Governance and Climate Vulnerability Index

Five case studies

Master Thesis

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Submitted in Partial fulfillment of Requirements for the Masters of Science Degree in Water and Environmental Engineering at Birzeit University, Palestine.

June, 2010

Abstract

Water resources around the Middle East are under an enormous stress resulted from the population growth and the extensive use of water resources that exceeds the water demand of the countries. Moreover, climatic aspects pose another dimension of stress on water resources; it has significant effects on environment, societies and economics. In fact, the governance of these countries has the tendency of increasing this stress or decreasing it, depending on its performance and efficiency in applying policies, legislation and managerial plans towards decreasing the poverty and the vulnerability of the countries specially those suffering from poverty.

Vulnerability to the impacts of Governance and Climate aspects needs to be addressed to assess the impacts of climate in linkage to socio-economic and governance performance. this assessment is needed to identify the countries where the governance and the political conflict is likely to impact on human livelihoods and on water resources in the cases of any climatic changes and hence affecting the vulnerability of its country and the ability of these countries to cope with any sudden changes that may face them.

In this research, the vulnerability of countries was assessed by introducing a new management tool consists of indicators that are combined together to form an index that targets the climate and governance aspects. This index is called Governance and Climate Vulnerability Index (GCVI), it measures vulnerability of countries/communities relatively to each other in relation to water elated issues, taking into accounts social, physical and political aspects in order to outline an integrated structural framework. These aspects are represented in a variety of relevant components joined together as indicators using a comprehensive approach to form an integrated management tool. The index was tested and applied on five countries as study cases, which are Israel, Jordan, Lebanon Palestine and Syria. The index has formed a comparison tool of the vulnerability for these countries in terms of the governance and climate aspects in linkage to water.

The Governance and Climate Vulnerability Index (GCVI) focused mainly on water related issues that might be effected by the climate changes and affects the ability of countries to cope with these changes. This has been achieved by identifying the governance factors that impede the introduction of beneficial changes and recommend policies and systems for reducing vulnerability. These factors influence the ability of countries to adapt in case of any changes,

therefore, the GCVI introduced the governance aspects from which the adaptation strategies will be developed and applied to protect water resources and decrease the vulnerability of the country.

Acknowledgment

I would like to express my deep gratitude to Dr. Ziad Mimi director of the Water Studies Institute, Birzeit University, for his unique cooperation, generous intellectual and kind inspirational support, empathy and advices. He was very patient, inspiring and encouraging through the whole period of my research.

My appreciations are due to Birzeit University, especially the Institute of Environmental and Water Studies including all the professors who have developed my skills during my study for the Master degree. I also would like to thank the examination committee; Dr. Maher Abu-Madi (Birzeit University) and Dr. Amer Marei (Al Quds University) for their valuable comments and directions on my thesis that have put my thesis in its final form.

Moreover, I would like to pass my sincere thanks and gratefulness for my family specially my parents, my husband and my mother in law for their continuous support and help. In addition to all the friends and colleagues for their encouragement and support that have helped me to complete this research successfully.

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Chapter One

Introduction

The world's climate is continuing to change at rates that are projected to be unprecedented in recent human history. Climate change is a very real phenomenon that will inevitably affect human populations in the coming decades since it is affecting the earth's physical and biological systems, and is expected to do so on forthcoming decades. Water is involved in all components of the climate system (atmosphere, hydrosphere, land surface and biosphere) (Roger et al., 2001). Therefore, climate change affects water through a number of mechanisms. And thought global water resources are limited, a more sustainable approach to water management, and equitable and ecologically sensitive strategies of water allocation and use, can reduce the vulnerability of the countries that are imposed to these climate changes (Sullivan, 2002).

Policies for development and environment are evolving as tools of behavioural change throughout the world, and it is now understood that an essential prerequisite to effective policy making is accurate monitoring backed up by rigorous interdisciplinary science. An adequate water supply is a prerequisite for human and economic development. It has been recognized that human behaviour can have an impact both on water, and on the global ecosystem, and that there is a need to regulate that behaviour in order to stabilize and sustain our future (Sullivan, 2002). This can be achieved and managed by applying mutations on several factors in the governance system.

In the Middle East, water resources are under an enormous stress resulted from the population growth and the extensive use of water resources that exceeds the water demand of the countries. This stress might grow further in countries that suffers from poverty and has limited social capacities. These factors have a large impact on the ability of the countries or communities to adapt strategies and alternatives for managing and saving the water resources (Sullivan and Meigh, 2005).

Climate change poses another dimension of stress on water resources in the Middle East region; it has significant effects on environment, societies and economics. Developing countries tend to be more vulnerable to these changes than other countries (Steven, 2002). In order to develop

strategies for adaptation to these global changes, it is necessary as a first step to make reliable and consistent assessments of vulnerability. This needs to be holistic, at the appropriate scale, and to integrate a wide range of relevant factors.

The governance of countries have the tendency of increasing stresses posed by any aspects or decreasing it, depending on its performance and efficiency in applying policies, legislation and managerial plans towards decreasing the poverty and the vulnerability of the countries and hence be able to develop and apply adaptation strategies. Therefore, when assessing the vulnerability of countries in relation to climate change that tackles water resources, then governance has to be introduced to this assessment since it has a great role in influencing the ability of nations and countries to cope with changes through its policies and adaptation strategies (World Bank, 2001).

In this research, both climate and governance aspects will be introduced and linked together to assess their effects on the vulnerability of countries in terms of water resources. Moreover, both aspects will be presented through variety of factors to perceive the influences of the different factors on each other and on the other hand to assess their effects on the communities or countries.

1. Objectives

The overall objective of this research is to develop a management tool that asses the Vulnerability of countries in the context of governance and climate changes. This is done through growing a relationship between biophysical and social aspects of vulnerability and integrating the outputs from both physical, governance (political) and social sciences within one structural framework.

The research is applied on five countries that are Israel, Jordan, Lebanon, Palestine and Syria, that have experienced more than 60 years of political conflict in addition to poverty and water scarcity. The specific research objectives can be summarized as follows:

1. To develop a comparative analysis approach that provides an integrated assessment of the impact of climatic, governance and political changes on the vulnerability of countries. Consequently, these analyses can make it possible to rank countries or communities within the same country, taking into account the physical, governance (political), environmental and socio-economic factors associated with water scarcity.

2. To identify the countries where the governance and the political conflict is likely to impact on human livelihoods and on water resources of the country and hence considered as more vulnerable. This can be done by assessing the social vulnerability in linkage to governance performance to be able to analysis the impacts of the performance of the governance on the society and hence the water resources.

3. To develop a tool that enables decision makers, national and international organizations, donors...etc who are concerned with water provision, to identify the vulnerable countries or communities so as to priorities the needs for interventions in the water sector between countries.

2. Study Areas

The five targeted countries; Israel, Jordan, Lebanon, Palestine and Syria, located along the shores of the eastern part of the Mediterranean Sea. Figure 1.1 shows the Map for the study areas. These countries are considered to be made up of a mix arid and semi-arid zones where rainfall percentages are relatively low in which the livelihood of the large population is to a significant degree controlled by the scarcity of water.

Moreover, these countries are being affected by escalating political tensions due to the occupation of Israel to Arab lands and subsequent lack of security since they have experienced more than 60 years of bloody conflict; civil war, foreign invasions, intifadas, detentions and closures.

Adding to that, these countries are characterized by a relatively high population growth, the annual population growth rate for Israel, Jordan, Lebanon, Palestine and Syria is respectively 1.8, 3.2, 0.8, 2.7 and 2.5% (World Bank, 2008), this will add additional stress on water resources existing in each country due to the increase on the demand.

The development and increase of the industrial development and expansion of agricultural irrigation is also putting these countries' water resources under high pressure. Thus, this corresponds to a continuous increase in water demand for each of these countries. That results in

a gap between demand and supply which has widened over the years. Despite the fact that water and financial resources for these countries are relatively considered limited.

Because of the diverse topography in the five countries; that is ranging from the snow-capped mountains of Lebanon to the world's lowest point on the shores of the Dead Sea, the climate is not uniform which consequently leads to differing vegetative cover and extremes in altitude create a number of distinct microclimates in this relatively small area. The variations are stark, for example, 43 per cent more rain falls in Beirut in January than falls in Damascus in an average year. However, the wettest months are between October and April, while the summer sees the rains nearly disappear; Amman, Jerusalem and Damascus receive—on average—less than a millimetre of rain from June through September. Temperatures fluctuate dramatically in an average year. In summer, they can climb to 37°C in Damascus, while snow is not unheard of in winter (IISD, 2009).

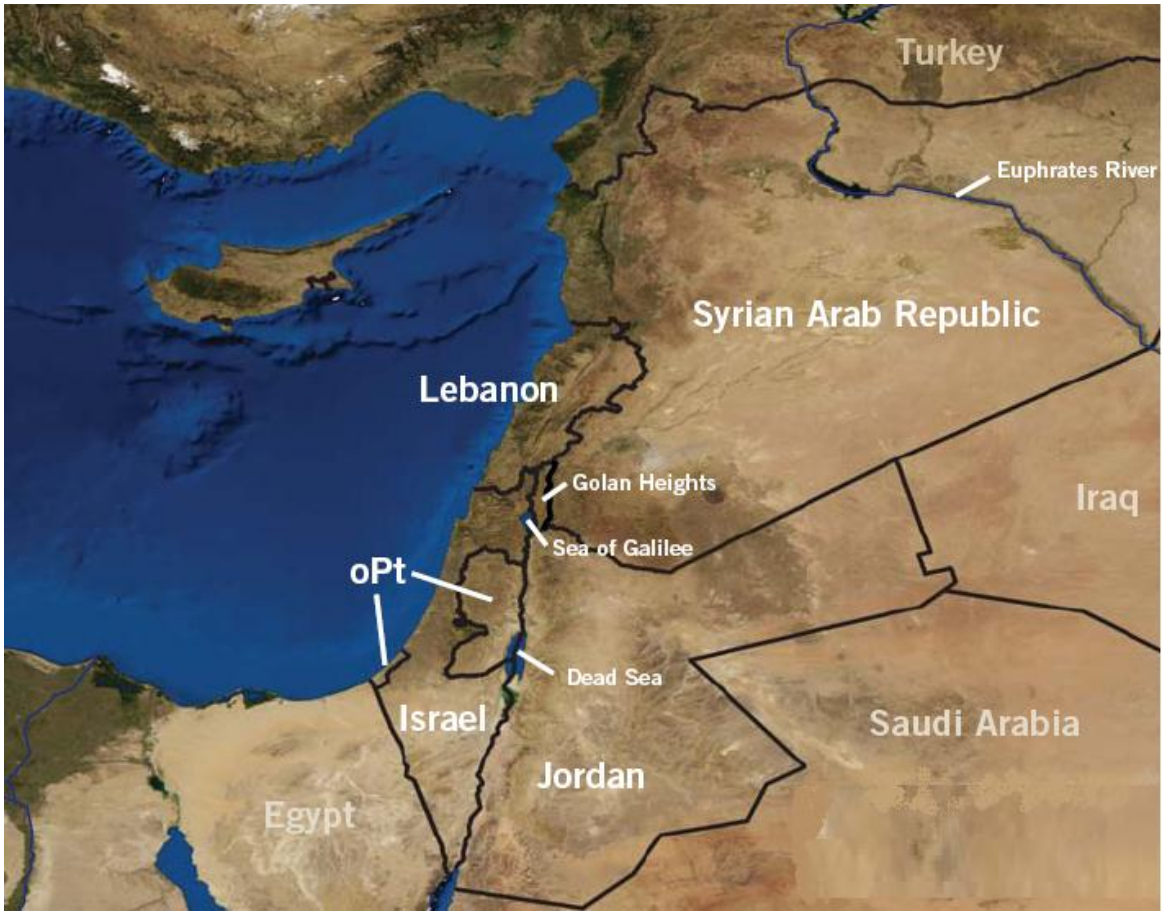


Figure1.1: The Map for the study areas; Israel, Jordan, Lebanon, Palestine and Syria. (IISD, 2009).

According to Falkenmark and Widstrand (1992) "a country whose renewable fresh water availability is less than 1,700 m^3/cap/year experiences periodic or regular "water stress". When fresh water availability falls below 1,000 m^3/cap/year countries experience chronic "water scarcity" (Lawrence et al, 2002).

The per capita annual share from renewable water resources in respect to the GDP per person in the five countries is displayed in Figure 1.2, that shows the significant difference between Israel that have 1,408 m^3/capita/year and Syria that have 1,056.7 m^3/capita/year, whereas the other three countries falls below the "water poverty" line of 1,000 m^3 per capita per year (ESCWA, 2007).

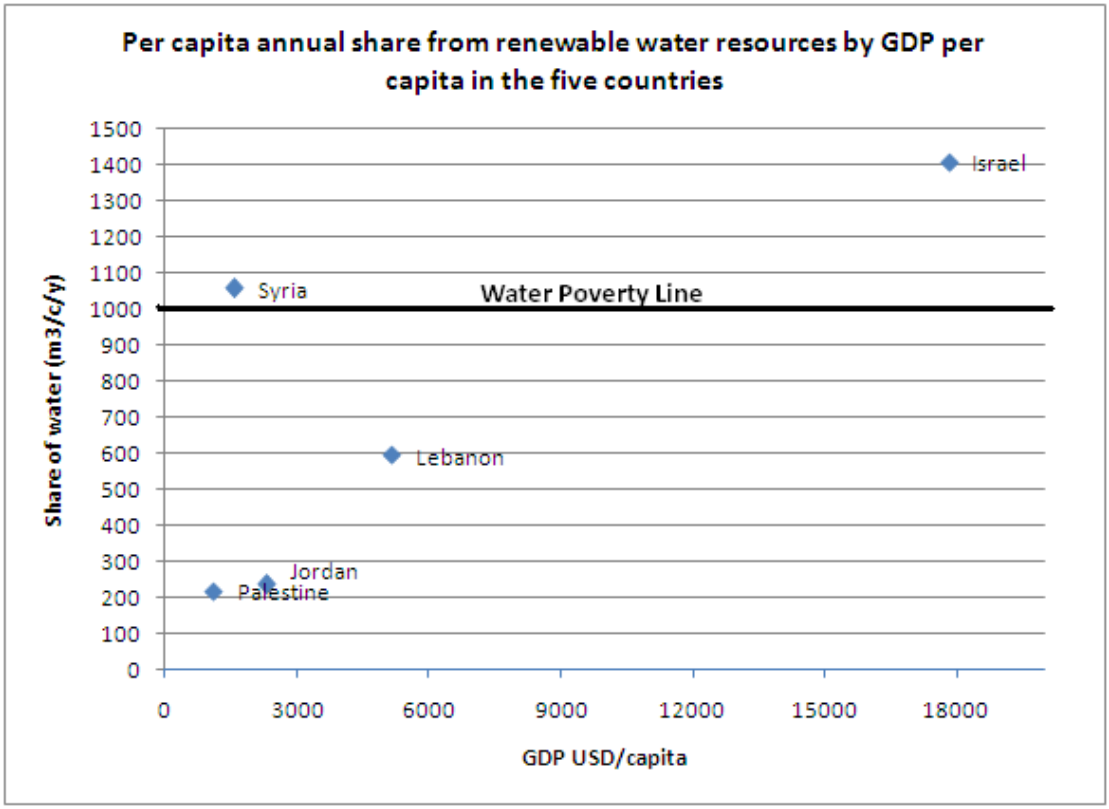


Figure 1.2: the per capita annual share from renewable water resources by GDP per capita in the five countries of the study area. Source: ESCWA (2007); UNDP (2008)

On the other hand, these five countries are located in the center of a complex political, social, and economical system. Regional conflicts have always affected these countries decision taking processes. Since water is a highly politicized and a naturally scarce resource, there have always been arguments over the ownership and use of these resources. For example, water have created an enormous conflict between Israel, Jordan, Lebanon and Syria on the control and allocation of

the Jordan River that is considered to be a transboundary source of water, it was part of the ongoing peace negotiations to solve this inconsistency, dropping the rights of the Palestinian to have a share in this resource. On the other hand, since 1967 Israel has occupied the western south of Syria "the Golan heights" and controlled Banias spring/river which is now falling administratively within the occupied Golan Heights (Amery, 2000). This river supplies annually a 120 MCM of water which runs down to the Jordan River, consequently, the Syrian is losing their right in this water. This has also created a long process of negotiations to return this right.

Also, Israel and the West Bank of Palestine share the Mountain Aquifer's three basins: the Western mountain, the Eastern Mountain and the North-eastern basins. Eighty percent of the natural replenishment of the aquifer takes place within the West Bank, but as the natural flow of the groundwater is from the West Bank towards Israel, the majority of the water withdrawal takes place in Israeli territory (in addition to the water use by settler communities inside the West Bank of Palestine) (IISD, 2009).

Therefore, water is considered a 'strategic' resource and a cause for tensions between countries in the region, therefore it became a major political matter that employed a variety of peace agreements that are all emphasizing on the water and civilian rights to have access to water resources and get sufficient quantities of water.

Chapter Two

Literature Review

The importance of water for people's livelihoods is now widely recognized. In developing countries, health problems related to water, the availability of and access to water for productive purposes and small-scale agriculture are all of great importance, especially to poor people. Because of these issues, poor people in developing countries tend to be vulnerable to short-term shocks as well as the longer-term variation being brought about by climate change. In addition, other global changes due to increasing population densities, greater competition for resources, environmental degradation and loss of biodiversity are contributing to the degree of vulnerability faced by millions of people. However, any sudden changes in the political or managerial contexts may also affect communities due to socio-political vulnerability. In order to develop strategies for adaptation to these global changes, it is necessary to make reliable and consistent assessments of vulnerability.

2.1 Definitions

2.1.1 Vulnerability

Adger (2006) defined vulnerability as a powerful analytical tool for describing states of susceptibility to harm, powerlessness, and marginality of both physical and social systems, and for guiding normative analysis of actions to enhance well-being through reduction of risk.

However, the term vulnerability has been used in various fields of study, like social science, geography, epidemiology, and environmental science, but sometimes with significantly distinct perceptions. Researchers from the natural hazards field tend to focus on the concept of risk, while those from the social sciences and climate change field often prefer to talk in terms of vulnerability (Downing et al., 2001). Social scientists and climate scientists often mean different things when they use the term "vulnerability"; whereas social scientists tend to view vulnerability as representing the set of socio-economic factors that determine people's ability to cope with stress or change (Allen, 2003), according to Nicholls et al, (1999) "climate scientists often view

vulnerability in terms of the likelihood of occurrence and impacts of weather and climate related events" (Brooks, 2003).

The World Bank (2001) saw that the probability of someone being exposed to socio-political and environmental risks would come under the definitions of vulnerability such as socio-political violence, crimes, natural disasters, and being pulled out of school.

On the other hand, the Department for International Development (Kenya, 2006) reported that the vulnerability is a function of economic, social, political, environmental and technological assets.

In this research, vulnerability will be targeted in terms of climate, governance and politics that will be linked to poverty or in other words to the economical situation of the countries.

