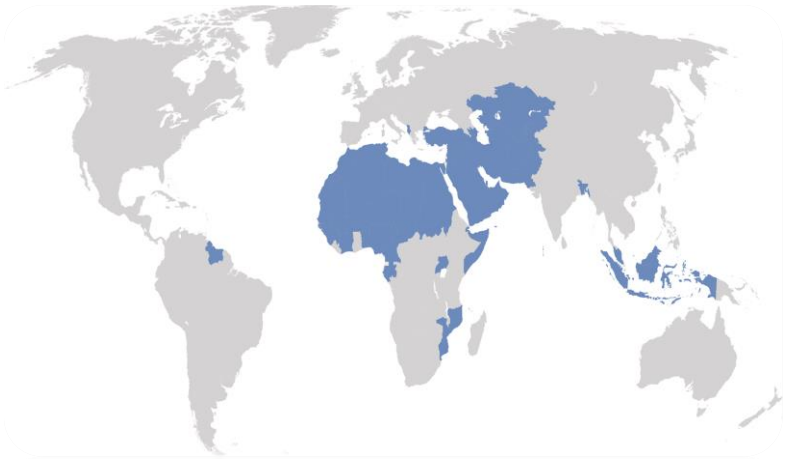

OIC ENVIRONMENT REPORT 2017

ORGANISATION OF
ISLAMIC COOPERATION

STATISTICAL, ECONOMIC AND
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FOR ISLAMIC COUNTRIES

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Acronyms

EAP	East Asia and Pacific
ECA	Europe and Central Asia
EPI	Environmental Performance Index
GDP	Gross Domestic Product
GHG	Greenhouse Gases
HLP	High Level Panel
ICT	Information and Communication Technology
IDP	Internally Displaced People
IEAG	Independent Expert Advisory Group
IEO	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean
MDGs	Millennium Development Goals
MENA	Middle East and North Africa
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OIC	Organization of Islamic Cooperation
SA	South Asia
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UNCCD	UN Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNOCHA	UN Office for the Coordination of Humanitarian Affairs
WHO	World Health Organization

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Foreword

Allah, the Almighty, says in the Holy Quran (20:53-54): “He Who has spread out the earth for you and threaded roads for you therein and has sent down water from the sky: With it have We brought forth diverse kinds of vegetation. Eat and pasture your cattle; verily, in this are signs for men endued with understanding.” Indeed, Allah has created the universe and its various resources for the use and welfare of mankind. While benefitting from these resources, however, human beings must not cause degradation and over-exploitation. An abundant number of verses of the Holy Quran and sayings of the Holy Prophet (PBUH) refer to just and sustainable use of natural resources while avoiding extravagance and wastefulness. As believers, therefore, Muslims are duty bound to attain higher level of environmental protection and conserve natural resources.

Though environmental changes are under way since centuries, their speed and intensity has increased tremendously in the recent times. For example, abnormal weather conditions and thus the natural disasters such as cyclones, floods, and droughts are a common occurrence today, causing wide spread destruction, deaths and displacement across the world. There are many scientific evidences which show that these rapid changes are mainly caused by the anthropogenic (human) activities related to industrial production, agriculture and transportation.

Despite the fact that generally whole world is and will be affected by the environmental degradation, its negative impacts are and will be more pronounced in developing countries. Being a substantial part of the developing world, OIC member countries are vulnerable to various environmental challenges. According to the latest findings of Environmental Vulnerability Index, majority of the OIC countries is above medium level of environmental vulnerability. Indeed, higher environmental vulnerability of OIC members emanates from their geographic locations, high dependence on climate sensitive natural resources and low adaptive capacities. Existing climate models predict worsening of environmental and climatic conditions in many OIC countries; posing serious social and economic consequences especially for the disadvantaged and poor populations.

Against this backdrop, this first-ever comprehensive OIC Environmental Report offers an in-depth analysis of the state of environment in OIC countries by looking into the latest comparable data and trends on key environmental indicators. I hope that findings of this report will spearhead joint efforts to enact appropriate policies and strategies towards protection and sustainable management of environment across the Islamic world.

Amb. Musa Kulaklıkaya
Director General
S E S R I C

Executive Summary

Environment Performance Analysis

The analysis of Environmental Performance Index (EPI), developed by Yale University, reveals that OIC countries perform poorly with a score of 59.4 compared to 65.4 for Non-OIC developing countries and 85.4 for developed countries. The environmental performance of OIC countries is not uniform and shows significant regional divergence. OIC countries located in Europe & Central Asia (ECA), Latin America (LA), and East Asia and Pacific (EAP) score higher than the world average with scores of: 72.4, 69.9, and 69.3 respectively. The worst performing OIC region is South Asia (SA) with a score of 46.9 followed by Sub-Saharan Africa (SSA) with a score of 48.7 and MENA with a score of 66.0.

Health

In the Health Impacts issue category, OIC countries as a group perform poorly in comparison to other country groups with a score of 53.7 indicating that environmental risks including unsafe water and sanitation as well as household and outdoor air quality are significantly impacting health in a negative manner. This is especially true for OIC countries in the MENA, SA and SSA with scores below the world average.

Air Quality

In the Air Quality issue category, OIC countries as a group lag other country groups with a score of 73.5; nonetheless, at the regional level OIC countries in LA, ECA, and EAP perform quite well; whereas the scores reveal that air quality is an area requiring significant improvement in OIC countries located in SA, SSA, and the MENA. Likewise, in the Water and Sanitation issue category OIC countries as a group lag behind other country groups. The OIC score of 62.7 is below the score of non-OIC developed countries, developed countries and the world average scores of 70.5, 98.7, and 73.4 respectively. The low score of OIC countries can be attributed to OIC countries located in SSA and in SA who are pulling the OIC score down, while other OIC regions are scoring above the world average of 73.4.

