OIC Countries & Natural Disasters: Assessment of Risks

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OIC COUNTRIES & NATURAL DISASTERS: ASSESSMENT OF RISKS

SESRIC

1 INTRODUCTION

All throughout history, natural disasters have been one of the greatest challenges against development of human societies. Many races, cultures, and civilizations were formed, evolved, or demised depending on their knowledge, technology, and capability to cope with adversities of nature. While this may seem to be history, natural or human-caused disasters are still among the serious threats to societies' socio-economic and political development around the world, even today. Floods, storms, epidemics, earthquakes, droughts, wild fires, and many more interrupt and distort the lives of many around the world again and again, in many instances taking lives, ruining investments, and forcing major relocations. Global warming, a human-caused global-scale natural hazard, will soon, if not already, severely and irreversibly impact our civilisation and its future if no serious actions are taken in near future.

Disasters are one of the major obstacles in the way of sustainable development in developing countries, especially among the least developed ones. The tragic earthquake and tsunami that struck Japan in March of 2011 is estimated to have caused between $122 to $235 billion in physical damage, of which only $14 to $33 billion is likely to be borne by the private insurers leaving a substantial part to be borne by households and the government.[1] Damages of such magnitude and only for one incidence of natural hazard are equivalent or more than the gross domestic product (GDP) of 146 of the 184 countries covered in the International Monetary Fund's 2011 World Economic Outlook.[2] In other words, a single disastrous event of the magnitude of the earthquake and tsunami in Japan in 2011 (which also led to other adversities), with a financial cost of about only 4% of Japan's GDP in 2010, may easily gobble up more than 100% of many countries' whole economy and their many years of investment in socio-economic and political development and, thus, their futures.

Such disastrous threats to sustainable development, with such potential adverse impacts, should leave no doubt for any policy maker in any developing country that disaster risk reduction ought to be an integral part of any national or local economic development strategy and plan. Substantial investments in institutional and legal frameworks, physical infrastructures, education and awareness, and beyond are required to educate people and organisations, and create capacities for prevention, preparation, response and recovery, with emphasis on prevention and preparation. The OIC Countries, if not the most in need of such provisions, are no exceptions. This report is the first effort to evaluate the status of OIC member countries (MCs) with regard to natural disaster risks with the aim of identifying two main drivers of risk: being relatively more prone to natural hazards and/or vulnerabilities.

This report clearly illustrates that while different OIC countries suffer from different types of natural hazards, with various frequencies and magnitudes, it is in fact their vulnerability to risks, or the lack of conditions and

[1] World Bank East Asia and Pacific Economic Update, Vol. 1, 2011.

[2] 2010 GDP ($ at current prices), World Economic Outlook Database, IMF, September 2011.

capacities for properly managing and reducing the risk of disasters, that is the main culprit. Almost 100% of natural disasters and their impacts (fatal, non-fatal, and financial) in low income OIC countries (OIC-LI) during 1960-2009 took place in countries that are also identified as OIC countries with low capacities for risk reduction (OIC-LRRC). There is clearly no doubt that there is a real need for cooperation among all OIC countries, with assistance from outside, to offer a hand to the people and governments in these countries to reduce their vulnerabilities to natural disasters, and save lives. Investments in response mechanisms and capacities are quite important. However, effective risk management of disasters requires, and involves, more than just a response mechanism. Reducing the risk of disasters requires viewing disasters as major barriers to sustainable socio-economic development, and managing the risks through investing in and enhancing the capacities for preserving the environment and ecosystems, eradicating poverty and inequality, appropriate rural and urban development, and improving the quality of governance, all of which contribute to vulnerabilities. Viewing risk of disasters as barriers to sustainable development necessitates the inclusion of a disaster risk management strategy as an indispensable and integral part of the overall development strategy, which has its roots in environmentally friendly socio-economic and political development and at the same time serves as the guardian of all developmental efforts and investments.

This study is not free of shortcomings and, all in all, is an initial attempt at bringing the importance of the issue at hand to the attention of the policy makers in OIC countries. Further efforts are on the way for improving upon the existing shortcomings.

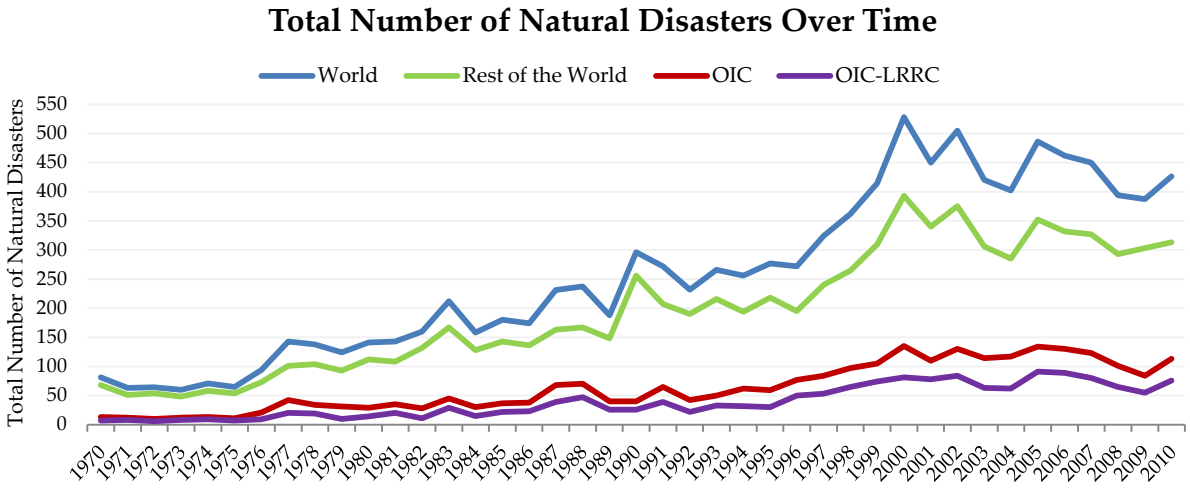
2 OVERVIEW OF TRENDS IN NATURAL DISASTERS & THEIR IMPACTS

2.1 Trends in Natural Disaster Occurrence

During 1960-2010, the number of natural disasters around the world (Table 1, [A]) significantly increased, from about 600 occurrences in the 1960s to almost 4,500 during the 2000s; an increase of about 7.5 times. The number of natural disasters per year at the world level increased from 81 incidences in 1970 to a record high of 528 in 2000, and to 426 in 2010 (Figure 1). The increasing trend in the number of natural disasters was mostly driven by the increase in incidences of floods, storms, and epidemics, perhaps in direct relation to the impacts global warming (Figure 2).

The OIC countries experienced a steeper trend in the occurrence of natural disasters during 1960-2010 (Table 1, [A]), significantly increasing from around 134 incidences in the 1970s to 1,178 in the 2000s; an increase of about 9 times, which is quite larger than that of the world. The number of natural disasters per year increased from 13 in 1970 to a record high of 135 in 2000 and slightly lower to 113 in 2010 (Figure 1). While OIC countries had a constant share of 23% in total number of natural disaster incidents in the world all throughout the 1960-1999, their share in fact increased to 26% during 2000-2009 (Table 1, [A]). The major drivers of such a fast increase in the number of natural disaster incidents among the OIC countries were floods, epidemics, earthquakes, storms, wet mass earth movements, droughts, and extreme temperatures, respectively in order of importance, with floods and epidemics having become the most frequent ones during the last forty years (Figure 3).

