

GOVERNANCE AND CLIMATE VULNERABILITY INDEX

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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. In this paper, the vulnerability of five countries (Israel, Jordan, Lebanon, Palestine and Syria) in terms of climate and governance change and their effects on water resources will be evaluated. The paper will introduce a new index which will be called Governance and Climate Vulnerability Index (GCVI). The index will measure the vulnerability of the five countries relatively to each other in relation to water related issues, taking into accounts governance and climatic indicators. 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.

Keywords: Governance; Climate change; Vulnerability, Index; Water Scarcity; Middle East.

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).

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 et al., 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 in the Middle East region 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 paper, the vulnerability of five countries (Israel, Jordan, Lebanon, Palestine and Syria) in terms of climate and governance change and their effects on water resources will be evaluated. The paper will introduce a new index which will be called Governance and Climate Vulnerability Index (GCVI). The index will measure the vulnerability of the countries/communities relatively to each other in relation to water related issues, taking into accounts governance and climatic indicators.

CLIMATE AND VULNERABILITY

Vulnerability is defined by Adger (2006) 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. Social scientists tend to view it as a set of socio-economic factors that determine people's ability to cope with stress or change while climate scientists often view vulnerability in terms of the likelihood of occurrence and impacts of weather and climate related events (Nicholls et al, 1999; Roger et al. 2001; Brooks, 2003; Allen, 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. On the other hand, Sullivan et al. (2007) have worked on a reliable and consistent assessment of the vulnerability by developing an approach which encapsulated human vulnerability and includes a representative range of social and physical indicators. They presented Climate Vulnerability Index (CVI) that helped to identify human populations most at risk from climate change impacts.

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 taking into account the governance aspects.

GOVERNANCE AND VULNERABILITY

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. Kaufmann (2005) defined governance as "The manner in which power is exercised in the management of a country's socio-economic resources". Consequently, 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. Kaufmann (2005) presented national indicators based on six key aspects of governance.

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. Whilst it is 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 (World Bank 2007).

METHODOLOGY

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 the above mentioned five countries.

In this paper, 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 the five countries. 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.

In this paper, social and physical indicators that encapsulate human vulnerability will be adapted from the Climate Vulnerability Index (CVI) presented by Sullivan et al. (2002; 2005). Those indicators are mainly represented by water resources, use, access, capacity, environmental and geospatial indicators. On the other hand, governance and political aspects which will be represented in a variety of indicators will be adapted from the World Bank (2001; 2006). Those indicators are voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. Those factors will be combined and be called Governance Index (GI).

Both indices: CVI and GI will be combined together using the Multilevel trade-off analysis using Composite Programming approach (Distance-Based Technique) developed by UNESCO (1987) to form the so called in this paper Governance and Climate Vulnerability Index (GCVI).

MULTILEVEL TRADE-OFF ANALYSIS USING COMPOSITE PROGRAMMING APPROACH

UNESCO (1987) has applied multilevel trade-off analysis using Composite Programming approach to determine 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. The approach is simple, results in a numerical value characterizing the existing state of the investigated system and adaptable to different systems. The approach starts by defining the system to be characterized by a set of indicators, selecting the set of the basic indicators which best characterizes the state of the system under investigation, grouping the set of basic (first) indicators into a smaller subset of second-level and third-level indicators. Then the following steps are to be followed:

1. Normalization of the basic indicators using the following Equation 1:

$$S_i = \frac{Z_{best} - Z_i}{Z_{best} - Z_{worst}} \dots\dots\dots(1)$$

Where:

S_i : 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_{worst} which is always between 0 and 1, which are according to the region's acceptable values or can be decided by a focus group to make countries' evaluation.

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

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

2. Calculation of the second-level composite distances using Equation 2

$$L_j = \left[\sum_{i=1}^{n_j} \alpha_{ij} S_{ij}^{p_j} \right]^{\frac{1}{p_j}} \dots\dots\dots(2)$$

Where:

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

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

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

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

α_{ij} : the weights expressing the relative importance of basic indicators in group j .

3. Calculation of the two third-level composite distances using Equation 3:

$$L_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} L_{jk}^{p_k} \right]^{\frac{1}{p_k}} \dots\dots\dots(3)$$

Where:

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

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

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

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

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

4. Calculation of the system composite distance function using Equation 4:

$$L = \left[\alpha_1 L_1^2 + \alpha_2 L_2^2 \right]^{1/2} \dots\dots\dots(4)$$

5. Calculation of the system composite Index using Equation 5:

$$L_{system} = 1 - L \dots\dots\dots(5)$$

where:

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

APPLICATION OF GCVI

GCVI will be estimated for the five neighbouring countries that are located along the shores of the eastern part of the Mediterranean Sea. 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 (Mimi et al. 2009).