Climate and Energy

In the Climate and Energy issue category, OIC countries performance as a group also lags behind other country groups with OIC countries in the MENA recording the lowest scores among OIC regions. On the other hand, OIC countries in ECA and OIC countries in SSA perform relatively well achieving scores above the world average. OIC countries performance in the Biodiversity & Habitat is no exception to the above as OIC countries as a group score 65.0, a score well below other country groups. All OIC regions -with

the exception of EAP- score below the world average. This weak performance points to the need for OIC countries to focus on expanding and improving the quality of protected areas already under management.

Fisheries

Fisheries is one of the environmental issues in which OIC countries perform better than other country groups indicating that OIC countries engage in less exploitative and unsustainable use of the sea. Forests is another area where OIC countries outperform other country groups; however, the picture is not rosy in all OIC regions as OIC countries in EAP have a very low score of 6.5 indicating that deforestation in these countries is a serious issue.

Agriculture and Water

In the Agriculture issue category, OIC countries as group perform very well with a score of 80.2 which is higher than the score observed in other country groups. However, when conducting the analysis at the OIC regional level, the analysis shows that OIC countries in EAP and in SA score below the world average indicating that these countries are underperforming in matching fertilizer inputs to crops. Finally, in the Water Resources issue category, OIC countries as a group lag in performance behind other country group with a score of 37.6 compared to 39.74 in non-OIC developing countries and 91.7 in developed countries. This indicates that the proportion of waste water that is treated is low in OIC countries.

Major Environmental Issues

Climate Change and Greenhouse Gas Emissions

OIC countries aggregate GHG emissions reach 6,500 Mt CO2e or 15% of the world's total GHG emissions. While the developed countries GHG growth is declining, growth in OIC countries is still very high at a level of 4.4% during the period 2000-2013. With this rate, GHG emissions are expected to be doubled in 2027. Nevertheless, the time for GHG emissions to double could be as soon as 2020 if the rate further increases. The sector responsible for such GHG emissions is mostly the energy sector which contributes to 72% of GHG emissions. The other sectors such as agriculture, waste, industry, and bunker fuels sector contributes at a relatively lower rates.

In 2013, CO2 emissions accounted for around two-third (64%) of the total GHG emissions in OIC countries. This ratio was significantly lower than the shares of other country groups. Nevertheless, share of CO2 in OIC total emissions has witnessed comparatively sharp increase of 7 percentage points since 1990.There is no doubt that the change to low carbon economy is an urgent need for sustainable development. This sectorial GHG emission shows the opportunity in pushing down GHG emissions by

focusing on specific sectors. Thus, energy sector is the sector to be given priority in order to decrease GHG emissions level.

Given the fact that countries with relatively small economies and/or small population are more likely to emit less GHG and vice versa, it is important to assess a country's performance by looking at GHG emission per-capita. As of 2013, per capita GHG emissions have witnessed an upward trend across the developing world. Developed countries recorded the highest per capita GHG emissions of 13.4 ton CO2e, while the averages of world and non-OIC developing countries were 6.1 and 5.3 ton CO2e, respectively. With average per capita GHG emissions of 4.0 ton CO2e, OIC countries recorded lower emissions compared to other groups.

Air Pollution

OIC countries lag other country groups in the Air Quality issue category indicating that air pollution in these countries is a serious challenge that needs to be addressed. At the OIC regional level, the analysis reveals that the challenge of Household Air Quality is a formidable challenge in OIC countries located in SA and SSA who score very low on this indicator. OIC countries performance on the Air Pollution - Average Exposure to PM2.5 indicator is lower than non-OIC developing countries but better than developed countries. However when it comes to health risk exposures, OIC countries performance is sub-standard. This is especially true for OIC countries in the MENA, SA, and SSA. When it comes to aaverage exposure to NO2, OIC countries exposure is higher than non-OIC developing countries but lower than developed countries. At the OIC regional level, the analysis shows that average Exposure to NO2 is an issue in OIC countries located in the MENA who score below the world average. As for the remaining OIC geographical locations they all record scores above the world average.

The analysis performed points out to an important fact which is: the major air pollution issue in OIC countries is related to indoor air pollution and to biomass burning; thus he policy focus in OIC countries should be on addressing indoor (household) air pollution. Cooking and heating requirements should be met while emissions are reduced through the use of modern stoves; cleaner fuels, such as liquid petroleum gas and electricity; improved ventilation; and reducing exposure.

Water Pollution

As for water pollution, its sources are many; however, in OIC countries the most significant sources are sewage and wastewater. For this reason it is no surprise that the OIC Water Vision identifies access to sanitation services as one of the major challenges which is still facing many OIC countries. Analyzing the percentage of OIC population without access to improved sanitation facilities helps quantify the challenge of water

pollution originating from sewage. In this regard, the EPI points to the weak performance of OIC countries in providing access to improved sanitation facilities. In this area, OIC countries score 67.4 compared to 70.5 in non-OIC developing countries and 97.4 in developed countries. This indicates that the percentage of the population in OIC countries that have access to improved sanitation facilities is relatively low. At the OIC regional level the challenge of access to sanitation facilities is gravest in OIC countries located in SSA, EAP, and SA. Whereas OIC countries in the remaining geographical locations perform better than the world average.