Figure 1 – Natural disasters significantly increased in the world and OIC countries during 1970-2010.



OIC-LRRC: OIC Countries with Low Risk Reduction Capacity.

Source: "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

Table 1 – Natural disaster trends & distribution

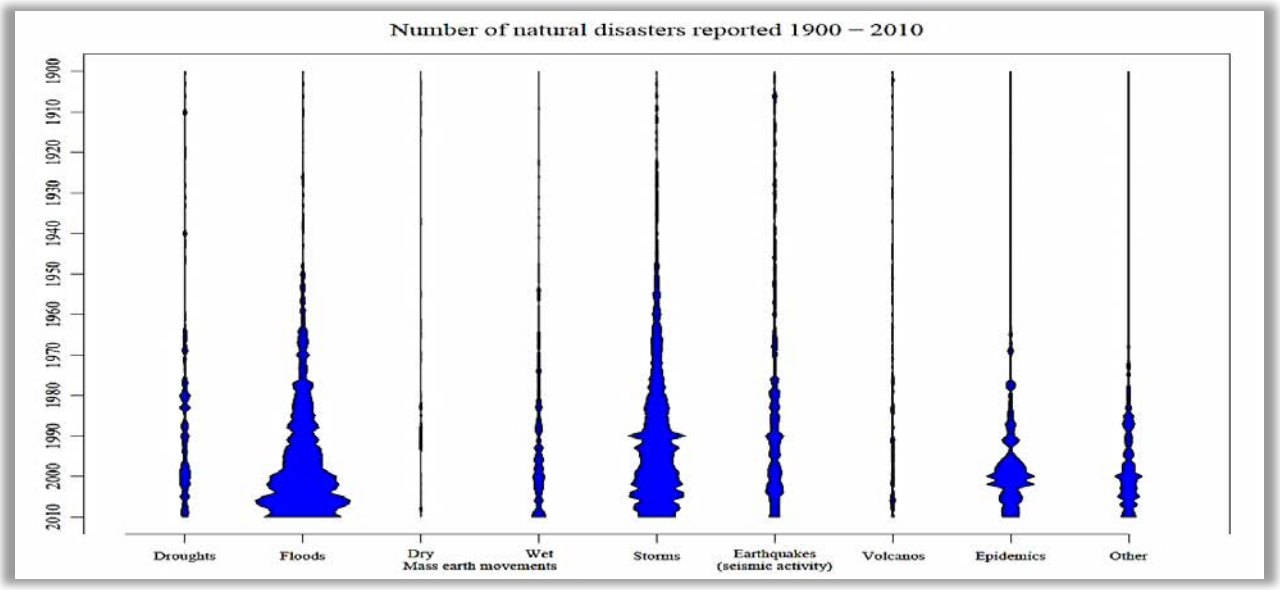
	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009
[A] ***Total number of natural disasters***					
World	*582*	*910*	*1,829*	*2,964*	*4,493*
Non-OIC countries	*448*	*711*	*1,409*	*2,283*	*3,315*
OIC countries	*134*	*199*	*420*	*681*	*1,178*
OIC % of world	*23%*	*23%*	*23%*	*23%*	*26%*
*OIC-LRRC % of OIC**	*46%*	*52%*	*59%*	*62%*	*64%*
*OIC-LI % of OIC***	*32%*	*37%*	*38%*	*42%*	*43%*
[A-1] ***Distribution of natural disasters within OIC (unweighted, per country per year)***					
Average	*0.24*	*0.36*	*0.76*	*1.24*	*2.14*
Standard deviation	*0.66*	*0.93*	*1.57*	*2.11*	*3.09*
[min , max]	*[0 , 6]*	*[0 , 12]*	*[0 , 12]*	*[0 , 15]*	*[0 , 19]*

* OIC-LRRC indicates OIC countries with low risk reduction capacity: Afghanistan, Bangladesh, Benin, Burkina Faso, Cameroon, Chad, Comoros, Côte d'Ivoire, Djibouti, Guinea, Guinea-Bissau, Iraq, Libya, Mali, Mauritania, Mozambique, Niger, Nigeria, Pakistan, Senegal, Sierra Leone, Somalia, Sudan, Tajikistan, Gabon, Gambia, Togo, Turkmenistan, Uganda, Yemen.

** OIC-LI indicates OIC countries with low income: Afghanistan, Bangladesh, Benin, Burkina Faso, Chad, Comoros, Gambia, Guinea, Guinea-Bissau, Kyrgyzstan, Mali, Mozambique, Niger, Sierra Leone, Somalia, Tajikistan, Togo, Uganda.

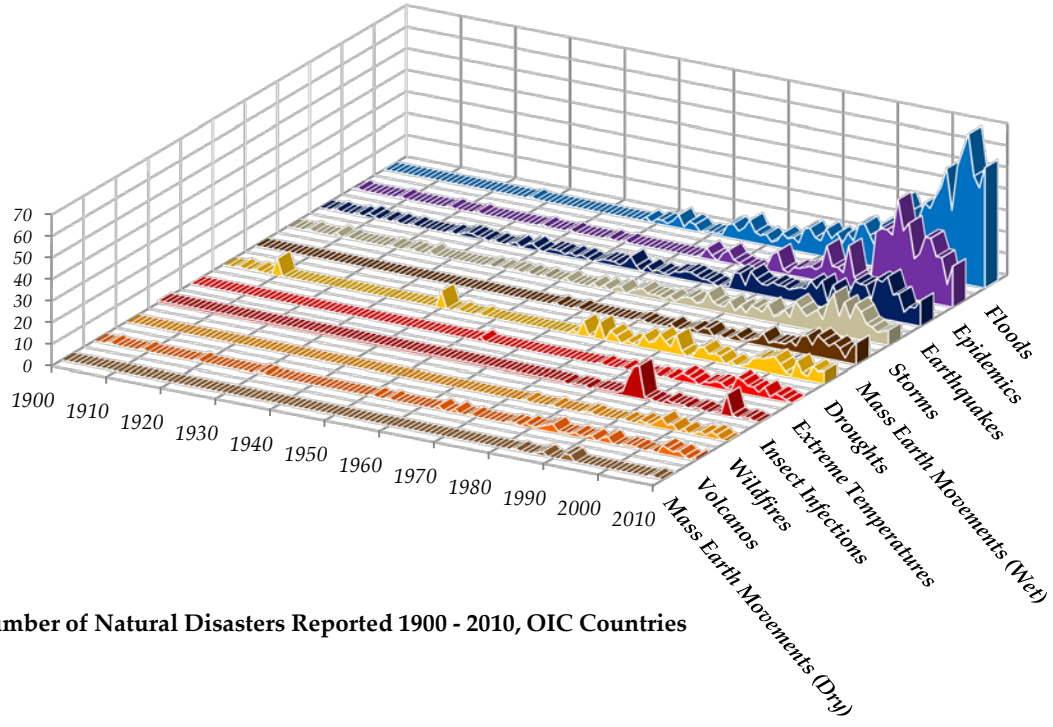
Source: "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

Figure 2 – Major drivers of the increasing trend in natural disasters in the world are floods, storms, and epidemics.



