	Chapter 3 of this Law contains articles regarding standards for quality of fresh, collected and treated water
National Water Plan of 2000	2000	sets directions until 2020 and proposes specific actions to be taken to achieve its goals, provides a program of projects and activities needed for the water sector development in Palestine
Palestinian Water Law No. 3	2002	aims to develop and manage the water resources; i.e. increasing their capacity, improving the quality and protecting water resources from pollution and depletion
Integrated Water Resources Management Plan (IWRMP)	2003	defines how water resources will be managed in an integrated approach; outlines the polices, goals, and objectives of the PWA and provides actions for achieving the objectives.
Palestinian standards for wastewater treatment and reuse	2005	recommends guidelines for the limit values for effluent from wastewater treatment plants and set values for treated wastewater and reuse.

National Sector Strategy: Water and Wastewater 2011-2013	2010	aims to provide 1) good governance and a legal and institutional environment, 2) equitable and continuous water services 3) equitable and continuous wastewater services and management 4) Efficient and effective water and wastewater institutions engaging all segments of society
National Water and Wastewater Strategy for Palestine	2013	aims to protect, conserve and attain sustainable management practices of water resources and wastewater services
Water and Wastewater Strategy 2014-2016	2013	aims at setting a strategy to improve the water and wastewater sector during the three years (2014-2016) in order to have a strategic developmental for the sector
Decree No. (14) Relating to the water Law	2014	aims towards water management and development of the Palestinian water resources
Strategic Water Resources and Transmission Plan &, Water Sector Policy and Strategy 2014	2014	describes the water sector's goals and needs, to serve as strategic guidance that deals with aspects such as water quantities; groundwater; surface water; desalination; rainwater harvesting; and wastewater reuse
National Development Plan- State Building to sovereignty: 2014-2016	2014	aim to achieve a Palestinian water and wastewater sector that is more organized and more capable of securing water rights to citizens and materializing a fair distribution for all purposes.
Palestinian Water Authority Strategy plan 2016-2018	2016	a strategic road map towards achieving an integrated sustainable management of the water resources on the bases of sound principal and effectiveness.

Sources: (ARIJ, 2015; PWA, NWSSP, 2016)

4.1.2.1 National Water and Wastewater Strategy (NWWS)

This strategy provided the planning and management framework needed to protect, conserve and attain sustainable management practices of water resources and for the improvement and sustainable management of water supply and wastewater services that meet the standards in the Palestinian Territories (PWA, NWWS, 2014).

The main objectives of this strategy are as follows:

1- Reinforcing the Palestinian Authority's (PA) approach to sustainable water resources management by ensuring that all arms of government work together in the pursuit of shared water resources management goals (PWA, NWWS, 2014); and

2- Establishing a framework for the coordinated development, regulation and financial sustainability of water supply and wastewater services to ensure concerted efforts towards improved water systems management, rehabilitation and maintenance (PWA, NWWS, 2014).

Over the last decades, the PWA focused on small-scale reuse schemes for experimentations and demonstration purposes. The recommendations from these experiments is to promote rapid progression to the medium-sized pilot projects that extending over few thousands of dunums. This will be implemented by the existing agencies; PWA, Ministry of Agriculture (MOA), WUA and farmers' association in order not to delay this step (PWA, NWWS, 2014).

In addition, to interact the farmers more rapidly, awareness-raising campaigns will be conducted to promote the idea to potential users about the benefits and safety of water reuse. To deliver this message; the mass media will be used as the important means for promoting the reuse issue and its associated benefits (PWA, NWWS, 2014).

The strategies for achieving the wastewater reuse goal can be summarized as follows:

1- **Completing the regulatory framework** by developing the mechanism necessary to encourage the farmers to use the treated wastewater without ignoring financial and economic parameters. Moreover, setting up the standards and guidelines for different crops irrigating and the environmental limit values of use. Additional regulations will be developed covering; investment in treated wastewater carriers (defining ownership, rules for implementation, funding arrangements), right-of-use and tariff-setting mechanism (PWA, NWWS, 2014).

2- **Assessing and costing opportunities for reuse** by investigating further development of wastewater reuse taking into account environmental and health barriers, within five years of this strategy it should include a detailed assessment of the irrigable land located downstream from future WWTPs or that could be supplied with a moderate pumping head (< 50 meters); and a rapid appraisal of the investment and running costs of the facilities to be constructed for each of the schemes (canal, storage, pumping stations), in order to enable the development of a robust business model for each reuse scheme (PWA, NWWS, 2014).

3- **Organizing reuse management** to ensure the equitable distribution of water between farmers a clear and concise institutional arrangements will be defined within 3 years. Reused wastewater will be affordable for agricultural users where the providers are responsible to treat the water with agreed standers. Wherever large scale wastewater reuse is carried out water quality monitoring will be conducted by an approved laboratory to ensure any further impact on environment and soil (PWA, NWWS, 2014).

4.1.2.2 Water Law of 2014

In April 2014, the new water law was published aiming to enhance the institutional body of water sector. Its article 17 announced the establishment of the Water Sector Regulatory council (WSRC), which aims to monitor all matters related to the operation of water service providers including production, transportation, distribution, consumption and **wastewater management**, with the aim of ensuring water and wastewater service quality and efficiency to consumers in Palestine at affordable prices (PWA, Water Law, 2014).

Before publishing this law, PWA was controlling all issues related to water and wastewater sector. NWWS stated that *"The PWA is performing a variety of functions, ranging from political and strategic functions (ministerial), and regulatory functions, to bulk utility operational functions, and infrastructure development project management functions. This combination functions is causing PWA to engage in a crisis management process which in turn has impaired its ability to perform and deliver its mandated duties properly. Accordingly, the institutional reform will be enacted to restructure the water sector based on functional roles separating governance level from water management level"* (PWA, NWWS, 2014, p.102).

Table 6 shows the allocation of the roles across ministries and public agencies regarding wastewater treatment these allocations were issued based on Water Law 2014.

Table 6: Allocation of Roles across Ministries and Public Agencies

Role	**Organization**
Strategy, priority setting and planning, including infrastructure	PWA, MOH, Environmental Quality Authority (EQA)
Policy Making	PWA, EQA, MOH
Information, monitoring and evaluation	PWA, EQA WSRC, MOH
Stakeholders engagement, citizen's awareness	PWA, EQA, MOH
Allocation of uses	PWA
Quality standards	PWA, EQA MOH, EOA
Compliance of service delivery	WSRC
Economic regulations (tariffs)	PWA
Environmental regulation	PWA, EQA

Source: (GWPMed, 2015)

4.1.2.3 Strategic Development Plan for 2017-2022

In May 2016, PWA published the strategic development plan (SDP) to guide the work of water sector institutions between the years 2017-2022, and to achieve agreed targets that contribute to accomplishing the objectives of the water sector reform on the short-term after the long-term strategy of years (2013-2032) (PWA, Reform Plan, 2016). In addition, it aimed to help PWA activating its role in leading the development of the Palestinian water sector and achieving the goals of this developmental and vital sector (PWA, SDP, 2016).

The objective of the strategic development plan in term of wastewater is improving the wastewater services and structure; collection, treatment, and reuse (PWA, SDP, 2016). Table 7 shows the objectives and their indicators of this strategic plan

Table 7: SDP Wastewater Objectives and Indicators

Objective	Indicators
- Increasing the efficiency of wastewater systems (collection, transportation and treatment) - Increasing agricultural areas suitable for treated water irrigation from nonconventional water resources - Providing an investment environment for private sector participation in this component	- Percentage of households connected to wastewater system or suitable on-site sanitation system (septic tanks and infiltration beds) - Percentage of wastewater treated in wastewater treatment plants - Percentage of treated wastewater meeting the Palestinian specifications - Number of WWTPs, the effluents of which meet the Palestinian specifications - Percentage of treated wastewater used for irrigation - The area of agricultural lands irrigated with treated water - Number of projects in which the private sector participates within this component

Source: (PWA, SDP, 2016)

4.1.3 Private Sector Involvement in Wastewater Treatment in Palestine

In Palestine, the private sector is not involved yet in the process of treating wastewater. NWWS mentions that the private sector participation in water supply and wastewater sector may be useful management tool to enhance upgrading the efficiency of water use and consumption and enhance the efficiency of operation and maintenance; encourage the private sector to invest and to actively participate in the national economy; job creation and rationalize public expenditures (PWA, NWWS, 2014). Moreover, NWWS suggests to apply the commercial practices in water

sector which is expected to bring several benefits, such as reductions in man-power required, increasing revenues; decreasing the tariff rate due to reduced operating costs; integration of technology into operations and management to substitute for labor and introducing innovative approaches to reduce water demand thereby increasing water supply. (PWA, NWWS, 2014).

The attempts of involving the private sector was obstructed by different barriers (PWA, 2010) for instance;

1- The water and wastewater sector is risky for investment, in addition to the absence of a clear investment plan that encourage the private sector to invest acquiring profits.
2- The capital of investment needed in this sector is much higher than the financial capability of the private sector.
3- The Palestinian Authority still hesitating form affecting the balance concept between the social and human aspects for the water sector and the guarantee the profit for the private sector.

In 2012, a joint committee, designated by the Prime Ministry, met and discussed the possibilities of private sector participation. The committee addressed two actions as recommendations to enhance private sector participations in treated wastewater reuse. Both actions relate to governance and the regulatory process, namely promoting the reuse of treated wastewater through a policy, and setting tariff and fee regulations (GWPMed, 2015).

4.2 Wastewater Reuse Projects and Practices in Jenin and Nablus

In this thesis, two cases were selected in order to understand the current use of the treated wastewater in Palestine, namely the Jenin and West Nablus WWTPs. Both WWTPs are named after the city they serve (see Figure 4).