The analysis also shows that OIC countries as a group treat a lower proportion of the wastewater they generate than other country groups. This has serious implication for OIC countries as untreated wastewater leads to high pollution levels, eutrophication of water bodies, high coliform bacteria counts, and hypoxia and fish-kills. In facing the challenge of water pollution, the OIC Water Vision provides useful objectives, framework, and implementation activities.

Desertification

Desertification is one of the major environmental challenges and threats for sustainable development across the world. Globally, around 25% of the total land, or 3.6 billion hectares, is decertified. Every year around 12 million hectares of productive land become infertile and unusable for farming due to desertification and droughts. In case of business as usual scenario, an estimated 60 million people be permanently displaced from the decertified areas to North Africa and Europe.

The level of desertification is particularly high in drylands covering over 40% of the earth's land surface, including 15% of Latin America, 66% of Africa, 40% of Asia and 24% of Europe. Dryland systems cover almost all land area of OIC countries. According to the findings of some climate model simulations for Africa, dryland area will shift and expand in several OIC member countries located in SSA region, including Benin, Burkina Faso, Mali, Nigeria and Senegal. At least 90% of the surface area of Burkina Faso, Egypt, Iraq, Kazakhstan, and Turkmenistan is classified as drylands.

Desertification is primarily caused by loss of vegetation. Therefore, vegetation cover is an important indictor to analyze the desertification vulnerability of a country/region. Among the OIC member countries, Sahel region is facing a kind of vicious cycle generated from both human and natural factors. The occurrence of droughts in the Sahel has been really catastrophic causing reduced productivity, leading to low vegetation cover that increased albedo, reducing water recycling and monsoon circulation, and soil erosion.

Desertification and water scarcity are inter linked. Usually, high incidence of water scarcity triggers and further aggravates the impacts of desertification through various channels like land and soil quality, soil structure, organic matter content and soil moisture levels. On the other hand, desertification and draughts have negative impacts on the quality and availability of water resources. The scarcity of water resources is main characteristic of OIC member countries located in dryland systems. These countries are suffering from high level of aridity with average precipitation in depth lower than 500m per year. In fact, 10 OIC countries from MENA have an average of precipitation in depth less than 100m per year.

Deforestation

During the period 1995-2015, OIC member countries have incurred significant losses in forest area with a total reduction of 667000 sq km. During the same period, member countries in SSA region reported the largest net loss of forests (23%) followed by SA (22%) and EAP (17%). On the contrary, MENA and ECA regions reported forest gain of around 16% and 9%, respectively. At the individual country level, 28 OIC members recorded forest losses ranging from 1% in Surinam, Guyana and Malaysia to 73% in Togo. Forest loss is driven mainly by the rapid urbanization and socio-economic transformation in these countries. In general, OIC countries as a group recorded comparatively very high rate of forest loss in both intervals.

Forest mortality due to drought and heat stress is pervasive in the present climate change impact. In the SSA region of OIC, increased tree mortality is linked to high incidence of drought and heatwaves. In Sahel region, long-term decreases in precipitation linked to climate change have caused a die-off of forest species whereas; forest mortality in Asia and Pacific countries such as Indonesia, Malaysia, Brunei, and Pakistan has been triggered by severe El Nino droughts. Carbon emissions and removals from forests area are an important indicator of the contribution of forests to the global carbon cycle. It is estimated that 300 million tons of carbon is losing to the atmosphere from drylands as a result of desertification each year, about 4% of total global emissions from all sources combined. Therefore, carbon sequestration are highly needed that can mitigate global warming.

Natural Disasters

The frequency, duration and impacts of disasters, which mostly related to the environmental issues, are on the rise. Since 1970, millions people has been affected in OIC countries from 3,040 disasters (mainly due to floods, epidemics, earthquakes and storms) and more than 1.4 million people killed, more than 28 million people became homeless due to these disasters. Much of the impacts could be avoided if adequate

actions were taken to reduce vulnerabilities of the communities. There is strong evidence that the critical drivers of vulnerabilities include rapid and inappropriate urban development, socioeconomic inequalities, trends and failures in governance, and environmental sustainability. In most of these indicators, OIC countries present a rather worrying picture, indicating that they are challenged by increased fragility and lack of capacities to prevent natural hazards turning into disasters.

Adaptation and Mitigation Mechanisms

Majority of the conventional environmental issues like climate change, deforestation, desertification etc. are global in nature. Therefore, it requires bilateral, regional and international collaborative efforts to address these challenges.

Over the years, global community has made significant progress in bringing together diverse stakeholders to deal with climate change. However, despite improvement, global community failed to make a significant dent in GHG emissions which are the prime cause of global warming and therefore, climate change. Developed countries, the major emitters of GHG, failed to uphold their commitments to cut emissions under the Kyoto Protocol regime, while due to their failure developing countries, especially the emerging one, are reluctant to consider any proposal to reduce their increasing contribution to total GHG emissions.

Among the OIC member countries, there is a widespread awareness about the problem of climate change and its negative consequences. They actively participate in the climate related summits, treaties, events, and projects. They have also developed their national and regional adaptation and mitigation strategies and strive hard to get technical and financial support from the international community to implement these strategies.

According to the latest estimates, global flow of climate finance was recorded at 741 billion in 2014. This amount was 15% higher than its level in 2011-12. During the same year, over 80 billion US$ of finance flow was reported from developed countries to developing countries. Across the developing world, mitigation-focused finance represented more than 70% of the public finance in 2014 whereas; adaptation finance provided to these countries accounted for about 25% of the total climate finance. It is worth noting that more than 80% of investments made by the multi-lateral development banks were focused on mitigation in 2014. The regional allocation of climate funding across the developing world reveals that Asia received the highest share followed by the Africa and Latin America and the Caribbean.