2.1.2 Vulnerability and Poverty

According to Desai (1995), poverty is a capability deprivation that shows that poverty is the result of a lack of at least one of the basic skills and conditions that characterize a society, and as such, is a relative concept. Poverty itself is recognized to be due to lack of five different livelihood that are, the capability to stay alive/enjoy prolonged life, to ensure biological reproduction, the capability for healthy living, the capability for social interaction and the capability to have knowledge and freedom of expression and thought (Desai, 1995). Having access to adequate water supplies for domestic and productive use can clearly be linked to most of these capabilities. The occurrence of poverty therefore not only depends on the conditions of life on which a person depends, but on the existence of a combination of circumstances or 'functioning' which gives rise to capabilities on which an individual can build (Steven et al., 2002).

"*It is particularly difficult to capture such time-specific effects on vulnerability, so proxies are necessary. When people are vulnerable to hazards and risks and have poor entitlements, migration can occur in response to shocks*". This verifies that developing countries, where natural resource-dependent rural livelihoods are predominant, high rates of rural-urban migration can be a sign of lack of resilience and narrow coping ranges in rural populations (Katharine Vincent, 2004).

Sullivan (2005) has found that the access and capacity components improve enormously in the poorer countries, while in the others they do not change a great deal as they are already good. Therefore, poorest counties are the most vulnerable under present conditions and will remain the most vulnerable, whereas the increase in vulnerability for the other countries will be much larger.

Hence, the United Nations Development Programme (UNDP) has developed an index called the Human Development Index (HDI) in the year 1990; this index uses an indicator of poverty that refers to the size of population below the poverty line. If a country has a large number below the poverty line it can be assumed that they will have more limited resilience in the face of risks and hazards, and in such cases, exposure might be more likely to translate into an impact (UNDP, 2007).

The nature of vulnerability is fundamental in determining whether hazard exposure will translate into impacts for poor countries or be mediated by the biophysical and/or human systems. At the same time, vulnerability as a potential state is difficult to assess due to the variety of determinants acting and interacting on different scales. It is therefore necessary to rely on indicators that best represent the complex underlying processes.

2.2 Measuring vulnerability using Indicators

The integrated water management requires appropriate use of water resources taking into consideration many factors relevant for human development. These factors are sometimes very complex to explain in a simple language, therefore indices have been found to be a feasible way to express such complex situations. Moreover, the current tendency for policymakers to identify milestones to progress requires an effective monitoring programme; thus there is interest in integrated indicators as tools for decision support.

Simpson and Katirai (2006) saw that indices are attractive because of their ability to summarize a considerable amount of technical information in a way that is easy for people to understand. Large amounts of data are gathered and categorized into mathematical equations that provide symbolic numbers used for comparisons.

Hammond et al, (1995) defined Indicators as a quantifiable constructs that provide information either on matters of wider significance than that which is actually measured, or on a process or

trend that otherwise might not be apparent. The totality of a number of complex and intangible processes indicators are of use to decision-makers at all levels, particularly in comparing across space and monitoring change over time (Katharine Vincent, 2004).

The Department for International Development in Kenya (2006) has identified the purpose of indices is to create better encapsulate a complex reality such an undertaking is limited in several ways. Consequently, indices have become more widely applied in social capital and capacities, and measure quality of life, human development, social vulnerability…etc.

The previously mentioned HDI which was developed by the United Nations Developing Programme (UNDP) consists of a composite statistic measuring people's well-being by combining indices measuring health, education and wealth. It offered a comparison of where countries stand in the world, and led the way in moving away from income as the sole measure of development (UNDP-POGAR, 2008).

The Department for International Development (2006) used indicators in their study of the climate vulnerability and poverty in Africa and aggregated the indicators to form indices in which wider range of variables has been incorporated. This was ideally leading to a more comprehensive model of reality. They saw that aggregating the indicators creates more opportunities for subjectivity and thus must be even more critically appraised.

2.3 Vulnerability and poverty in Climate Change

Climate change impacts can have significant effects on the environment, societies and economies. For human populations, climate change impacts can be devastating, giving rise to economic disruption and mass migration as agricultural systems fail, either through drought or floods. Therefore, the vulnerability of such changes has to be well studied in order to overcome impacts that may appear especially for communities suffering from poverty (Sullivan et al., 2007).

Liverman (1994) has highlighted the importance of assessing the complex reality of vulnerability when predicting future impacts of environmental change as the most vulnerable people may not be in the most vulnerable places: poor people can live in resilient biophysical environments and be vulnerable, and wealthy people can be in fragile physical environments and live relatively well.

Understanding the impacts of climate change is thus inextricably linked with the human conditions that create a resilience or vulnerability to that event (Katharine Vincent, 2004).

The World Bank (2002) stated that *"the linkages of climate change impacts to poverty are dynamic, often inter-connected, and context-specific – reflecting geographic location; economic, social, and cultural characteristics; prioritization and concerns of individuals, households, and social groups; as well as institutional and political constraints."*

Sullivan et al, (2002) have designed the Water Poverty Index (WPI) to contribute to the global effort to tackle water problems and to provide a useful tool to monitor progress, identifying those areas of greatest need and enabling prioritization of action in the water sector. The WPI also provides an ease of understanding for policy- and decision-makers, transparency of the process, empowerment of local communities and adaptability to a variety of local situations and scales.

Steven at al, (2002) defined the WPI as an integrated tool for water management that evaluates poverty in relation to water resources availability. In which it develop a better understanding of the relationship between physical extent of water availability and the level of household and community welfare. WPI was considered as an interdisciplinary approach that links physical and social sciences within a structural framework enabling policy makers to identify appropriate mechanisms to deal with the causes of the problems. That develops a relationship between physical extent of water availability and the level of household and community welfare

Sullivan et al, (2003) have practiced the WPI in an international level applied for 140 countries intending develop a comparison tool to focus attention on improving water management performance across the world.

Sullivan et al, (2007) have worked on a reliable and consistent assessment of the vulnerability in which a wide range of relevant factors was integrated to develop a strategy of adaptation for any future global change. They have developed an approach which encapsulated human vulnerability and includes a representative range of social and physical factors. This approach is an index-base called the Climate Vulnerability Index (CVI). CVI helped to identify human populations most at risk from climate change impacts and can be applied at variety of scales in which more indicators can be added to identify other changes that poses risks on populations such as political changes.

The World Economic Forum (2002) has developed an index called the Environmental Sustainability Index (ESI) in which it measures 20 indicators to address an overall progress toward environmental sustainability for 142 countries. Each indicator combines two to eight variables, for a total of 68 underlying data sets. One of the main components of it is the reduction of human vulnerability.

2.4 Governance and Vulnerability

Getting back to the definition described by the Department for International Development (2006), that vulnerability is a function of economic, social, political, environmental and technological assets. World Bank (2001) illustrated that poverty, civil society, vulnerability, and Governance are all frequently linked to each other; for example, poverty reduction is connected to governance as a precondition on the other hand, the civil society is linked with good governance and democracy. Therefore, a comprehensive attempt at capturing social vulnerability ideally needs to have some measure of the strength and stability of government.

Kaufmann and Kraay (2008) defined governance as *"The manner in which power is exercised in the management of a country's socio-economic resources"* and later it was considered as the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; the respect of citizens and the state for the institutions that govern economic and social interactions among them (World Bank, 2008).

However, United Nations Development Programme (UNDP, 1997) has also defined Governance as: *"the 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"*.

Weiss (2000) clarified that: *the concept of governance denotes the use of political authority and exercise of control in a society in relation to the management of its resources for social and economic development"*. Later, The United Nations Developing Programme has measured Governance performance using indicators that are usually narrowed down to measure more specific areas of governance such as electoral

systems, corruption, human rights, public service delivery, civil society, and gender equality. (UNDP, 2004)

Therefore, governance can be represented in too many definitions hence there is a variety of indicators that can be combined together to form an index to measure the governance and political capacity. However, such indicators are obviously politically charged. Such index is theoretically-driven and developed by a transparent and respected data sets compiled by international organizations such as the World Bank and United Nations Development Programme.

The World Bank (2001) has reported in its proposed strategy for poverty reduction, and outlines three approaches: promoting opportunity, facilitating empowerment, and enhancing security. Similar strategies can be applied to reduce vulnerability. These approaches cannot be achieved without good governance since they are part of its very vital elements. It is believed that a government or state can be considered as 'good' when its people are provided with three very basic needs: economic security, social services and physical security or peace.

Kaufmann (2005) presented national indicators based on six key aspects of governance that are voice and accountability; political instability and violence; government effectiveness; regulatory quality; rule of law; and control of corruption. Their indices are based on several hundred individual variables measuring perceptions of governance drawn from many data sources (World Bank, 2007). These indicators were studied and have covered 200 countries and have been compiled annually since 1996 and formed the basis for the World Bank's booklet, "*A Decade of Measuring the Quality of Governance; Governance Matters 2006*. Court et al. (2002) developed governance indices for the United Nations University, which carried out a cross country governance assessment survey for 22 countries using questionnaires comprised of 30 indicators, covering the same governance arenas included in the previous World Bank index (World Bank, 2007).

Whilst ideally a strong governance structure ought to reduce social vulnerability, there might be cases where political issues such as corruption act to impede equitable access to resources and distribution of entitlements. Perhaps unsurprisingly, corruption is a complicated phenomenon to quantify even if it can be observed in the first place. Transparency International (TI, 2009) has

worked on a Global Corruption Index using a comprehensive and transparent methodology giving the importance of corruption as a determinant of social vulnerability.

2.5 Combining Indices

Sullivan et al. (2002) have used the composite index approach in combining the variable components to form the Water Poverty Index (WPI) and the Climate Vulnerability Index (CVI). It is a well tried and tested approach which was a basic construction of the Human Development Index (HDI) introduced by the UNDP. It is based on combining a series of relevant variables together to form a more comprehensive insight into a particular situation in comparison to other approaches. The structure of this approach according to Sullivan et al. (2005) for developing the Climate Vulnerability Index (CVI) is:

$$\text{CVI} = \frac{r_r R + r_a A + r_c C + r_u U + r_e E + r_g G}{r_r + r_a + r_c + r_u + r_e + r_g}$$

Where:

R, A, C, U, E and G are the resource, access, capacity, use, environment and geospatial components, respectively.

r_r, r_a, r_c, r_u, r_e and r_g are the weight applied to each of the components.

While there are a number of approaches that can be used to form an Index, such as: (Steven et al., 2002)

- Composite Index
- Simple time analysis approach
- Matrix approach
- Gap method

UNESCO (1987) has developed a multi-level Index approach called a composite programming (Distance-Based Technique), which is an empirical technique, which was first created by Badrossy and Bogardi (1983) to resolve a geological exploration problem (UNESCO, 1987). Then UNESCO has applied this approach for the determination of the actual state of the water related environment from a joint ecological-socioeconomic standpoint. It has combined several

indicators for multiple levels that consist of sets of components; hence combine more than three levels of decomposition. This approach differs from other methods by its ability to combine different scales of systems and able to account for the changing preferences between development and conservation.

In this research, five countries have been studied in terms of Climate and governance to address the needs and the vulnerability of countries especially those suffering from poverty. This is done by linking the physical and social sciences together to form an integrated index using the multi-level index approach that combines a variety of determinants relying on indicators that represent the climate change and the governance indicators.

Chapter Three

Methodology

3.1 General

This research aims to develop an index that measures vulnerability of five countries' relatively to each other in the relation to water, taking into accounts social, physical and political sciences in order to outline an integrated structural framework. Hence, it will be an evaluation tool that can be used to examine the vulnerability of communities in terms of any governance, social or climate aspects towards water resources. It can also be used in some managerial works and decision making such as for planning, assessing and monitoring.

Climate and governance aspects in terms of water resources cannot be measured directly, they have to be represented in a variety of relevant components joined together to identify the vulnerability effects on countries. Therefore, in this research, the components of climate and governance indicators will first be selected and identified to form a comprehensive and relative reflection of the vulnerability of countries.

In this research, Governance and Climate Vulnerability Index (GCVI) will be developed to form a comprehensive analytical approach that provides an integrated assessment of the impact of climatic and governance aspects on the vulnerability of countries. This will be made by incorporating climate and governance vulnerability indicators to form a complete tool for water management. This index will help in assessing the social vulnerability in linkage to governance performance and hence it will make it possible to analyse the impacts of the performance of the governance on the society and so the water resources. Consequently, these analyses can make it possible to rank countries or communities within the same country to priorities the needs for interventions, taking into account the physical, governance, environmental and socio-economic factors associated with water. Thus enables decision makers, national and international organizations who are concerned with water provision, to identify the vulnerable countries or communities so that adaptation strategies can be developed and population can be protected.

Social and physical factors that encapsulate human vulnerability were first adapted from the Climate Vulnerability Index (CVI) created by Sullivan et al. (2002), these factors are mainly represented by water resources, use, access, capacity, environmental and geospatial indicators. Each of these indicators includes a variety of aggregated indices. On the other hand, governance and political aspects will be represented in a variety of indicators adapted from the Wold Bank (2000), these indicators are voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. In which they will be combined to represent a Governance Index (GI).

All these factors represented by the (CVI) and the (GI) will be combined together using the composite index approach to form the Governance and Climate Vulnerability Index (GCVI). This index will be tested and applied for the five countries (Israel, Jordan, Lebanon Palestine and Syria). In which it will form a comparison tool of the vulnerability for these countries in terms of the governance, climate and political aspects.

The components that are forming the Climate Vulnerability Index (CVI) and the governance indices (GI) are listed in two groups below.

3.2 Variables of the Climate Change

(Sullivan, 2005)

- Resource (R): that represents the physical availability of surface and ground water from the renewable water resources in addition to non-conventional water resources, including variability and quality of the resource as well as the total amount of water.

- Access (A): represent basic water and sanitation needs recognizing that water availability for growing food (irrigation) is as important as for domestic and human consumption.

- Capacity (C): that tries to capture the socio-economic variables which impact on access to water or are a reflection of water access and quality and the effectiveness of people's ability to manage water.

- Use (U): The efficiency of how water is used for domestic, agricultural and industrial purposes.

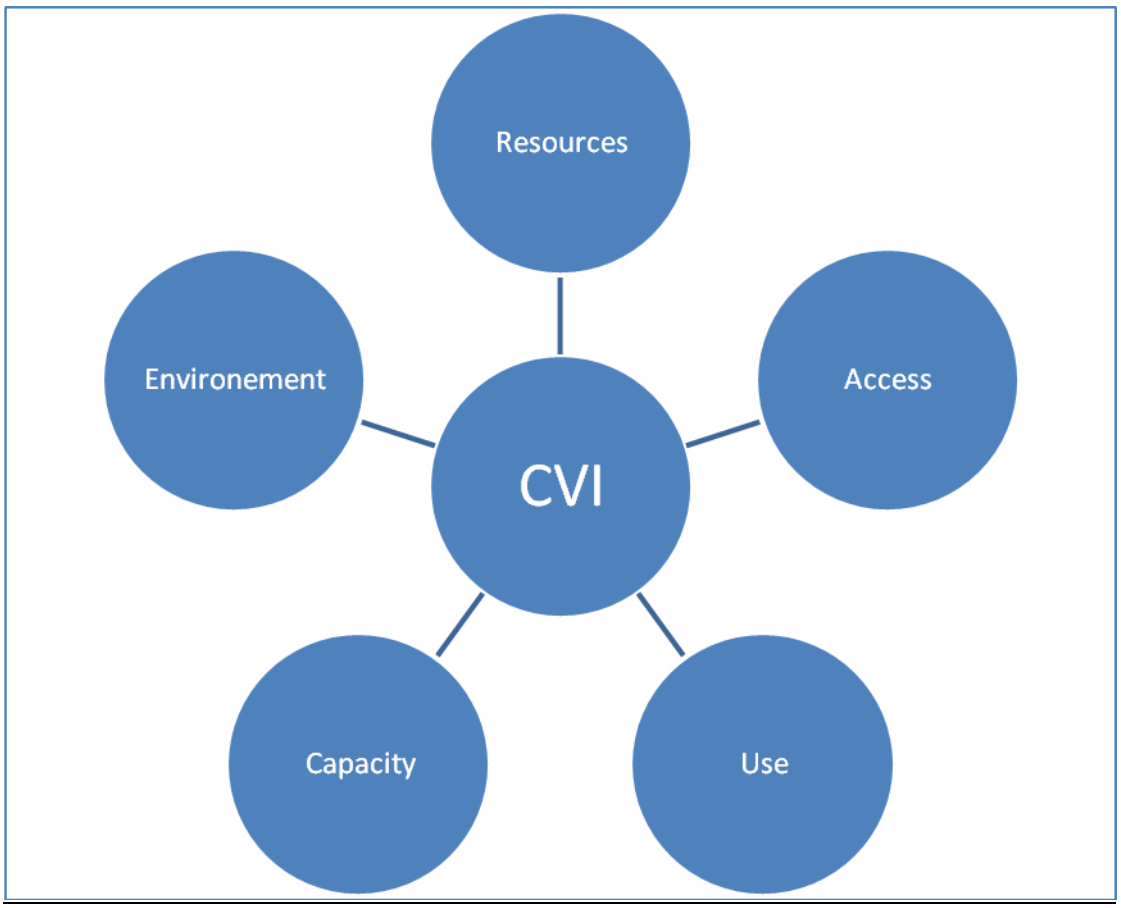
- Environment (E): A measure of how human water use impacts on ecological integrity.

- Geospatial (G): a specific geographical attribute that represents the degree of risk arising as a result of the physical or geographical nature. This can be represented by measuring the extent of land at risk from sea level rise, tidal waves, or land slips, degree of isolation from other water resources and/or food sources, deforestation, desertification and/or soil erosion rates, degree of land conversion from natural vegetation, deglaciation and risk of glacial lake outbursts.

These indicators consist of a variety of indices to represent the main indicator in which wider range of variables can be incorporate to give a comprehensive model for the reality. Figure 3.1 shows the structure of the Climate Vulnerability Index (CVI) and how these indicators combine to form the index.

In this research, the above mentioned variables are adapted to be included in the CVI according to Sullivan et al. (2007), whereas the geospatial indicator will not be included due to lack of data for the five countries, therefore, this indicator will not be incorporated to the index, but it is recommended to have future studies for measuring the variables forming this indicator.

Figure 3.1: Structure of the Climate Vulnerability Index CVI (Sullivan et al., 2007).



3.3 Variables of Governance

(World Bank, 2006)

- Voice and Accountability (VA): the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

- Political Stability and Absence of Violence (PS): perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism.

- Government Effectiveness (GE): the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy

formulation and implementation, and the credibility of the government's commitment to such policies.