4.2.1 Case 1: Jenin Wastewater Treatment Plant

Jenin Governorate is located in the northern part of the West Bank, 125 m above the sea level with a population of 318,958. The area of Jenin Governorate is 583 Km^2, of which 180.9 Km^2 is agricultural lands that count for 31% of the total area. A total of 48 local municipalities are under the Jenin Governorate (PCBS, 2016).

Jenin Governorate is considered as one of the most important areas for the agricultural sector of Palestine due to the existence of the large and fertile plain, Marj Ibn Amer. This plain is considered as a vital source of agricultural products for most of the West Bank, and represents the largest share among the agricultural lands of the Jenin Governorate.

The total amount of water demand in the Jenin Governorate yearly is 15.4 MCM, and the total supply from all resources (groundwater, springs and water purchased from Mekorot) is 6.8 MCM. However, because of transferring losses the consumed amount is 3.9 MCM, the actual deficit (the difference between the demand and the consumption) is 11.5 MCM (PWA, 2011).

The percentage of population that is connected to the water network is 93.2%, with 39.2 liters per capita per day (1/c/d) actual consumption (PWA, NWWS, 2014; PCBS, 2016), while only 15.6% of the population in the governorate is connected to the sewer network (PWA, NWWS, 2014). The wastewater generated by Jenin Governorate is 3.9 MCM yearly, of which 2.9 MCM is collected in cesspits and 1.1 MCM streaming to the wadis and then to Israel (PWA, NWWS, 2014).

Figure 4: Location of Jenin and Nablus Governorates

4.2.1.1 Description of the Jenin WWTP

Jenin WWTP is one of the 6 central WWTPs in the West Bank that was constructed in 1970. Its located in north west of Jenin city within a residential neighborhood over an area of 27 dunums. It serves about 40% of Jenin city population and 100% of the Jenin refugee camp's population (Asmah, 2016). The unserved population (60% of Jenin city population) are connected to the sewer network but because of the difference in elevations, the generated wastewater is left to flow into near the wadi of Al-Muqatta (Asmah, 2016) and then to the Israeli treatment plant called Gilboa.

In 2009, Jenin WWTP was rehabilitated and divided into two lines. Each line has two aerated lagoons and one polishing pond using secondary treatment technology (Asmah, 2016). The rehabilitation was funded by a grant of the KFW with 1.8 million Euros and Jenin Municipality with 1 million Dollar. The rehabilitation redesigned the WWTP to have an average capacity of 9,000 m^3/day, but now it receives an approximately about 3,500 m^3/day. A further rehabilitation project is still waiting to be approved, which is funded by Royal HaskoningDHV, Palestinian Development & Investment Company (PADICO Holding), Jenin Municipality and the Palestinian Hydrology Group for Water and Environmental Resources Development with total budget of 2.9 million Euro where 1.7 million Euro is from the Dutch Government (RVO, 2012).

Jenin WWTP is operating under the responsibility of the Jenin Municipality. The cost of treating 1 cubic meter of wastewater is 1.15 NIS, and the citizen are not paying for any services regarding the treatment of wastewater. Moreover, the municipality is operating the Jenin WWTP without any funding from other organization.

4.2.1.2 Reuse Practices in Jenin

After the rehabilitation of Jenin WWTP was accomplished, The American's Near East Refugee Aid (ANERA) started an initiative project to reuse the treated wastewater that flow out of Jenin WWTP for agricultural purposes. The project was funded by OPEC Fund for International Development (OFID) and ANERA's community of donors (ANERA, 2015). The launched program utilizes recycled water from Jenin WWTP to benefit 240 farming families that use the water to irrigate their agricultural lands (ANERA, 2015) . The reuse scheme has a 26 km water network that can irrigate 8,000 dunums (WUA, Interview 1, 2017). Within the scope of the project, ANERA constructed a pool inside Jenin WWTP to collect the treated wastewater and pump it, then filtrate that water as final stage, add Chlorine and distribute it to the network.

ANERA's role is not limited to constructing the infrastructure of the project. It also helped farmers to create the very first farmers' cooperative, namely Marj Bin Amer Farmers' Association (hereafter "Jenin WUA"), where the members benefit from training and awareness raising sessions. Moreover, ANERA through Jenin WUA provided them with needed equipment, water tank, and seeds. ANERA as an NGO is not allowed to distribute the treated water by itself, thus this association was also necessary for the farmers and the reuse project.

Number of members of Jenin WUA is 70 in total, of which 50 are active and reusing the treated wastewater that counts for approximately 3,200 m^3/day. This quantity irrigates a 400 dunums cultivated area of fodder crops (Millet, Alfalfa and Barley) and 300 dunums of trees (Citrus fruits, Almonds, Pecan, Apple and Avocado).

The pilot project started with the cultivation of 26 dunums of alfalfa, this type of fodder crops is harvested 10 times per year and the reuse project counts for 13% of the local production of this fodder crop type (WUA, Interview 1, 2017). Moreover, ANERA introduced a subsurface irrigation technology to the farmers, which improves efficiency by saving 25% of irrigated water, as compared to the sprinkler irrigation, and the improved quality of crops grown could be noticed by naked eye (ANERA, Interview 3, 2017).

The fees that the farmers are paying now covers just the cost of service (pumping, Chlorine, labors and maintenance) which count for 0.70 NIS per cubic meter, which is much cheaper than the regular price of freshwater that is 4.00-5.00 NIS. The Palestinian law (Decree No.14, 2014) stated "the treated wastewater using secondary treatment is free of charge for usage if it is taken from the outlet of the treatment plant" (Al-Khatib, et al., 2017) pp. 11, and this encourages the farmers to use this cheap water resource and now the Jenin WUA is unable to accept another 30 requests that are on the waiting list to provide them with treated wastewater.

4.2.2 Case 2: Nablus-West Wastewater Treatment Plant

Nablus Governorate is located in the northern part of the West Bank; 500 m above the sea level, with a population of 389,329. The area of Nablus Governorate is 605 Km^2, of which 130.4 Km^2 is agricultural lands that count for 21.6% of total, and 53 local municipalities are under Nablus Governorate (PCBS, 2016)

Nablus Governorate is considered as the center of north West Bank, its middling the mountains series of Palestine and considered as a connection point from Jenin city in the north to Hebron in the south. Nablus is known to be the economic capital of Palestine due the variety of activities `in agricultural production (Olive, Almond, Apricot, Pomegranate and Fig), industry (handmade Soap, Furniture, Building Stones, etc.), enterprises and sweets industry.

The total quantity of water demanded for Nablus Governorate yearly is 19.1 MCM and the total water supplied from all resources (groundwater, springs and water purchased from Mekorot) is 15 MCM. However, because of transferring losses the consumed amount is 10.2 MCM and the actual deficit (the difference between the demand and the consumption) is 8.9 MCM (PWA, 2011).

The percentage of population connected to the water providing network is 86.4%, with 64.7 liters per capita per day (1/c/d) actual consumption (PWA, NWWS, 2014; PCBS, 2016). Only 51.8% of the population in the governorate are connected to the sewer network (PWA, NWWS, 2014). The wastewater generated by Nablus Governorate is 10.2 MCM yearly, of which 3.3 MCM flows to cesspits, 4 MCM flows into Israel and 2.9 MCM flows into the wadis (PWA, NWWS, 2014)

4.2.2.1 Description of the Nablus-West WWTP

In 1998, the financial agreement for the implementation of sewage project for Nablus West was signed between the German Government through KfW and Nablus Municipality. So far, the allocated funds reached up to 39 million Euros. The construction works of the project have been completed in July 2013; however, it was put into operation in November 2013. The project consisted of construction trunk, interceptor of 12 km and a WWTP over an area of 100 dunums. Nablus-West Wastewater Treatment Plant (Nablus-West WWTP) was designed to treat 14,000 m3/day of wastewater using tertiary treatment technology. The plant is located near Beit Leeds' village junction, which is 15 km north-west of Nablus city. The percentage of wastewater connected to the treatment facility is 45% with quantity of 10,000 m3 collected daily using the gravity from Nablus city in addition to the villages of Zawata, Beit Eba, Beit Wazan, Deir Sharaf and Qusin in the future. (NW-WWTP, Anuual Report , 2017).

Operation assistance for two years at the cost of 1.10 million Euros has been allocated through KfW to guide and train Nablus-West WWTP staff. The operation assistance was provided by the Kinetics-Passavant Reodiger (KPR) and completed in November 2015 (NW-WWTP, Anuual Report , 2017).

The Nablus-West WWTP is operated as an activated sludge process with a mechanical treatment, a biological treatment and a sludge treatment steps with gas utilization. Three construction stages have been planned for the Nablus-West WWTP: stage 1 with a design flow

will reach 14,000 m3/day 2020, stage 2 with design horizon in 2025, and a final stage 3 with design horizon in 2035 (NW-WWTP, Anuual Report , 2017). The treated wastewater biological and chemical characteristics were fully complying with the MoAs' by-law (34/2012) for reusing standards (NW-WWTP, Anuual Report , 2017)

Nablus-West WWTP is fully operated by the Nablus Municipality, 22 workers are employed at the treatment facility (NW-WWTP, Anuual Report , 2017). The treatment costs of one cubic meter of wastewater is 1.30 NIS (WSRC, 2015) and the citizens are paying 0.5 NIS per consumed cubic meter of freshwater as a service of treating (NW-WWTP, Interview 2, 2017).

4.2.2.2 Reuse Practices in Nablus

With reference to MoA by-law (34/2012), the treated wastewater quality of NW-WWTP has Grade (A). Thus, Nablus Municipality adopted a pilot reuse projects to use the treated wastewater for agriculture sector to irrigate some types of crops. For instance; avocado, olive, apple, almond, pomegranate, persimmon, pistachio, apricot, pecan, citrus, peach, alfalfa, barley, vetch, fig and walnut (NW-WWTP, Anuual Report , 2017).