1. Introduction

There is a widespread consensus that environment is essential for the sustainable social development and economic growth across the world. In the recent past, the year 2015 has become a turning point in global efforts to transform the social and economic development into a more sustainable one. In this context, the global community agreed on a set of 17 sustainable development goals to be achieved by 2030, half of them related with environment and climate change. In addition, 196 countries met at the United Nations Framework Convention on Climate Change (UNFCC) 21st Conference (COP 21) in order to establish a new "Paris Agreement" on climate change with the ambition of limiting changes in global temperatures to below 2^{o}C or 1.5^{o}C warming in 2100 compared to the pre-industrial levels.

Environmental degradation poses serious negative implications for our planet and its habitat. Human induced change in climatic conditions is one of the most serious environmental problems facing the world today. As a result of climate change, weather patterns are becoming more and more erratic; agricultural productivity is on decline; air pollution and spread of diseases like respiratory and dermal diseases and cancer is on rise; water quality is deteriorating, causing outbreak of water-borne diseases and illness transmitted by insects; melting of icebergs and increase of sea level is causing the disappearance of many inhabitant land; and social and political problems arising

from the increase of migrants, refugees, or displaced population escaping from negatively-effected environments to other appropriate locations or countries.

Developing countries, including OIC members, are disproportionally affected by the most devastating effects of climate change. Among the OIC countries, impacts of climate change vary due to their geographic locations, degree of reliance on agriculture and adaptive capacities. For example, agriculture sector will be more affected in member countries located in hot regions like Africa and South and East Asia compared to those located in comparatively cold region of Central Asia & Europe. Similarly, being the high emitters of CO_2 emissions, OIC Oil exporting members are more vulnerable to climate change but due to higher income and economic development levels many of them could adapt and mitigate to climate change more conveniently than the OIC Least Developed Countries. Furthermore, rising sea level will be more catastrophic for Bangladesh, Egypt and Maldives compared to other member countries located near the sea shore.

Environmental and climatic changes in recent times have caused unprecedented extreme weather conditions and natural disasters in many OIC countries. The major components of natural disaster incidents in OIC countries were floods, epidemics, earthquake, storms, wet mass earth movements, droughts, and extreme temperatures. These disasters have not only contributed to the loss of human lives but have also given a huge blow to the economy. The unpredictable weather conditions have also contributed to increased breeding of desert locusts resulting in locust attacks on food crops, the worst being in 2004, which threatened the food security in 24 countries in the MENA region (AFED, 2009).

There is increasing awareness among the OIC member countries regarding the necessity of combating the negative impacts of environmental changes by applying climate-friendly technologies, enhancing adaptive capacity and collaborating with international community. They have worked out many initiatives both at national and regional levels in this regards. Furthermore, the OIC member countries also participate and contribute actively in the UNFCCC activities and try hard to benefit from available funds for environment friendly investments. Nevertheless, due to the growing pressure on the economy and environment, an integrated adaptation policy for the OIC as whole is required. Such a policy would aim to raise the level of awareness, interaction and cooperation on environmental issues among OIC member countries. This would involve partnerships at national, regional, and OIC level, including governments, civil society organizations, the media, decision makers, field practitioners, researchers,

scientists and advocacy communities. This network will enable scientists, decision-makers and stakeholders to share knowledge and experiences.

Against this backdrop, this report takes stock of environmental performance of OIC countries by looking into the latest available statistics on different components of Environmental Performance Index (EPI) in Section 2. The Section 3 discusses the major environmental issues faced by the OIC countries, including: climate change and greenhouse gas emissions; air and water pollution; desertification and deforestation and natural disasters. A synopsis of adaptation and mitigation efforts made, so far, by the OIC countries to tackle the climate change is given in Section 4. The main findings of the report are summarized in Section 5 along with policy recommendations aiming to enhance the implementation of interventions to improve the state of environment in OIC countries.

2. Environmental Performance Analysis

Developing relevant indicators based on scientific knowledge is essential for effective assessment and policy making. However, in the environmental domain this is not an easy task since measurement poses of one of the most challenging tasks in assessing environmental performances. It is difficult to accurately measure, for example, environmental damages caused by human activities or human health affected by environmental harms. Attaching an exact value for environmental benefits or costs also remains trying.

In evaluating the environmental performance of OIC countries in this report, the Environmental Performance Index (EPI) developed by Yale University is chosen. The EPI is chosen because it takes a comprehensive approach evaluating countries environmental performance both from the human side and the ecosystem side. The EPI also evaluates countries' performance on high-priority environmental issues thus helping policy makers identify areas for improvement. The EPI gives decision makers access to important environmental data organized in a way that is easily understandable, useful, and drives productive competition. Furthermore, the EPI allows countries to compare their performance to neighbors and peers. Finally, the EPI measures the performance of a total of 180 countries worldwide providing good coverage of OIC countries with 56 out of the total 57 OIC countries included in the 2016 data set (the only OIC country not covered is Gambia).

Environmental Health and Ecosystem Vitality are the EPI's two main objectives that provide an umbrella for the Index's issue areas and indicators. Environmental Health measures the protection of human health from environmental harm. Ecosystem Vitality measures ecosystem protection and resource management. These two objectives are divided into nine issue categories that encompass high-priority environmental policy issues including Agriculture, Air Quality, Biodiversity and Habitat, Climate and Energy, Forests, Fisheries, Health Impacts, Water Resources, and Water and Sanitation (See Figure 2.1)

Figure 2.1: EPI Framework

Source: Yale University EPI website.