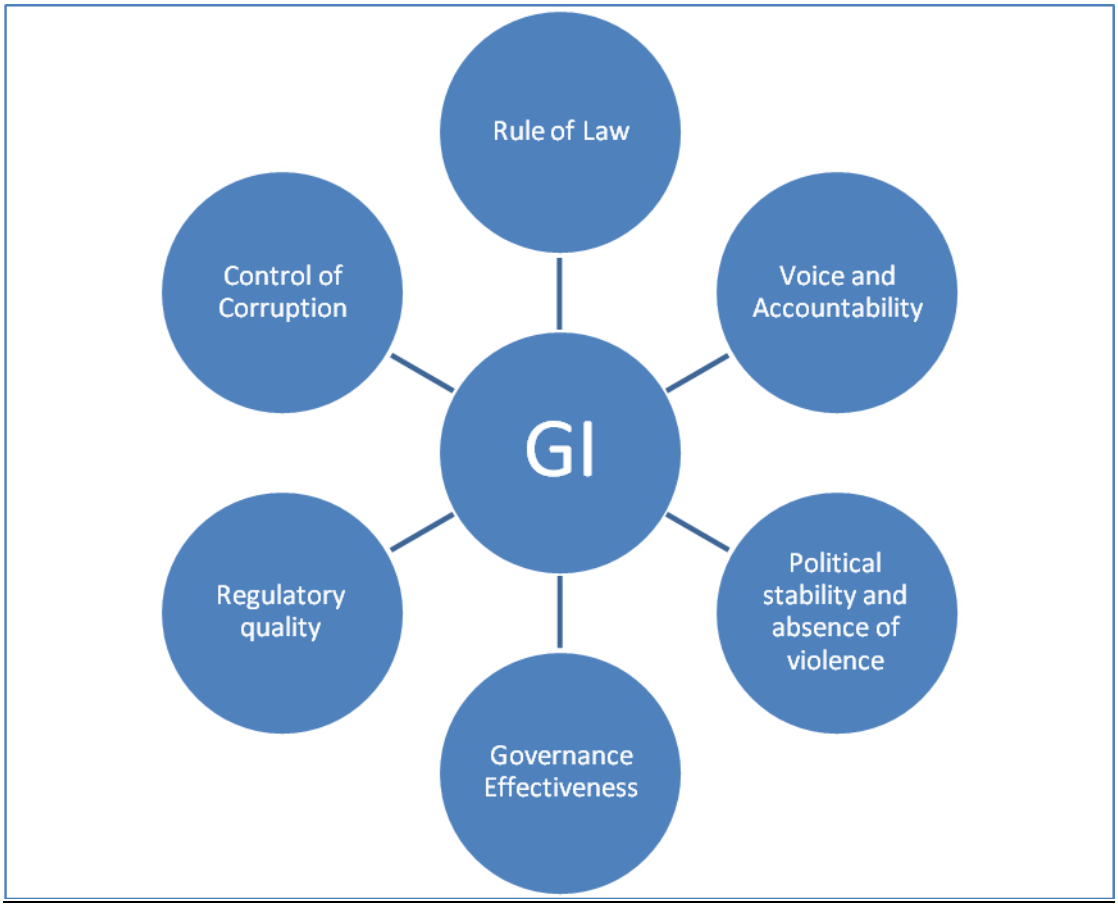
- Regulatory Quality (RQ): the ability of the government to formulate and implement sound policies and regulations that permits and promotes private sector development.

- Rule of Law (RL): the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.

- Control of Corruption (CC): the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

UNDP-POGAR (2008) classifies the up-mentioned governance indicators as follows; the first indicator voice and accountability falls under the evaluation of participation in the governance, whereas the Governance effectiveness and Political stability is considered to fall under the Political indicators. While regulatory quality and rule of law are considered as one indicator, that is the rule of law. Finally the last indicator control of corruption is representing the transparency of the governance. Therefore, in this research these aggregated indicators will be adapted to form the Governance Index (GI) under the classification of the UNDP indicators. Figure 3.2 shows the structure of the Governance Index (GI) and how these indicators combine to form the index.

Figure 3.2: Structure of the Governance Index GI (World Bank, 2006).



3.4 Composite Programme (Multi-Level approach)

In this research, the composite programming (UNESCO**,** 1987) will be adapted for analysing the multi-level indicators. As it has been illustrated before, that each indicator in this research combines a variety of components, set of second level indicators- forming one indicator which is considered as the third level indicator. For example, the resources is listed under the second level indicator that combines groundwater, surface water, non-conventional water and water quality components that are forming the first level indicators. Subsequently, these sets of the first and second level indicators will provide both indices-the third level indicators- in which they will be combined to form the final level composite indicator which is our aimed index.

3.4.1 Aggregating the Indicators

In this research, the final level composite indicator will be consisted of the Governance and Climate Vulnerability index (GCVI), this index will be formed from two indicators- the third level indicator (CVI and GI). The second and third level indicators are listed in Table 3.1. The second level indicators will be formed by combining the first level indicators that are listed in Table 3.1.

Table 3.1: Second and third- Level indicators

Second Level Indicators	Third Level Indicators
Composite Indicators	
Resources	**Climate Vulnerability**
Access	
Use	
Capacity	
Environment	
Government Effectiveness	**Governance Vulnerability**
Political Stability and Absence of Violence	
Voice and Accountability	
Regulatory Quality	
Rule of Law	
Control of Corruption	

3.4.2 Normalizing the Indicators

This approach does not have the ability to combine variables with different types of data (e.g. quantity of water that might be presented by (m3/cap/year) and quality of water that might be presented by (mg/liter)); therefore, the indices have to be converted to values between 0 and 1 to enable variables combinations. This can be done by normalizing the indices by giving maximum and minimum (best and worse) values for every basic indicator. The best values would mean an ideal value representing ideal conditions in the region or country considered. Similarly, the worse values of the basic indicators correspond to the absolute adverse situation in the region or the

country. Whereas, in a number of cases, the minimum value represents the best situation, such as the water quality indicators, in this case the minimum value will be the ideal case.

Normalizing the basic indicators can be achieved by using the following formula (UNESCO, 1987):

$$S_i = \frac{Z_{best} - Z_i}{Z_{best} - Z_{worst}} \quad \text{..... (3.1)}$$

Where:

S_i : is the index indicating the place or Z_i, it is a measure of acceptability of the actual value of the basic indicator since it is between the Z_{best} and Z_{worse} which is always between 0 and 1.

Z_i : is actual or predicted value of the basic indicator with number i.

Z_{best} and Z_{worst} : are the best and worse acceptable values of Z_i.

Usually the best and worse values are according to the region's acceptable values or can be decided by a focus group in which they provide an ideal range for any indicator to make countries' evaluation. In this research, the best and worse values of the governance indicators were adapted according to the UNDP-POGAR (2008) estimated ideal ranges. Whereas, the climate indicators' ideal ranges were assumed according to the maximum and minimum country values world records.

3.4.3 Combining the Indices to form the overall Index

The second-level composite distances are calculated for every second-level sets of basic indices, this can be done using the following equation (UNESCO, 1987):

$$L_j = \left[\sum_{i=1}^{n_j} \alpha_{ij} S_{ij}^{P_j} \right]^{\frac{1}{p_j}} \quad \text{..... (3.2)}$$

Where :

L_j : is the composite distance for second-level group j of the basic indicators

S_{ij} : is the actual value of basic index i in second-level group j of basic indicators.

P_j : is the balancing factor among indicators for group j. It is equal to or greater than 1.

n_j : is the number of the basic indicator in group j.

α_{ij} : is the weights expressing the relative importance of basic indicators in group j. it is represented as follows:

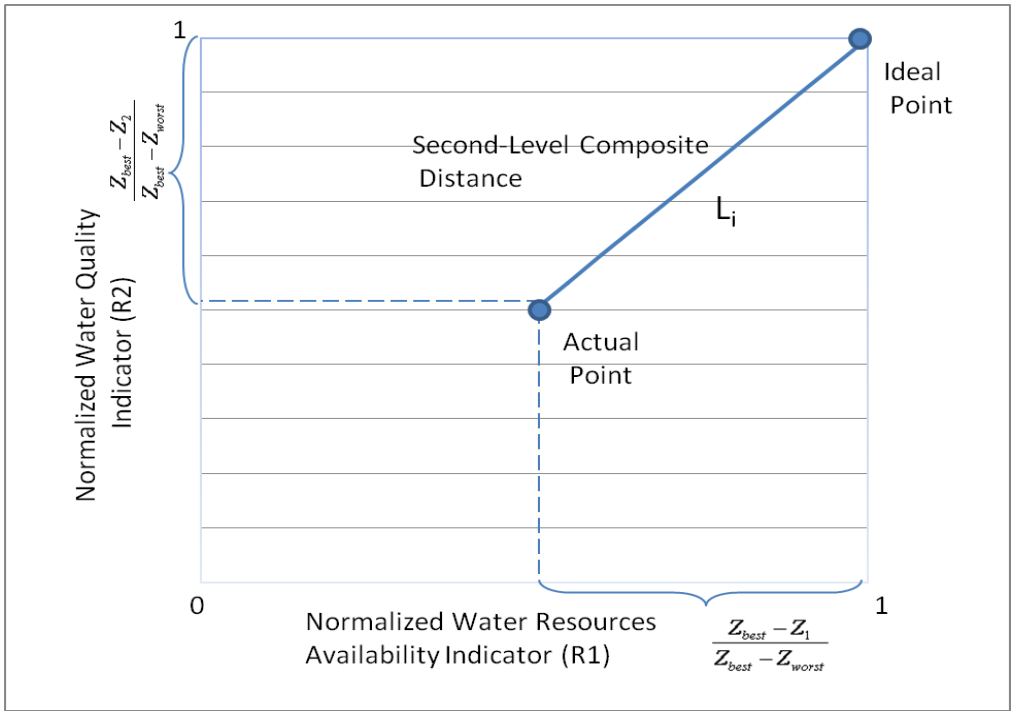
$$\sum_{i=1}^{n_j} \alpha_i = 1$$

The parameter p reflects the importance of the maximal deviation, the larger the value of p the greater the concern with respect to the maximal deviation. p=1 and p=2 seems to be good choices (UNESCO, 1987).

This equation will be used to calculate the second-level indicators that are the Resources, Use, Access, Capacity and Environment that are to form the first indicator of the third level indicator group which is the Climate Vulnerability Index (CVI). While the second indicator in the third level indicator group is the Governance Index (GI) which will be formed by combining the second level indicators that are Voice and Accountability, Governance Effectiveness, Rule of Law, Regulatory Quality, Political Stability and Absence of Violence and Control of Corruption.

Figure 3.3 shows L_i which is the distance between the ideal point (Z_{best} and Z_{worst}) for indicator i and the point corresponding to the actual state (Z_1, Z_2). This figure is applied as an example on the first indicator measured in this research which the Resources (R), which i presented in two indicators; the Water Resources Availability (R1) and the Water Quality (R2).

Figure 3.3 : Second-Level Composite Indicator for the Resources Indicator (UNESCO, 1987).



When the composite distances for every second-level group have been calculated, the two third-level composite distances will be calculated from the second-level composite distances using the following equation (UNESCO, 1987):

$$L_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} L_{jk}^{p_k} \right]^{\frac{1}{p_k}} \quad \text{..... (3.3)}$$

Where :

L_k : is the composite distance for third-level group k.

L_{jk} : is the second-level composite distance.

P_k : is the balancing factor for the third-level group k.

m_k : is the number of elements in the third level group k.

α_{ij} : is the relative importance among elements in third-level group k.

By this, the final level composite indicator, which is the composition between the third-level distances that are the Governance and the Climate Vulnerability Indices, will be calculated by using the following equation (UNESCO, 1987):

$$L = \left[\alpha_1 L_1^2 + \alpha_2 L_2^2\right]^{1/2} \quad \text{..... (3.4)}$$

And the system composite Index can be calculated using the following equation:

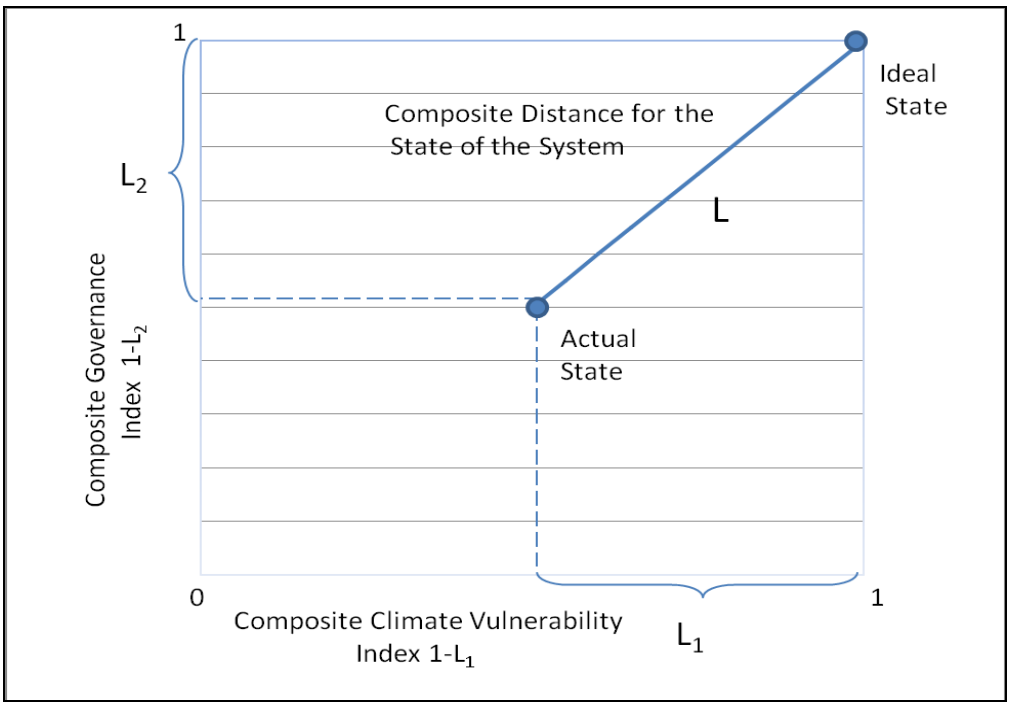
$$L_{system} = 1 - L \quad \text{..... (3.5)}$$

where:

L_{system} : is the final level composite indicator.

Figure 3.4 shows the joint third-Level distances of the Governance and Climate Vulnerability Composite Indicators for the state of system.

Figure 3.4 : Joint Governance-Climate Vulnerability Composite Indicator (UNESCO, 1987).



The indices therefore show a country's relative position to other countries, for any indicator lies between 0 and 1. Multiplying it by 100 can give a clearer look for the evaluation and comparison between countries. The higher the value of the indicator gives an indication of lower vulnerability. Consequently, the two indices CVI and GI (the third-level indicators) are to be joined together following the same criteria and the above-mentioned equations to form the Governance and Climate Vulnerability Index (GCVI).

This approach will be applied on the five study areas, Israel, Jordan, Lebanon, Palestine and Syria to measure the GCVI for each of them to form a comparison between countries and to know which is the most Vulnerable among all. Table 3.2 lists all the indicators of the first, second and third level indicators that will form the final level composite indicator (GCVI).

Appropriate variables from many existing datasets were identified in order to be included to form the framework of the index GCVI for the five countries. In particular, the data that is related to water resources, access and use will be taken from the ESCWA (ESCWA , 2007), and those related to socio-economic and capacity will be taken from UNDP datasets (UNDP, 2007). Whereas, environmental components will be taken from the Environmental sustainability Index

(World Economic Forum, 2002). On the other hand, the governance indicators will be represented from the datasets of the World Bank (World Bank, 2008).

Table 3.2 : A summary of all the indicators forming the GCVI

First Level Indicators		Second Level Indicators	Third Level Indicators	Final Level composite Indicator
R1	Water Resources	**Resources**	**CLIMATE (CVI)**	**GCVI**
R2	Water Quality			
A1	Access to improved drinking water	**Access**		
A2	Access to improved sanitation			
A3	Proportion of irrigated land to the cultivated land			
U1	Domestic water use	**Use**		
U3	Agricultural water use			
U4	Industrial water use			
C1	Under five mortality rate	**Capacity**		
C2	Educational Level			
C3	% reporting illness due to water supplies			
C5	GDP per capita (PPP) (US$)			
E1	Water stress (Pollution)	**Environment**		
E2	Biodiversity			
E3	Percent of land area under protected status			
GE	Government Effectiveness		**GOVERNANCE (GI)**	
PS	Political Stability and Absence of Violence			
VA	Voice and Accountability			
RQ	Regulatory Quality			
RL	Rule of Law			
CC	Control of Corruption			

Chapter Four

Data Analysis and Results

4.1 Climate Vulnerability Indicators

4.1.1 Resources

Resources index is a basic indicator of the availability of water for both surface and ground water (Sullivan et al., 2005). In fact, the reliability and variability of the resource is a significant factor that affects the availability of water; this should be in a way or another represented and included in this indicator. Since the more variable the resource, the smaller is the proportion of the total resource that can actually be used. However, water quality is also an important factor influencing the availability of the resource (Lawrence et al., 2003). This requires an evaluation of the water source variables to assess its quality. In this section, the water resources including surface and groundwater are discussed for the five study areas Israel, Jordan, Lebanon, Palestine and Syria.

4.1.1.1 Water Resources in Palestine

Palestinians are experiencing a severe water crisis caused mainly by the lack of control over the Palestinian water resources. Access to water resources by Palestinians in the occupied Palestinian Territory is controlled by Israel and the amount of water available to Palestinians is restricted to a level which does not meet their needs and does not constitute a fair and equitable share of the shared water resources. Israel is using more than 80% of the ground water resources from the Mountain Aquifer of Palestine. Moreover, all of the surface water available from the Jordan River of which Palestinians are denied any share. Moreover, Palestine is facing water shortages because of aridity and rapidly growing population with higher water demand (Amnesty, 2009).

As a Result, water resources for Palestinian are mainly from groundwater, the main aquifers are, the mountain aquifer in the West Bank and the classical costal aquifer in Gaza strip which are a

direct infiltration of the rainwater. The overall balance of water in the West Bank is estimated 679 MCM/yr, while in Gaza it is estimated at 45 MCM/yr (Daibes, 2004).

Groundwater

Gaza aquifer is threatened by seawater and salt groundwater intrusion due to over pumping. And the major source of new groundwater in the aquifer is rainfall. Rainfall is sporadic across Gaza and generally varies from 400 mm/yr in the north to about 200 mm/yr in the south. The lateral inflow to the aquifer is estimated at 10- 15 MCM/yr. Some recharge is available from the major surface flow (Wadi Gaza). But because of the extensive extraction from Wadi Gaza in Israel, this recharge is limited to, at its best 1.5- 2 MCM during the ten to 50 days the wadi actually flows in a normal year. As a result, the total freshwater recharge at present is limited to approximately 55-65 MCM/yr (ESCWA, 2007).

Whereas the West Bank overlies the Mountain Aquifer Basin which is consists of the Eastern Aquifer Basin, the Western Aquifer Basin and the North-eastern Aquifer Basin that are discussed as follows: (ESCWA, 2007)

1. The Eastern Aquifer Basin is an endogenous Palestinian basin since recharge and discharge are restricted to the West Bank. The highest amount of well pumping from this basin occurs in Israeli settlement wells near the main fault in the Jordan Rift Valley in which the Israelis pump 36.7 MCM/yr from only 38 wells while Palestinians pump 18.8 MCM/yr from 197 abstraction wells.