Currently there are three projects for reusing the treated wastewater from Nablus-West WWTP:

1- In 2015, the Nablus-West WWTP started an educational project to study the reuse of treated wastewater in irrigation, the irrigated crops and the effect on soil. The project was implemented on an area of 40 dunums, with a fund of 462,000 Euro from KfW and it is fully operated by Nablus Municipality. This project reuses 100 m^3 of treated wastewater per day.

As shown in Figure 6, within the scope of this project 15 kinds of fruit trees and fodder crops are cultivated, namely avocado, olive, apple, almond, pomegranate, persimmon, pistachio, apricot, walnut, pecan, citrus, peach, alfalfa, barley, vetch.

Figure 5: Pilot Project, 40 Dunums

Source: NW-WWTP

Within this pilot project, and to test different types of irrigating a parcel with an area of 8 dunums divided equally. Each 4 dunums cultivated with alfalfa and irrigated with two different methods; the sprinklers and the subsurface technology. It was found that within the same characteristics of soil; the irrigation with subsurface technology is much better and could be noticed by unexperienced people. In addition, the subsurface irrigation technology consumes less water for 4.5 m^3 per dunum per day, while it consumed 6 m^3 per dunum per day with sprinkler irrigation (NW-WWTP, Interview 2, 2017).

2- In April 2017, Nablus-West WWTP has operated a reuse project for 140 dunums (see Figure 6) that is funded by a USAID grant of 500,000 Euro. This project is also considered as a pilot project and it aims to enlarge the scale that Nablus-West WWTP works on and to obtain enough information for implementing the large-scale project.

Although it is not the first project, there was a difficulty to gather the farmers for this project, because they were not convinced yet.

This project will reuse 225 m^3 /day for the first year and will increase to 450 m^3/day for the second year to irrigate the trees of olive, almond, pomegranate, apple and fig. This project is operated by Deir Sharaf WUA, which is considered as the connection between the farmers, government and donors.

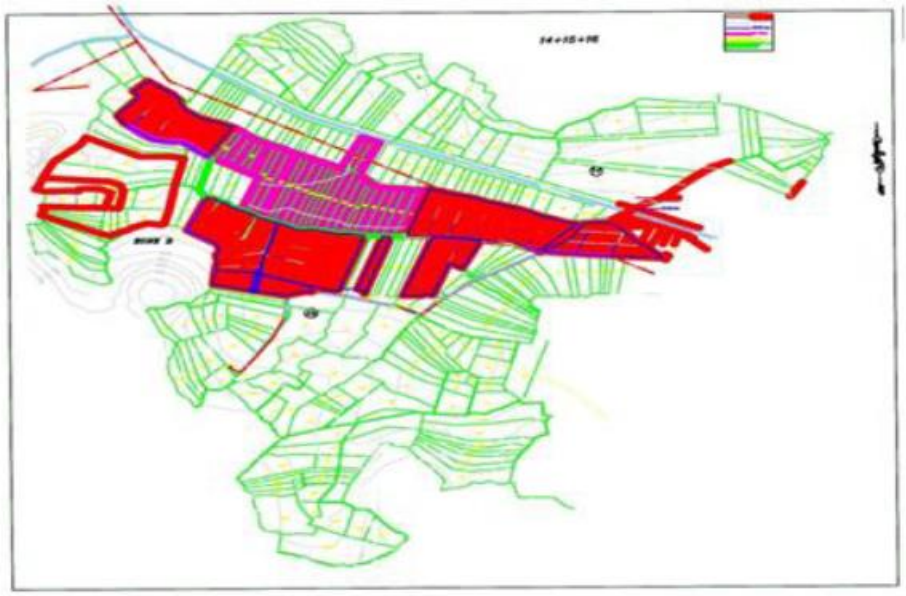

Figure 6: Pilot Project, 140 Dunums

Source: NW-WWTP

In early August 2017, the third pilot project has been launched with a fund of 1.5 million Euro from KfW to reuse the treated wastewater to irrigate 120 dunums of olive, alfalfa and almond (see Figure 7), and it is consuming 540 m^3/day. The project agreement that was signed between Deir Sharaf's WUA, KfW and Nablus-West WWTP considered operating and maintaining the project by Nablus-West WWTP and training the farmers for two years. This project broke the public acceptance barrier of reusing the treated wastewater. Now, Nablus-West WWTP is looking for new funds to irrigate an additional 100 dunums (NW-WWTP, Interview 2, 2017; NW-WWTP, 2017).

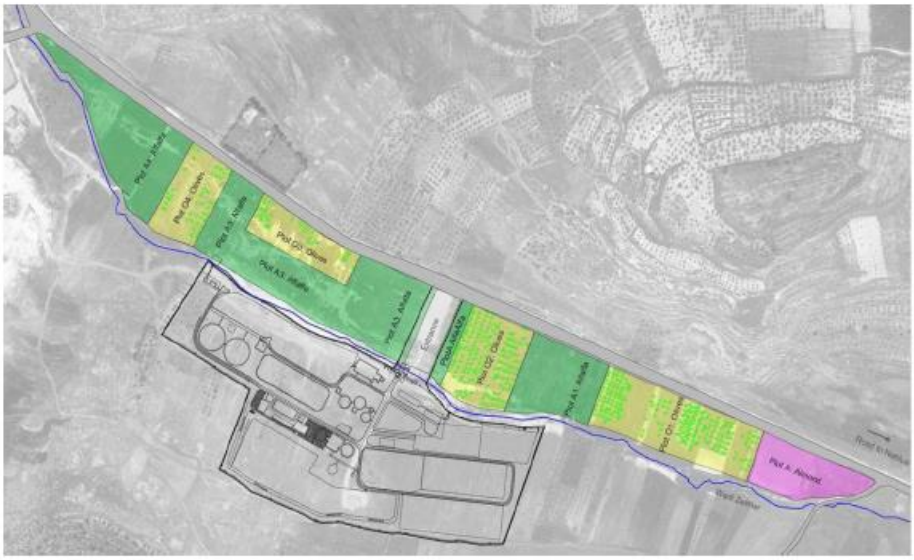

Figure 7: Pilot Project 120 dunums

Source: NW-WWTP

3- On 12th of August 2017, the agreement of the largest project of reusing treated wastewater in Palestine was signed between Nablus Municipality and the German Government represented by KfW in presence of representatives for (MoA, PWA, WRSC and EQA) to reuse all wastewater treated by Nablus-West WWTP with a fund of 10 million Euros, this project is expected to start at the end of 2019.

The area of this project is 2800 dunums and expected to use 8200 m^3/day, this means the use of all the wastewater treated by Nablus-West WWTP in addition to ongoing project in the peak months (June, July and August).

This project will be operated by Deir Sharaf WUA to irrigate alfaalfa, pecan, walnut, almond and olive. In addition, this project includes building a reservoir with a capacity of 10,000 m^3. The project is also expected to enhance the agricultural sector by offering an extra 3,000,000 m^3 of water per year, and create new job opportunities in the agricultural sector.

Before the agreement of this project signed, it passed through difficult stages represented by getting the permission for constructing the project from the Israeli side because the project is located in Area C (see Figure 7, the blue line is the boundary of the project area).

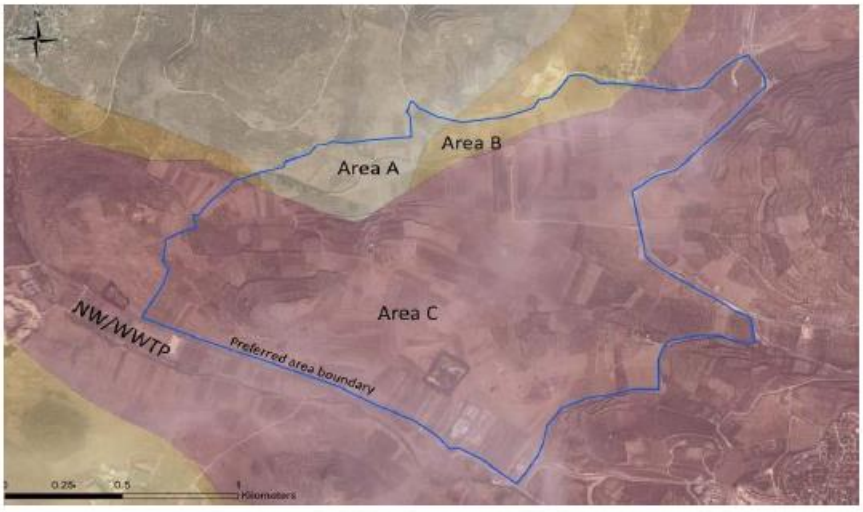

Figure 8: Large-Scale Project 2800 dunums

Source: NW-WWTP

To conclude, the aims of the pilot projects are: marketing the reuse project to the public when they see the results by eye like in Jenin when the 26 dunums increased to 140 dunums after the experiment proof its successes (WUA, Interview 1, 2017). In addition, they provide an in-depth study on wastewater reuse from the perspectives of water consumption, soil effect and crops productivity. (NW-WWTP, Interview 2, 2017). Moreover, it facilitated improving the cooperation between all stakeholder by working together to reach the goals (Nablus Municibality, Interview 12 , 2017). In Nablus, the pilot projects are paving the road for a high quality large-scale project such as the 2800 dunums project that has been signed recently.

4.3 Governance Assessment of Wastewater Reuse

4.3.1 Description of the Governance Dimensions

This section answers the first sub-question of this research on how the governance context of wastewater treatment and reuse in Palestine can be described in terms of the four governance dimensions, namely actors, problem perspectives and goal ambitious, strategies and instruments, and responsibilities and resources.