Source: "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

Figure 3 – Major drivers of the increasing trend in natural hazards among the OIC countries are floods, epidemics, earthquakes, storms, wet mass earth movements, droughts, and extreme temperatures.



Number of Natural Disasters Reported 1900 - 2010, OIC Countries

Source: Prepared based on the data from "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

While the OIC-level facts and figures regarding natural disasters are alarming on their own, the distribution within OIC reveals a more dramatic picture. In average, each OIC country experienced about 0.24 natural disasters each year in the 1960s, 0.36 in the 1970s, 0.76 in the 1980s, 1.24 in the 1990s, and 2.14 in the 2000s. To the extent that the averages could be misleading, it is important to note that among the OIC countries with reported natural disasters during the fifty years since 1960, the standard deviation around the reported averages was also increasing; from 0.66 in the 1960s to 3.09 in the 2000s. In other words, there has been a substantial and increasing disparity in terms of the number of natural disasters experienced by each country per year in each decade. Some OIC countries experienced substantially higher number of incidents relative to others and this discrepancy widened over time. As a result, the distance between the OIC country with the maximum number of natural disasters per year and the one with minimum number in each decade grew from about 6 disasters per year in the 1960s to 12 in the 1970s, 12 in the 1980s, 15 in the 1990s, and 19 in the 2000s (Table 1, [A-1]).

Such trends in the number of natural disasters among OIC countries are very concerning, especially that a high share of these incidences are increasingly happening in OIC countries with low capacities for disaster risk reduction (indicated by low DARA's Risk Reduction index[3]) or in low income OIC countries (identified by the World Bank). Out of total natural disasters occurring among OIC countries, about 46% in the 1960s, 52% in the 1970s, 59% in the 1980s, 62% in the 1990s, and 64% in the 2000s were in the OIC countries identified with low capacities for disaster risk reduction (OIC-LRRC), and about 32% in the 1960s, 37% in the 1970s, 38% in the 1980s, 42% in the 1990s, and 43% in the 2000s were in the low income OIC countries (Table 1, [A]).

2.2 Trends in Natural Disaster Impacts

Table 2 reports different aspects of the impacts of natural disasters in the world and OIC countries. In terms of the number of people non-fatally affected[4] (Table 2, [A]) the overall trend has been increasing in OIC countries from 50 million people in the 1960s to a high of 220 million in the 1980s and declining to 175 million in the 2000s. Even though the share of OIC countries in the total non-fatally affected people in the world has been declining, the magnitude of people affected is still undeniably high.

Within OIC, the majority of non-fatal disaster impacts during 1960-2009 took place in countries that are identified both as low income (OIC-LI) and with low capacities for disaster risk reduction (OIC-LRRC); i.e. in the most vulnerable of all OIC countries. The OIC member countries with low capacities for risk reduction have suffered the most; in average about 88% of people non-fatally affected by natural disasters within OIC have been in the OIC-LRRC member countries during 1960-2009. The more vulnerable low income OIC countries have had an average of 72% share in non-fatally affected people among OIC countries during the fifty years since 1960. Only during 2000-2009, of the 175 million non-fatally affected people among OIC countries, 154 million were in OIC-LRRC and 128 million in OIC-LI countries. Of the 18 OIC countries identified as OIC-LI, only one is not identified as OIC-LRRC.[5] There is clearly no doubt that there is a real need for cooperation among all OIC countries, with assistance from outside, to offer a hand to the people and governments in these countries to reduce their vulnerabilities to natural disasters, and save lives. (Table 2, [A])

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[3] DARA is an independent organization committed to improving the quality and effectiveness of aid for vulnerable populations suffering from conflict, disasters and climate change. This index assesses capacities and conditions for effective risk management policies, strategies and activities for reducing the impact of hazards on vulnerable local communities.

[4] Affected, made homeless, and/or injured.

[5] Only Kyrgyzstan in the group of OIC-LI is not identified as OIC-LRRC.

The average number of people non-fatally impacted by disasters per country per year across the five decades since the 1960 (Table 2, [A-1]) has been increasing fast. In average in each OIC country about 90,000 were non-fatally affected per year in the 1960s; this number increased to 320,000 in the 2000s. At the same time, while the maximum number of people affected in a country in the 1960s was 16 million people, in the 2000s this number was about 37 million people.

Table 2 – Impacts of natural disasters

	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009
[A] ***Population non-fatally affected (millions)***					
World	*200*	*544*	*1,242*	*2,023*	*2,279*
OIC countries	*50*	*94*	*220*	*193*	*175*
OIC % of World	*25%*	*17%*	*18%*	*10%*	*8%*
OIC-LRRC % of OIC	*92%*	*92%*	*96%*	*71%*	*88%*
OIC-LI % of OIC	*79%*	*70%*	*85%*	*53%*	*73%*
[A-1] ***Distribution within OIC (unweighted, millions)***					
Average per country per year	*0.09*	*0.17*	*0.40*	*0.35*	*0.32*
Standard deviation	*0.97*	*1.87*	*3.27*	*2.30*	*2.03*
[min , max]	*[0 , 16]*	*[0 , 38]*	*[0 , 56]*	*[0 , 37]*	*[0 , 37]*
[B] ***Population fatally affected (thousands)***					
World	*1,750*	*987*	*794*	*525*	*838*
OIC countries	*169*	*414*	*316*	*296*	*340*
OIC % of World	*10%*	*42%*	*40%*	*56%*	*41%*
OIC-LRRC % of OIC	*69%*	*89%*	*96%*	*75%*	*37%*
OIC-LI % of OIC	*62%*	*87%*	*45%*	*65%*	*11%*
[B-1] ***Distribution within OIC (unweighted, thousands)***					
Average per country per year	*0.31*	*0.75*	*0.57*	*0.54*	*0.62*
Standard deviation	*2.66*	*13.64*	*7.71*	*6.36*	*7.86*
[min , max]	*[0 , 49]*	*[0 , 300]*	*[0 , 150]*	*[0 , 142]*	*[0 , 167]*
[C] ***Cost of damages (current prices, million dollars)***					
World	*18,446*	*53,847*	*187,980*	*699,539*	*891,227*
OIC countries	*1,118*	*3,277*	*15,963*	*67,003*	*45,363*
OIC % World	*6%*	*6%*	*9%*	*10%*	*5%*
OIC-LRRC % of OIC	*64%*	*80%*	*44%*	*17%*	*36%*
OIC-LI % of OIC	*52%*	*30%*	*24%*	*13%*	*17%*
[C-1] ***Distribution within OIC (unweighted, million dollars)***					
Average per country per year	*2.2*	*5.6*	*29.0*	*122*	*83*
Standard deviation	*14.8*	*48.9*	*286.5*	*1,068.7*	*480.6*
[min , max]	*[0 , 201]*	*[0 , 662]*	*[0 , 5,200]*	*[0 , 21,000]*	*[0 , 5,230]*

Source: "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

Sadly, similar patterns are also observed with regard to fatal impacts of natural disasters within OIC (Table 2, [B]). Over the fifty years since 1960, more than 1,500,000 people were killed by natural disasters in OIC countries. While the decadal number of people killed by natural disasters was declining in the world, the OIC countries experienced an opposite trend. As a result, the share of OIC countries in total number of deaths by natural disaster in the world increased from 10% in the 1960s to more than 40% in the 2000s. Within OIC, a high majority of the people who lost their lives due to natural disaster were living in countries identified as both OIC-LRRC and OIC-LI countries, while increasingly more are getting killed in non-LRRC and non-LI coutnries.

