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Disaster Mitigation Towards Sustainable Development in the Occupied Palestinian Territories

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Abstract. Due to political, economical and social conditions dominating the Occupied Palestinian Territories (OPT; consisting of the West Bank, including East Jerusalem, and the Gaza Strip), the Palestinian people and government in the OPT face a multitude of challenges, in relation to governance, development, sustainability, and natural disasters. In this paper, several interventions that form the basis of some present and future Palestinian developmental and planning dilemmas are tackled. Among the challenges the Palestinian people facing are natural disasters. Such disasters have caused enormous losses and have set back economic progress in developed and undeveloped countries alike. On the Palestinian arena, the water shortages, the environmental degradation, and the land and natural resources' depletion, which all go hand in hand with the political conflict in the Middle East, are perceived to be the most significant anthropogenic disasters currently affecting the Palestinian people in the OPT. In addition, natural disasters are significantly considered a potential threat to the OPT's population. Earthquakes in the region are considered a major hazard, with low probability but high adverse impacts. Adding to this, the proposed Red Sea-Dead Sea Conveyance that will bring about two billion cubic meter of saline water from the Red Sea to the Dead Sea will be potentially, if constructed, a huge source of induced earthquakes. Moreover, the future looks not so promising; due to the rapid population growth and the way the cities are developing in the OPT, as more than 50% of the Palestinian population lives in what is defined as "hazard-prone" areas. These areas are particularly vulnerable, because of their dependence on complex infrastructures. Moreover, the lack of knowledgeable professionals and technical capabilities in the OPT, in regard to disaster-sound management, is another reason for the current chaotic situation.

Keywords: Disaster Mitigation, Sustainable Development, Red Sea – Dead Sea Conveyance, Occupied Palestinian Territories.

INTRODUCTION

The Mediterranean region, in general, and the eastern side of it, in particular, including Historical Palestine (currently known as the Occupied Palestinian Territories (OPT) and the State of Israel) [Map 1] have been subjected to various anthropogenic and natural disasters. Wars, political instabilities, water scarcity, draught and desertification, as well as earthquakes are primary disasters that have affected the area. The Arab-Israeli wars of 1948, 1952, 1967, 1973, and 1982, along with the two Palestinian Intifadas (public uprisings) in 1987 and 2000 and the continuous Israeli invasions to the OPT since 2002 until the present time all had have catastrophic impacts on the social, economical,

historical and cultural dimensions of the Palestinian society, as well as the natural resources of the whole region of the Middle East.

It is well known that the optimum approach to meeting disasters is through concerted efforts of cooperation and coordination at all levels. Being under military occupation for the last 40 years and counting, the Palestinian society defines the role of the international community in terms of the actual services provided, which supposed to be productive and constructive. Accordingly, it should be emphasized that the need to develop a National Disaster Plan (NDP) in the OPT is based on the needs and aspirations of the local Palestinian population. This may provide the Palestinian people with an effective role in the process of preparedness for, and prevention and mitigation of disasters [1]. It should be indicated that the Palestinian society has, potentially but not sufficiently, the technical and human capacities to assist in the development of an NDP to meet the hazards through preparedness. Whilst a Palestinian national committee exists for natural disaster mitigation since 2003, each discipline has been planning in isolation and, hence, an integrated national plan does not exist yet. It is true that workshops and training courses were and still being presented at the national level, but they have been not effective and not productive. What is actually needed for an NDP in the OPT is to first clearly identify the roles of each player, both locally and nationally, parallel with the support of the international community.

Natural disaster risk is intimately connected to processes of human sustainable development. Disasters, as in the case of the OPT as briefly discussed above, has always put development plans at risk. At the same time, the development choices that have been made so far by individuals, groups and communities, as well as by the PNA have not made much progress, due to the ongoing political instabilities in the region. Therefore, liberation of the Palestinian people from the Israeli Occupation should go hand-in-hand with development projects, such as the proposed NDP.