The multi-level aspect of governance was not conspicuous in neither of the two cases. However, reuse of wastewater is managed by the governmental organizations, such as PWA, MoA, and EQA, as it became a national matter (PWA, NWWS, 2014). Local level is represented by the municipalities that direct water and wastewater services for the areas they are responsible for, with interaction of water user associations and public (ANERA, Interview 3, 2017; PARC, Interview 4, 2017; WSRC, Interview 10, 2017; MOA, Interview 8, 2017).

4.3.1.1 Actors

Main Actors of Wastewater Reuse in Palestine

The main actors of wastewater reuse in Palestine are summarized in the Table 8 in addition to their roles.

Table 8: Main actors of wastewater reuse in Palestine

Actors	Role
Palestinian Water Authority (PWA)	Licensing of water resources (groundwater, surface water, treated wastewater), drafting of bylaws and water regulations, prepares general water and wastewater policies, strategies and plans, and ensuring their implantations.
Water Sector Regulatory Council (WSRC)	Monitoring water production, transportation, distribution, consumption, and wastewater management. aiming at water and wastewater services quality and efficiency at affordable prices.
Ministry of Agriculture (MoA)	Drafting of agriculture-related laws and legislations; agricultural policy-making; provision of agricultural services; regulation of irrigation water use; supervise of treated wastewater reuse.
Municipalities	Water service provider; management of local water and wastewater resources; implement water tariff setting cost; O&M of WWTP
Water Users Associations (WUA)	Manages the services of supplying irrigation water and treated wastewater at the local level

Ministry of Health (MoH)	Water quality standard issuing, water and wastewater sampling, issuing the health consideration on water and wastewater policies, and citizen's awareness
Environmental Quality Authority (EQA)	Participation of water and wastewater Policy-making, environmental regulation, issuing quality standards with MoH, planning, evaluation of the quality of treated wastewater
Donor organizations	Funding constructing WWTP, funding water and wastewater policies and strategies designing, monitoring implementing the reuse projects and/or WWTP constructing, qualifying the employees of WWTP to run the facility independently
Private Companies	for the future, institutionalize the wastewater reuse projects, O&M of WWTP, treating wastewater, distribution treated wastewater, and issuing and collecting bills.
Public Members	Potential users of treated wastewater (farmers, small industrial companies, individuals, etc.)

The main actors are categorized into the following four main categories based on the practices of reusing the treated wastewater in Jenin and Nablus:

WUA: The PWA regards WUAs as "very important institutional partners" due to the potential role they can play in the management of irrigation water (GWPMed, 2015). The policy promotes the formalization of these WUAs and the development of sound contractual arrangements between WUAs and bulk water providers (PWA, NWWS, 2014). Therefore, WUAs participate in most of the reuse projects, handling the responsibility of operating the project and distributing the treated wastewater to the farmers, working as a connection between farmers, government and donors. Their responsibility start after the wastewater is treated and flows out of the treatment facility. Additionally, in cooperation with MoA and NGOs they are holding training and awareness sessions for the farmers about the safety instructions of reusing the treated wastewater.

In Jenin, Marj Ibn Amer Farmers' Association was established by ANERA and as a part of the project ANERA is financing J-WUA to support the idea of reusing (ANERA, Interview 3, 2017). In Nablus, Deir Sharaf Farmers' Association (N-WUA) handling the responsibility of managing operating the reuse projects.

WWTPs: The WWTPs are the provider of the treated wastewater and their responsibility is to treat the water to meet the standards of the Palestinian Specification Institution for reusing the treated wastewater. Depending on the type of the agreement, WWTPs can have other

responsibilities such as operating, maintaining the reuse project, training the WUA's on operating procedure and qualify them to run the project by their own, as experiences in the pilot project of 120 dunums in Nablus. (NW-WWTP, Interview 2, 2017) In Jenin city, the responsibility of the Jenin WWTP is just to treat the water and send it to the pool from which it will be transferred to the users (Jenin Muncipality, Interview 7, 2017).

Governmental organizations such as MoA, WRSC, PWA, MoLG and EQA: These organizations are considered as control bodies to monitor the process of reusing, they establish a committee for each project to ensure achieving the goals accurately (WSRC, Interview 10, 2017).

Donor organizations: In some agreements, responsibility falls on the donor organizations to do specific issue for the project. For example, in Nablus-West WWTP Kfw provided operational assistance to operate, guide and train Nablus-West WWTP staff for two years (NW-WWTP, Anuual Report , 2017), but in general the role of the donor organizations is to monitor the project implementation (WSRC, Interview 10, 2017).

Involvement of farmers

Most of the actors of reusing treated wastewater are considered and invited for any meetings for designing, implementing and discussion about strategies, policies, by-laws and workshops conducted related wastewater:

> *"few years ago we were inviting all the stakeholders on many levels for a meeting or workshop about reusing treated wastewater and few were joining us, nowadays we invite them for the same reasons and see new entities who want to interact in this pivotal issue and want to know all new matters about reusing wastewater issue either from private sector NGO's and public. and all are most welcome for this national matter"* (WSRC, Interview 10, 2017) .

However, the water user association is not satisfied, since they were not involved in policy-making or strategy designing for wastewater reuse or any other issue related to the agricultural sector:

> *"We are not invited to any workshop regrading anything related of wastewater reusing either to be policy-making or strategy designing, since we start reusing this new source*

and we did not see them once at all, knowing we are the most important part as water user" (WUA, Interview 1, 2017).

Regarding this issue, MoA stated that *"water user association or the farmer's union are inactive associations, the number of their members is low and not representative. Moreover, we are inviting them, but in most cases, they do not attend all meetings, we are now in the process of legalizing the by-law of WUA"* (MOA, Interview 8, 2017) .

Committees for project implementation

For each project, a committee is formed that consists of different actors such as PWA, MoA, EQA, MoE, WSRC, NGOs and local municipalities, to control and follow up the related issues directly. However, the outcome of these committees varies between Nablus and Jenin. "*We were meeting frequently to keep monitoring the newly matters of reusing treated wastewater but we did not feel that our voice was reached to the upper levels, our comments and notices was not considered, everything is only papers and did not processed to implementing phase"* (Jenin Muncipality, Interview 7, 2017).

In Nablus, by the inauguration ceremony in 2012 for Nablus-West WWTP that committee was established to monitor Nablus-West WWTP (Nablus Municibality, Interview 12 , 2017). The role of different actors was complementarily where each actor responsibility falls in his domain of action, this committee still active; meeting, monitoring and issuing municipal by-laws when necessary; "*the committee's role is to consider everything put on table, accepting different points of view from all and interacting with problems in a complementary manner related to each actor terms of reference"* (Nablus-ECU, Interview 5, 2017).

Public acceptance and involvement

Public members are now increasingly accepting to reuse the treated wastewater. The demand on the treated wastewater is increasing specially after the proof that it is cheaper and efficient for irrigating. Currently, the Jenin WUA is not able to supply new farmers with treated wastewater after it reused all the treated wastewater from Jenin WWTP. To increase the treated wastewater, a study to connect the area with different levels to the treatment plant was performed. The suggested solution is to pump the wastewater form the collecting area to the treatment plant and then reuse the wastewater, which will double the treated wastewater per day and will give the

opportunity to new farmers to get use of the treated wastewater (Jenin Muncipality, Interview 7, 2017; WUA, Interview 1, 2017).

In Nablus-West WWTP, it was difficult to involve the farmers for the project of 140 dunums, but after the results appeared and when the project of 120 dunums announced; the farmers were competing to take the benefits of joining the project and the Nablus-West WWTP is now looking for a fund to expand the project to another 100 dunums (NW-WWTP, Interview 2, 2017). Public willingness for reusing the treated wastewater has changed recently, their goal is to farm with clean and sustainable source of water regardless its origin (Farmer, Interview 11, 2017).

4.3.1.2 Problem Perspectives and Goal Ambitions

Design criteria for the wastewater reuse projects

In Nablus three pilot projects were designed to reuse the treated wastewater from Nablus-West WWTP in irrigation with different areas and crops. One pilot project and medium-scale project is implemented in Jenin. For both cities, the criteria to choose the areas and crops are stated as following:

1- **Area selection**: the three areas that were selected for the pilot projects in Nablus were near the treatment facility, one inside and the other two outside. That was to reduce the cost of transferring the water from the Nablus-West WWTP to the land for irrigating, saving time of getting the permission from the Israeli authorities, control the process of reusing, studying the result and training the farmers (NW-WWTP, Interview 2, 2017). In Jenin the reuse area is in the plain as closest as to the treatment facility to reduce the expenses of pumping water to the farmers.

2- **Crop selection:** for all projects, the criteria of selecting the crops were based firstly on MoA by-law (34/2012) to specify the allowed crops to be irrigated with the treated wastewater. Article 8 of by-law (34/2012) stated that it is not allowed to irrigate the vegetables with the treated wastewater even if it is with grade A; which is the highest Palestinian standard (PSI, 2012). The second parameter is the demand of the Palestinian market on crops such as the fruits and the fodder crops (PCBS, 2013). Nowadays, the Palestine market suffering from deficit of 80% of fodder crops and 50% of fruit products (MOA, Interview 8, 2017), in addition to high prices and the control of the Israeli side on

these vital products, the ambition is to be self-sufficient and cope the deficit of the Palestinian market with these products at low affordable cost using the reuse projects. Thirdly, the consumption of water; the fodder crops need to be irrigated with a high quantity of water, such as up to 6 m^3 per dunum per day for Alfalfa. Therefore, the availability of water at the treatment facility encourages the choice of such products.

It should be taken into consideration that farmers are hesitating to take the risk of cultivating a crop that takes too long to harvest. Because they are not owners, but renters who are looking for a fast revenue. Thus the trees are not interesting for them because it will start making money after 5 years at least (WUA, Interview 1, 2017).