   However, about 66 springs are distributed all over the Eastern basin under the Palestinian control that yields 39.9 MCM/yr. But in general it can be stated that a great number of Mountain springs have a low to very low discharge rate, while the strong springs are found in the Jordan Valley area. On the other hand, Israel controls a handful of mainly brackish to hyper saline springs along the Dead Sea. They discharge 88.5 Mcm/yr (ESCWA, 2007)
2. The North Eastern Aquifer Basin extends from the area south of Nablus towards the north beyond the borders of the West Bank. It is the smallest of the three basins and by that has the smallest portion of recharge in fact most of the recharge originates within the West Bank. From this basin, 85 Palestinian wells pump around 11.5 MCM/yr in the West Bank while only 9 Israeli wells pump 13.4 MCM/yr. From this basin, about 74 springs

comes out to Palestinian with a discharge of 14.0 MCM/yr. While, the rest of the springs discharge more than 75 MCM/yr, emerges from springs inside Israel (ESCWA, 2007).

3. The Western Aquifer Basin is the largest of all groundwater basins in Historical Palestine. It includes the western part of the West Bank Mountains and extends to the coastal areas, and from the north central mountains area to the Hebron mountain in the south. Two main aquifers are present in this basin: the upper and the lower aquifers. The average annual natural recharge for the Western Aquifer Basin is around 400-440 MCM/yr. The mountains of the West Bank are the main recharge source to this basin. Most of its water is pumped from Israeli wells that are situated along the West Bank –Israeli border. While Palestinians have a marginal share in groundwater pumping from this basin. Their 151 wells run at a comparably low average pumping rate. Therefore, their average pumping is as low as 6% of the Israel. Whereas, Israel has more than 500 wells inside and along its borders with the West Bank, in addition to only 5 abstraction wells within the West Bank (ESCWA, 2007).

Surface water

The only source of surface water in the West Bank is the Jordan River in which Palestinians lost their right in the access to this riover since the 1967 hen the Israelis announced that the Jordan valley is a military zone (COHRE, 2008).

On the other hand, the surface water system in Gaza Strip consists of wadis, which only flood during very short periods, except for Wadi Gaza; which is the major wadi in the Gaza Strip that originates in the Negev Desert in a catchment area of 3,500 km^2. However, rainfall varies significantly from one year to another and thus annual discharge can range from 0 to 100 Mcm/yr. In addition, Wadi Gaza at present is diverted by the Israelis towards reservoirs for artificial recharge and irrigation. This means that nowadays, only a little water out of the huge floods may reach the Gaza Strip, if any, due to the Israeli practices. There are two other insignificant wadis in the Gaza Strip, namely Wadi El Salqa in the south and Wadi Beit Hanon in the north, that are almost always dry (ESCWA, 2007).

4.1.1.2 Water Resources in Lebanon

Lebanon is made up of two principal hydrological regions, the Mediterranean watershed, which gives rise to 12 perennial rivers from the western slopes of the mountain ranges, flowing from

east to west and emptying into the sea. And the interior watershed, which is the source of the Litani, Assi (Orontes), and Hasbani rivers.

Precipitation varies spatially, as well as temporally in Lebanon, its average in the highlands is 1,500 mm/year, and the mountain peaks along the western ranges receive about 2,000 mm (Amery, 2003). Lebanon is in a relatively favourable position as far as rainfall and water resources are concerned. However, constraints for development consist in the limited availability of water during the seven dry summer months due to the very low water storage capacity, the difficulty of capturing the water close to the sea, and the shortcomings of the existing water delivery systems and networks.

Surface water

The total length of streams in Lebanon is 730 km, mainly on the western side of the mountains, which have steep slopes (FAO, 2008).

In total, there are about 40 major streams in Lebanon and, based on the hydrographic system, the country can be divided into five regions:

- The Asi-Orontes Basin in the north; the Asi-Orontes River flows into the Syrian Arab Republic in the northeast of the country; this river is considered as a transboundary River).
- The Hasbani Basin in the southeast; the Hasbani River 170`km long, which flows into Israel in the southeast of the country, is a tributary of the Jordan river; (Transboundary River).
- The Litani Basin in the east and south; the Litani River reaches the sea in the southwest of the country with average annual water flow of about 475 MCM/year.
- The coastal river basins; the northern El Kebir River Basin is shared with the Syrian Arab Republic, the river itself forming part of the border between the two countries before flowing into the sea.
- Small scattered and isolated sub-catchments remaining in-between, with no noticeable surface stream flow, such as the endorheic catchments and isolated coastal pockets.

The first three river basins cover about 45% of the country.

Springs are commonly found in Lebanon, in total, there are about 2,000 major springs generating about 1,150 MCM/year. Other springs are commonly found along the coast or in the submarine

area. They are also called "non-conventional" springs because it is more or less impossible to capture their water before it flows into the sea.

Total surface water outflow in Lebanon is estimated to be 2,200 MCM/year (ESCWA, 2007), of which 160 MCM flows to the sea. Moreover, about 415 MCM of water outflow to the Syrian Arab Republic through the Asi-Orontes River, and about 160 MCM/year flows to the northern Israel through the Hasbani/Wazani complex (FAO, 2008).

Groundwater

There are eight major aquifers, with a total estimated volume of 1,360 MCM/year. Exploitable groundwater ranges from 400 to 1,000 MCM (Samad, 2003). The total mean annual groundwater recharge is about 150 MCM (ESCWA, 2007).

The transboundary Mount Hermon aquifer contributes to the discharges of the Banias springs in the Golan Heights and the Dan springs in Israel (the occupied Syrian lands). The total groundwater outflow is estimated at about 1,020 MCM/year. Of this total, 740 MCM is estimated to flow to the sea, and 150 MCM to Israel (Hulah Lake) and 130 MCM to the Syrian Arab Republic (Dan Springs) (FAO, 2008).

Other Resources

Lebanon generates an estimated 310 MCM of wastewater per year, of which 249 MCM is produced by the domestic sector. In 2006, treated wastewater was only 4 MCM, of which 2MCM were destined for agricultural purposes, and the rest disposed of in the marine environment by direct diversion to the rivers, or it was infiltrated by deep seepage to groundwater. The potential for reuse of domestic wastewater is estimated at around 2 MCM/year (FAO, 2008). Some illicit irrigation from untreated wastewater is practised. Another source of non-conventional water is desalinated sea water, which is estimated to be 2 MCM (ESCWA, 2007).

4.1.1.3 Water Resources in Jordan

Jordan is one of the first world's poorest countries in terms of water, with an annual per capita share of water for all purposes standing at about 110-150 m^3. Jordan can generally be considered as an arid area, with more than 90% of Jordan's total area receiving less than 200 millimetres rainfall per year and more than 70% of the country receiving less than 100 millimetres of precipitation on a year.

The pattern of rainfall is characterized by an uneven distribution over the various regions, and strong fluctuation from year to year in terms of quantity and timing. So Jordan is characterized by a pronounced scarcity of renewable fresh water resources, which averages at about 1,253 MCM per year (ESCWA, 2007), or approximately 234 m3 per capita for all uses. Thus, Jordan's water resources are, on a per capita basis, among the lowest in the world (Raddad, 2005).

Surface water

Total renewable water resources are estimated at 1,253 MCM/ year. Long-term average renewable surface water resources are approximately 746 MCM/year (ESCWA, 2007). Surface water resources are unevenly distributed among 15 basins. The largest source of external surface water is the Yarmouk River, which enters from the Syrian Arab Republic after first forming the border with it. It then joins the Jordan River coming from Israel, taking its name. The natural annual flow of the Yarmouk River is estimated at about 400 MCM, of which about 100 MCM are withdrawn by Israel (FAO, 2008).

However, the total actual flow is much lower at present as a result of the drought and the upstream Syrian development works of the 1980s. The Yarmouk River is the main source of water for the King Abdullah Canal (KAC) and is thus considered to be the backbone of development in the Jordan Valley. A main tributary of the Jordan River, controlled by the King Talal Dam and also feeding the KAC, is the Zarqa River. There are also 6–10 small rivers, called "Side Wadis" going from the mountains to the Jordan Valley. Other basins include the Mujib, the Dead Sea, Hasa and Wadi Araba.

Groundwater

Jordan's groundwater is distributed among twelve major basins, ten of which are renewable groundwater basins and two in the southeast of the country fossil groundwater aquifers. Total renewable groundwater resources have been estimated at 507 MCM/year (ESCWA, 2007). Groundwater resources are concentrated mainly in the Yarmouk, Amman–Zarqa and Dead Sea basins. The safe yield of renewable groundwater resources is estimated at 275.5 MCM/year (FAO, 2008). At present most of it is exploited at maximum capacity, in some cases beyond safe yield. Of the twelve ground water basins, six are being overexploited, four are balanced and two are underexploited.

Overexploitation of groundwater resources has degraded water quality and reduced exploitable quantities, resulting in the abandonment of many municipal and irrigation water-well fields (FAO, 2008).

Other resources

Twenty-three sewage treatment plants are in operation and the treated wastewater is used in irrigation. More than 80 percent of sewage water of the greater municipality of Amman is treated in four plants and then released to end up using it in the irrigation (this involves 78 percent of the treated wastewater). Treated wastewater from the other plants is used around the plants and mixed with surface water to irrigate areas in the Side Wadis. The wastewater entering the treatment plants reached 101.8 and 107.4 MCM in 2004 and 2005 respectively (FAO, 2008), while reused treated wastewater in these two years was around 74 MCM (ESCWA, 2007).

Another source of non-conventional water is provided from desalinated water production that became significant in the last few years and reached 5 MCM/year (ESCWA, 2007).

4.1.1.4 Water resources in Syria

Water resources in Syria are under a heavy and increasing stress. Any alteration in climatic patterns that would increase temperatures and reduce rainfall would greatly exacerbate existing difficulties. These changes in climate will be amplified in the water environment.

The available water resources of the country are estimated around 14,779 MCM/year (ESCWA, 2007). Where the renewable surface water resources are estimated at 9,880 MCM/year and groundwater recharge at 4,898 MCM/year. This means that the per capita available water from renewable water resources is about 1,056.7 MCM/year. However, most of the basins suffer from water shortage. The average overall water deficit of Syria from 1995-2005 was 651 MCM/year and is expected to increase to 2,077 MCM/y in 2026-2027 due only to population and development growth (FAO, 2008).

Syria is depending in more than 75% of the total water resources on five main rivers shared between neighboring countries (Euphrates ,Tigris ,Yarmok ,Orontes and Nahr El Kabir Janobi) There are only one official agreement regarding Orontes basin (between Lebanon and Syria) . For Euphrates there is a protocol of under standing between Turkey and Syria for delivering 500 m^3/s/day of which 52% is delivered to Iraq after the official agreement signed between both

countries .For Yarmok and Nahr El Kabir Janobi and Tigris nothing up to now is done .Even for Euphrates the protocol is not officially adopted by the Turkish government and the Parliament, so it could not be considered as a final agreement .

Seven main hydrographic basins can be identified: Al Jazeera, Aleppo (Quaick and Al Jabbool sub-basins), Al Badia (Palmyra, Khanaser, Al Zelf, Wadi el Miah, Al Rassafa, Al Talf and Assabe'biar sub-basins), Horan or Al Yarmook, Damascus, Asi- Orontes and Al Sahel. Rainfall and snowfall represent the major water supply for the basins, except for the Al Jazeera and Asi-Orontes, the main sources of which are located in the neighbouring countries. There are 16 main rivers and tributaries in the country, of which 6 are main international rivers:

- The Euphrates (Al Furat), which is the largest river in Syria. It comes from Turkey and flows to Iraq. Its total length is 2,330 km, 680 km of which are in the Syrian part.
- The Afrin in the northwestern part of the country, which comes from Turkey, crosses the Syria and flowing back to Turkey.
- The Asi-Orontes in the western part of the country, coming from Lebanon and flowing into Turkey.
- The Yarmouk River which is in the southwestern part of the country with sources in Syria and Jordan and which forms the border between these two countries before flowing into the Jordan River.
- The El-Kabir with sources in the Syrian Arab Republic and Lebanon and which forms the border between them before flowing to the sea.
- The Tigris, which forms the border between the Syrian Arab Republic and Turkey in the extreme northeastern part. (FAO, 2008).

Groundwater

About 90% of the total actual groundwater inflow in Syria is coming from Turkey and 9% from Lebanon. Moreover, the annual water outflow from Syria to Israel and Jordan is estimated to be 19% and 7% respectively.

The main groundwater aquifers are those of Anti-Lebanon and the Alouite Mountains. There are a number of springs discharging from this aquifer system, such as the Ari-Eyh, Barada, Anjar-Chamsine and Ras El-Ain. Recharge to the system occurs from intense precipitation in the

mountainous regions which infiltrates through the fractures and fissures of the karstified surface layer.

Another significant aquifer system is that of the Damascus plain aquifers extending from the Anti-Lebanon Mountains in the west to the volcanic formations in the south and east of the country. The major carbonate Haramoun mountain aquifer is located between Lebanon and Syria (FAO, 2008).

Other sources

The total wastewater production in Syria is about 1,364 MCM (FAO, 2008). The treatment of municipal wastewater was carried out mainly in the towns of Damascus, Aleppo, Hims and Salamieh and it reached 1,280 MCM (ESCWA, 2007), in which all treated wastewater is reused.

4.1.1.5 Water resources in Israel

Total internal renewable water resources are estimated at 7,769 MCM/year (FAO, 2008) which forms about 1,408.5 m^3 capita yearly. Moreover, the overlap between surface water and groundwater is considered negligible.

Surface Water

Surface water entering the country is estimated at 305 MCM/year, of which 160 MCM from Lebanon (including 138 MCM from Hasbani), 125 MCM from Syria, and 20 MCM from the West Bank (FAO, 2008).

The only river in Israel is the Jordan River which is the most important shared surface water resource for Israel. It supplies up to 650 MCM/year of water to Israel and none to the Palestinians (Amnesty, 2009). The main sources of fresh surface water in Israel include:

- Lake Tiberias, is the only natural freshwater lake in Israel which divides the upper and lower portions of the Jordan River system. It has traditionally provided about a third of the country's domestic, agricultural and industrial water requirements.

Groundwater

The most important source of groundwater in Israel is the Mountain Aquifer; it is replenished mostly in the West Bank by the infiltration of rainfall and snowfall and flows northwards and

westward towards the territory of Israel and towards the Jordan River in the east. It is actually composed of three aquifers (or basins) – the Western, North-Eastern and Eastern aquifers – with a total average yield of 679 to 734 MCM/year (World Bank, 2009), whereas the estimate of 679 MCM/year is that used by the Israeli authorities to decide the yearly quantity of water allocated to the Palestinians under the Oslo Accords.

The Coastal Aquifer is another source of groundwater in Israel. It is located under the coastal plain of Israel and the Gaza Strip. Its yearly sustainable yield is estimated at up to 450 MCM in Israel (Amnesty, 2009). Additional groundwater resources in Israel include the Western Galilee and Carmel Aquifers in the north and the Negev-Aravah Aquifer in the south. There is no reliable figure for the yield of these aquifers (Amnesty, 2009).

Other sources

An Israel's national water supply company (Mekorot), has built and operated small and medium-size desalination facilities in the southern part of the country that generates 25 MCM of water per year, mainly from brackish water. One large plant for the desalination of seawater was recently completed on the Mediterranean coast, and is now producing 115 MCM/year of potable water.
Out of a total of 450 MCM of sewage produced in Israel, about 96 percent is collected in central sewage systems and 64 percent of the effluents are reclaimed (290 MCM); 283 MCM are adequately treated. According to the World Bank statistics, the total non-conventional resource of water in Israel is about 450 MCM/year (World Bank, 2009).

The Water Resource index is represented in two variables, the renewable and non-conventional water resources (R1) which indicates the water quantity and affordability, in addition to the water quality (R2) which represents the ability to use the water through the knowledge about its quality that shall meet the standards for drinking water. Each of there indicators are consists of several components to signify them, these indicators including their components are discussed in the following two parts including the statistical data for the five study areas.

1. **Water Resources availability: from Renewable and non-conventional water resources (R1)**

The renewable water resources include surface and ground water expressed as per capita quantities but it is important to measure the variability and reliability of the resource that is the

most relevant system, which needs to be examined. Whereas the non-conventional water resources is that water produced from other sources such as treated wastewater, agricultural drainage or desalinated water. Table 4.1 includes the statistical data for non-conventional, surface and ground water resources available for the five study areas.

Table 4.1 : Water Resources Availability for the five countries

(R1) Water Resources availability	Palestine	Jordan	Lebanon	Syria	Israel
1. Renewable water resources (MCM/year)					
Total surface water	0*	746	2,200	9,880	NA
Mean annual groundwater recharge	679	507	150	4,898	NA
Total renewable water resources (MCM/year)	679	1,253	2,350	14,779	7,769
Annual share from renewable water resources (m3/year/capita)	215	234	594.5	1056.7	1408.6
Non-conventional water resources (MCM/year)					
Mean annual production of desalinated water	0	5	2	0	NA
Mean annual production of treated wastewater for reuse	0	74	2	1,280	NA
Mean annual production of agricultural drainage for reuse	0	NA	NA	2,246	NA
Total water resources from non-conventional sources(MCM/year)	0	79	4	3,526	450
Annual share from non-conventional water resources(m3/year/capita)	0	14.8	1.1	190.7	65.5
Total water Resources (MCM/year)	679	1,332	2,354	18,305	8,219
Total per capita annual share (m3/year)	**215**	**248.8**	**595.5**	**1,247.4**	**1,474.1**

Sources: ESCWA (2007); COHRE (2008); World Bank (2009); FAO 2008

*: The Palestinians right of the share surface water resources in the Jordan River can not be forgotten or denied.

2. Water Quality (R2)

The following variables give an indication about water quality, since water availability is considered limited when water quality does not meet drinking water standards. In this research, the following variables were selected to represent the water quality (R2) owed to data availability

in the study areas, whereas other variables might give a wider idea about water quality. The variables are:

- Dissolved oxygen concentration and Phosphorus concentration: a measure of eutrophication for surface water, which has an important impact on the health of aquatic resources and ecosystems. High levels correspond to low eutrophication.
- Suspended solids and Electrical conductivity: a measure of water quality and turbidity.

These variables including the statistical data for the five study areas are presented in Table 4.2.

Table 4.2: Water Quality for the five countries

	(R2) Water Quality	Palestine[1]	Jordan	Lebanon	Syria	Israel
1.	Dissolved oxygen concentration (Milligrams/ Liter)	8.5	8.91	5.78	5.83	10.33
2.	Phosphorus concentration (Milli grams/Liter)	0[3]	1.01	0.38	0.21	0.42
3.	Suspended solids (Natural Log of Milligrams/Liter)	0[3]	4.5	6.1	5.01	2.83
4.	Electrical conductivity (Micro-Siemens/Centimeter)	780	1014.42	1696.86	1608.99	2149.96

Source: World Economic Forum (2002)

1: (Eng. Magida Alawneh, 2010) Personal communication with the head of the water quality department in the Palestinian water department.

3: In Palestine, people lost their right in accessing the surface water areas therefore phosphorous and suspended solids variables were considered to be zero.