The trend in financial cost of damages due to natural disasters in OIC countries is also very concerning (Table 2, [C]). The average total cost of damages across all OIC countries has followed a steep trend. It rose from just more than one billion dollars in the 1960s to almost 50 billion dollars in the 2000s. Despite the decreasing trend, the low income countries in OIC have in average endured close to 30% of these costs. It is to be noted that the decreasing trend in the share of OIC-LI in total financial damages caused by natural disasters in OIC over the last fifty years is concealing a bleaker reality: 52% of about 1.2 billion dollars in the 1960s versus 17% of about 50 billion dollars in the 2000s. Even including the inflation rate over these years is not going to substantially change this comparison.[6] The average financial cost of natural disaster born by a country in year within each decade has also been increasing fast. In fact, the maximum estimated cost of natural disaster born by an OIC country within any year in the 2000s is about 26 times that of the 1960s.

The worrying trends in frequency and magnitude of impacts of natural disasters in OIC countries call for action. It is crucial for the purpose of risk management to know whether the difference in frequency of natural disasters across countries is due to being relatively more prone to higher number of natural hazards, which is beyond control, or due to lack of capacities and conditions for reducing risks and vulnerabilities that lead natural hazards to become disasters, which can be improved. The next section addresses this matter for OIC countries.

3 DISASTER RISK & ITS DRIVERS

Disaster or its risk arises when hazards (such as flood, storms, droughts, etc.) interact with physical, social, economic and environmental vulnerabilities and considerably impact systems societies rely on. The Earth is shaped by a wide variety of natural processes, many of which can occur in ways that can pose a threat to such systems and hence form a natural hazard. Natural hazards generally cause death, injury, relocation and destruction of or damage to houses, agricultural land, buildings, infrastructure and communities. However, these impacts substantially escalate when hazards impact a vulnerable system, in which case the natural hazard becomes a natural catastrophe or a natural disaster.

The effects of a natural disaster on an area or community depend on many factors. These include those related to the event itself – its magnitude and frequency – as well as those related to the community: its size and density of population and assets, how prepared the affected population is, and their economic resources to either mitigate a potential disaster and/or recover afterwards.

Risk of disaster is defined here in terms of the potential number of people killed as a result of natural hazards interacting with vulnerable conditions over a given period of time.[7] Specifically, natural disaster risk (NDR) is

[6] $1 in the 1960 was worth about $7 in 2009. In other words, $1.2 billion in 1960 was equivalent to about $8.4 billion in 2009.

[7] Please see the 2009 UNISDR Terminology on Disaster Risk Reduction, United Nations. (Accessible via http://www.unisdr.org/we/inform/terminology.)

modeled here as a function of risks induced by being prone to natural hazards (NHR), the size of population (Pop), and risks induced by vulnerabilities (VR) according to the following equation (UNDP, 2004): $NDR = NHR \times Pop \times VR$.

In the absence of any natural hazard, there would be no risk of a disaster. At the same time, if a natural hazard occurs in an area with no population, the disaster risk would also be zero. Given the occurrence of natural hazards and the population, it is the vulnerabilities that determine the scale of impacts; lower levels of vulnerability induce milder impacts.[8]

Assessing the risks induced by being prone to hazards and the risks induced by vulnerabilities are integral parts of disaster risk assessment. A geographic region that is more prone to natural hazards face higher risk of disasters. At the same time, for a similar hazard happening in two different regions, the entailed risk of a disaster (total number of people potentially impacted) depends on the vulnerabilities of each region. The "vulnerability" in this sense is defined as the physical, social, economic, and environmental capacities and conditions of each country for devising effective risk management policies and strategies, and implementing measures for reducing the impact of hazards on vulnerable local communities (ISDR, 2011), which determine the scale of damage from the impact of a given hazard (UNDP, 2004). Therefore, in assessing the risk of natural disasters for any geographic division (e.g., a country or a group of countries), especially with the purpose of reducing risks, it is necessary to take account of the risks induced by vulnerabilities as well as those induced by being prone to natural hazards.

The current report uses the EM-DAT database[9], the only global disaster database that covers all types of disaster and many countries over long period of time and is freely available, to assess the three types of risks: disaster risks, and its two sub-components – the risk of being prone to natural hazards and risk induced by vulnerabilities. The Centre for Research on the Epidemiology of Disaster (CRED) maintains the EM-DAT database at the University of Louvain in Belgium. Events that conform to a consistent definition of a disaster are included in the database. Such events meet at least one of the following criteria: 10 or more people reported killed; 100 people reported affected; a call for international assistance; and/or a declaration of a state of emergency. These criteria exclude smaller events which are not considered disasters here. The low number of required deaths for an event to be considered a disaster guaranties that unavailability of information on frequency and magnitude of natural hazards does not severely bias the calculations here.[10]

The following sub-sections assess the three types of risk separately for each OIC country. Section 3.1 assesses the manifested disaster risks; that is, based on the number of people actually impacted. By preparing a Natural Disaster Risk Index, this section identifies the member countries that are faced with higher risks of natural disaster. Section 3.2 assesses the natural disaster risks induced solely by being prone to natural hazards, following the all-hazard approach[11]. This section essentially measures the would-be impact of disasters in OIC countries if their vulnerabilities were at the lower levels of countries with high capacity for risk reduction

[8] This is an important point because, for instance, incidences of drought (per occurrence and per unit of population) rarely impact the population in the developed countries but severely impact in the developing countries, due to their higher levels of vulnerability.

[9] EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain - Brussels - Belgium.

[10] The EM-DAT database does not provide information on frequency of natural hazards (some of which can become natural disasters) and the magnitude of events that result in disasters, which are necessary for more precise calculation of risks.

[11] That takes all different types of natural hazards into consideration.

(HRRC)[12]. The ranking of countries based on the assessments in this section illustrates which OIC countries are more prone to natural hazards. An essential step in doing so is to make the comparison of different types of natural disasters possible. While it is often said that a country with, for instance, one disastrous incidence of flood and one of mass earth movement during a year has experienced two natural disasters, since these two types of disasters have different innate potentials for impacting the surrounding environment,[13] it is necessary to make them comparable. For each type of disaster, the average impact (total affected people, or deaths, or damages)[14] per occurrence of disaster and per million of population in HRRC countries can be used to convert the different types of natural disaster in OIC countries into equivalent terms. To the extent that the HRRC countries have lower vulnerabilities than OIC countries, this conversion is independent from the internal vulnerabilities of each OIC country, and therefore indicates the would-be total impact if each OIC countries had vulnerabilities at the level of the HRRC countries. Section 3.3 combines the results of the preceding two sections to assess the vulnerabilities of countries. Calculation of the two subcomponents (or drivers) of disaster risk, especially the risks induced by vulnerabilities, will help to understand the reasons behind high risk of disaster in some countries and identify areas of focus for the purpose of risk reduction.