Seeing wastewater as a resource

In the last decade, PA was not treating the wastewater to avoid counting it as a resource for the Israeli side. Currently, the wastewater is treated and counted as a resource especially within the limited access to the rightful water resources for the Palestinians (PARC, Interview 4, 2017). Similarly, until the last few years, the main goal for constructing the WWTPs was just an environmental consideration. However, the design was not for reusing the treated wastewater, but only for treating it to reduce the pollution (MOA, Interview 8, 2017). Nowadays, the goal has changed to treat and reuse wastewater. All the proposed projects must be studied and designed for treating and reusing to be approved, such as the Nablus-West WWTP (MOA, Interview 8, 2017). Jenin WWTP was designed to only treat the wastewater. After implementing the reuse project, 2 million NIS were saved in the last year, as a result of decreased fines that are charged by the Israeli government for the wastewater that flows to Israel (WUA, Interview 1, 2017). In contrast, in addition to the cost of treating wastewater at Nablus-West WWTP, another 6 million NIS are paid yearly as fines to the Israeli government because of throwing the treated wastewater again to the polluted streams, and not reusing it. Updating the goals regarding wastewater treatment is important, since it will prevent resources from double loss, the first is losing the treated wastewater and the second is paying the fines to the Israeli government (WSRC, Interview 10, 2017).

The percentage of houses that are not connected to the sewer network is high. Most people in rural areas are using cesspits to discharge their wastewater, to connect the rural areas with sewer network a project has been completed two years ago but it is still not operating yet. It was realized

that the wastewater should be reused to cope with the deficit of irrigation water (Farmer, Interview 11, 2017).

In Nablus, Nablus-West WWTP is serving the western part of the city and it is proposed to treat the eastern part by East-Nablus WWTP (which is not constructed yet), that will provide a new resource of irrigation water. In Jenin, when the connecting project is completed, it will increase the quantity of treated wastewater that can be used. All these goals are aiming to increase the treated wastewater and its applications.

Treating industrial vs. domestic wastewater

Nablus-West WWTP is treating only domestic wastewater, while the industrial raw wastewater is flowing to wadi and mixed with the domestic wastewater, some industrial facilities are treating their wastewater primarily but the majority discharge it to wadi specially the east area of Nablus. The cooperative committee realized this problem and started working to enforce the by-law 16/2013 of connecting the industrial facilities to the public (domestic) sewer network, obliging the industrial polluters to treat their wastewater onsite to reach a certain quality that enables it to be treated with the domestic wastewater (by-law, (16/2013), Article 10 and 11, 2013) Unfortunately, this strategic goal for Jenin is missing.

> *The industrial wastewater is polluted with heavy metals or chemical materials that prevent it from being treated with domestic wastewater, our role is to assure that the industrial entities are following the rules and implementing an onsite treatment unit* (Nablus-ECU, Interview 5, 2017)

Additionally, municipality of Nablus studying now the reusing options for industrial sector such as concrete industry. To create another source that consumes the treated wastewater in winter and spring seasons (Nablus Municibality, Interview 12 , 2017).

4.3.1.3 Strategies and Instruments

The strategic goal is to treat 24% of the wastewater generated in Palestine by 2022, and to reach this goal another supportive instruments was mentioned to increase the percent of the connected houses to the sewer network form 31% nowadays to 45% by 2022 (PWA, SDP, 2016).

Laws, regulations and guidelines

In Palestine, no laws are issued without the approval of the legislative council, which is not functioning due to internal political problems in Palestine. Therefore, by-laws are issued by the ministerial council to avoid disputes between different actors. The existence of an updated water law and its different by-laws enhanced the legal framework of the water sector, showing and illustrating the tasks, responsibilities and the authorities for the different parties (PWA, SDP, 2016). In addition, a manual was published by the MoA regarding the reuse of treated wastewater, also stating the crops that are allowed to be irrigated with treated wastewater (MOA, Interview 8, 2017), and by-law 16/2013 of connecting industrial facilities to the public sewer network.

Till now, guidelines on using treated wastewater remains missing in the Palestinian water law (Al-Khatib, et al., 2017). Moreover, the absence of clear mechanisms for the implementation of laws and strengthening the application of regulations, in cooperation with various institutions considered as a threat towards reusing treated wastewater (PWA, SDP, 2016).

The Palestinian standards are very strict regarding using the treated wastewater for irrigation. In some cases, the treated wastewater has a higher quality than the freshwater used for drinking or irrigating (MOA, Interview 8, 2017). However, the Palestinian government allowed to import the vegetables from the Israeli side knowing that they were irrigated using the treated wastewater. The interviewee from the Palestinian Standard Institute stated that *"this specification of by-law (34/2012) for reusing treated wastewater was not written on solid rocks that you cannot change or rewrite, if any part was found necessary to be changed we are flexible to change it as it is based on science"* (PSI, Interview 9, 2017). Others however believe that as these specifications are strict, which is good for public health (ANERA, Interview 3, 2017).

Tariff and WUA By-laws

In Jenin city, many water wells are owned by individuals who control the prices and selling farmers the water. This sector is monitored by WSRC as Water Law 2014 article 24 mentioned, but the by-laws regarding the pricing system is not approved yet by the council of the ministers (MOA, Interview 8, 2017; WSRC, Interview 10, 2017).

The tariffs' by-law will clarify the system of pricing licenses for all the waters' resources for instances; groundwater, treated wastewater, desalinated water, surface water and any other

source could be found in future, also it is for all users and services providers (National Water company, municipalities, individuals, private sector … etc.). Moreover, that will allow WSRC to monitor the well owners based on clear criteria about the procedure to follow, and the license that they need to operate (WSRC, Interview 10, 2017).

Water Users Associations by-laws that regulate the shape of these associations is also on the waiting list to be approved by the council of ministers, this by-law identifying the responsibilities and tasks regarding water users, the process of extracting license in addition to the members' rights and responsibilities. This law comes in order to improve the role of WUA's and in decision making (MOA, Interview 8, 2017).

Oslo Agreement and License obtaining

As a result of Oslo agreement signed 1993 between the Palestine and Israel, a Joint Water Committee (JWC) was established to control the shared issues of water between both sides, the function of the JWC shall be to deal with all water and wastewater related issues in the West Bank. This agreement specially in article 40 and schedule 8 mentioned that any activity of constructing and developing the water and wastewater facilities in any area (A, B, C) shall have the approval by the JWC first. Treating, reusing or properly disposing of all domestic, urban, industrial, and agricultural wastewater must be with approval of JWC (Oslo Agreement, 1993). Additionally, The issue of ownership of water and wastewater related infrastructure in the West Bank should be addressed in the permanent status negotiations (Oslo Agreement, 1993) that is not functioning anymore.

Moreover, JWC forced the Palestinian in to use a high standards that's higher than the used in Israel specially for reusing and treating the wastewater as a condition to get the license (PARC, Interview 4, 2017) as stated in the article 40. The JWC including partners from both sides, however it is controlled completely by the Israeli side (PWA, 2011).

However, obtaining licenses from the Israeli side is a complicated process that consumes time and money. The degree of complexity becomes even higher for licenses of any facility located in Area C (NW-WWTP, Interview 2, 2017). of the 30 proposed Palestinian WWTP proposals submitted to the JWC since 1995, only 4 have received approval from Israel. Even with JWC approval, the construction of these WWTPs has been delayed repeatedly (PWA, 2011).

Financial instruments

The financial instrument to promote reusing of treated wastewater are not clearly stated in the policies and strategies except for secondary treated wastewater, but they are existing on the ground. Currently, any farmer who want to participate a reuse project he will be offered a subsurface irrigating network, pipes, agricultural equipment, trees, seeds and water that is 8-10 times cheaper than the regular price. And the contribution cost is just 20% (WSRC, Interview 10, 2017; MOA, Interview 8, 2017).

Nablus Municipality charged the citizens 0.5 NIS for each cubic meter of freshwater consumed as treatment cost in relation with the international principle of water management "the polluter pays" and selling the treated cubic meter of wastewater to the farmers for 0.5 NIS to encourage them to use it (NW-WWTP, Interview 2, 2017). That would enhance covering partially the cost of treating process 1.3 NIS/m^3 (WSRC, 2015) that fully funded by the municipality.

Jenin city is not charging the citizens anything yet. The decision of applying the principle of "the polluter pays" has been approved by the municipality council and waiting the approval by the ministerial council to be implemented (Jenin Muncipality, Interview 7, 2017). The cubic meter cost for Jenin municipality is 1.15 NIS and it will give it free of charge to the farmers because the Palestinian law sell the wastewater secondary treated free of charge. And this increases the financial burden on the municipality. (Jenin Muncipality, Interview 7, 2017).

The costliest issue in operating the treatment facility is the electricity, Nablus-West WWTP installed Combined Heat and Power (CHP) unit to produce electricity from biogas and it almost covers 80% of the electricity demand of the WWTP (NW-WWTP, Anuual Report , 2017). On the other hand, Jenin WWTP was suffering from electricity blackouts resulted in accumulation of wastewater which released malodors, this issue has been resolved recently and it mostly occurred in summer months due the high demand on electricity in Jenin city (Jenin Muncipality, Interview 7, 2017).

Private sector involvement

The private sector involvement is not accepted yet because it will increase the price of the cubic meter to be three times its current price from users point of view, and this will not encourage the farmers to use the treated wastewater as a result will decrease their profit and cause a loss in other cases (WUA, Interview 1, 2017). However, the interviewee from the WRSC highlighted the

necessity of involving the private sector to be involved in the reuse projects, because this will enhance the quality of the reuse concept and marketing of it. In order to prevent a monopoly by the private sector, WSRC plans to monitor the prices to meet the shared benefit between the farmers and/or other users, and the private sector, and this is related to the tariff by-law that will also enhance private sector involvement (WSRC, Interview 10, 2017).

The government is concerned about involving the private sector to the water and wastewater projects and in (PWA, SDP, 2016) its issued an indicator about the number of projects that private sector participates in wastewater. However, there is still no solid background or clear investment plan that attract the private sector to invest in the reuse projects.