Risk Realization

The concepts of risk, hazard and vulnerability are dynamically interconnected. The relationship of these elements can be expressed as a simple formula [Formula 1] [2]. This formula demonstrates the concept that the greater the potential occurrence of a hazard and the more vulnerable a society to that hazard, the greater the risk is. It is also important to note that human vulnerability to disaster is inversely related to human capacity (preparedness and/or readiness) to cope with anticipated effects of that disaster.

$$\text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Preparedness}} \qquad \text{i)}$$

A disaster occurs when natural, technological, political, economical or societal conditions have an impact on human beings and their built environment. However, on a paradoxical scale, those who have more resources (as in the case of the Israelis who have

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been occupying the Palestinian Territories since June 1967) often have a greater capacity to withstand the effects of a hazard than the poorer or marginalized societies (as in the case of the Palestinian population under the Israeli Occupation). The Palestinian vulnerable conditions are more tangible. This is due to different reasons, including (to name just a few) rapid population growth; urban or mass migration and emigration due to political, economical or otherwise reasons; inequitable patterns of land ownership; lack of sound education and awareness; and lack of subsistence agriculture. All of these reasons and many others affecting the Palestinian population in the OPT have led to unsafe sitting of buildings, high unemployment rates, poverty, unpredicted future, etc. Therefore, knowledge management is critical to potentially reduce the risks resulted from disasters. However, the current situation in the OPT is characterized by excessive amounts of misleading data and paucity of reliable documentation. Accurate and classified information is urgently needed before more disasters may occur, in order to document the magnitude of their potential risks, and to justify the investment in preparedness for, and prevention of, such disasters. After a disaster occurs, such information is also needed, in order to assess and report on the resulted damage and on present-day and future needs [Table 1].

TABLE ii). Society Risk Management (Based on Formula (1))

<table>
<tr><td rowspan="3">Disaster = Risk Realization (the likelihood of a disaster happening)</td><td rowspan="1">Risk Quantity</td><td>Hazard:
Political, physical, technological, or societal potential threat to human beings and their welfare.</td><td>Prevention (eliminate risk) and Mitigation (reduce risk) programs.

(Proactive project work at all levels).</td><td rowspan="3">Society-Risk Management</td></tr>
<tr><td rowspan="2">Risk Quality</td><td>Vulnerability:

Exposure and susceptibility of people’s suffering and death, urban environmental damage, and services stoppage or loss.</td><td>Vulnerability Reduction Program:

Factors affecting Palestinian human vulnerability are: Israeli Occupation, poverty, increased population’s density, especially at the central business districts, rapid urbanization, changes in way of life (transitional political context), environmental degradation and rapid pollution growth, lack of awareness and information.

Examples are:
Adopting appropriate proactive building codes and practices (design, construction and maintenance), community capacity building, government functionaries at all levels, and legal ramifications of all relevant laws, by-laws and regulations.</td></tr>
<tr><td>Preparedness:
Available and potential resources to resist the impact of a hazard.</td><td>Emergency Preparedness Program:

Examples are: Develop and test early warning systems, prepare evacuation plans, establish respond policies, develop operational plans, secure resources, and training.</td></tr>
</table>

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Building for Earthquakes

Although a great deal has been learned about earthquakes and their effects on buildings, seismic design is still an inexact science, due to the fact that it deals with dynamic forces rather than static ones. It is also because of the many variables involved, which are often difficult to precisely predict, which, in turn, makes optimal design to resist the resulting lateral forces difficult to do. Another associated difficulty with seismic design is that the forces produced by an earthquake are so great, which makes no building to completely resist all energy, resulted from a major earthquake without damage. Building codes and analytical methods of earthquake design are, therefore, a compromise between what could resist earthquakes and what is reasonable, in terms of cost and time. Working to that end, the current approach of designing earthquake-resistant structures echoes the notion of, first of all, not collapse during a major seismic activity. Furthermore, the components of the affected buildings should not cause additional damage or personal injury, even though the buildings themselves may be structurally damaged. Moreover, structures should be able to withstand minor earthquakes without significant damage.