4.1.2 Access

This indicator represents the "right of entry" to sufficient, safe and affordable water that is vital for human beings, taking into account the extent of access to that water or source of water. This includes the access to irrigation and sanitation facilities. In which it can represent how well provisioned the targeted population is (Sullivan et al., 2005).

Adequate access to safe water is a necessary condition for an acceptable quality of life, it has been declared as a “derivative right” because it supports the achievement of existing legal covenants

relating to human rights. As a result, access to water as a basic human right has now been recognized by the United Nations (Sullivan et al., 2005).

The following indices are taking into account the basic water and sanitation needs, considering water used for agriculture recognising that water availability for growing food is as important as for domestic and human consumption.

1. **Access to improved drinking water (A1):** means that the home or compound is connected directly to a piped system or that a public fountain, well, or stand post is located within 200 meters of the home (Billig et. al, 1999) and having a protected dug well, spring or rainwater collection (WHO/UNICEF, 2000).

2. **Access to improved Sanitation (A2):** means that the household has a private facility or shares a facility with others in the building or compound (Billig et. al, 1999).

3. **Irrigation land in proportion to cultivated land (A3)**(Sullivan, 2005): this indicator shows the vulnerability of that sector to water stress, which has implications for national food security depending on production and trade patterns(FAO, 2009).

Table 4.3 lists the three indicators that represent access including the data for the five study areas.

Table 4.3: Indicators on Access to water and sanitation for the five countries

Indicator		Palestine	Jordan	Lebanon	Syria	Israel
A1	Total population with access to improved drinking water (%)	83	97	65	90	99
A2	Total population with access to improved sanitation (%)	30	56	44.6	70	100
A3	Proportion of irrigated land to the cultivated land (%)	4	5.7	26.1	20.7	45.2

Source: ESCWA (2007); Bou-Zeid and Fadel (2002); FAO (2008); World Resources Institution (2003).

Despite all what it has been mentioned about water resources in the upper part of this chapter, the five countries are still suffering from having adequate access to water and sanitation, for

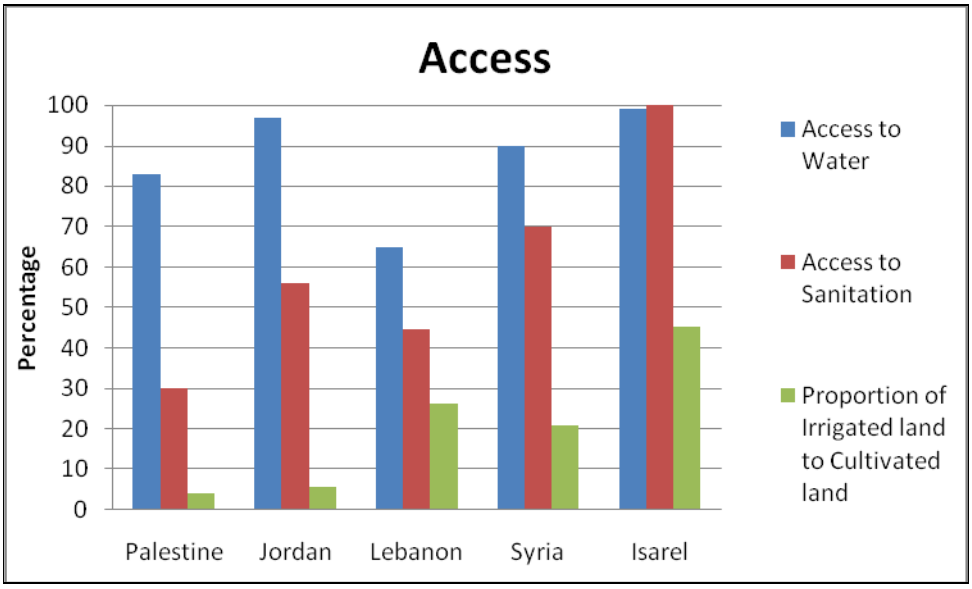
example the Syrian are loosing their right in water from the occupied Golan Heights, (the western south of Syria) since they lost the access to their lands. On the other hand, the Lake of Tiberia is still the heart of the Israel-Syria negotiations to lay a small territory of 20 square kilometres. This disputed piece of land determines access for Syria to the lake's waters and the Upper Jordan Valley (IRC, 2007). In Jordan, despite the improvement in the percentage of access to water resources; still access to sanitation is not having an increase in the percentage.

For Israel, since it is a new developed country, people do not have any problem in accessing to water and sanitation services, they had the best percentage in comparison to the four other countries. While access to water resources by Palestinians is controlled by Israel and the amount of water available to Palestinians is restricted to a level which does not meet their needs and does not constitute a fair and equitable share of the shared water resources. Israel uses more than 80 per cent of the water from the Mountain Aquifer, the only source of underground water in Palestine, as well as all of the surface water available from the Jordan River of which Palestinians are denied any share (Amnesty, 2009).

Moreover, Palestinian has a lack of access to sanitation services, which is a point of crisis for them. In fact, there is a serious shortage of piped fresh water supply, this shortage is due to the Israeli 'security' measures inside the West Bank which restrict the Palestinian access to water resources, services and facilities due to roadblocks (including earth mounds and trenches), checkpoints, the barrier wall and 'settler only' roads. Therefore, many of the Palestinian communities that are not connected to the water networks have been cut off from their nearest water filling point and must travel long distances to fetch water. Moreover, the barrier wall is creating a closed zone in the west bank that will exclude the most fertile land from the West Bank, and is rich in water resources. Consequently, many communities are now isolated from their water supply or water well, that might be used for irrigation or drinking water (COHRE, 2008). About 123 communities with an estimated population of 177 thousand do not have a taped water supply in the occupied Palestinian territory (PWA, 2009).

The percentages of access to water, sanitation and the proportion of irrigated land to cultivated land between the five countries is illustrated in figure 4.1 that shows a comparison between the five countries in terms of access.

Figure 4.1: A comparison on the three indices of the Access for the five countries (ESCWA, 2007)



4.1.3 Use

This Indicator gives an idea about the total per capita annual consumption in the three main sectors, domestic, agricultural and industrial. It gives an indication of the total share of the water resources used in each country. This gives a crude measure of water use efficiency (Sullivan et. al. 2005).

This index has three components:

- Domestic water use per capita (m^3/cap/yr).
- Agricultural water use per capita (m^3/cap/yr).
- Industrial water use per capita (m^3/cap/yr).

Water use for the three sectors in the five study areas are discussed in this part as follows:

4.1.3.1 Water use in Palestine

In Palestine the per capita domestic supply is very variable and discontinuous. Nominal supply rates to a quarter of the connected population are less than 60 l/cap/day, well below the 100 litres per capita daily recommended by the World Health Organization (WHO), with some

network services providing quantities that are below the supply threshold adopted by international humanitarian disaster response agencies to avoid epidemics (World Bank, 2009).

The agricultural sector also reflects the bulk of power imbalance in fact it consumes more than 52% of the water allocated for Palestinian (FAO, 2008). The per capita water use in the agricultural sector is about 43.2 m^3/capita/year (ESCWA, 2007). Hence, the NGO Peace Now reported that per capita, the irrigated areas of settlers were 13 times larger than those allocated for Palestinians. Due to the economic decline of the West Bank as a result of Israeli imposed restrictions more and more communities are increasingly dependent on agriculture for both their food security and income (COHRE, 2008). Finally, the industrial water does not form a great amount due to the restrictions on the materials entering West Bank and Gaza, and the percentage of the industrial water use is about 4% of the water (ESCWA, 2007).

4.1.3.2 Water Use in Israel

In Israel, approximately 42% of all water is used for agriculture. The amount of water devoted to agriculture has stabilized since the mid-1990s, due largely to the installation of water conservation technologies for irrigation. Industrial water demand appears to have stabilized as well, because increases in industrial water withdrawal are minimal. Whereas, the domestic withdrawal is continuing to demonstrate a sharp increase (Lautze and Kirshen, 2009), that reaches 51% of the whole water for Israelis so Israeli citizen's domestic consumption is around 320 litres per person per day (COHRE, 2008).

3.1.3.3 Water Use in Jordan

In Jordan the agricultural water withdrawal accounts around 65 % of the total water withdrawal whereas the domestic and industrial purposes account around 31 and 4 percent, respectively. During periods of water shortage strict measures are taken, such as rationing water allocations and reducing or banning the cultivation of irrigated summer vegetables. Overexploitation of renewable groundwater resources by farmers is a common practice (FAO, 2008).

4.1.3.4 Water Use in Syria

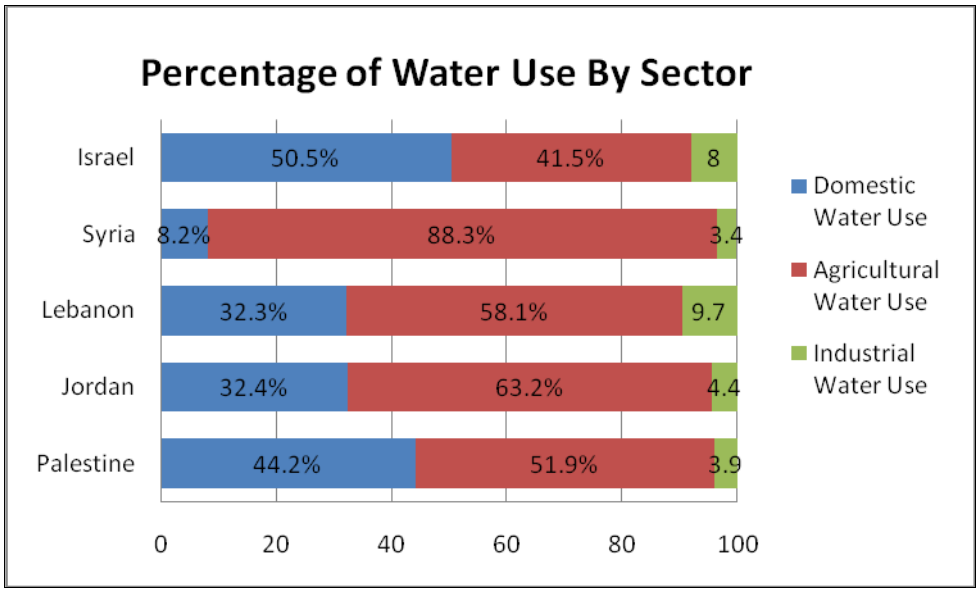
The main water user in Syria is the agricultural sector which consumes from 94% of the Tigris and Khabour basin, 71% from the Barada and Awaj basin which is about an average of 88% of the total water use in Syria (FAO, 2008) Whereas, the domestic and industrial consumption does not exceed the 8% and 4 % respectively.

4.1.3.5 Water Use in Lebanon

A large share of water in public distribution systems in Lebanon is lost through system leakages. There is 35–50 percent seepage from the water supply networks, which is almost all infiltrated to the aquifers. Water withdrawal in Lebanon consumed for domestic purposes is estimated to form 32% of the water consumption. Whereas the few data are available on the current or expected water needs of the industrial sector but the consumption is estimated to form 10% of the water use in Lebanon. While the remaining water is consumed for the agricultural purposes.

Water Use in agriculture is having the greatest share of the total water use for all the five study areas, this can be shown in Figure 4.2 that illustrates the percentages of water use by sectors for Israel, Jordan, Palestine, Syria and Lebanon.

Figure 4.2: the percentage of water use by sector in the five countries (ESCWA, 2007)



The three indices forming the Use indicator are listed in table 4.4 which include the statistical data of the water use for the three sectors described by (m^3/capita/year).

Table 4.4: Indicators on water use for the five countries

Use (m^3/c/year)		Palestine	Jordan	Lebanon	Syria	Israel
U1	Domestic water use	36.7	52.1	124.9	78.7	103.6
U2	Agricultural water use	43.2	101.6	227.7	845.3	163.6
U3	Industrial water use	3.2	6.5	11.6	32.9	16.4

Source: ESCWA (2007); FAO (2008)

4.1.4 Capacity

Generally, the capacity is the specific ability of an entity measured in quantity and level of quality, over an extended period. But here this indicator gives sense of income to allow purchase of improved water, education and health which interact with income and indicate a capacity to lobby for managing water supplies. It tries to capture those socio-economic variables which can impact on water management or its access and quality (Lawrence et al., 2002)

The relationship between water use and economic development growth in human populations is creating an increasing demand for water, and if standards of living are to rise, water consumption per capita is also likely to rise. This means that water resource availability, or lack of it, is linked to economic and social progress, suggesting that development is likely to be influenced by how water resources are managed. At a national level, it can be seen that countries which have higher levels of income tend to have a higher level of water use (Sullivan et al., 2002)

The following components form the capacity index:

1. Under five mortality rate: this is a well-established health indicator, and it is one that is closely related to access to clean water (C1).
2. Educational Level (C2).
3. Membership of water users associations (C3).
4. % households reporting illness due to water supplies (C4).
5. GDP per capita (PPP) (US$) (C5):
   This is the average income per head of population adjusted for the purchasing power of the currency. This is considered to be a much more accurate measure of the average standard of living across countries (Lawrence et al., 2002)

The most significant negative impact on health and quality of life in Jordan were caused by water pollution at an estimated cost of 0.71-1.24 % of the GDP. Diarrhea and mortality damages were estimated at 31 million Jordan Dinar annually are caused by lack of safe drinking water and proper sanitation and inadequate domestic, personal and food hygiene (Fayyad, 2009).

While in Lebanon water-related diseases, especially diarrhoea, are one of the leading causes of mortality and morbidity among children less than five years old. In addition, health problems resulting from exposure to water pollutants often result in health care costs and absence from work.

Even thought the Gross domestic product in Syria is about 37 US$ billion which is relatively better than Palestine, Lebanon and Jordan that have an average of 7, 24 and 12 US$ respectively. Its level of education is lower than those in the three other countries (ESCWA, 2007).

Palestine remains economically non-industrialized, with one third and the base of the economic GDP made up from agriculture, little industrial development because of Israeli restrictions. The per capita GDP of between US$610 and US$2,400 annually (ARIJ, 2007). The value of GDP in 2008 indicates to overall growth rate of 5.9% compared with the year 2007. In 2007, half of all households (54.8%) in the Palestinian Territory relied on wages and salaries from the private sector as their main source of income. However, the percentage of poor households rose by 22.4% in the West Bank compared to 35.6% in Gaza Strip during 1997-2007 (PCBS, 2009).

Table 4.5 includes all of the above mentioned indices forming the Capacity indicator for the five study areas, but the third indicator "membership of water users associations" (C3) does not have any available data in the study areas therefore; it has been cancelled in the final calculations.

Moreover, there are no statistical records of the percentage of households reporting illness due to water supplies in both Israel and Palestine; hence, this indicator was also negated in the calculations. Therefore, the capacity indicator is represented by the other four indices mentioned above.

Table 4.5: Indicators on the capacity of the five countries

Capacity		Palestine	Jordan	Lebanon	Syria	Israel
C1	Under five mortality rate (per 1000 live births) %	23	26	30	15	6
C2	Educational Level (Index) %	88.4	88	84.5	76.9	73
C3	Membership of water users associations	NA	NA	NA	NA	NA
C4	% households reporting illness due to water supplies	NA	0.9	0.4	2.4	NA
C5	GDP per capita (PPP) (US$)	1,051	4,901	10,109	4,511	24,320

Source: Israeli Bureau of statistics (2008); World Economic Forum (2002); WHO (2008); World Bank (2005); Tamimi and Isayed (2008)

4.1.5 Environment

This index tries to capture a number of environmental indicators which reflect on water provision and management that were included in the Environmental Sustainability Index (ESI) (World Economic Forum, 2002). These indicators cover water stress "Pollution", biodiversity and the lands under protection status. Whereas, a variety of components can be used to represent this indicator as much as the data is available.

The index is calculated on the basis of an average of the following component indices (Lawrence et al, 2002):

1. Water stress indicator which is based on the following indices (E1) :
    - Fertilizer consumption per hectare of arable land,
    - Pesticide use per hectare of crop land,
    - Industrial organic pollutants per available fresh water
    - The percentage of country's territory under severe water stress (the Environment Sustainable Index (ESI's) terminology): which specifies the regional distribution of water availability relative to population and consumption needs is as important as its overall water availability. This variable captures the percent of the territory that is under water stress, which will affect the availability of water for environmental services and human well-being. (World Economic Forum, 2002)
2. Percent of land area under protected status (E2).

3. Biodiversity based on the percentage of threatened mammals and Birds (E3).

A brief discussion about some of the indices forming the environment indicator for the five countries is discussed in this part.

4.1.5.1 Palestine

Farmers' use of pesticides in Palestine has increased significantly, in particular in irrigated farming. Unfortunately, this increase has not been accompanied by a full understanding of the impacts of pesticides on human health, beneficial soil organisms and micro-organisms and the environment as a whole (ARIJ, 2007).

A total of 123 pesticides are currently being used in Palestine. Because of the economic value of the crops, pesticide use is much higher in irrigated farming. It is estimated that 96.6 percent of irrigated land is treated with pesticide. The total quantity of pesticide used is estimated to be around 1,471 tons per year, 730 tons used in the West Bank, and 741 tons used in Gaza Strip. The unregulated use of these chemicals is detrimental to the area's biological and genetic diversity. Integrated pest management programs will need to be implemented as part of the larger strategy to maintain biodiversity.

Certainly, there is a perceptible increase of environmental consciousness among Palestinians. Initiative has been taken in environmental education through the Education for Environmental awareness program launched by a group of private schools to increase the understanding of biodiversity (ARIJ, 2007).

On the Other hand, Palestinians do not have adequate wastewater collection systems and treatment this increases the pollution and stresses the environment. About 69% of the Palestinian is not connected to sewerage system, in fact, they depend on cisterns to collect the wastewater, and only 31% of the population is connected to wastewater treatment plants (PWA, 2009).

4.1.5.2 Israel

Wastewater treatment plants are working efficiently in Israel that prevents the environment and the water resources from being polluted. On the other hand, pesticides usage levels is relatively considered to be low since Israel exports a variety of fruits, vegetables and cheeses.

Yet Israel's biological diversity - of genes, species and ecosystems- is endangered largely as a result of accelerated development and population growth. While about 20 percent of Israel's land area is preserved within declared nature reserves, most of them are located in the desert area. Only about three percent of the Mediterranean region is protected in nature reserves (Israel Ministry of Environmental Protection, 2010).

4.1.5.3 Syria

The causes of Biodiversity loss in Syria can be summarized in the growth of the population and the strife for agricultural, industrial and urbanization development. This is affecting the ecological balance of arid and semi-arid systems to the point of desertification and biodiversity loss (Barkoudah et al, 1997).

4.1.5.4 Lebanon

The discharge of industrial effluents into streams and runoff from agricultural and horticultural lands and human settlements carries significant chemicals loads that often run directly into streams. Pesticides and herbicides are often applied unmonitored on fruit trees and vegetable crops. The Lebanon State of the Environment reported that sinkholes are often receptacles for dumping refuse, raw sewage and other untreated waste that often flow directly into water systems used for public consumption, watering gardens, nurseries and the like (USAID, 2009).