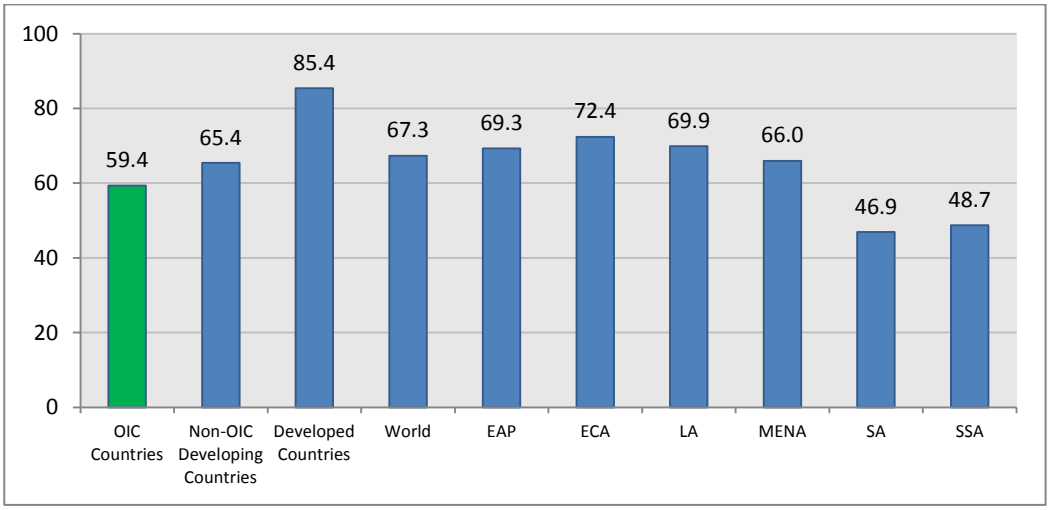
2.1 Overall Environmental Performance

The Environmental Performance Index (EPI) is constructed through the calculation and aggregation of more than 20 indicators reflecting national-level environmental data. These indicators fall under the nine issue categories shown in Figure 2.1. A proximity-to-target methodology is used to benchmark country's performance against targets. The targets are high performance benchmarks defined primarily by international or national policy goals or established scientific thresholds. Country scores are determined by how close or far countries are to targets. Scores are standardized (i.e., on a scale of 0 to 100) for comparability, weighting, and aggregation. The worst performer(s) countries who are at the "low performance benchmark" receive a score of 0. Best performer(s) countries who achieve the target receive a score of 100 (EPI, 2016).

The performance of OIC countries as a group on the EPI in comparison to other country groups is depicted in Figure 2.2 (left side). As the figure shows, OIC countries perform the worst among all country groups with a score of 59.4 compared to 65.4 for Non-OIC developing countries and 85.4 for developed countries. The environmental performance of OIC countries is not uniform and shows regional divergence. OIC countries located in Europe & Central Asia (ECA), Latin America (LA), and East Asia & Pacific (EAP) score higher than the world average with scores of: 72.4, 69.9, and 69.3 respectively. The worst performing OIC region is South Asia (SA) with a score of 46.9 followed by Sub-Saharan Africa (SSA) with a score of 48.7 and Middle East and North Africa (MENA) with a score of 66.0.

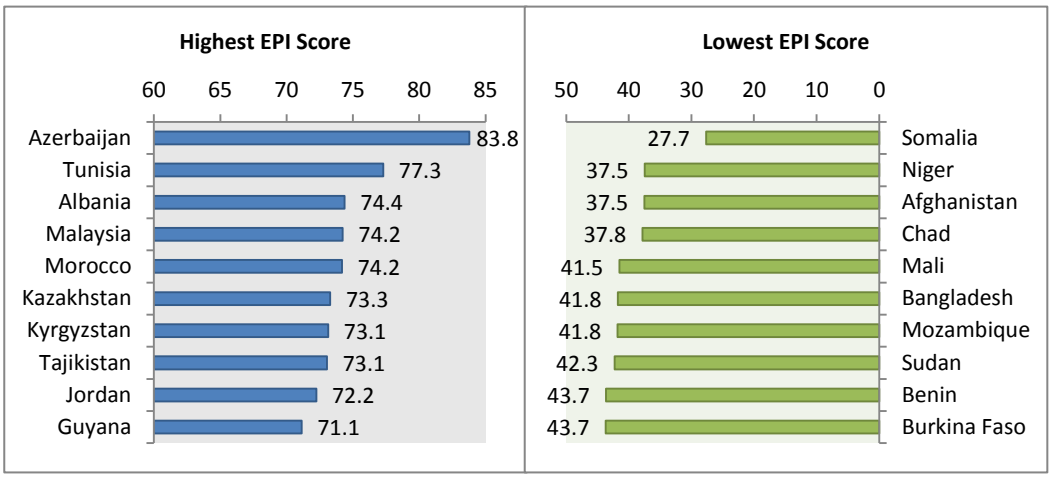
Conducting the analysis at the OIC country level is of significant importance since it reveals the OIC countries having the best performance who can act as a benchmark and a source of knowledge to other OIC countries. The analysis at the OIC country level also reveals the worst performing OIC countries that are in need of support to increase their capacity and to be on the receiving end of knowledge transfer. The left hand side of Figure 2.3 reveals the best performing OIC countries on the EPI while the right hand side of the figure reveals the worst performing OIC countries.

Figure 2.2: Environmental Performance of OIC Countries, 2016



Source: EPI, 2016.

Figure 2.3: The Best and Worst Performing OIC Countries



Source: EPI, 2016.