3.1 Natural Disaster Risks

Figure 4 ranks the OIC countries based on the disaster risks, the measurement of which is explained in Information Box 1. This measure essentially ranks the countries according to the number of people killed by natural disasters in each country during 1970-2009. Given the unit of measurement, the ratios between countries' values have a clear meaning: relative risks.

Bangladesh tops the list with more than 528 thousand deaths reported during the 40 years from 1970 to 2009, followed by Indonesia (195,894 deaths) and Sudan (160,704). Other than these three countries the number of deaths due to natural disasters in Iran, Mozambique, Pakistan, Turkey, and Somalia were all above the OIC average (24,816 deaths).

The first look at this graph (Figure 4) makes one to think that the impact of natural disasters in terms of people killed is only serious in a handful of OIC countries; it is not correct. It is important to note the average deaths from natural disasters during the same period in the 18 countries that form the top 10% of the ranking of countries based on capacities for risk reduction (DARA's Risk Reduction Index) is 3,067 with the total of 55,213 deaths. In other words, during the forty years since 1970 only in the top 18 countries in the ranking in Figure 4 with highest number of deaths, about 1,289,749 people could have been saved if these countries had the same level of exposure to natural hazards and vulnerabilities as those of the top 10% HRRC countries.[15] This number is more than the average population of Gambia, Guyana, Djibouti, Surinam, Comoros, Brunei, Bahrain, or Maldives during 1970-2009, all of which are among the least risky countries according to Figure 4.

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[12] The countries considered here are the following countries that form the top decile of DARA's Risk Reduction Index: Australia, Austria, Canada, Denmark, Estonia, Finland, France, Germany, Hungry, Iceland, Ireland, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and United Kingdom.

[13] For instance, in average, floods cause more damage and affect higher number of people than mass earth movements.

[14] In this study, the number of deaths is used since it is the most precise measure of impacts compared to total affected people or the size of damages.

[15] Taking into account the differences in frequency of natural hazards and populations between the two groups of countries will not change this result substantially, resulting in 1,136,926 saved lives in the top 18 OIC countries in Figure 4.

This raises the question that to what extent the deaths shown in Figure 4 are driven by exposure to natural hazards and vulnerabilities. Are the countries that seem to be among the safest during the forty years since 1970 according to Figure 4, placed there due to not being as exposed to natural hazards compared to others? Or is it because they are much less vulnerable but have similar physical exposure to natural hazards? Answering this question is critical in the sense that if the reason is the absence of vulnerabilities in spite of similar exposures, then it is really only the handful of countries with the highest risks shown in Figure 4 that should be concerned and the rest of the OIC countries could focus their attention on any areas other than risks of disasters. To address these questions, the next two sections will decompose the disaster risk into risks driven generated by being prone to natural hazards and risks induced by vulnerabilities.

Information Box 1 – Calculation of Disaster Risk

Disaster risk for a country (NDR_c) is measured according to the following formula:

$$\boldsymbol{NDR_c = \sum_h N_{ch} \times \frac{\overline{Pop}_c}{1,000,000} \times \bar{a}_{ch}},$$

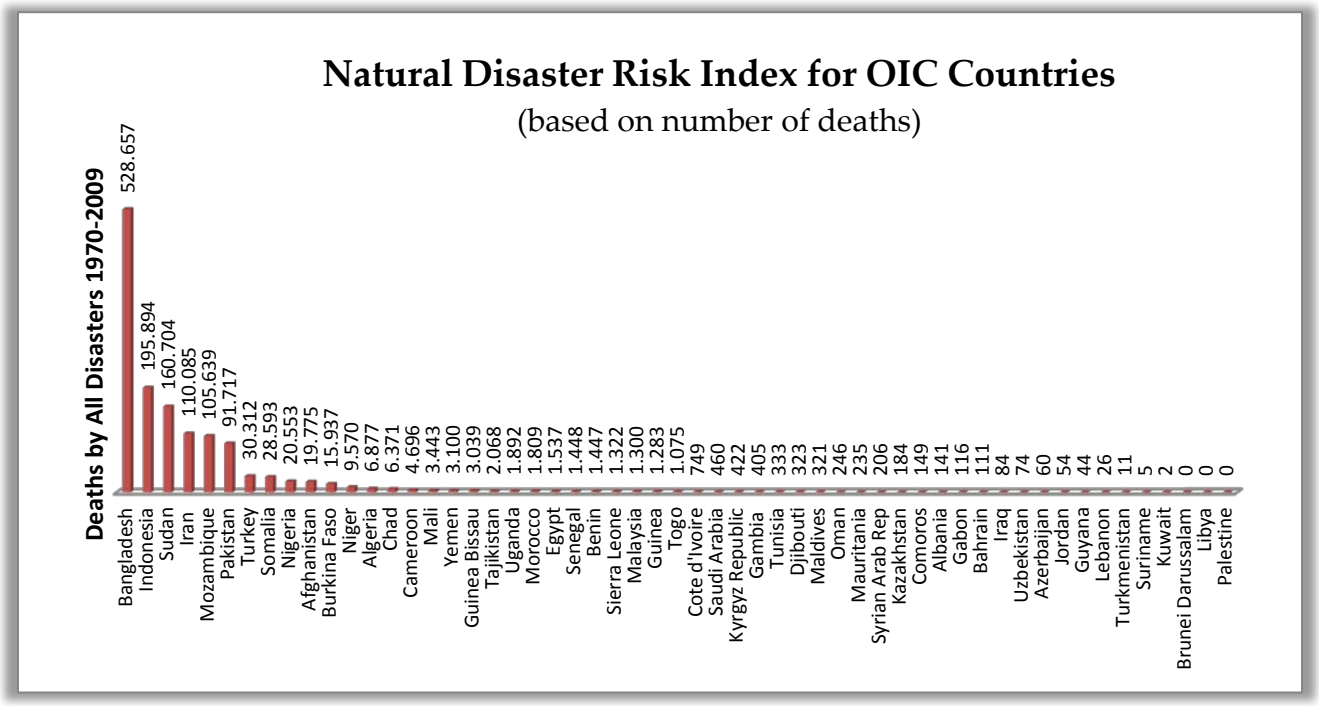
where summation is over different types of natural hazard (h), N_{ch} indicates the number of natural hazards of type h in country c during 1970-2010, $\overline{Pop}_c$ is the average population of country c during the same period, and $\bar{a}_{ch}$ is the average number of people killed per occurrence of natural hazard of type h per 1,000,000 population during 1970-2009. Essentially, this formula measures how many people were fatally affected by all types of hazard during the period:

$$\bar{a}_{ch} = \frac{A_{ch}}{N_{ch} \times \overline{Pop}_c / 1,000,000} \Rightarrow \boldsymbol{DR_c = \sum_h A_{ch}},$$

where A_{ch} is the total number of fatally affected people in country c by natural hazards of type h during 1970-2009.