4.3.1.4 Responsibilities and Resources

Responsibilities regarding wastewater reuse

The responsibilities now are clear for each actor working in the water and wastewater sector, no overlapping in roles was detected and all actors working at the same distance for any project. Before declare No14. 2014 there was an overlapping and unclear responsibilities but it is removed now (WSRC, Interview 10, 2017; PSI, Interview 9, 2017; PARC, Interview 4, 2017; MOA, Interview 8, 2017).

The process of getting the licenses for any treatment project or reusing treated wastewater is moving through clear process. Each actor has his own checklist that is needed to approve these projects. The roles of all actors complete each other, serving to achieve reusing treated wastewater. (PARC, Interview 4, 2017; MOA, Interview 8, 2017)

To understand the responsibilities in practical manner, the following elaboration listing the responsibilities of each actor as a committee member in the reuse project and Table 9 summarizes these responsibilities (WSRC, Interview 10, 2017).

Municipality: Would be responsible for monitoring the effluent quality and sustaining the delivery of effluent which meets Palestinian standards for reuse. As such, it is also the service provider for the reclaimed water. Basically, its responsible for; operating and maintaining (O&M) of WWTP, effluent monitoring and delivery, and establishing cost of delivery according to Tariff Law.

Water Users Association (WUA): The WUA is the user of the reclaimed water. Basically, its responsible for; apply for necessary permits from MoA for irrigation, management of the reuse scheme including the daily operation like water control, water meter reading, crop selection together with farmers, follow-up with farmers on any conflicts, payment delays.

In addition to, O&M of irrigation system of all equipment including the daily follow-up of the irrigation network (pipes, leakages, pressure drop, water quantities etc.), collecting fees and accounting (either reading the water meters or recharging the pre-paid meters) and issuing bills, paying water bills to the Municipality (or the treated wastewater provider). preparation of yearly budgets and balance sheets about all income and spending of the WUA., monitoring of product quality. Test in site will be done in full coordination with MoA and under the supervision of the Agricultural engineer the WUA will have, and manage input purchase and marketing of agricultural products.

Ministry of Agriculture MoA: The MoA approves the reuse activity and provides guidance and advice to the WUA and its farmers on cropping and good agricultural practice. Basically, its responsible for; approving reuse scheme including issuing of permits for the WUA/Farmers based on the crop selection, guiding and advising farmers on the best practices and supporting them in dealing with any unforeseen problems during the implementation, monitoring of products by conducting site visits to the scheme on regular basis. pesticide usage surveys: the ministry will also guide the WUA/Farmers on how to use pesticides properly and in good manner, and soil monitoring: The MoA will do the necessary tests for the soil to ensure that using treated wastewater will not affect the soil quality.

Palestinian Water Authority (PWA): The PWA is the main regulatory body for water and wastewater resources in Palestine. Basically, its responsible for; water Policy and Strategy, reuse development and restructuring, water resource licensing and monitoring, and help in identifying the reservoir land from the farmers.

Water Sector Regulatory Council (WSRC): Overarching regulatory role with regard to monitoring of new licenses for WUA, system operations and pricing of the reclaimed water. Basically, its responsible for; approval of water prices and cost of supply, the municipality shall submit the water tariff to the WSRC for approval, and supervise and Inspect compliance with the conditions, requirements and indicators stipulated in the licenses and permits.

Environmental Quality Authority (EQA): The EQA reviews Environmental Impact Assessments (EIAs). Basically, its responsible to; make sure that there is no environmental hazards, and usually this is completed with the preparation and approval of the EIA for the project.

Ministry of Health (MoH): it is responsible for sampling water (never done before for effluent, it is only drinking water so far.

Table 9: Actors and Responsibilities

Actor	Responsibility
Municipality	O&M, monitoring effluent and delivery and setting cost of service based on tariff law
WUA	O&M irrigating system, collecting bills from farmers and paying to provider, monitoring agricultural products quality and marketing it
MoA	Issuing of reuse permits for the WUA/Farmers, guiding farmers on the best agricultural practices, conduct survey on pesticide usage, soil monitoring
PWA	Approves the construction of the WWTPTs , designing water Policy and Strategy, water resource licensing and monitoring, identifying the reservoir land from the farmers.
WSRC	Approval of effluent tariff, setting minimal operational standards, monitoring and inspection of compliance of these standards (operational inspections), monitoring of supply agreements, addressing complaints of consumers/ farmers/ WUA against suppliers
EQA	Environmental monitoring review and environmental impact assessment EIA review
MoH	Water sampling

Qualification of the WWTP staff

Nablus-West WWTP has 22 employees, including engineers, lab technician, operators, guards and farmers who work in the pilot project inside the WWTP. KfW provided operational assistance to operate, guide and train Nablus-West WWTP staff for two years which qualify them to operate the WWTP by their own and producing a high quality results classified as grad A according to the Palestinian Standard Institution (NW-WWTP, Anuual Report , 2017). The facility

is operated continuously, i.e., 24 hours per day and 7 days per week. Moreover, the treatment facility has its own lab and lab technician to test the quality of the treated wastewater daily and ensure that everything is operated within the standards.

Jenin WWTP lacks qualified staff. It is operated by three people, namely one engineer and two unqualified workers who are changing frequently. The WWTP is operating for 8 hours per day only. This causes an insufficient quality of water, which sometimes cannot be used in irrigation (WUA, Interview 1, 2017).

4.3.2 Assessment of Governance Qualities

This section answers the second sub-question of this research on how supportive is the governance context of wastewater treatment and reuse in Palestine, based on the assessment of the four governance dimensions described in section4.3.1 and using the four qualities: extent, coherence, flexibility and intensity.

4.3.2.1 Extent

Actors: This dimension is assessed as being supportive, since many different social and governmental participate are involved in reusing treated wastewater matters from policy-making to implementations. These include the PWA, MoA, MoE, MoH, WSRC, EQA, PSI, Local Municipalities (MoLG) and NGOs' (PARC, ANERA). However, the WUAs claim that they are not involved in policy-making, and the MoA stating that these associations are not activated yet and they are in the process of legalizing their by-law.

Problem perspective and goal ambitious: This dimension is assessed as being moderate to high, since most of the problems are considered and the goals to resolve these problems are clearly stated in the policies and strategies. While other major problems are not addressed yet for instance; the problem of water scarcity in Palestine is not a water availability issue rather than an Israeli practices preventing the Palestine from reaching their water resources (Agriculture Expert, Interview 6, 2017), which intern reflect on the trans-boundary wastewater resources where the Palestinian wastewater is for the exclusive use of Israel's agricultural sector even if the Palestinian pay for treating it (PWA, 2011).

Another problem that was recently addressed is the salinity of soil after years of using the treated wastewater since the full dependency on treated wastewater without considering the salinity of soil representing a huge risk on this land to become an arid area (PARC, Interview 4, 2017).

The issues related to crop and area selection for reuse projects addressed the market problem in terms of crops deficit, and political conflict issues for licensing on Area C, which indicates the importance of pilot projects to enhance better understanding of practical problem perceptions.

Strategies and Instruments: This dimension is assessed as being moderate. The most important strategy is the National Water and Wastewater Strategy for Palestine 2012-2032 that highlighted the reform of the institutional water and wastewater sector and contributed in issuing the Water Law 2014, this law contributed to improve communication between the key-actors and increased coordination between them (WSRC, Interview 10, 2017).

In terms of instruments, the laws are well defined, but some are still inactive because of absence of legalization council which complicates its implementation. Additionally, other legal instruments such as guidelines of reusing treated wastewater is still missing (Al-Khatib, et al., 2017). While the financial instrument is waiting for approval by the ministries council to be enacted such as tariff by-law (WSRC, Interview 10, 2017).

Responsibilities and resources: This dimension is assessed as being moderate, since all the interviewees approved that the responsibilities were assigned clearly after the new Water Law of 2014, showing the tasks, responsibilities and authorities for the different parties (PWA, SDP, 2016). However, the responsibility of the private sector is not assigned or clarified.

4.3.2.2 Coherence

Actors: This dimension is assessed as being supportive. Most of the interviews revealed that the actors have a strong interaction, and they are working like one team to manage the matters related the treated wastewater reuse and there are no trust issues between them (Nablus Municibality, Interview 12 , 2017; PARC, Interview 4, 2017; MOA, Interview 8, 2017; WSRC, Interview 10, 2017; Nablus-ECU, Interview 5, 2017). Also (PWA, SDP, 2016) agreed on the

existence of good coordination between different governmental parties. For example, when MoA develops its strategy, it coordinates with PWA, EQA and other related bodies (MOA, Interview 8, 2017).

Problem perspective and goal ambitious: This dimension is assessed as being moderate to high, since the current goals of reusing treated wastewater is complementing each other as observed on (PWA, NWWS, 2014). Further, the strategies for the years 2013, 2014 and 2016 are all supporting the idea of reusing treated wastewater and work like short-term goals to reach the long-term goals. However, the non-addressed problems mentioned in section 4.3.2.1 will hinder the reuse activities in order to protect land from becoming arid.

Strategies and Instruments: This dimension is assessed as being supportive. The governance system is based on synergy to improve the reusing of treated wastewater. For example; the by-laws intended to be legalized (tariff and WUA) are expected to encourage different actors in the reuse projects such as; the WUA to activate their role of distributing the treated wastewater to the farmers as a result the farmers to reuse the treated wastewater. Moreover, the private wells will be controlled. The profit determination issue will be systemically identified for the private sector which will enhance its involvement. (WSRC, Interview 10, 2017; MOA, Interview 8, 2017).