The analytical methods of analysis and design of earthquake-resistant structures are complex, even with the simplified static analysis method that is allowed by the building codes. However, a great deal of resistance is provided by the basic configuration and structural system of a building. The design of buildings for earthquake loads requires an early and close collaboration between the architects and construction engineers, in order to arrive at an optimum cost-effective structural design, while satisfying the needs of the client.

On the Palestinian arena, this approach has become widely acknowledged, due to the latest invaluable endeavors done by the Palestinian National Committee for Disaster Mitigation. However, the Committee defines more actions needed in the future. These actions are mainly to study better estimate losses, to effectively adapt new technologies that mitigate losses, to improve prediction of natural hazards like earthquakes, to define impacts of disasters on natural ecosystems, and to assess the vulnerability of critical infrastructures. Moreover, thorough studies and programs for expanding placement of recording instruments and sensors in the designated active seismic regions inside and around the OPT, and for developing tools for 3-D modeling and simulation to predict building performance during earthquakes, are needed. Meanwhile, it is to be expected that efforts between Palestinian stakeholders would lead to significant progress towards building resiliency in the Palestinian urban areas, hoping that this will be accomplished in the near future. This is based on scenarios indicating that 20% of all buildings in the Palestinian-built areas would suffer total damage, and 25% partial damage, in the event of an earthquake of a moderate to high magnitude may take place in the OPT with an epicenter located at the Dead Sea area [3] (more details are given below about the Dead Sea area).

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Land-Use Policy

The OPT consists of two areas: the West Bank and the Gaza Strip. The land area of the OPT is about 6,023 km^2, with an estimated population of about 4 millions. The average population density is approximately 430 capita/km^2 in the West Bank, and approximately 4,000 capita/km^2 in the Gaza Strip [4]. Of the total area of the OPT, only about 30% is cultivated, while forests cover less than 1.5% of the OPT [5]. Planning for, and managing land use in, the OPT, to create sustainable communities, help in reducing the scale and adverse effects of disasters. Land-use plans enable local governments to gather and analyze information about the suitability of land for development, so that the limitations of hazard-prone areas are understood by policy makers, potential investors, and community residents. For plans' preparation, local governments engage in problem-solving processes, which ensure that all stakeholders understand the issues which the community faces. Plans involve the systematic generation and evaluation of alternative courses of action. In this way, the plans help insure that the approach chosen to reduce vulnerability is an optimal one, by taking into account the community's present circumstances, the future prospects, and the goals and aspirations of its residents [6]. Those plans, once adopted, will guide the choice of developing management measures, by establishing rules to ensure that urban growth occurs in locations, where design characteristics have the ability to reduce risks of natural disasters.

The goal of the Palestinian population in the OPT must be to foster better understanding of why inappropriate land-use patterns have occurred in the past, and to layout land-use planning procedures, as a vision of sustainability and concrete suggestions for policy reform. In order to classify the land area according to its characteristics [Table 2], one needs first to conduct micro, meso and macro studies. Then, one can employ further studies that are dedicated to the development process of the Palestinian society.

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TABLE iii). Area classification according to physical characteristics [7]

Area	Land Characteristics	Land Management & Policy-Tools Development
Secured	-Landslides and collapses -High valuable agricultural land -Coordinating excellent cultural sites -Natural reserves	-No changes in land uses -Protection and insurance
Restricted Development	-Sensitive water basins -Medium valuable agricultural land	-Development is acceptable under specific constrains (EIA) -Following architectural planning and regulations constrains
Observed Development	-Non-sensitive areas -No concerns in agriculture -No collapse; geologically safe	-The main part of development is in this area -Following architectural planning and regulations constrains

The Proposed Red Sea-Dead Sea Conveyance (RSDSC):