Ideally, it would have been appropriate to include for each incidence of natural hazard its magnitude and its impact per occurrence per million of population given its magnitude. However, the EM-DAT database does not provide any information on the magnitude of each event. Therefore, acknowledging the shortcoming imposed by the lack of access to needed information and as a way to address this shortcoming, the manifested impacts and the number of natural disasters instead of the number of natural hazards are used to calculate the risk. This approach guaranties that only natural hazards with magnitudes beyond the thresholds that make them potentially disastrous are included and their magnitudes are accounted for in a way in terms of their impacts.

Figure 4 – Natural Disaster Risk Index for OIC countries based on the number deaths by all disasters during 1970-2009: Bangladesh, Indonesia, Sudan, Iran, Mozambique, Pakistan, Turkey, and Somalia faced higher risks than the average of OIC (24,816 deaths).



Source: Prepared based on the data from "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

3.2 Natural Disaster Risks Induced by Exposure to Natural Hazards

To figure out the extent to which natural disaster tolls are solely due to being prone to natural hazards, it is necessary to take account of vulnerabilities and take out their effect. This is done here by answering the following question: what would have been the toll of disasters in an OIC country if it had had vulnerabilities similar to a reference group of countries that are deemed to have lower vulnerabilities than majority of OIC countries? This question can be addressed by recalculating the disaster risk using tolls per occurrence per million people (α's) that belong to the reference group of countries rather the country itself, as explained in Information Box 2. The reference group is made up of the top 10% countries with highest capacities and conditions for risk reduction (HRRC) based on DARA's Risk Reduction Index.[16]

Figure 5 ranks the countries based on disaster risks induced solely by being prone to natural hazards, in the sense that their own vulnerabilities are excluded from calculations. Of the total 1,364,904 deaths due to natural disasters in OIC countries, only 227,978 (17%) seem to be due to being prone to natural hazards. In other words, if all OIC countries had lower vulnerabilities similar to the reference group, about 1,136,926 deaths would have been saved during 1970-2009. In Bangladesh, while the actual number of deaths due to natural disasters was about 528,627 (Figure 4), in the absence of vulnerabilities that Bangladesh is suffering from, the toll of natural

[16] Australia, Austria, Canada, Denmark, Estonia, Finland, France, Germany, Hungry, Iceland, Ireland, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and United Kingdom.

disasters on lives would have become about 85,040 (Figure 5). Bangladesh, Pakistan, Indonesia, Turkey, Nigeria, Egypt, and Afghanistan faced higher natural hazard risks than the average of OIC (4,145 deaths).

The changes in the order of ranking between Figures 4 and 5 are also of interest. While Bangladesh tops the rankings in both, some countries have moved to the left while others to the right. The left-movers are the countries that face higher risks, when only taking the exposure to natural hazards into account, and the right-movers vice versa. For instance, while Iran has an overall natural disaster risk ranking of 4 out of 55 OIC countries covered[17] during 1970-2009, taking into account only exposure to natural hazards it has a ranking of 8.

Information Box 2 – Calculation of Disaster Risk Induced by Being Prone to Natural Hazards

Natural Hazard risk for a country (NHR_c) is measured according to the following formula:

$$\boldsymbol{NHR_c = \sum_h N_{ch} \times \frac{\overline{Pop_c}}{1,000,000} \times \tilde{a}_{rh}},$$

where summation is over different types of natural hazard (h), N_{ch} indicates the number of natural hazards of type h in country c during 1970-2010, $\overline{Pop_c}$ is the average population of country c during the same period, and $\tilde{a}_{rh}$ is the average number of people killed per occurrence of natural hazard of type h per 1,000,000 population during 1970-2009 in a reference group of countries that are deemed to have lower vulnerabilities than the majority of the OIC countries: $\tilde{a}_{rh} < \bar{a}_{ch}$ for all disaster types. Essentially, this formula measures how many people would have been fatally affected by all types of hazard during the period had they had vulnerabilities at the levels of the average of the reference group – i.e., only because of the extent of their exposure to natural hazards – inasmuch as such a counterfactual can be approximated.

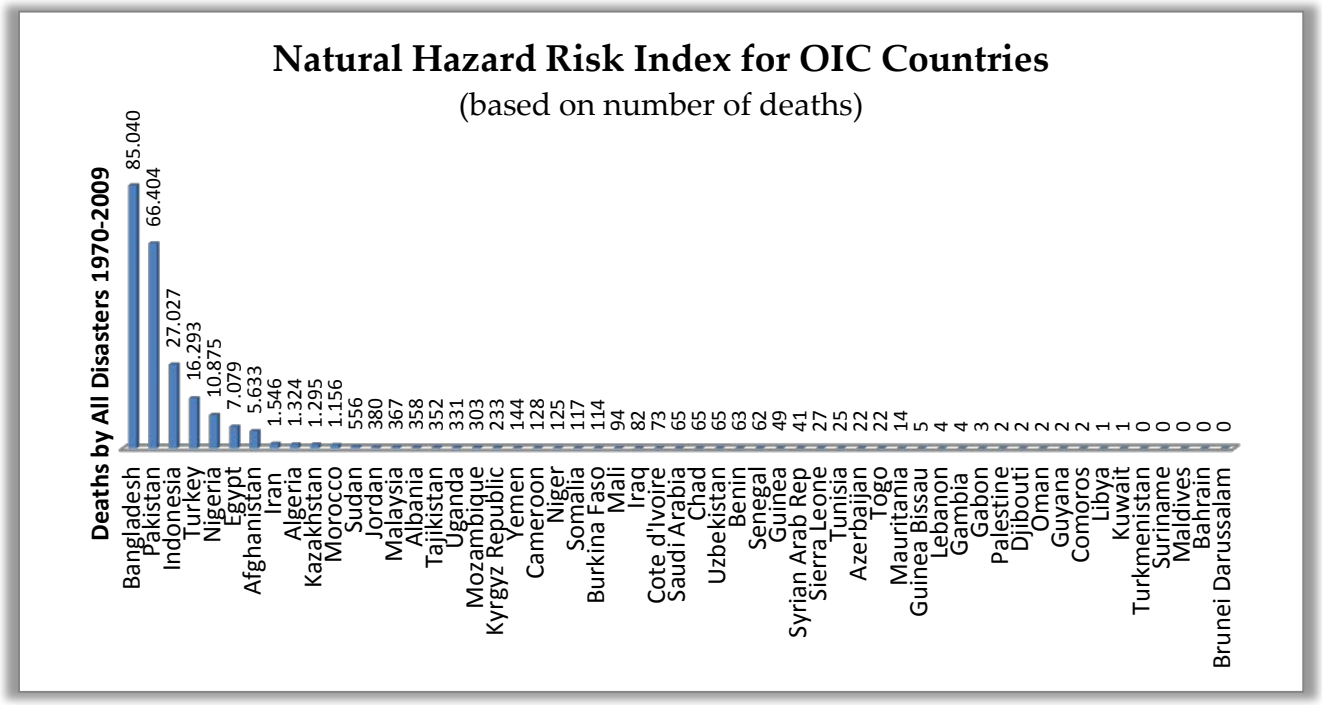
$$\boldsymbol{\tilde{a}_{rh} = \frac{A_{rh}}{N_{rh} \times \overline{Pop}_r / 1,000,000}},$$

where A_{rh} is the total number of fatally affected people by natural hazards of type h, N_{rh} is the total number of hazards of type h, and $\overline{Pop_r}$ is the average total population in the reference countries during 1970-2009.