Lebanon has been designating protected areas since 1942 when the Government of Lebanon established eight protected sites pursuant to Decree 343. These early protected sites were very diverse ranging from urban parks (Horsh Beirut), to springs (nabaa el laban), forests (the oak forest in Mrouj and the cedars of Bcharre) and historic monuments (temple of Baalbeck). Since 1942, several ministries have been designating protected areas including the ministries of Tourism, Agriculture, Culture and most recently Environment (USAID, 2009).

Lebanon enjoys a very rich biodiversity due to its largely mountainous landscape and extreme variability in climatic conditions, over 9,119 species of plants and animals were identified and a higher number remains to be identified.

About 57 percent of the forest cover is broadleaved species (primarily oaks), with coniferous species (mainly pines) contributing about 31 percent. The remaining portion is mixed broadleaved and coniferous forests (USAID, 2009).

4.1.5.5 Jordan

The Jordanian habitat and its wildlife communities have undergone significant changes over the centuries and continue to be threatened by a number of factors. A rapidly expanding population, industrial pollution, wildlife hunting and habitat loss due to development have taken a toll on Jordan's wildlife population. In recent decades, Jordan is addressing the threats to the environment, beginning the process of reversing environmental decline (Jordan Geography and Environment Institution, 2001).

Jordan's habitat is unique in that the intersection of dense forest, arid desert, and tropical geography endows the country with a rich variety of plants and microorganisms that can be studied efficiently in a relatively small land area. More than 2,500 wild plant species from 700 genera exist; of these, there are approximately 100 endemic species, 250 rare species, and 125 very rare species (RTI, 2006).

The indicators representing the Environment indicator for the five study areas are listed in Table 4.6 that includes data statistics for the five countries.

Table 4.6: Indicators on the environment and sustainability of resources for the five countries.

Environment		Palestine	Jordan	Lebanon	Syria	Israel
E1	**Water stress (Pollution)**					
1.	Fertilizer consumption per hectare of arable land	1,892	918.86	3,360.33	698.80	3,450.14
2.	Pesticide use per hectare of crop land	1,471	1,495.0	8,809.02	4,761.05	4,482.06
3.	Industrial organic pollutants per available fresh water	NA	11.53	NA	NA	27.07
4.	The percentage of country's territory under severe water stress	100	82.6	82.1	99.6	100
E2	**E2. Biodiversity**	**4.25**	**8.47**	**7.54**	**5.14**	**9.37**
E3	**E3. Percent of land area under protected status**	0	3.1	0.46	0	15.68

Source: World Economic Forum (2002); Tamimi and Isayed (2008); ARIJ (2007); Palestinian National Information Centre (2006)

Data on the industrial organic pollutants for Lebanon, Syria and Palestine were not available, therefore this variable in not included in the final calculations.

All of the indicators forming the Climate Vulnerability Index (CVI) are listed in Table 4.7 that includes a summery for all the statistic data for the five countries, Israel, Jordan; Lebanon, Palestine and Syria.

Table 4.7: A summary of the CVI values for the five countries. (summary of all the above tables)

Basic Indicators for CVI	Palestine	Jordan	Lebanon	Syria	Israel
Total per capita annual share from renewable water resources	215	234	594.5	1,056.7	1,408.6
Per capita share from non-conventional water resources	0	14.8	1.1	190.7	65.5
Dissolved oxygen concentration (mg/Liter)	8.5	8.91	5.78	5.83	10.33
Phosphorus concentration (mg/Liter)	0	1.01	0.38	0.21	0.42
Suspended solids (Natural Log of mg/Liter)	0	4.5	6.1	5.01	2.83
Electrical conductivity (Micro-Siemens/Centimeter)	780	1014.42	1696.86	1608.99	2149.96
Total population with access to drinking water (%)	83	97	65	90	99
Total population with access to sanitation (%)	30	56	44.6	70	100
Proportion of irrigated land to the cultivated land	4	5.7	26.1	20.7	45.2
Domestic water Use (m^3/cap/yr)	36.7	52.1	124.9	78.7	103.2
Agricultural water use (m^3/cap/yr)	43.2	101.6	227.7	845.3	163.6
Industrial water use (m^3/cap/yr)	3.2	6.5	11.6	32.9	16.4
Under five mortality rate	23	26	30	15	3.9
Educational Level	88.4	88	84.5	76.9	73
% reporting illness due to water supplies	NA	0.93	0.43	2.43	NA
GDP per capita (PPP) (US$)	1,051	4,901	10,109	4,511	24,320
fertilizer consumption per hectare of arable land	1,892	918.86	3,360.33	698.8	3,450.14
pesticide use per hectare of crop land	1,471	1495	8,809.02	4,761.05	4,482.06
percentage of country's territory under severe water stress	100	82.6	82.1	99.6	100
Biodiversity	4.25	8.47	7.54	5.14	9.37
Land area under protected status	0	3.1	0.46	0	15.68

4.2 Governance and Political Indicators

Governance (G)

Governance has the ability to impede or facilitate the introduction of beneficial changes and recommend policies and systems in the country. Since poverty, civil society, vulnerability, and Governance are all frequently linked to each other and the economic, social, political, environmental and technological assets are all functions of vulnerability. Then, poverty reduction can be achieved by the good governance that works on a proper legislations and regulations to developing and improve all the sectors in the country and hence has an appropriate management system that focus on reducing the vulnerability by providing the basic needs of economic security, social services and physical security or peace.

UNDP defined the Governance as:

> *"Governance is the system of values, policies and institutions by which a society manages its economic, political and social affairs through interactions within and among the state, civil society and private sector. It is the way a society organizes itself to make and implement decisions achieving mutual understanding, agreement and action. It comprises the mechanisms and processes for citizens and groups to articulate their interests mediate their differences and exercise their legal rights and obligations. It is the rules, institutions and practices that set limits and provide incentives for individuals, organizations and firms. Governance, including its social, political and economic dimensions, operates at every level of human enterprise, be it the household, village, municipality, nation, region or globe".* (UNDP, 2004)

Governance consists of a Variety of factors that have to be studied to indicate the performance of the governance in any country. For example, the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them, are all aspects that are to be taking into consideration while evaluating the governance (World Bank, 2006). These factors can be summarized and represented in some indicators that are:

1. Voice and Accountability
2. Political Stability and Absence of violence/terrorism

3. Government Effectiveness
4. Regulatory Quality
5. Rule of Law
6. Control of Corruption

In the following sections, the governance indicators will be discussed in each of the five countries, Israel, Jordan, Lebanon, Palestine and Syria. Data that are representing these indicators were collected and compared between the mention countries. Consequently, the governance Index for each country will be measured to illustrate the comparison between these countries to show which of these countries has"good governance" and which has "poor".

4.2.1 Voice and Accountability

The extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media (World Bank, 2006). It is a subjective governance indicator aggregated from a variety of sources and measuring perceptions of: free and fair elections, civil liberties, political rights, military in politics, change in government, transparency in laws and policies (World Bank, 2006). The estimated range for this indicator varies between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008)

The voice and accountability that combines all the components mentioned above is represented and discussed for the five countries as follows:

4.2.1.1 Palestine

The civil and political rights of all Palestinians are adversely affected by the continued occupation by Israel and the resulting restrictions on their freedom of movement. Palestinian's access to, and full enjoyment of civil liberties and political rights are affected by the economic, social, and cultural restraints placed on their lives (Azzouni, 2008).

They had the right in the elections process which was held in 2006, this election was the first election to the Palestinian Legislative Council since 1996, and it was considered to be free and fair. Whereas, subsequent elections were repeatedly postponed due to the ongoing Israeli-Palestinian conflict.

For the freedom of press in Palestine, the Israelis denies this right on the Palestinians, they are routinely detaining Palestinian and journalists covering stories in the West Bank and Gaza. Moreover, they denies journalists' travel permits and revoked or delayed issuing press credentials, all of which amounted to de facto censorship (U.S. Department of State, 2004).

4.2.1.2 Jordan

Accountability indicator in Jordan is comparatively considered to be very low. And as it is known, Jordan is a kingdom country and citizens do not have the right to change their government. They may only participate in the political system through their elected representatives to Parliament. However, the King has discretionary authority to appoint and dismiss the Prime Minister, Cabinet, and the upper house of Parliament, to establish public policy and to dissolve the Parliament (U.S. Department of State, 2004).

Civil rights are in principal guaranteed by the Jordanian law, in fact, human rights organizations are continuously complains about arbitrary arrests, incommunicado detention and the use of torture in Jordanian prisons. The National Center for Human Rights (NCHR) noted that Jordan's regional governors detained more than 12,000 citizens without trial during the year 2007. Accused Islamists regularly point to the fact that they have been charged on the basis of pre-trial statements made under physical duress (Bertelsmann Stiftung, 2007).

On the other hand, Jordan's media suffers from oppressive media legislation, informal pressure from the intelligence services, and cautious advertisers and printers afraid of running afoul of the governmentIn addition to constitutional guarantees of the right to freedom of expression and of the press, the Parliament approved a new Press and Publications Law on March 21 that explicitly prohibits "detention as a result of the enunciation of an opinion in speech, writing, or through other means. The government owns substantial shares in Jordan's two leading daily newspapers, and all publications must obtain licenses from the state (Freedom House, 2008).

Although many problems remained, the government's respect for human rights improved in some areas in comparison to the previous years. But still, reports of continue committing abuses, allegations of torture, arbitrary arrest and detention, lack of transparent investigations and the unaccountable security services, infringements on citizens' privacy rights, harassment of members of opposition political parties, and significant restrictions assembly and association are still remained in Jordan (U.S. Department of State, 2004).

4.2.1.3 Lebanon

The Government's overall human rights records are considered poor; although there were some improvements in a few areas, however, serious problems are still remaining. The right of citizens to change their government is significantly restricted by the lack of complete government control over parts of the country, shortcomings in the electoral system, the flawed 2000 elections, and Syrian influence (U.S. Department of State, 2004).

Even thought, the Constitution provides that elections for the parliament must be held every 4 years. In turn, the parliament elects the president every 6 years. Theoretically, a controversial and ambiguous asset declaration law provides accountability, but the law is not enforced, and officeholders are very rarely held accountable (Bertelsmann Stiftung, 2007).

Lebanon's constitution guarantees largely unrestricted civil rights. In practice, civil rights have been restricted in the past, especially in the 1990s and until 2005 when Syrian forces withdrew from Lebanon. Since then, freedoms of association, assembly and demonstration have been practiced rather freely (Bertelsmann Stiftung, 2007). Although politicians who rose to power during the occupation continued to dominate the Lebanese government, they quickly shed their loyalties to Syria and committed themselves to ending egregious violations of political and civil liberties (Freedom House, 2008).

And for the freedom of press, The constitution provides for freedom of the press, though the government restricts this right in practice. The government continues to take steps to limit journalists, though with less impact than before, as the diversity of media outlets and the momentum of political events have made it increasingly difficult to restrict press coverage (Freedom House, 2006).

4.2.1.4 Syria

The records for the accountability and the human rights in Syria are also remained poor. The citizens do not have the right to change their government. In fact, the government continues to commit serious abuses against Syrian, and poses torture in detentions. It prevents any organized political opposition in which there have been very few anti-government manifestations (U.S. Department of State, 2004).

Prison conditions are very poor, and still the government commits arbitrary arrests and detention, prolonged detention without trial, fundamentally unfair trials in the security courts, and infringement on privacy rights (Bertelsmann Stiftung, 2007)

The Syrian government continued to place severe restrictions on press freedom in 2007. Although the constitution provides for freedom of speech and of the press, a constellation of repressive laws restricts such rights in practice (Freedom House, 2008).

4.2.1.5 Israel

The law provides citizens with the right to change their government peacefully, and citizens exercised this right in practice through periodic, free, and fair elections held on the basis of universal suffrage for adult citizens. The country is a parliamentary democracy with an active multi-party system in which political views were wide-ranging. Relatively small parties, including those who primary support is among Israeli Arabs (Palestinians living in the occupied Palestine since 1948, which is totally controlled by the Israeli government), regularly won seats in the legislature "Knesset".

In Israel, there is no constitution; a series of "basic laws" provide for fundamental rights. The legislature, or Knesset, has the power to dissolve the government and limits the authority of the executive branch.
On the other hand, the Israeli law provides the freedom of press, and the government generally respected this right in practice. Therefore, the law authorizes the government to censor any material reported from Israel or the occupied territories that it regards as sensitive on national security grounds (U.S. Department of State, 2004).

The Government interferes in individual privacy in some instances. Such as the ability to marry, within the country, by not recognizing Jewish marriages. On the other hand, human rights groups issued complaints regarding torture, insufficient living space, and inadequate medical care for those detained in interrogation centers. The Israeli and international human rights organizations continued to report allegations that security forces tortured detainees during interrogation and that police officers beat detainees. The conditions in military detention camps and Israeli interrogation centers for Palestinian security detainees held in Israel remained poor, and did not meet international standards (U.S. Department of State, 2004).

Finally, the Government generally respected the human rights of its citizens; however, there continued to be problems with respect to Arab citizens' treatment. The Government detained without charge thousands of persons in Israel, the West Bank and Gaza (U.S. Department of State, 2004). Data representing voice and accountability for the five countries are listed in Table 4.8.

Table 4.8: Voice and accountability indicator for the five countries

Country Name	Voice and Accountability indicator
Palestine	-0.94
Jordan	-0.71
Lebanon	-0.40
Syria	-1.75
Israel	0.69

Source: World Bank (2008)

4.2.2 Political Stability and Absence of Violence

This indicator is perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism. It is a subjective governance indicator aggregated from a variety of sources and measuring perceptions of the likelihood of destabilization (ethnic tensions, armed conflict, social unrest, terrorist threat, and internal conflict, fractionalization of the political spectrum, constitutional changes, and military coups)(World Bank, 2006). The estimated range for this indicator varies between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008). The political stability and absence of violence is discussed for the five countries as follows:

4.2.2.1 Palestine

The political instability in Palestine has never ended since years, due to the occupation of their land and the lost of all their human rights and the procrastination of the Israelis to solve this problem. In addition to the lost of the Palestinian the right to access their lands and to use of their resources. Today, many individuals and organizations are working to non-violently combat the continued occupation of Palestine. But still there are weekly demonstrations against settlements, the barrier wall and land confiscation continues despite the attempts to make them

go away. In weekly demonstrations, Palestinians are actively disproving the false notion that violent rebellion is the only way to fight against the occupation (U.S. Department of State, 2004).

4.2.2.2 Jordan

In 2005, terrorist attacks targeted three hotels in Amman known to be popular with foreigners, but most of the 60 killed are believed to be Jordanians. Despite the effectiveness of Jordan's counter-terrorism efforts and the resulting tightening of the security environment which is underway, further terrorist attacks remain possible. In early 2009, the government announced that it had made a series of arrests of elements aligned with the Muslim Brotherhood that had formed a militant faction. The Muslim Brotherhood insisted that it is only interested in democratic reform and that it was not militarizing (U.S. Department of State, 2004).

4.2.2.3 Lebanon

The political stability in Lebanon is still considered as very low. Violence and discrimination against women, abuse of children, and discrimination against Palestinians, forced labor remained problems. In addition to the problem of trafficking in persons (US Department of state). Political violence and human rights violations that occurred during the civil war and under Syrian tutelage have not been persecuted yet (Bertelsmann Stiftung, 2007). However, members of the security forces used excessive force and tortured and abused some detainees and the prison conditions is remaining poor (Freedom House, 2008).

4.2.2.4 Syria

The Government prevented any organized political opposition, and there have been very few anti-government manifestations. Continuing serious abuses included the use of torture in detention; poor prison conditions; arbitrary arrest and detention; prolonged detention without trial; fundamentally unfair trials in the security courts; and infringement on privacy rights.

Torture has been generally less used (Bertelsmann Stiftung, 2007). Violence and societal discrimination against women are remaining a problem. The Government discriminats against the stateless Kurdish minority, suppressed worker rights, and tolerated child labor in some instances. It also maintains effective control of the security forces, however, the members of the security forces commits numerous serious human rights abuses (U.S. Department of State, 2004).

4.2.2.5 Israel

Israel's overall human rights record in the occupied territories remained poor and worsened in the treatment of foreign human rights activists as it continued to commit numerous, serious human rights abuses.

The Government did little to reduce institutional, legal, and societal discrimination against the country's Arab citizens, who constituted approximately 20 percent of the population but did not share fully the rights and benefits provided to, and obligations imposed on, the country's Jewish citizens. Discrimination and societal violence against women persisted, although the Government continued to take steps to address these problems. Discrimination against persons with disabilities persisted. Trafficking in women into the country for the purpose of forced prostitution was a continuing problem. There was evidence of labor trafficking among the country's estimated 236,000 foreign workers. Abuse of foreign workers, including prostitutes, some of whom were trafficked to and employed illegally in the country, continued (U.S. Department of State, 2004).

Table 4.9 lists the data of the Political stability and absence of violence for the five countries.

Table 4.9:Political Stability and Absence of Violence/Terrorism Indicator for the five countries

Country Name	Political Stability and Absence of Violence/Terrorism
Palestine	-1.76
Jordan	-0.32
Lebanon	-1.94
Syria	-0.56
Israel	-1.39

Source: World Bank (2008)

4.2.3 Government Effectiveness

It is a subjective governance indicator aggregated from a variety of sources and measuring perceptions such as bureaucratic quality, transaction costs, quality of public health care and government stability. It represents the degree of the services independence from political

pressures, and the quality of policy formulation and implementation, in addition to the credibility of the government's commitment to such policies (World Bank, 2006). Estimates range between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008).

Governance effectiveness by countries is discussed for each of the study areas in this part.

4.2.3.1 Palestine

Since Palestine is under the occupation of Israel, the effectiveness of the government led by the Palestinian National Authority is considered quite weak. This weakness is in terms of forming policies and regulation from one hand and implementing it in other hand, in spite of all the efforts done during the last years to achieve better quality of health, education, security and stability among the citizens. But still the country's government is relatively considered low effective (U.S. Department of State, 2004).

4.2.3.2 Jordan

Jordan has faced an improvement in terms of government effectiveness in the last couple of years. The Government's respect for human rights improved in some areas, whereas it imposes some limits on freedom of religion in some areas. It also posted official and societal discrimination against adherents of unrecognized religions. In addition to some restrictions on freedom of movement and violence against women, restrictions on women's rights, and societal discrimination against women persisted. Child abuse remained a problem, and discrimination against Palestinians persisted. Abuse of foreign domestics was a problem that began to be addressed this year, and child labor occurred (U.S. Department of State, 2004).

4.2.3.3 Lebanon

The effectiveness of the government in Lebanon remained poor, Lebanese government infringed on citizens' privacy rights and surveillances of political activities. It limits press and media freedom and restricts freedom of assembly and imposes some limits on freedom of association. In fact, there were also some restrictions on freedom of religion and movement (U.S. Department of State, 2004).

4.2.3.4 Syria

In Syria the government effectiveness indicator is low since the Government's human rights record remained poor, it continued to commit serious abuses. Citizens do not have the right to change their government. The Government significantly restricted freedom of speech, the press

and restricts freedom of association on the other hand the freedom of assembly does not exist under the law. In fact, the Government does not allow independent domestic human rights groups to exist; however, it permitted periodic meetings of unlicensed civil society forums throughout the year. Finally, it place some limits on freedom of religion and freedom of movement (U.S. Department of State, 2004).