A Potential Hazard

Brief Description

Further to the hazards that affects the OPT (as briefly discussed above), the Red Sea-Dead Sea Conveyance (RSDSC) [Map 2] will form, if constructed, a real hazard, in terms of the induced earthquakes that may result from such a mega project. This is particularly important, as the RSDSC will be constructed in a seismically active area. The Dead Sea is the lowest elevation and the lowest body of water on the Earth's surface, as it lies at about 425 m below mean sea level. Also, the Dead Sea water (known as brine) is unique because of its chemical characteristics, as it has the highest salinity and density of any other sea water all over the world. The Dead Sea shores are the natural extension of the tectonic African-Syrian Rift System, as it is bounded by towering fault escarpments from both the eastern and western sides. The Dead Sea shores are the natural borders of Historical Palestine (OPT and Israel) on the west and of Jordan on the east. The declared crux of the proposed Conveyance between the Red Sea and the Dead Sea is to restore the considerable decline of the Dead Sea water level. Only in the last 30 years or so the water level of the Dead Sea has fallen by about 25 m (0.8 to 1 m a year). This is because of the

water-mismanagement policies and strategies of the riparian and upstream countries in the vicinity, as well as the pumping of the Dead Sea water into evaporation ponds that are used in producing salts. Thus, the Dead Sea Basin (the terminal lake of the Jordan River Valley), which is a unique natural heritage (habitat for wildlife); a global cultural, archeological and religious site; a natural clinic for many illnesses; and a nice place for tourists coming from all over the world, is under a serious threat of disappearing. The proposed RSDSC will be located in the Araba Valley, which is between the Gulf of Aqaba and the Dead Sea [Map 2]. The length of the RSDSC will be between 180 and 200 km [8]. It is estimated that the RSDSC project will transfer about 2 billion cubic meters (BCM) of salt water per year, of which about 850 million cubic meters (MCM) will be desalinated. The difference in water level between the Red Sea and the Dead Sea (which is about 550 m altogether, including the natural difference of water levels of both of the seas, which is about 425 m, adding to this the height to which the Red Sea water will be pumped, which is about 125 m) will be used in power generation. This power will be used, in turn, for running the desalination plant(s) that will be constructed during the course of the project.

Impacts of the Proposed Project

The proposed project can be interpreted as one of the biggest projects in the region, which seeks to restore the Dead Sea, to generate power, to provide a sustainable source of fresh water to the neighboring nations, to establish development projects, to build new cities and rehabilitation centers, to create jobs, and to activate the peace process in the region. On the other hand, the project has serious negative side effects. The huge intakes of saline water from the Red Sea may have unwanted and unpredicted implications on the marine ecosystem that includes some of the most beautiful coral reefs in the world. In addition, mixing the waters of both of the seas will certainly have considerable negative environmental impacts, which will affect the chemical and biological characteristics of both of the seas, reflecting on the tourism and salt industries in the region. Also, the direction of the proposed RSDSC, which will go over an important groundwater basin (the Eastern Aquifer System underlying the Occupied West Bank), will raise the probability of groundwater contamination, due to leakages or sudden overflows of the non-treated transported water that has high salt concentrations. Among many other substantial anticipated impacts of the RSDSC is the seismic hazard. As the proposed RSDSC will go through a high ranked active seismic area, where hundreds of earthquake epicenters (at different depths and with different magnitudes) have been documented over the years, the seismic risk that may result from such a huge project is really high. This is due to the fact that the proposed RSDSC will run through the area of Araba Valley, which itself is a part of a regional fault. This regional fault runs from the African Horn in the south, through the Araba Valley and the Dead Sea Basin, and through the Jordan River Valley to the north until it reaches the Taurus-Zagros' mountains in Turkey. It is a left-lateral strike-slip fault, with horizontal and parallel movement to the strike, existing between the tectonic plates of the Arabian Peninsula and the Sinai Peninsula. The fault area in the Araba Valley (which is tectonically also known as the "Jordan Rift Valley") is