The reference group is made up of the top 10% countries with highest levels of capacities and conditions for risk reduction (HRRC), based on DARA's Risk Reduction Index. These countries in decreasing order of risk reduction capacity are: Switzerland, Sweden, Denmark, Ireland, Norway, Finland, United Kingdom, Austria, Spain, Estonia, Iceland, Canada, Germany, Australia, New Zealand, France, Hungary, and the Netherlands.

[17] Data for Qatar and UAE is not available.

Figure 5 – Natural Hazard Risk Index for OIC countries based on the would-be number deaths by all disasters during 1970-2009 had all countries have similar and lower vulnerabilities: Bangladesh, Pakistan, Indonesia, Turkey, Nigeria, Egypt, and Afghanistan faced higher risks than the average of OIC (4,145 deaths).



Source: Prepared based on the data from "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

3.3 Natural Disaster Risks Induced by Vulnerabilities

The ratio between *NDR* and *NHR* indicates the impact of vulnerabilities, which amplify the tolls taken by natural hazards and lead them toward becoming disasters. Figure 6 provides a ranking of OIC countries based on their vulnerabilities. Three messages clearly rise to the surface: firstly, other than a handful of countries on the right of the graph the rest are faced with considerable vulnerabilities (values of higher than one); secondly, some countries are faced with staggeringly high levels of vulnerability (the countries on the left); and thirdly, the ranking of countries in Figure 6 based on vulnerabilities is quite different from the rankings in Figures 4 and 5.

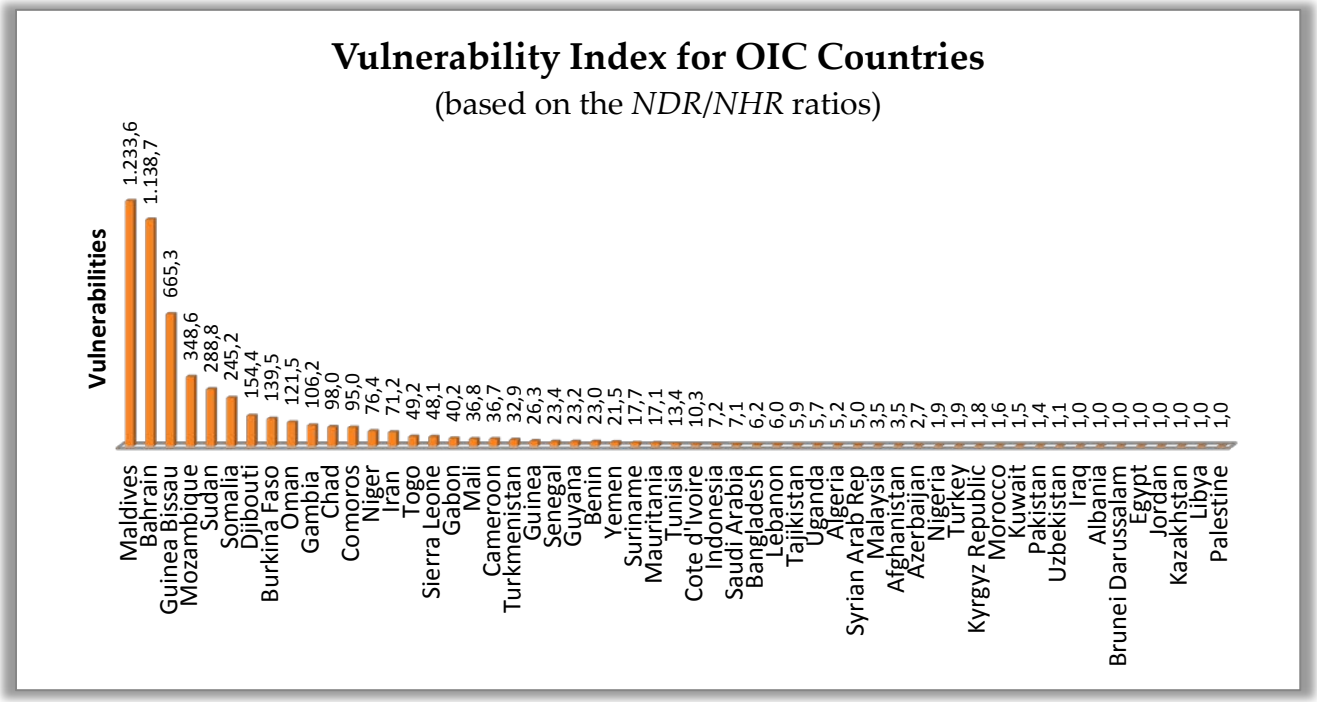
Other than Iraq, Albania, Brunei, Egypt, Jordan, Kazakhstan, Libya, and Palestine, the rest of the 47 OIC countries covered in this review are facing vulnerabilities that amplify the death tolls of natural hazards by a factor of 1.1 in the case of Uzbekistan up to a factor of 1,234 in the case of Maldives. In the case of Bangladesh, which is identified as one of the countries with very high risk of natural disasters and topped the rankings in Figures 4 and 5, the vulnerabilities multiply the death tolls of natural disasters by a factor of 6.2 compared to 1,139 for Bahrain, which was among the least natural disaster risk laden countries according to Figure 5.

While based on the ranking in Figures 4 it seemed like natural disaster risk is only a matter of concern in a handful of OIC countries and not for the others, combination of Figures 5 and 6 indicate that in fact if it does seem so, it is only because the time has not arrived yet. The time will hopefully never arrive, but any

governments among the OIC countries cannot afford the consequences if it arrives, because then the staggering levels of vulnerabilities will substantially put their populations at fatal risk.