2.2 Environmental Health

Environmental Health is one of the two objective areas measured by the EPI and measures the protection of human health from environmental harm. Environmental Health has a 50% weight in the overall EPI score and is divided into three issue categories each carrying equal weigh which are: Health Impacts, Air Quality, and Water & Sanitation.

2.2.1 Health Impacts

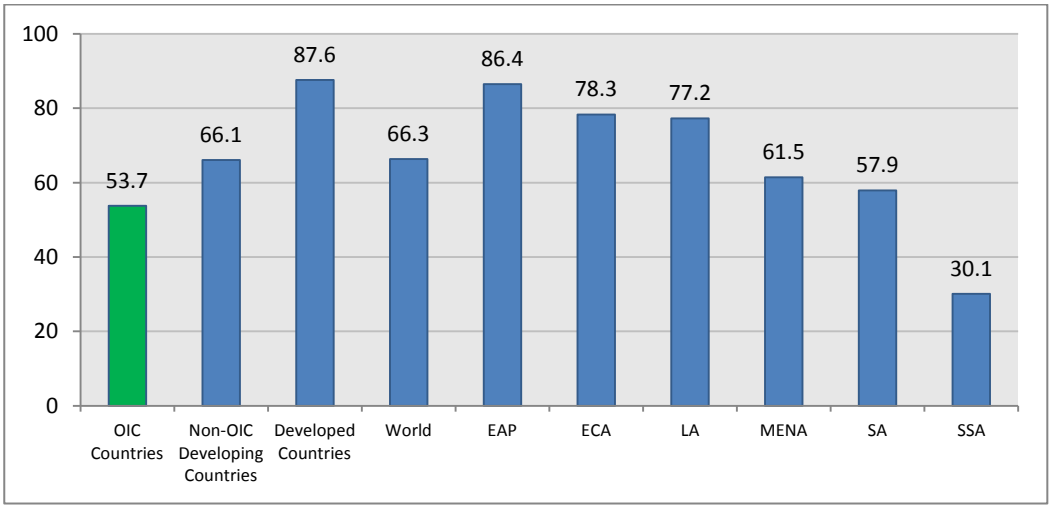
The interaction between human health and the environment has been extensively studied and environmental risks have been proven to significantly impact human health, especially in developing countries. The World Health Organization (WHO) estimates that 24% of the global disease burden and 23% of all deaths can be attributed to environmental factors. Among children 0–14 years of age, the proportion of deaths attributed to the environment was as high as 36%. On average, children in developing countries lose 8-times more healthy life years, per capita, than their counterparts in developed countries from environmentally-caused diseases (WHO, 2006).

The Health Impacts issue category assesses human health risks associated with unsafe water and sanitation as well as household and outdoor air quality. It describes actual health outcomes, complementing the EPI's Air Quality and Water indicators (will be discussed in the next chapter of the report), which characterize the factors that drive these health effects rather than the outcomes themselves. Measuring environmental factors aligns with policy targets promulgated by the World Health Organization and

United Nation's Sustainable Development Goals, yet this approach captures a partial picture. Health Impacts issue category fills in the missing half of the equation, reporting on human health risks to environmental pollution and providing a summary of health outcomes across age and gender. By quantifying environmental health risks for an entire population, the Health Impacts issue category gives an aggregate estimate of how environmental pollution affects human health. Specificity allows policymakers to spot public health threats and identify interventions that would best prevent hazardous exposure and reduce negative health outcomes (EPI, 2016).

OIC countries performance as a group in the Health Impacts issue category is shown in Figure (2.4). The left hand side of the figure shows that OIC countries as a group perform poorly in comparison to other country groups in the Health Impacts Issue Category with a score of 53.7. This score is well below the score of 87.6 and 66.1 achieved by developed countries and non-OIC developing countries respectively. The OIC countries score clearly indicates that environmental risks including unsafe water and sanitation as well as household and outdoor air quality are significantly impacting health in a negative manner.

Figure 2.4: OIC Countries Performance in the Health Impacts Issue Category



Source: EPI, 2016.

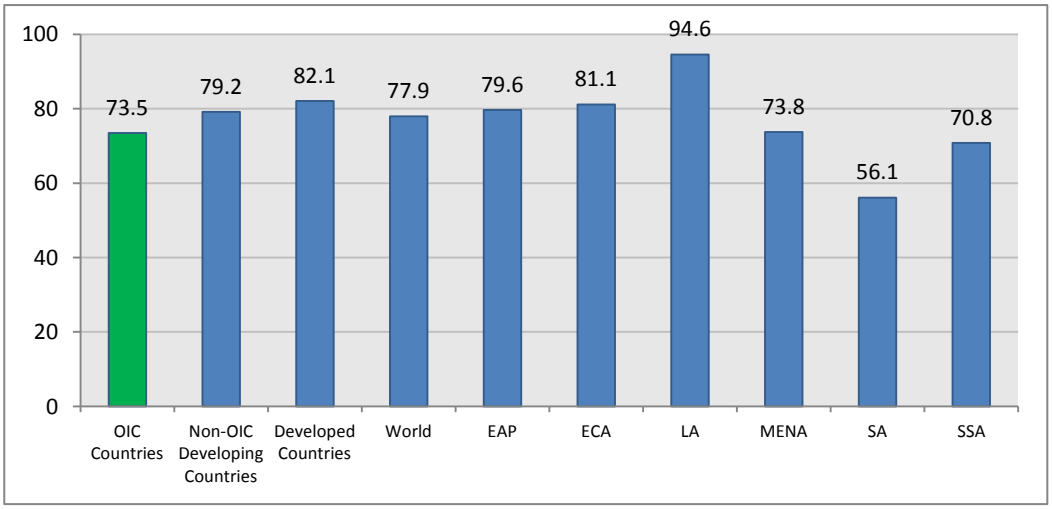
2.2.2 Air Quality

Air pollution to a great extent results from economic activities such as industry, agriculture and transportation, as well as from domestic household activities such as cooking and heating. Air pollution damages health and the environment and thus needs to be measured and tracked in order to manage and reduce it. The Air Quality issue category measures: exposure to fine particulate matter, nitrogen dioxide, and