4.2.3.5 Israel

The Government generally respected the human rights of its citizens; however, there continued to be problems with respect to its treatment of its Arab citizens. Israeli and international human rights organizations continued to report allegations that security forces tortured detainees during interrogation and that police officers beat detainees. The conditions in military detention camps and Israeli interrogation centers for Palestinian security detainees held in Israel remained poor, and did not meet international standards (U.S. Department of State, 2004).

Table 4.10 shows data countries of the governance effectiveness for the five study areas.

Table 4.10:Government Effectiveness Indicator for the five countries

Country Name	Government Effectiveness
Palestine	-1.36
Jordan	0.27
Lebanon	-0.64
Syria	-0.67
Israel	1.3

Source: World Bank (2008)

4.2.4 Regulatory Quality

A subjective governance indicator aggregated from a variety of sources and measuring the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (World Bank, 2006). Estimated range between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008). All the study areas are discussed in terms of the regulatory quality below.

4.2.4.1 Palestine

The Palestine government and politics works within the framework of the rules and regulations as laid down in the Constitution of Palestine. The Constitution came into existence in 1968. In 2001 the first draft of this constitution was published. The legislature of Palestine which is known as the Palestinian Legislative Council is unicameral in nature with 132 members. Half of the members are elected on the basis of proportional representation and the rest half are elected by traditional constituencies (U.S. Department of State, 2004).

The Judicial Authority Law of 2002 granted the Palestinian judiciary a certain degree of independence and power. But implementation of this on the ground has been impeded by resistance by the executive branch to the independence of the judiciary and continual disputes between the Higher Judicial Council and other institutions. Although most differences have been resolved in favour of the Higher Justice Court, the resulting decisions have not been institutionalised by law, and the potential for further disputes continues to exist (U.S. Department of State, 2004).

Recently, the judicial branch of the Palestinian National Authority (PNA) became divided as a result of the Hamas takeover of the Gaza Strip, as was the case with the other institutions of the PNA. Hamas has set up a Higher Justice Council in Gaza in parallel with the PNA Higher Judicial Council, which has resulted in two judicial authorities on the ground. Because most PNA judges in the Gaza Strip do not have a relationship with the Higher Justice Council and its courts, Hamas has recently appointed and promoted a large number of judges to fill the vacuum (Transparency International, 2009).

The Independence of the Judiciary Law and the PA Basic Law define the authorities of the three Governmental branches and prescribes direct election of a president accountable to his cabinet and to the elected PLC; however, neither law has yet been fully implemented. Without such laws to constrain them, PA security officers refuse to carry out some High Court of Justice orders to release detainees (U.S. Department of State, 2004).

4.2.4.2 Jordan

In Jordan the Constitution provides for an independent judiciary; however, the judiciary was not independent in practice and remained subject to pressure and outside interference. The King appoints the Higher Judiciary Council, a committee that determines judicial appointments, advancement, and dismissal. In 2001, Parliament passed a law giving the Council increased

independent jurisdiction over the judicial branch and limiting the Ministry of Justice's administrative control over judges (U.S. Department of State, 2004).

4.2.4.3 Lebanon

The judiciary in Lebanon remains the main guarantor of civil rights and the legal medium through which to seek redress. However, a person's right to life and security are not adequately protected against infringements from others (Bertelsmann Stiftung, 2007).

Even though, the judiciary operates relatively independently, even thought the ministry of Justice appoints some judges based on the religious affiliation of the prospective judge. In addition, its functions are partially restricted by factors such as corruption, political interference and confessional representation (to the detriment of merit and professionalism). The constitution provides for an independent judiciary, and all citizens enjoy access to the system that is relatively well organized and offers the possibility to appeal decisions.

On the other hand, many citizens doubt the existence of equality before the law. Rather, people perceive the judicial system as being open to manipulation by political and confessional interests (Bertelsmann Stiftung, 2007).

4.2.4.4 Syria

The Constitution provides for an independent judiciary; however, the two courts dealing with cases of alleged national security violations were not independent of executive branch control. Political connections and bribery sometimes influenced verdicts in regular courts. The judiciary is politicized by Ba'th party appointments and suffers from corruption and interminable delays in litigation. As such, it elicits little public confidence and is, rather, a major obstacle to the rule of law. It does not protect civil liberties or property rights. Redress of grievances typically rests on access to informal clientele connections. Though it has not been attempted, reform and independence of the judiciary is widely recognized as essential to Bashar's reform project (Bertelsmann Stiftung, 2007).

4.2.4.5 Israel

In Israel, there is no constitution; a series of "basic laws" provide for fundamental rights. The legislature, or Knesset, has the power to dissolve the Government and limit the authority of the executive branch (U.S. Department of State, 2004).

Table 4.11 lists the data countries of the regulatory quality for the five study areas.

Table 4.11 :Regulatory Indicator for the five countries

Country Name	Regulatory Quality
Palestine	-1.12
Jordan	0.34
Lebanon	-0.20
Syria	-1.17
Israel	1.2

Source: World Bank (2008)

4.2.5 Rule of Law

This indicator is the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence. It is a subjective governance indicator which is aggregated from a variety of sources and measuring perceptions of the following concepts: legal impartiality and popular observance of the law (World Bank, 2006). Estimates range between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008). All the study areas are discussed in terms of rule of law below.

4.2.5.1 Palestine

The Palestinian Legislative Court has no real authority over borders or defence policy. Laws governing Palestinians in the occupied territories derive from Ottoman, British Mandate, Jordanian, Egyptian, and PA law, as well as Israeli military orders.

Court hearings are open to the public unless the court decides on its own initiative, or at the request of one of the parties, to restrict public access for ethical reasons or to maintain public order. Sentencing is always done in an open session. Judges must provide justification for their rulings as stipulated by Article 7 of the Judicial Authority Law. Palestinian courts do not monitor the performance of the executive branch unless a case involving the executive is brought to court. The Higher Justice Court has the authority to hear appeals to decisions made by the officials of the executive branch, including the president. Article 30 of the Basic Law clearly states that (Transparency International, 2009).

The Palestinian Basic Law, amended in 2003, guarantees freedom of expression in line with international standards and constitutional practice applied in democratic states (Mendel and Khashan, 2006).

4.2.5.2 Jordan

The parliament passed a controversial political parties law in 2007. Existing parties that failed to meet the new criteria would be banned. However, an independent judicial body, rather than the Interior Ministry, would grant party licenses. State funding would be distributed according to parliamentary representation, and parties would continue to be penalized for receiving foreign funding. The overall purpose of the law was to reduce fragmentation in politics, but reformists expressed concern that it could be used to limit legitimate opposition. New legislation that took effect in Jordan in 2008 led to a significant decrease in the number of political parties, though the consolidation was seen as a potential boon to the remaining parties. Separately, the government proposed a civil society law that would seriously impede the activities of nongovernmental organizations. Restrictions on freedom of expression led to several arrests and jail sentences during the year (Freedom House, 2009).

4.2.5.3 Lebanon

The Lebanese constitution is a refernce text that defines the functioning of Lebanese judicial system. The constitution and several texts are the main sources of provisions related to the independence and impartiality of the judiciary (Euro-Mediterranean human rights network, 2008).

4.2.5.4 Syria

The Syrian legal system is primarily based on civil law, and was heavily influenced by the period of French rule that stretched from 1920 to 1946. The judicial system is generally corrupt, inefficient, and rife with political influence. In practice there is very little judicial independence, especially above the lower-court level. The military-security apparatus has tremendous influence over the judicial and legislative branches and at times even over the executive branch, which it essentially serves (Freedom House, 2009).

With the legislature and the judiciary dominated by the regime, there is no conventional separation of powers. This is true both in a constitutional and in a practical sense. The presidency generates the reform legislation, which the parliament routinely approves. Parliament is mainly a consultative body and cannot influence the formation of the government. This function is shared

between the president and party politburo. The parliament merely responds to government legislation, normally approving it (Bertelsmann Stiftung, 2007).

4.2.5.5 Israel

In Israel, there is no formal constitution or Bill of Rights. The protection of human rights has fallen to the judiciary. The Most chapters of Israel's prospective constitution have already been written and enacted as Basic Laws.

In the absence of a Bill of Rights, the Supreme Court has made a large contribution to the protection of civil liberties and the rule of law. It developed a principle according to which statutes should be interpreted in a manner that presumes that the legislature has, generally speaking, no intention to curtail liberties or to empower other public authorities to do so. Thus, the Court confirmed the normative superiority of basic laws over ordinary legislation. The Supreme Court also plays an important role in protecting individual rights and preserving the rule of law through its function as the High Court of Justice. When the rule of law is threatened by government action, it is often left to the courts alone to restrain the government (Israel Ministry of Foreign Affairs, 2009). Table 4.12 shows data countries of the Rule of law for the five study areas.

Table 4.12:Rule of law Indicator for the five countries

Country Name	Rule of law
Palestine	-0.81
Jordan	0.49
Lebanon	-0.73
Syria	-0.54
Israel	0.88

Source: World Bank (2008)

4.2.6 Control of Corruption

This indicator is the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. A subjective governance indicator aggregated from a variety of sources and measuring perceptions of the following concepts: corruption among public officials, corruption as an obstacle to business, frequency of "irregular payments" to officials and judiciary and perceptions

of corruption in civil service (World Bank, 2006) Estimates range between -2.5 and 2.5; higher is better (UNDP-POGAR, 2008).All the study areas are discussed in terms of control of corruption below.

4.2.6.1 Palestine

Transparency and the consolidation of PA finances became priorities in the wake of Yasser Arafat's death in 2004, due to rampant corruption during his presidency. Abbas instituted budget controls, ended the old system of cash handouts to political loyalists and members of security services, and launched a widespread corruption probe in 2005. While the Hamas-led government that took control following the 2006 PLC elections expressed a willingness to subject itself to budgetary oversight, many foreign governments were nonetheless reluctant to contribute money out of concern that it would be used for terrorist operations. Prime Minister Salam Fayad, who was appointed by Abbas after the PA schism in 2007, is highly regarded for his commitment to transparent government. Transparency International did not rank Palestine in its 2007 Corruption Perceptions Index (Transparency International, 2007).

4.2.6.2 Jordan

Corruption persists in the executive and legislative branches of government, though the authorities have made progress in combating it in recent years. In September 2006, the parliament approved anticorruption legislation that would create a six-member commission, appointed by the prime minister, tasked with investigating graft. The government is sensitive to public charges of corruption. Jordan was ranked 53 out of 180 countries surveyed in Transparency International's 2007 Corruption Perceptions Index (Freedom House, 2009).

4.2.6.3 Lebanon

The perception of corruption within the public sector is widespread. Corrupt officeholders are not prosecuted adequately under the law, though they occasionally attract adverse publicity. In a system where compromise is always necessary to maintain a balance of power between various groups and to protect confessional spheres of influence, enforcing accountability and integrity in office becomes very difficult.

Most integrity mechanisms and tools to curb corruption are nonexistent or ineffective in Lebanon. Still, political and petty corruption abound. Fighting corruption would need a political decision, which is not forthcoming as it is directly related to the balance of power between major players. Lebanon lacks any legislation that provides access to information. The only way the

public hears about corruption is when something is leaked to the press or is publicly declared by a state official (Bertelsmann Stiftung, 2007).

4.2.6.4 Syria

Corruption is systemic in Syria. Although the president embarked on an anti-corruption campaign in the waning years of his father's presidency, corruption has not lessened. Indeed, given the absence of accountability to a strong president and the increasing overlap of the state and private sectors, it may have increased. At least the outright theft of public firms, like what happened in Eastern Europe, has been avoided. The president has made no direct assault on the new class of crony capitalists whose corrupt stranglehold on the economy deters productive investment.

4.2.6.5 Israel

Corruption continued to increase in Israel according to the annual Global Corruption Report published by Transparency International. In recent years, many cases of abuse of power have come to light. Public corruption undermines basic principles of justice, the quality of government, social solidarity and the quality of life of the citizens and residents of the state. It also prejudices economic growth and the volume of economic investments in the country and even raises the price of government services. Untreated, corruption can undermine the systems of government and the foundations of society and render the administration illegitimate. the number of public officials subject to criminal procedures because of their involvement in acts of corruption has grown; the state comptroller reports in the last years have uncovered cases of political appointments on a larger scale than ever before; analyses of the structure of the government systems in Israel and the degree of trust and social solidarity suggest that corruption may have become routine in government and politics (Fuchs and Navot, 2008).

Table 4.13 lists the control of corruption indicator data in the five countries.

Table 4.13: control of corruption Indicators for the five countries

Country Name	Control of corruption
Palestine	-0.13
Jordan	0.41
Lebanon	-0.83
Syria	-1.07
Israel	0.87

Source: World Bank (2008)

All the above mentioned indicators that are forming the Governance Index (GI) are summarized in table 4.14 including the data for the five study areas.

Table 4.14: Summary of the data for the indicators forming GI for the five countries (World Bank, 2009).

Country	Voice and Accountability	Political Stability and Absence of Violence	Government Effectiveness	Regulatory quality	Rule of law	Control of corruption
Palestine	-0.94	-1.76	-1.36	-1.12	-0.81	-0.13
Jordan	-0.71	-0.32	0.27	0.34	0.49	0.41
Lebanon	-0.40	-1.94	-0.64	-0.20	-0.73	-0.83
Syria	-1.75	-0.56	-0.67	-1.17	-0.54	-1.07
Israel	0.69	-1.39	1.3	1.2	0.88	0.87

4.3 Sample of Calculations

The variable of the indicators are first classified under the first, second and third level indicators. In addition, since the variables are in different units, all the values are to normalized using equation 3.1.

$$S_i = \frac{Z_{best} - Z_i}{Z_{best} - Z_{worst}}$$

The indicator "Access" which is one of the indicators forming the CVI will be calculated and given as a sample of calculation for one of the countries of the case study which is "Palestine".

Therefore, applying equation 3.1 for normalizing the variables forming the access indicator for Palestine are shown as follows:

$$S_{A1} = \frac{100 - 83}{100 - 0} = 0.17$$

Z_{best} and Z_{worst} : the best and worse values are assumed to be 100 and 0% respectively. While the second variable for this indicator is access to sanitation (A2) is normalized as follows:

$$S_{A2} = \frac{100 - 30}{100 - 0} = 0.70$$

The best and worse values are also assumed to be 100 and 0. Finally the third variable for this indicator is the proportion of irrigated land to the cultivated land (A3) is normalized as follows taking into consideration that the best value is assumed to be 50 representing 50% of the land:

$$S_{A3} = \frac{50 - 4}{50 - 0} = 0.92$$

Annex 1 Table (d) shows all normalised values for all levels of indicators for the five countries.

Then next step will be the combination of the normalized values that can be achieved using Equation 3.2, that calculates the second level composite distance for the indicator Access (A). This is calculated as follows:

$$L_j = \left[\sum_{i=1}^{n_j} \alpha_{ij} S_{ij}^{P_j} \right]^{\frac{1}{p_j}}$$

$$L_A = \left[(0.17^2 \times 0.33) + (0.70^2 \times 0.33) + (0.92^2 \times 0.33) \right]^{\frac{1}{2}}$$

$$= 0.671$$

Where:

The weight α_{ij} is considered to be equal and represented as follows:

$$\sum_{i=1}^{n_j} \alpha_i = 1$$

That is (1/the number of variables) which is:

$$\alpha = \frac{1}{3} = 0.33$$

If the value of Access indicator needs to be known, then Equation 3.5 is to be used. For example the Access indicator is calculated as follows:

$$L_{Access} = 1 - 0.671 = 0.329 \times 100 = 32.9\%$$

The indicators for the Climate vulnerability are shown in Table 4.15 and the Governance Indicators are shown in Table 4.16.

After applying the same procedure on all the indicators under the second level composite indicators see Annex I-Table (e), Equation 3.3 can be applied to combine the third level composite indicators that are the Access, Resources, Use, Capacity and Environment. The third level composite distance of these variables can be calculated using Equation 3.3 as follows:

$$L_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} L_{jk}^{p_k} \right]^{\frac{1}{p_k}}$$

$$L_{CVI} = \left[\begin{matrix} (0.67^2 \times 0.2) + (0.84^2 \times 0.2) + (0.89^2 \times 0.2) + (0.63^2 \times 0.2) \\ + (0.69^2 \times 0.2) \end{matrix} \right]^{\frac{1}{2}}$$

$$= 0.751$$

The same procedure is used for the Governance Indicators, and Equation 3.2 is used again to find the third level composite distance that is used as follows:

$$L_{GI} = \left[\begin{matrix} (0.17 \times 0.08^2) + (0.17 \times 0.12^2) + (0.17 \times 0.1^2) + (0.17 \times 0.09^2) + \\ (0.17 \times 0.07^2) + (0.17 \times 0.09^2) \end{matrix} \right]^{\frac{1}{2}}$$

$$= 0.747$$

The third level composite distance is presented in Annex I table (f). The final level composite indicator, which is the composition between the third-level distances that are the Governance and the Climate Vulnerability Indices, it is calculated by using Equation 3.4 as follows:

$$L = \left[\alpha_1 L_1^2 + \alpha_2 L_2^2 \right]^{1/2}$$

$$L = \left[0.5 \times 0.751^2 + 0.5 \times 0.747^2 \right]^{1/2}.$$

$$= 0.748$$

And the system composite Index can be calculated using Equation 3.5 as follows:

$$L_{system} = 1 - L$$

$$L_{system} = GCVI = 1 - 0.748 = 0.25 \times 100 = 25.1\%$$

4.4 Results and Discussions

In this research, appropriate variables from existing datasets were identified in order to be included to form the framework of the index GCVI for the five countris. In particular, the data that is related to water resources, access and use were taken from the ESCWA (ESCWA , 2007), and those related to socio-economic and capacity were taken from UNDP datasets (UNDP, 2007). Whereas, environmental components were taken from the Environmental sustainability Index (World Economic Forum, 2002). On the other hand, the governance indicators were

represented from the datasets of the World Bank (World Bank, 2008). The overall data forming the indicators of the Climate Vulnerability Index (CVI) are represented in Table 4.8 and those representing the Governance Index (GI) are listed in Table 4.14.

After collecting the data representing each indicator to form the CVI and GI, the composite programming approach had been adapted to calculate the GCVI index (UNESCO, 1987). The procedure of this approach has been applied for developing the index and calculating its values for each of the targeted areas. The procedure was applied first by using Equation 3.1 (chapter 3) to normalize the different values of the indicators for both the governance and climate indicators. Annex I table (d) shows the values of the normalized indicators. Then equation 3.2 was used to calculate the second-level composite distances for every second-level group of basic indicators (first-level indicators). The values of these indicators can be calculated using equation 3.4. After that, the third-level composite distances for every third-level group of basic indicators were calculated using equation 3.3. The values of the second-level indicators for the Climate Vulnerability Index and index's values are represented in Table 4.15. And those representing the Governance Index are listed in Table 4.16 for each of the five countries. The values are multiplied by 100 to be in a percentage form to facilitate the evaluation.