Responsibilities and resources: This dimension is assessed as being moderate to high. Before the Water Law 2014, the coherence of the various actors was low because of unclear responsibilities and overlapping roles (Al-Khatib, et al., 2017), now the responsibilities are clarified and the roles became more coherent. (WSRC, Interview 10, 2017). It aims to establish cooperation within and across institutions. The committees that established for each project motivated the actors for cooperation instead of competence since the success is the for the team not for single actor (Nablus Municibality, Interview 12 , 2017; MOA, Interview 8, 2017; PARC, Interview 4, 2017). However, the privates sector among this committee is not exist.

4.3.2.3 Flexibility

Actors: This dimension is assed as being supportive. Involving new actors into the system is very easy as revealed from the WSRC interview. As mentioned before, the meetings and workshop invitations are open to new stakeholder who want to interact in the reusing sector,

moreover social participant and NGOs are considered in these workshops (WSRC, Interview 10, 2017).

Problem perspective and goal ambitious: This dimension is assessed as being supportive. The goal of constructing the WWTP was reassessed and changed from being for treating only and adding the reuse object (MOA, Interview 8, 2017). Also, the ability of changing the standards to be fit with scientific research is considered as an added value when it seems that the standard is restrict the reusing of treated wastewater (PSI, Interview 9, 2017). Moreover, realizing the problem of the industrial wastewater in Nablus city and exerting efforts to enforce by-law of 16/2013 (Nablus Municibality, Interview 12 , 2017) supports the assessment above.

Strategies and Instruments: This dimension is assessed as moderate, the instruments used are limited to legal and financial instruments, and the actors have the choice to combine these instruments. In some cases, the financial instrument is used as the in pilot project in Nablus to encourage the farmers to participate their lands and obliging the industrial polluters to treat their wastewater before flow it to the domestic sewer network (WSRC, Interview 10, 2017; PARC, Interview 4, 2017; MOA, Interview 8, 2017; Nablus-ECU, Interview 5, 2017; Nablus Municibality, Interview 12 , 2017).

Responsibilities and resources: This dimension is assessed as low, however the flexibility of the responsibilities of the actors is high, the resources are not. The resources of the reusing project in Palestine is funded by donors as a grant as in both cases Nablus and Jenin, it is not possible to reallocate the resources for different purpose or to different place. Each resource has its own characteristics that cannot be changed (WSRC, Interview 10, 2017; PARC, Interview 4, 2017; MOA, Interview 8, 2017; Nablus-ECU, Interview 5, 2017; Nablus Municibality, Interview 12 , 2017).

4.3.2.4 Intensity

Actors: This dimension is assessed as being supportive. All different actors are pressuring to improve the reuse of treated wastewater. Even the public members have broken the acceptance barrier and started irrigating with treated wastewater, and they are competing to take this opportunity of reusing (WUA, Interview 1, 2017; NW-WWTP, Interview 2, 2017).

Problem perspective and goal ambitious: This dimension is assessed as being moderate, majority of the goals could be achieved by the current strategies, while the absence of clear guidelines that mapping the road for the reuse projects is obstructing improving this sector as expected. Additionally, the dependence on the fund to operate the WWTP and the reuse project is a temporary solution that will not sustain the reusing projects.

Strategies and Instruments: This dimension is assessed as being restrictive. The existence of the political barriers and the difficulty of extracting the licenses for treated wastewater reuse projects is hindering the improvement of reuse practices and preventing the strategies from being implemented (NW-WWTP, Interview 2, 2017). in Addition to the high fines charged by the Israeli government which exhausting the government financially (PWA, 2011). Which calling for major behavioral deviation on the political level to apply the instruments effectively.

Responsibilities and resources: This dimension is assessed as being moderate. Palestinians are mostly dependent on the grants to support the construction and operation of WWTPs and the reuse projects (GWPMed, 2015). The WWTPs' sustainability is the main resource to change the current situation. Each facility should have sufficient funds to cover the costs of continuing operations and maintenance; otherwise it will stop working after the funds end (PWA, 2013b).

4.3.2.5 Assessment Summary

GAT Result Table

Table 10 summarizes the assessment of the governance context of reusing the treated wastewater in Palestine.

Table 10 :Assessment summary

Quality / Dimension	Extent	Coherence	Flexibility	Intensity
Actors	Supportive	Supportive	Supportive	Supportive
Problem perspective and goal ambitious	Moderate +	Moderate +	Supportive	Moderate
Strategies and Instruments	Moderate	Moderate +	Moderate	Restrictive
Responsibilities and resources	Supportive	Moderate +	Restrictive	Moderate
Overall assessment of the qualities	Supportive	Moderate +	Moderate +	Moderate

Qualities Assessment Summary

Supportive extent - *two dimensions are supportive and the other two range from moderate towards high*. All the actors are involved in the reuse projects, most of the problems are addressed, most of the instruments are used and the responsibilities were assigned clearly to each actor.

Moderate to supportive coherence - *three dimensions range from moderate towards high and one is supportive.* The actors have strong interaction and most of the goals are complementing each other in most of the strategies, the synergy between the instruments of reusing the treated wastewater is existing and the actors promotes cooperation within and cross the institutions.

Moderate to supportive flexibility - *two dimensions are supportive and other two ranges from low to moderate*. It is easy to include new actors in the system, possible to reassess the goal, and there is opportunity to combine the instruments. However, it is not possible to pool the resources or to reallocate them.

Moderate Intensity - *two dimensions are moderate, one is low and the other is supportive*. All the actors are pressuring to improve the reuse sector, with minor changes to the current policy the goal will be achieved, minor need for behavioral deviation from the running practice of the instruments and most of the changes required could be achieved by the available resources.

Most Supportive/Restrictive Dimensions

The most supportive dimension is the “actors”, since all the actors are involved in the process of reusing the treated wastewater and their interaction is institutionalized stable and there is trust. They are also working as one team to improve the reuse of treated wastewater. It is easy to include new actors in the system. They are all pressuring strongly towards improving the wastewater reuse sector. On the other side, the “instruments and strategies” is the most restrictive dimension, especially with absence of the enforcement of the laws and the guidelines of reusing the treated wastewater. in addition to, the current political status that hindering the reuse project because of the conflict between Palestine and Israel. There is also a need for behavioral deviation within the running practices in order to achieve the goals.

5. Conclusions and Recommendations

5.1 Conclusions

This research was conducted to assess the governance of reusing the treated wastewater in Palestine by studying two local cases, namely Jenin and Nablus. The governance dimensions included in the assessment are actors; problem perceptions and goal ambitions; strategies and instruments; responsibilities and resources. These dimensions were assessed using the qualities of extent, coherence, flexibility and intensity, and by answering the questions in the governance assessment matrix. This section draws conclusions through answering the two sub-questions based on the research results.

1- **How can the governance context of wastewater treatment and reuse in Palestine be described in terms of the dimensions selected?**

In terms of the **actors**, the findings revealed that various actors are involved in managing the reusing of treated wastewater activities. These actors mainly include PWA, MoA, EQA, MoH, MoLG, WUAs and NGOs, such as PARC, ARIJ and ANERA, with the absence of private sector and the non-involvement of WUA in policy-making.

Regarding **problem perceptions and goal ambitions,** most of the problems faced reusing the treated wastewater sector were addressed. For example, the aim of constructing the WWTPs became treating and reusing, the demand of the Palestinian agricultural market influences the irrigated crops selection to supply the market need such as fodder crops. Moreover, problem of the industrial wastewater flowing to the streams without being treated is also considered.

According to **strategies and instruments**, the Palestinian context is suffering from an inactive Legislative Council that is responsible to legalize the laws and legal instruments. There are however financial instruments, such as the low price of treated wastewater sold to the farmers, the incentives for farmers who use the treated wastewater, such as free or discounted agricultural equipment, seeds, trees, subsurface irrigation technology, etc.

The conflict between Palestine and Israel at the political level resulted in a complex procedure on obtaining the licenses for constructing the WWTPs or reusing the treated wastewater

in Area C referring to Oslo agreement and article 40. This is considered as the main barrier that assumed to be resolved in the current strategies.

Within the global context, the Palestinian wastewater management system considers most of the principles mentioned by (CEP 65, 2012), namely polluters pay principle, the precautionary principle and open access to information. Other principles such as applying realistic standards and regulations are missed but they are very important to improve the reuse practices. Further, applying the balance between the economic and the regulatory instruments is mandatory since Palestine is considered as a developing country, and it should apply the cost-effectiveness and administrative feasibility as recommended by (CEP 65, 2012).

On the regional context, Israel and Jordan are the closest countries to Palestine, both are using less strict standards considering the same quality in treating and in some cases higher (UG & ECS, 2013), in Jordan, it was proven that the legal instruments are not enough awareness campaign should be combined with these instruments (Kampa, et al., 2010)

The main result in this section is the emergence of the public acceptance, which was also theoretically expected from an earlier survey: "*The barriers against treated wastewater was mainly the economic and social factors and the acceptability of the public is not affected by age, sex of education it is only affected by the location of living*" (Arafat, 2015, p. 129). Nowadays, the farmers are using the treated wastewater and others are willing to use it. Which considered as important instrument to improve the sector.

The fourth dimension about **responsibilities and resources** highlighted the improvement in assigning the responsibilities for the actors after the contradictions in the previous laws. However, some of these responsibilities should be more specific.

2- How supportive is the governance context of wastewater treatment and reuse in Palestine?

The assessment of the qualities of the governance system of reusing the treated wastewater in Palestine showed that the governance context is supportive in the quality of extent, and moderately supportive in terms of coherence, flexibility, and intensity.

The governance system is highly supportive in terms of actors, since majority of the actors are involved and they are cooperating to achieve the goal of improving the reusing of treated wastewater. They are open to new actors and all are working to make the change in the community. Basically, that could be referred to small area of West Bank and the limited number of qualified and skilled people who are in charge even if they working in different entities.