percentage of the population burning solid fuel indoors. Suspended particulates contribute to acute lower respiratory infections and other diseases such as cancer. They can penetrate human lung and blood tissue, leading to higher incidences of cardiovascular and lung disease. Cooking with solid fuels over open fires or in simple stoves exposes households to daily pollutant concentrations that lie between those of second-hand smoke exposure and active smoking. Nitrogen dioxide (NO2) is produced as a result of road traffic and other fossil fuel combustion processes. Strong associations between NO2 and mortality have been identified in multi-city studies around the world (Geddes et al., 2015).

OIC countries performance in the Air Quality issue category is displayed in Figure (2.5). The performance of OIC countries with a score of 73.5 lags that of other country groups. At the OIC regional level, OIC countries in Latin America, Europe & Central Asia, and East Asia perform quite well; whereas the scores reveal that air quality is an area requiring significant improvement in OIC countries located in South Asia, Sub-Saharan Africa, and the MENA (the challenge of air quality in OIC countries is addressed in details in the next chapter of this report).

Figure 2.5: OIC Countries Performance in the Air Quality Issue Category



Source: EPI, 2016.

2.2.3 Water and Sanitation

According to the OIC Water Vision; adequate access to clean water and sanitation services is a central element of water security, and their importance to human health and productivity cannot be overstated. Within the OIC member states, water supply and sanitation service coverage ranges from very low to very high, with some nations providing universal access for all regions, while in others coverage is poor, and

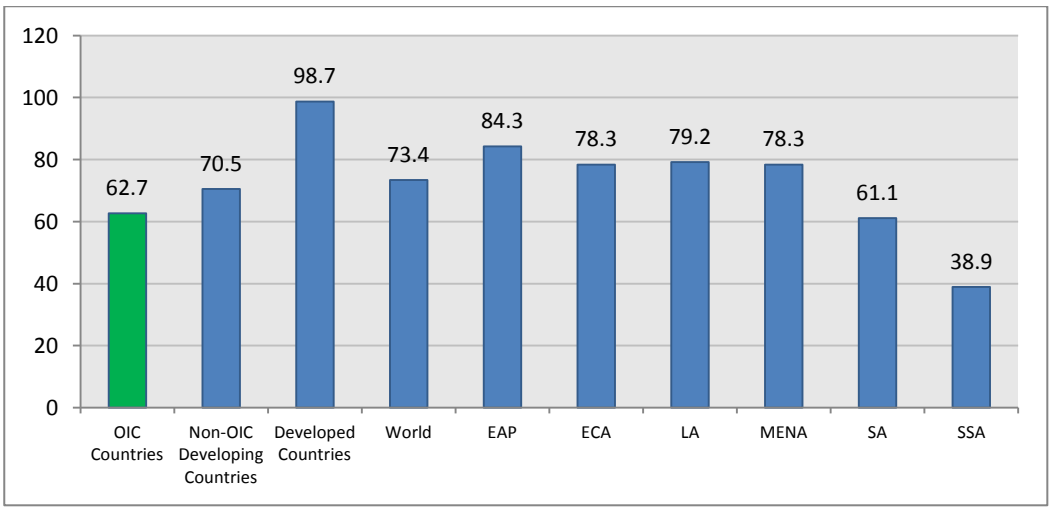
adequate household services limited to well-established urban areas. These differences largely reflect the variations in socio-economic conditions across the OIC (OIC Water Vision, 2012).

The Water and Sanitation issue category tracks the portion of a population with access to safe drinking water and sanitation infrastructure. Access to safe drinking water reduces exposure to toxins, disease vectors, and harmful contaminants, promoting general health and wellbeing. Diarrhea, for instance, the leading cause of death among children, is caused chiefly by contaminated water consumption. Access to Sanitation is a vital measure tracking a nation's ability to maintain healthy drinking water supplies, minimize its population's contact with dangerous bacteria and viruses, and diminish other environmental threats associated with improper waste management (EPI, 2016).

As the OIC Water Vision mentions, access to safe water and sanitation services is a challenge in OIC countries (this challenge is discussed in more details in the following chapter of this report) with great divergence between OIC regions and countries as clearly illustrated in Figure 2.6.

The figure demonstrates that OIC countries as a group lag behind other country groups in the Water & Sanitation Issue Category. The OIC score of 62.7 is below the score of non-OIC developed countries, developed countries and the world average scores of 70.5, 98.7, and 73.4 respectively. The right hand side of Figure 2.6 reveals that OIC countries in Sub-Saharan Africa and in South Asia are pulling the OIC score down, while other OIC regions are scoring above the world average of 73.4.

Figure 2.6: OIC Countries Performance in the Water & Sanitation Issue Category



Source: EPI, 2016.

2.3 Ecosystem Vitality

Ecosystem Vitality is the second objective area measured by the EPI and measures ecosystem protection and resource management. Ecosystem Vitality has a 50% weight in the overall EPI score and is divided into six issue categories: Climate & Energy, Biodiversity and Habitat, Fisheries, Forests, Agriculture, and Water Resources.