In this research, for the simplicity, equal weights for the variables of the indicators were considered. While, weighted values could be more useful for the purposes contributing to national policy goals.

Table 4.15: The Climate Vulnerability Index and Summary of the Indicators for the five countries

Country	Resources	Access	Use	Capacity	Environment	CVI
Palestine	15.8	29.2	11.1	37.1	31.3	**24.9**
Jordan	17.9	43.1	17.6	38.0	38.7	**30.2**
Lebanon	22.3	53.4	34.0	38.5	24.6	**33.6**
Syria	56.0	61.7	58.1	41.6	30.2	**48.2**
Israel	55.8	94.5	32.4	56.9	48.0	**52.9**

Table 4.15 shows the values of the CVI generated in the five compared countries. These values can give some indication of how the CVI scores may vary between these five countries. From this, we can see that the scores of the CVI range from 24.9 representing Palestine to 52.9 that representing Israel.

Table 4.16: The Governance Index and Summary of the normalized Indicators for the five countries

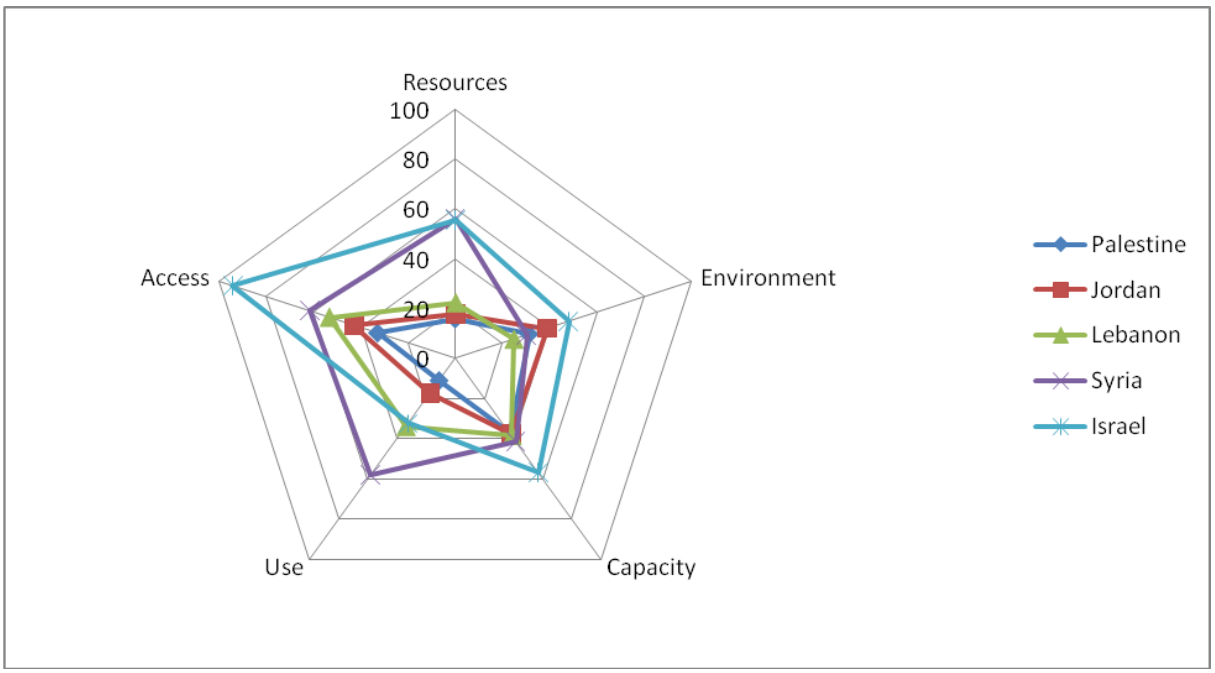
Country	Voice and Account-ability	Political Stability & Absence of Violence	Government Effectiveness	Regulatory Quality	Rule of law	Control of Corruption	GI
Palestine	31	15	23	28	34	27	**25.3**
Jordan	36	44	55	57	60	58	**50.3**
Lebanon	42	11	37	46	35	33	**32.6**
Syria	15	39	37	27	39	29	**29.6**
Israel	64	22	76	74	68	67	**57.3**

Figure 4.3 shows that although there is some similarity in scarcity of water for Jordan and Palestine, the access to this water has a great influence on the vulnerability of the county and subsequently leads to a decrease in the CVI score, that demonstrates the vulnerability of these countries to the climate changes in relation to water related issue. On the other hand, the CVI score for Syria is relatively considered to be low in comparison to the water resources available in the country and the score of access to these resources, but since the per capita water use is found to be low this has affected the value of the vulnerability of this country.

Israel, which is an occupying country, controls water resources and the access to this water, it is found to be the least vulnerable in comparison to the four other countries. Especially that the socio-economic variables represented in the capacity indicator is relatively high, that can give an estimate that this country may have more capacity to adapt in terms of any climatic aspects might appear in relative to the others.

Applying the GCVI on the five countries has given a wider idea of the vulnerability of these countries in response to water resources. Moreover, as it has been discussed in the literature how vulnerability is linked to the performance of the governance, the index has illustrated this fact and gave a great idea of how weak governance performance increases the vulnerability of the country, which is presented in the low value of its index.

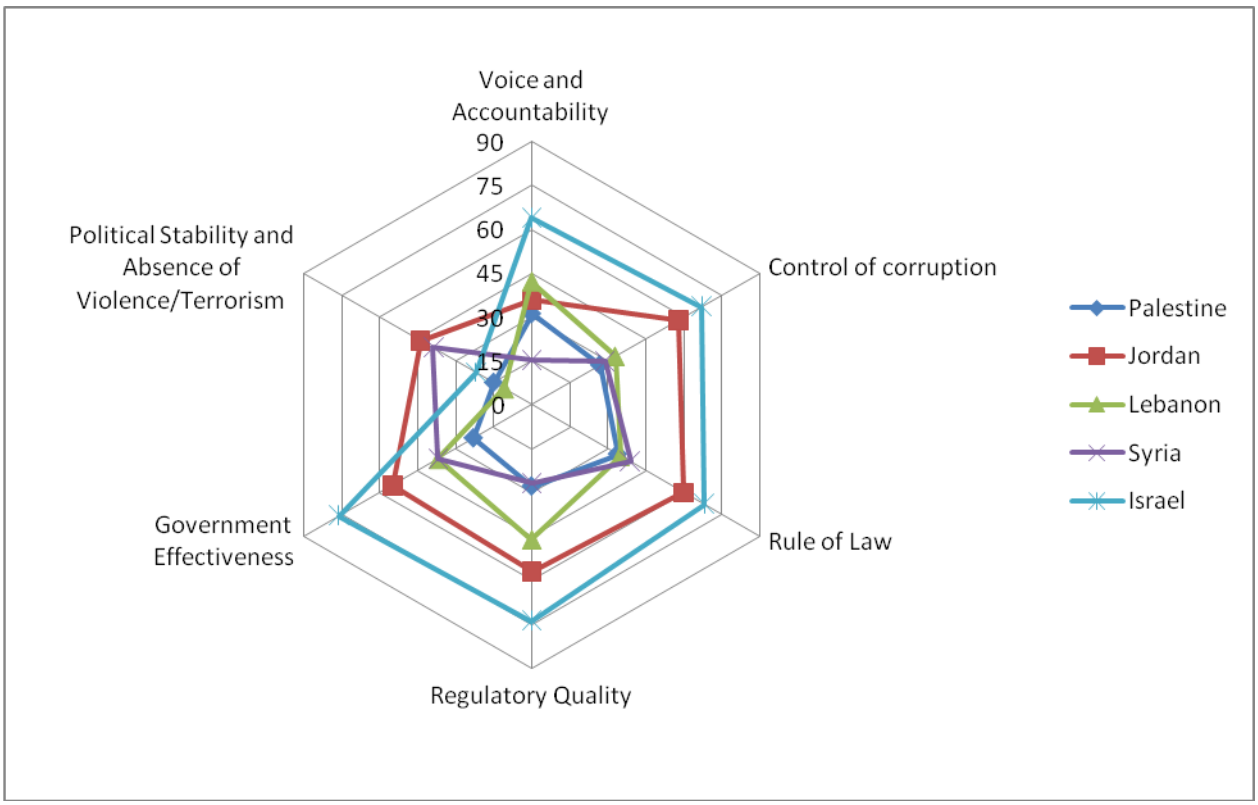
Figure 4.3: A comparison between values of the CVI components for the five countries



For example, the governance index for Syria is considered relatively low, this gives an indication of a weak political, economical and institutional affairs. While on the other hand the CVI is rather high, but the great bond that links the two variables that effect and affects each other's has influenced the overall performance of the country therefore its vulnerability in terms of the governance and climate is low and that can be clear in the GCVI value. The case of Jordan is taking an opposite direction, it has a high value of governance index in comparison to other countries, but since water resources is limited, then the CVI is low, consequently the GCVI value will be affected and lowered, this can give an indication of the vulnerability of this country in comparison to the other countries.

Figure 4.4 shows a comparison between the Governance Indicators for the five countries. It also shows how Israel has a high governance performance represented by the higher values of the indicators in comparison to the other countries, despites the fact that the political stability has a low value due to the political violations that are taking place in the area.

Figure 4.4: A comparison between values of Governance Indicators for the five countries



Combining the two indicators; the Climate Vulnerability Index (CVI) and the Governance Index (GI), to form the GCVI has given a wider idea of the vulnerability of each country in terms of any changes that might occur in both indices. Table 4.17 represents the values of both indices and the values of the GCVI for the five countries. Overall, the results show that the most vulnerable country of the five in terms of governance and climate is found to be Palestine. Palestine in the present condition is under the occupation where it does not have any control of its water resources, access and use. However, the political situation and the unstable governmental conditions in Palestine played a huge role in decreasing the socio-economical level and hence the capacity to manage and develop the country with all the resources available. and hence the ability to develop adaptation strategies.

The GVCI can show how different locations may vary with respect to the different components of the index itself. On which it has provided guidance on how development assistance can best be targeted for the maximum benefit of the country in future responses and planning.

Table 4.17: GCVI indicators

Country	CVI	GI	GCVI
Palestine	24.9	25.3	**25.1**
Jordan	30.2	50.3	**39.4**
Lebanon	33.6	32.6	**33.1**
Syria	48.2	29.6	**38.2**
Israel	52.9	57.3	**55.0**

The values in Table 4.17 show how the vulnerability of countries can be affected by the performance of the governance. For example, if one of the countries is considered less vulnerable in terms of any climatic changes (CVI value is high); while on the other hand, it has weak governance (low GI value). Hence when applying the approach and calculating the GCVI, the country will be considered vulnerable because of the performance of its governance that affects its ability to sustain and cope with the climate change.

On the other hand, governance might influence the climate vulnerability through its effective water resources management, the uses of water in all the sectors and introducing devices to save water, taking good care of the environment and introducing new water sources such as reusing the treated wastewater….etc. These strategies and others are a reflection of a good adaptation and performances that are introduced from good governance.

Applying this methodology on communities within the same country will show how this index can be applied at a variety of scales, moving the comparison to a national scale level in which data can be collected countrywide. This can highlight a comparison between the national and international assessments. In the other hand, it can specify the more vulnerable communities in the country in which the governance may focus on in its future plans. And provide stimulus for discussion of the approach, which could go some way to capture the complexity of the water management problem that is linked to the governance status in each country.

Chapter Five

Conclusions and Recommendations

5.1 Conclusions

Developing GCVI and applying it on the case studies Israel, Jordan, Lebanon, Palestine and Syria has demonstrated the generic applicability of this tool. It has established a comparison method in the performance of the countries and its Vulnerability to climate aspects in the water sector, which intersects with the governance performance that might vary according to the political situation of the region. This made it possible to rank countries taking into account the physical, governance, environmental and socio-economic factors associated with water scarcity. GCVI will enable decision makers who are concerned with water provision, to identify the vulnerable countries or communities so as to priorities the needs for interventions in the water sector between countries.

Applying GCVI on the five countries have showed that the areas suffers from water scarcity and instability of the socio-economic and political aspects. In addition to that, they also suffer from the lack of access to their water resources and the capacity to adapt and cope with any future impacts that might face the countries in terms of any change in the climate or governance aspects.

This research has introduced the governance to test the vulnerability of countries, in which it influences their vulnerability in the case of climate change, through its performance and governmental system that develop strategies and policies to manage water resources in an effective way. This can be achieved through its effective water resources management, introducing devices to save water in all sectors, taking good care of the environment and introducing new water sources such as reusing the treated wastewater….etc. These strategies and others are a reflection of a good adaptation and performances that are to be set up by good governances.

5.2 Recommendations

This index may combine a variety of other components that might not have been included in this research, such as soil erosion indicator that can be incorporated in the environment indicator. (This indicator has not been included in this research for the unavailable of data in the study areas). The inclusion of more variables that are relevant to the indicator may have more accurate and a wider reflection to the exact situation in the targeted country or community. We recommend to focus on the geospatial indicator in this region and to have some measures for this component in order to be able to incorporate it in future studies.

In response to the previous results it is recommended to develop appropriate water resources management and governance performance, enhancement in the environmental policies, increasing awareness on multiple levels so as to decrease the vulnerability of countries in terms of any climatic or governance aspects and to achieve the suitable adaptation measures.

Some of the adaptation measures that are recommended to be taken into consideration are to look for new water resources, for example to develop non-conventional sources of water that can be exploited in the future including use of surplus winter runoff, wastewater reclamation, seawater and brackish water desalination and rainfall enhancement by seeding clouds with silver iodide crystals.

In this research, while calculations the GCVI, we have considered the weights for the variables are all equal for the simplicity. While, weighted values could be more useful for the purposes contributing to national policy goals. Therefore, we recommend to give different weights for each variable and to see how that might affect the GCVI and hence the Vulnerability of the countries.

This index has been applied on country level and we recommend applying it on the national level of countries in future researches in order to test the Vulnerability of communities within the same country basing on accurate data to focus on the vulnerable communities to draw policies for future planning and decision takings.

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Annexes

Annex (I):

Table (a): Normalizing the Sub-indicators for the first level Indicators (Water Resources Availability, Water Quality and water stress)

First Level Indica-tors	Basic Indicators for the First Level Indicators	Palestine	Jordan	Lebanon	Syria	Israel
Resources Availability (R1)	Total per capita annual share from renewable water resources	1.24	1.22	0.92	0.54	0.24
	Per capita share from non-conventional water resources	1.00	0.93	0.99	0.05	0.67
Water Quality (R2)	Dissolved oxygen concentration	0.30	0.22	0.84	0.83	-0.07
	Phosphorus concentration	0.00	0.45	0.17	0.09	0.19
	Suspended solids	0.00	0.45	0.61	0.50	0.28
	Electrical conductivity	0.72	0.49	-0.20	-0.11	-0.65
Water Stress (E1)	Fertilizer consumption per hectare of arable land	0.38	0.18	0.67	0.14	0.69
	Pesticide use per hectare of crop land	0.15	0.15	0.88	0.48	0.45
	Percentage of country's territory under severe water stress	1.00	0.83	0.82	1.00	1.00

Table (b): The distance of the sub-Indicators of the First level composite Indicators.

First Level Indica-tors	Basic Indicators for the First Level Indicators	Palestine	Jordan	Lebanon	Syria	Israel
Resources Availability (R1)	Total per capita annual share from renewable Water resources	0.77	0.75	0.42	0.14	0.03
	Per capita share from non-conventional Water Resources	0.50	0.43	0.49	0.00	0.23
Water Quality (R2)	Dissolved Oxygen concentration	0.02	0.01	0.18	0.17	0.00
	Phosphorus Concentration	0.00	0.05	0.01	0.00	0.01
	Suspended Solids	0.00	0.05	0.09	0.06	0.02
	Electrical Conductivity	0.13	0.06	0.01	0.00	0.11
Water Stress (E1)	Fertilizer consumption per hectare of arable land	0.05	0.01	0.15	0.01	0.16
	Pesticide use per hectare of crop land	0.01	0.01	0.26	0.07	0.07
	Percentage of country's territory under severe water stress	0.33	0.23	0.22	0.33	0.33

Table (c): Values of the First Level Indicators.

The First Level Indicators	Palestine	Jordan	Lebanon	Syria	Israel
Water Resources Availability (R1)	**1.13**	**1.08**	**0.96**	**0.38**	**0.51**
Water Quality (R2)	**0.39**	**0.42**	**0.54**	**0.49**	**0.37**
Water Stress (E1)	**0.62**	**0.49**	**0.79**	**0.64**	**0.74**

Table (d): The Normalized values for all the Indicators

Normalized first level Indicators		Palestine	Jordan	Lebanon	Syria	Israel
R	Water Resources Availability	1.13	1.08	0.96	0.38	0.51
	Water Quality	0.39	0.42	0.54	0.49	0.37
A	Total population with access to drinking water	0.17	0.03	0.35	0.10	0.01
	Total population with access to sanitation	0.70	0.44	0.55	0.30	0.00
	Proportion of irrigated land to the cultivated land	0.92	0.89	0.48	0.59	0.10
U	Domestic water Use	0.76	0.65	0.17	0.48	0.31
	Agricultural water use	0.96	0.90	0.77	0.15	0.84
	Industrial water use	0.95	0.91	0.83	0.53	0.77
C	Under five mortality rate	0.46	0.52	0.60	0.30	0.08
	Educational Level	0.12	0.12	0.16	0.23	0.27
	GDP per capita	0.99	0.94	0.87	0.94	0.70
E	Water Stress	0.62	0.49	0.79	0.64	0.74
	Biodiversity	0.21	0.42	0.38	0.26	0.47
	Land area under protected status	1.00	0.85	0.98	1.00	0.22
GI	Government Effectiveness	0.69	0.64	0.58	0.85	0.36
	Political Stability and Absence of Violence	0.85	0.56	0.89	0.61	0.78
	Voice and Accountability	0.77	0.45	0.63	0.63	0.24
	Regulatory Quality	0.72	0.43	0.54	0.73	0.26
	Rule of Law	0.66	0.40	0.65	0.61	0.32
	Control of Corruption	0.73	0.42	0.67	0.71	0.33

Table (e): The Second Level Composite Distances for the Second Level Indicators.

Second Level Composite Distances		Palestine	Jordan	Lebanon	Syria	Israel
R	Water Resources Availability	0.84	0.82	0.78	0.440	0.442
	Water Quality					
A	Total population with access to drinking water	0.67	0.57	0.47	0.38	0.06
	Total population with access to sanitation					
	Proportion of irrigated land to the cultivated land					
U	Domestic water Use	0.89	0.82	0.66	0.42	0.68
	Agricultural water use					
	Industrial water use					
C	Under five mortality rate	0.63	0.62	0.62	0.58	0.43
	Educational Level					
	GDP per capita					
E	Water Stress	0.69	0.61	0.75	0.70	0.52
	Biodiversity					
	Land area under protected status					

Table (f): The Third Level Composite Distances for the Third Level Indicators.

The Third Level Composite Distances	Palestine	Jordan	Lebanon	Syria	Israel
Climate	0.75	0.50	0.67	0.70	0.43
Governance	0.75	0.70	0.66	0.52	0.47