The restrictive dimension is the strategies and instruments and mainly in term of intensity, due to the political status issues that hindering improving the sector and obtaining license for WWTPs and reuse projects. Also in terms of extent is just limited to legal and financial instruments, where the legal instruments lack of legalization and financial depending on the grants or external funds.

Comparing the results between Nablus and Jenin, it is obvious that the reuse practices in Jenin higher than Nablus but currently after signing the new large scale project Nablus will be the largest consumer of treated wastewater. However, the governance system in Nablus is much supportive. The qualification of the staff, the new technology used in the Nablus WWTP, treatment cost service collecting, multi-actor committee that monitored the WWTP, and the goal perspectives are more supportive for the reuse practices. In Jenin, the WWTP lacks experienced operators that leads in some cases to stop not using the treated wastewater because of insufficient treeing, in addition the Jenin WWTP does not have a lab to test the effluent. Moreover, it is operated by an old technology that many parts need for replacement.

To conclude, the governance system of reusing the treated wastewater is improving, and the public acceptance opens the doors towards improving this sector rapidly, especially for the end-users in industrial or agricultural sectors. The continuous issuing and updating of the by-laws indicates the importance of this sector for the government, and the future ambitions of benefitting from treated wastewater as a main water resource, at least for agricultural sector.

5.2 Recommendations

The implementation of policies regarding wastewater treatment and reuse in Palestine can be improved through the following recommendations, based on the assessment of the four dimensions elaborated and discussed in section 4.3.1.44.3:

Actors

1- Expanding the interactions with the public members to prevail their role as the main actor in reusing the treated wastewater process. This could be achieved by emphasizing their participation in policy-making, meeting, workshops, meetings etc. considering their different forms of participation as individuals, NGOs and WUAs.
2- Involving the private sector using a pragmatic approach, which considers them as a possible main actor in the future to improve the reuse of treated wastewater.

Problem perspectives and goal ambitious

1- Considering the Palestinian-Israeli conflict and associated agreements (such as article 40 of the Oslo Agreement), and their consequences (such as obtaining licenses, transboundary water and wastewater discharge, water extraction, permit procedures in Area C) as the main barrier in improving the wastewater reuse, and building the future strategies to circumvent this barrier.
2- Studying the possible impacts of reusing the treated wastewater on environment (such as shallow aquifer salinity and crop contamination) and humans (such as diseases and infections).

Strategies and instruments

1- Issuing a detailed guideline about the reuse of treated wastewater, and more realistic and enforceable standards and regulations matching the specific practices and experiences in Palestine.
2- Activating the legal instruments by legalizing the by-laws, which will enhance the reusing of treated wastewater sector and control the individual practices, such as water use by private well owners.
3- Improving public participation in wastewater reuse by lunching a comprehensive awareness campaign about the treated wastewater reuse on all public scales.

4- Constructing a large-scale agricultural project, which is fully irrigated with treated wastewater, and cultivating different high quality types of fruit and vegetables then selling it to the public to market these projects.
5- Issuing a regulation to create an attractive climate for private sector investments, and implementing institutional and economic reforms to promote private sector involvement as an instrument to enhance the quality of treated wastewater and marketing the reuse concept.

Responsibilities and resources

1- Enhancing the responsibilities of actors by explicating them more in policies and strategies, especially for the PSI, private sector and Ministry of Economy.
2- Including an O&M feasibility in the design of each WWTP project to ensure covering its running costs and avoiding the interruption of operations when funds or grants stop.
3- Investing more to scale up the irrigation projects that use treated wastewater, which in turn will create more jobs, increase the revenues for the farmers and the WWTP that supply the reclaimed wastewater.
4- Providing a periodic assessment of the governance context to inform the actors about any changes that might occur in the broader governance context, which goes beyond the individual responsibilities of each actor.

5.3 Further Research

Future research can include detailed studies of 1) possible reuse options for excess treated wastewater in winter season in Palestine, 2) the effects of involving the private sector on reuse project, and 3) the effect of using the treated wastewater on the different industries.

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Appendices

Appendix 1. Governance Assessment Tool - Questions

Governance dimension	Quality of the governance context			
	Extent	**Coherence**	**Flexibility**	**Intensity**
Levels and scales	How many administrative levels are involved in implementing and designing reusing treated wastewater policies?	Do these administrative levels work together and recognise each dependency?	Is it possible to move up and down levels (up scaling and downscaling)	Is there a strong impact from a certain level towards behavioural change or management reform?
Open Question	In the process of implementing and designing reuse treated wastewater policies is there is a dominant level? What is it and how many levels they are and how it is easy to move between them?			
Actors and networks	Are all relevant stakeholders involved?	What is the strength of interactions between stakeholders?	Is it possible to include new actors and how much it is easy to shift the lead from one actor to another when it is needed?	Is there a strong pressure from an actors or actors coalition towards behavioural change or management reform?
Open Question	Which actors are involved in the process, how it is their relation and the performance of management reform?			
Problem perspectives and goal ambitions	To what extent are the various problem perspectives taken into account?	To what extent do the various perspectives and goals support each other, or are they in competition or conflict?	Are there opportunities to reassess goals?	How different are the goal ambitions from the status quo or business as usual?
Open Question	How does the problem was taken into consideration, the interrelation of goals with each other?			
Strategies and instruments	What types of instruments are included in the policy strategy?	To what extent is the incentive system based on synergy?	Are there opportunities to combine or make use of different types of instruments? Is there a choice?	What is the implied behavioural deviation from current practice and how strongly do the instruments require and enforce this?
Open Question	What are the instruments used, the possibility to combine them and their influence of implying this?			
Responsibilities and resources	Are all responsibilities clearly assigned and facilitated with resources?	To what extent do the assigned responsibilities create competence struggles or cooperation within or across the institutions?	To what extent is it possible to pool the assigned responsibilities and resources as long as accountability and transparency are not compromised?	Is the amount of allocated resources sufficient to implement the measures needed for the intended change?
Open Question	How the responsibilities are facilitated with resources and is it possible to measure implement the measures needed for the intended change?			

Appendix 2. Governance Assessment Tool - Evaluation Manual

Governance dimension	Quality of the governance context			
	Extent	**Coherence**	**Flexibility**	**Intensity**
Level and scale	Supportive: All levels are involved in implementing and designing policies of reusing treated wastewater? Neutral: most levels are involved Restrictive: minority of levels are involved	Supportive: The levels consider they all work together and recognise its dependence Neutral: The levels consider few multi-level issues exist and recognise their dependence Restrictive: The levels consider, most levels are missing, but they recognise their dependence	Supportive: It is possible to move up and down levels, depending on the issue in what they could consider a free manner Neutral: It is possible to move up and down levels, depending on the issue, only through certain articles in the policies Restrictive: It is not possible to move up and down levels even when there are certain articles in the policies to do so	Supportive: All levels are working to bring behavioural change or management reform Neutral: Most levels are working to bring behavioural change or management reform Restrictive: The minority of levels are working to bring behavioural change or management reform
Actors and networks Supportive Neutral: Restrictive	Supportive: all relevant stakeholders are involved? Neutral: most of the stakeholders are involved Restrictive: Few stakeholders are involved	Supportive: the interaction is institutionalised, stable and there is trust. Neutral: Most interactions are institutionalised, stable and there are trust issues Restrictive: the institutionalised interaction is not operating, actors report stability and/or trust issues	Supportive: it is easy to include new actors, shift leadership and social capital creation. Neutral: some of the following is possible (include new actors, shift leadership and social capital creation) Restrictive: the choice of (include new actors, shift leadership and social capital creation) is restricted.	Supportive: there is a coalition of different actors who pressuring strongly towards behavioural change or management reform. Neutral: a minority of different actors are pressuring. Restrictive: one or none of the actors are pressuring
Problem perspectives and goal ambitions	Supportive: all problem perspectives are considered Neutral: most of the problem perspectives are considered Restrictive: few of problem perspectives are considered	Supportive: all of the actor's goal support each other Neutral: most of the actor's goal support each other Restrictive: there is conflict/ competition the actor's goals	Supportive: it is possible to reassess all aspects of the goals during the implementation process Neutral: some aspects of the goals can be reassessed Restrictive: it is not possible to reassess the goals or could be after the implementation phase.	Supportive: the goals can be achieved with the current policy Neutral: some minor changes to current policy will achieve the intended goals Restrictive: major changes are required to achieve the goals

Strategies and instruments	Supportive: no instruments or strategies are missing Neutral: some are missing Restrictive: significant number is missing	Supportive: the policy allows creations of synergy among the instruments and there are no overlaps or conflict between them. Neutral: some overlaps or conflicts are existing Restrictive: the policy does not allow creations of synergy among the instruments and there are overlaps or conflict	Supportive: there is opportunity to combine and use different instruments Neutral: there is opportunity to combine and use different instruments as it stated in the policy/law Restrictive: there is/no opportunity to combine and use different instruments but the actors do not do it.	Supportive: no need for behavioural deviation and the instruments are enforced properly Neutral: There is minor need for behavioural deviation from the running practises and the instruments are facing small issues during enforcement Restrictive: there is a major need for behavioural deviation from the running practises and the instruments are facing important issues during enforcement.
Responsibilities and resources	Supportive: responsibilities clearly assigned with resources Neutral: responsibilities clearly assigned but some have no resources. Restrictive: responsibilities clearly assigned but there are insufficient resources	Supportive: the actors promote cooperation within and across institutions Neutral: the actors promote cooperation within and across institutions, but some issues were reported Restrictive: the actors promote cooperation within and across institutions. However, actors report significant issues.	Supportive: It is possible to pool the assigned responsibilities/resources Neutral: It is possible to pool partially some of the assigned responsibilities/resources Restrictive: It is not possible to pool the assigned responsibilities	Supportive: there are enough resources needed for the intended changes Neutral: there are resources to attain most of the responsibilities to achieve the intended goals Restrictive: there is a lack of resources to comply the responsibilities to achieve the intended changes