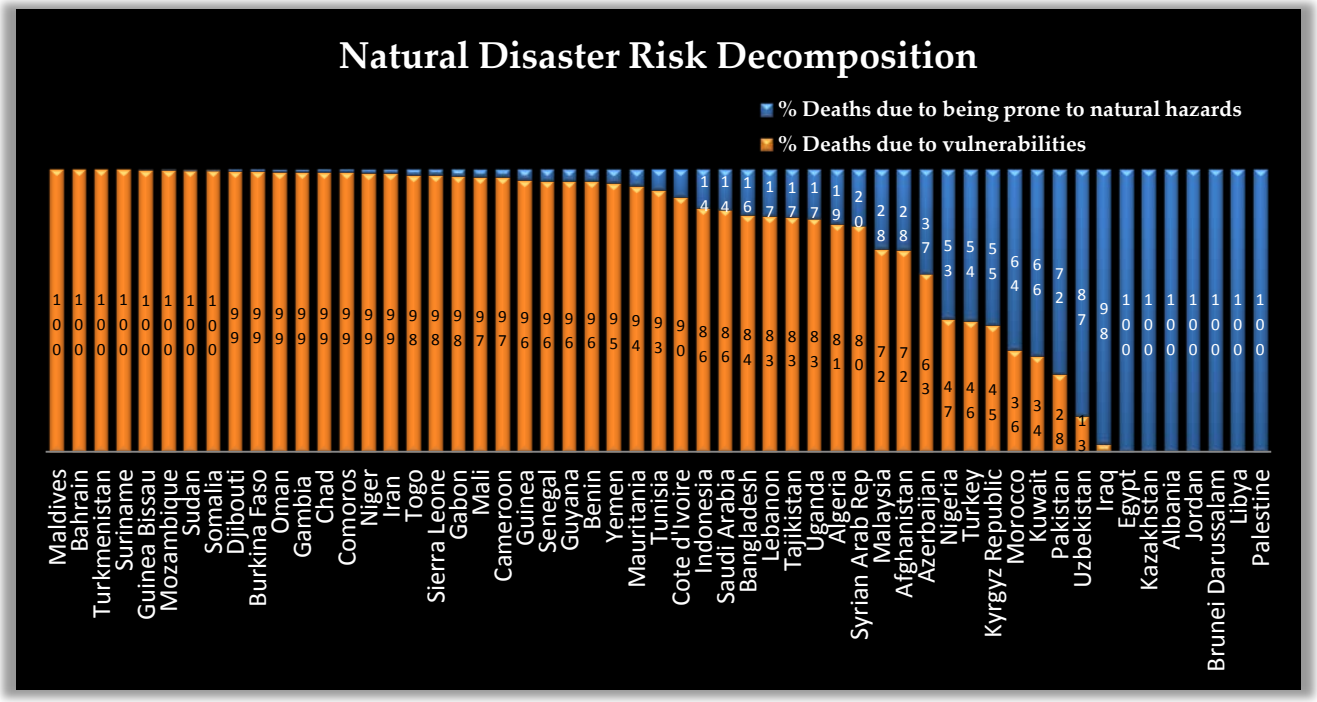
It is very important to note that the countries with high vulnerabilities are not necessarily the ones who have already suffered the most in terms of the absolute number of death tolls. As highlighted before, a country like Bahrain with only 111 deaths over the forty years since 1970 – one of the lowest levels among OIC countries – can suffer the most given its level of vulnerabilities – that is second only to Maldives – if the pattern of occurrences changes not in favour of this country. This argument not only applies to Bahrain but to all of the 47 OIC countries with a vulnerability index of higher than one. This message is clearly illustrated in Figure 7, which decomposes the natural disaster risks based on the share of natural hazard risks (blue) and vulnerabilities (orange). In majority of countries (30 out of 55), the risks induced by vulnerabilities forms more than 50% of the natural disaster risks.

Figure 6 – Vulnerability Index for OIC countries based on the ration of Natural Disaster Risk Index to Natural Hazard Risk Index: 45 out of 55 OIC countries are facing staggeringly high vulnerabilities.



Source: Prepared based on the data from "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

Figure 7 – Decomposition of Natural Disaster Risk for OIC: In 40 out of 55 OIC countries vulnerabilities, rather than being prone to natural hazards, is the main cause (more than 50%) of death tolls in natural disasters.



Source: Prepared based on the data from "EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium."

4 CONCLUSION

For a similar hazard happening in two different regions, the entailed risk depends on the vulnerabilities of the two regions. In other words, the capacities and conditions of each region for devising effective risk management policies and strategies, and implementing measures for reducing the impact of hazards on vulnerable local communities. Accurate, well-in-advance prediction of the time, place, and intensity of natural disasters may be almost impossible. Nevertheless, their long term behaviour is well-known and is being continuously measured and modelled. While the location, severity, and frequency of hazards put a limit to reduction in vulnerability, many governments have yet to find effective ways of reducing and managing the risks they pose, or are procrastinating investments in this regard. The consequence has been and *will be* nothing but natural hazards increasingly becoming disaster risks.

This report clearly illustrated that while different OIC countries suffer from different types of natural hazards, with various frequencies and magnitudes, it is in fact their vulnerability to risks, or the lack of conditions and capacities for properly managing and reducing the risk of disasters, that is the main culprit. It was shown that in majority of countries (30 out of 55), the risks induced by vulnerabilities form more than 50% of the natural disaster risks. Moreover, it was explained that almost 100% of natural disasters and their impacts (fatal, non-fatal, and financial) in low income OIC countries (OIC-LI) during 1960-2009 took place in countries that are also identified as OIC countries with low capacities for risk reduction (OIC-LRRC). There is clearly no doubt that

there is a real need for cooperation among all OIC countries, with assistance from outside, to offer a hand to the people and governments in such countries to reduce their vulnerabilities to natural disasters, and save lives. Investments in response mechanisms and capacities are quite important. However, effective risk management of disasters requires, and involves, more than just a response mechanism. Reducing the risk of disasters requires viewing disasters as major barriers to sustainable socio-economic development, and managing the risks through investing in and enhancing the capacities for preserving the environment and ecosystems, eradicating poverty and inequality, appropriate rural and urban development, and improving the quality of governance, all of which contribute to vulnerabilities. Viewing risk of disasters as barriers to sustainable development necessitates the inclusion of a disaster risk management strategy as an indispensable and integral part of the overall development strategy, which has its roots in environmentally friendly socio-economic and political development and at the same time serves as the guardian of all developmental efforts and investments.

The quality of a country's capacities and conditions for disaster management appears to have a significant influence on the underlying drivers of risk. When similar numbers of people are affected by hazards of similar severity, wealthier and poorer countries generally experience radically different losses and impacts (Anbarci et al., 2005; Kahn, 2005; Kellenberg and Mobarak, 2008; UNISDR, 2009; Keefer et al., 2011). Whereas relative wealth is a key determinant, other factors such as the strength of democracy (Kahn, 2005; Keefer et al., 2011), inequality (Abranci et al., 2005; Kahn, 2005; UNISDR, 2009), corruption (Escaleras et al., 2007; Keefer et al., 2011), and voice and accountability (UNISDR, 2009), also play roles in the social construction of risk. Countries with higher income, lower inequality, lower corruption, and more democratic regimes have been found to experience less casualties from disasters. Drivers of inadequate capacities for risk management include, among others, badly planned and managed urban and regional development, the degradation of hazard-regulating ecosystems such as wetlands, mangroves and forests, increasing poverty and inequality, and lack of democracy and rule of law (i.e., lack of effective governance). These drivers interact through multiple feedback loops and together translate hazards into disaster risk.

Quality of governance – the actions, processes, traditions and institutions by which authority is exercised and decisions are taken and implemented – is the key factor in understanding the vulnerabilities. Although the causes and impacts of natural hazards are increasingly well understood, and despite almost 20 years of internationally orchestrated awareness and education programmes by various international organisations such as the United Nations and World Bank, the escalating losses associated with natural hazards indicate that the right institutional environment and appropriate governance is still lacking.

Most OIC countries still rely on the traditional disaster management structures that are mainly international post-disaster response and relief agencies, and lack the capacities for effective risk reduction. This grim fact is reflected in the poor risk reduction capabilities indicated by the Risk Reduction Index. According to the latest release in 2011 (GAR 2011), about 75% of the OIC member countries are identified as having low or extremely low capacities for effective risk management policies, strategies and activities for reducing the impact of natural hazards on vulnerable local communities. On the other hand, individual efforts particularly for mitigation and preparedness have so far lacked the systemic facilitation and enhancement of collective disaster risk reduction capacities among the member countries as an effective mechanism for assisting the low income member countries that lack the required capacities and are the most at the risk of human and capital losses due to disasters.

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