As stated in earlier section, social and physical indicators that encapsulate human vulnerability will be adapted from the Climate Vulnerability Index while governance indicator (GI) will be adapted from the World Bank (2001; 2006). Both indices: CVI and GI will be combined together using the Multilevel trade-off analysis using Composite Programming approach to form the Governance and Climate Vulnerability Index (GCVI). The following presents the definitions of the basic indicators for both CVI and GI:

a. Basic Indicators of CVI (Sullivan, 2005)

- **Resource:** It presents the physical availability of surface and ground water from the renewable water resources in addition to non-conventional water resources.
- **Access:** It presents basic water and sanitation needs recognizing that water availability for irrigation is as important as for domestic and human consumption.
- **Capacity:** It 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:** It presents the efficiency of how water is used for domestic, agricultural and industrial purposes.
- **Environment:** It measures of how human water use impacts on ecological integrity.

b. Basic Indicators of GI (World Bank, 2006)

- **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.
- **Political Stability and Absence of Violence:** perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism.
- **Government Effectiveness:** 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:** the ability of the government to formulate and implement sound policies and regulations that permits and promotes private sector development.
- **Rule of Law:** 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:** 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.

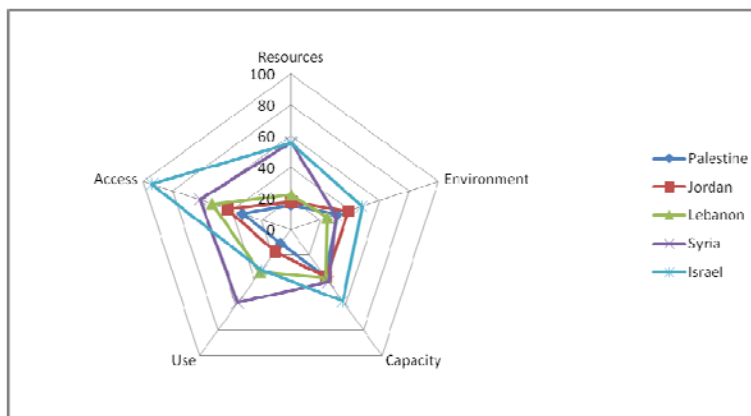
Appropriate data from existing datasets was identified in order to be included to form the GCVI for the five countries. In particular, the indicators that are related to water resources, access and use were taken from ESCWA (2007) and those related to socio-economic and capacity were taken from UNDP-POGAR (2008) and UNDP (2007). Basic climatic and environmental indicators were taken from the Environmental sustainability Index (World Economic Forum, 2002).

DISCUSSION AND RESULTS ANALYSIS

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 the full control of its water resources, access and use (World Bank, 2009). 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.

Figure 1: A comparison between values of the CVI indicators for the five countries

Figure 1 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.

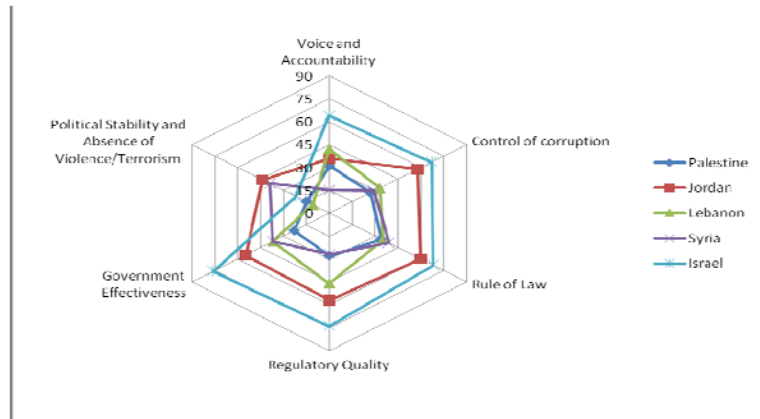


On the other hand, the CVI score for Syria is relatively considered to be low in comparison to the water resources available in the country and the score of access to these resources, but since the per capita water use is found to be low this has affected the value of the vulnerability of this country.

Israel controls water resources and the access to this water and 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.

Figure 2: A comparison between values of Governance Indicators for the five countries

Figure 2 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, despite the fact that the political stability has a low value due to the political violations that are taking place in the area.



GCVI has given a wider idea of the vulnerability of these countries in response to water resources. 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.

Table 1 shows 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.

Table 1: GCVI indicators

Country	CVI	GI	GCVI
Palestine	32.9	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

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. On 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.

CONCLUSION

Development of GCVI and applying it on five countries 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.

GCVI have showed that the five countries suffer 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.

The paper has introduced the governance indicator 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.

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.

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