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about 160-km long, stretching from the Gulf of Aqaba on the Red Sea in the south to the southern tip of the Dead Sea in the north. Knocking on the anticipated seismic effects, one should notice that the slip rate (rate of movement along the fault) ranges from 1 to 10 mm annually, which has led to the formation of alternating extensional grabens and compressional folds along the area of the fault. The part of the regional fault that runs through the Dead Sea has been the source of several large historical earthquakes, as well as other earthquakes occurred in the last few decades, which were felt by residents in the neighboring areas. In addition, there is a steady micro-seismic activity along the fault in the Jordan Rift Valley. So, the seismic activity along the Araba Valley is complex and can endanger many facilities of the proposed project (RSDSC). Geologists and seismologists predict that (given the 1-10 mm annual slip rate) the Dead Sea fault, as an extension of the Araba Valley, should and could trigger fatal earthquakes of 7.0 in magnitude every 200 years. Besides the seismic activity, hundreds of sinkholes (up to 1 m in depth and a diameter of 25 m each) have been developed, over the last decades, along the shores of the Dead Sea [Map 2]. Consequently, large areas are subsiding, which can potentially result in some kind of seismic activity. The sinkholes phenomenon is due to the decline of the water level of the Dead Sea, which has led to drops in the groundwater table in the surrounding areas. In addition to the above-mentioned potential hazards that may be produced from the proposed RSDSC project, a major problem arising is the geographical location of the project that includes the hydropower facilities and the desalination plant(s) in a seismically active region. Moreover, there is some concerns that using huge amounts of explosives to dig for the RSDSC (before the transfer of water in the Conveyance), and the rush of large quantities of water in the region will lead to strong seismic activities, due to the fact that the Earth's crust is thinner in the project’s area than anywhere else on Earth, because of the Jordan Rift fault that goes deep in the Earth's crust. Moreover, there are some concerns that the rush of huge quantities of water in the region, which will be partially used in desalination, will lead to a strong seismic activity.

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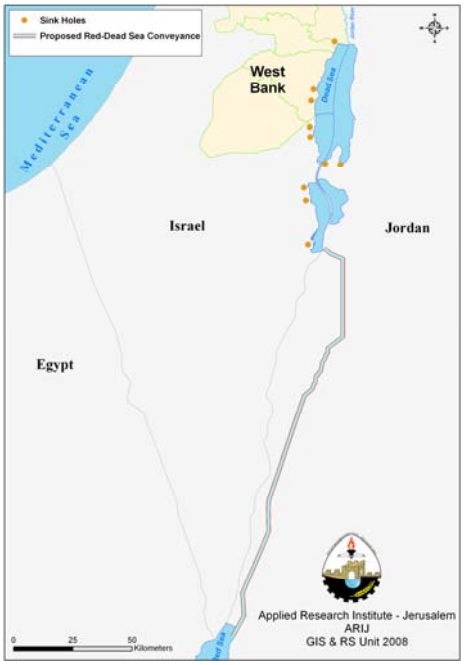
MAP 1. Palestine within the Current Regional Context



MAP 2. Proposed Red Sea-Dead Sea Conveyance (RSDSC) [9]

Conclusion

The Israeli Occupation practices have resulted in resource depletion, shortage in fresh-water supplies, degradation of the environment, increases in unemployment, increases in poverty rates, decreases in agricultural production, and in incapacitating the PNA to adequately fund and develop public infrastructures. Unless the Israelis end their Occupation of the Palestinian Territories, the debate of envisioning a sustainable and a consistent developmental process, which seeks optimum risk management, will remain out of question and far from reality. The above-mentioned reasons, along with the lack of sovereign control by the Palestinian people over their land and natural resources, and the lack of inefficient and non-transparent current system of land administration by the PNA, are all paramount reasons hindering and undermining the process of sustainable development programs in the OPT. Meanwhile, the Palestinian people in the OPT have to take into consideration the importance of expediting the stipulation of a set of public policies and special standards, which are considered increasingly important for advancing the implementation of a risk-management tools' system for the good benefit of the Palestinian society. Regarding the RSDSC project, ARIJ strongly recommend that the Feasibility Study and the Environmental and Social Assessment Studies, which are financially supported by the World Bank should be carried out without hesitation. This must be done in a very scientific manner, based on facts, transparency, and objectivity, in order to decide whether to go ahead with the project or to veto it.

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