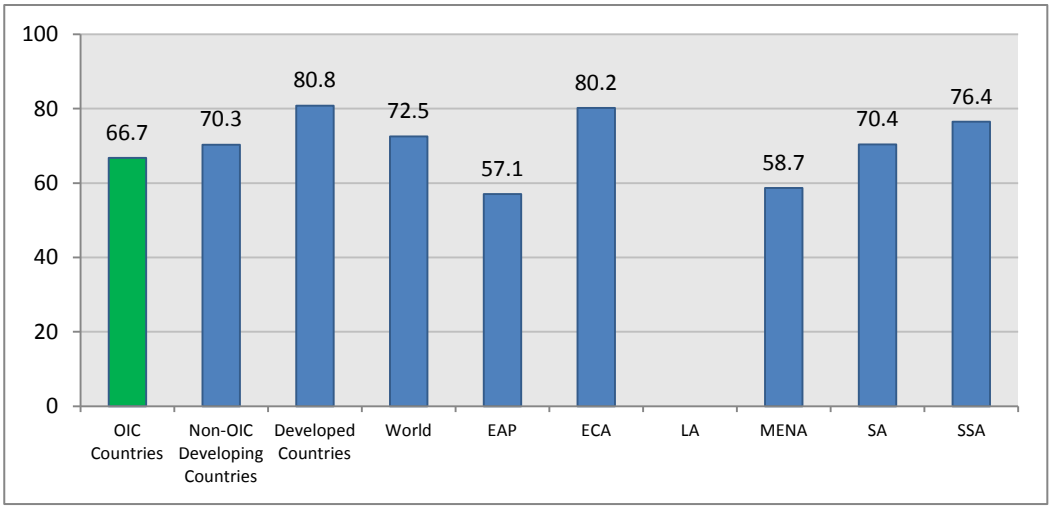
2.3.1 Climate & Energy

The climate change problem is one of the biggest challenges facing mankind. The reliance on fossil fuel as a source of energy is driving the problem of climate change. Other energy sources also pollute air and water and threaten the climate. According to the International Energy Agency, greenhouse-gas emissions from the energy sector represent roughly two-thirds of all anthropogenic greenhouse-gas emissions and CO2 emissions from the sector have risen over the past century to ever higher levels. Effective action in the energy sector is, consequentially, essential to tackling the climate change problem (IEA, 2015)

The Climate and Energy issue category assess trends in national efforts to reduce carbon emission intensity over time. The indicators under the Climate and Energy issue category are sensitive to varying national policy obligations and take into consideration economic and industrial development. A country's trend in carbon intensity is benchmarked against relevant economic peers (GDP Purchasing Power Parity or PPP per capita) and given a score based on whether a country is underperforming or over performing relative to peers (EPI, 2016).

OIC countries performance in the Climate & Energy issue category is shown in Figure 2.7. OIC countries performance as a group in this issue category lags behind other country groups. OIC countries in Europe & Central Asia and OIC countries in Sub-Saharan Africa perform relatively well on the Climate & Energy issue category achieving scores above the world average. Other OIC regions perform below the world average with OIC countries in the MENA recording the lowest scores among OIC regions with a modest score of 58.7.

Figure 2.7: OIC Countries Performance in the Climate & Energy Issue Category



Source: EPI, 2016.

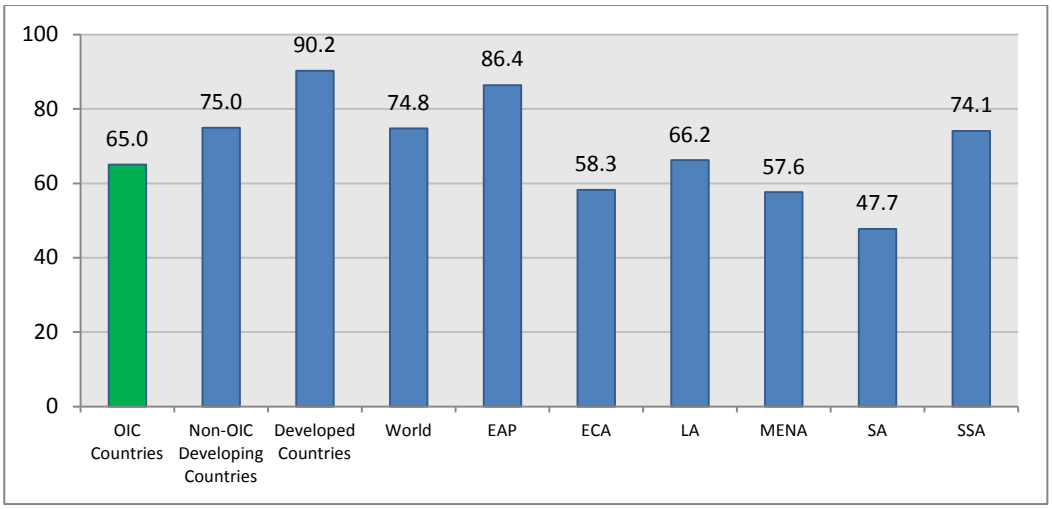
The majority of emission growth is expected to be generated by developing countries. OIC countries are all classified as developing countries and are undergoing high development and urbanization rates. This coupled with the fact that OIC countries as a group already perform poorly in the Climate & Energy issue category highlights the importance of climate mitigation in OIC countries. In this respect, developing clean-energy sources becomes a high priority (the challenge of climate change is discussed in more details in the next chapter of this report).

2.3.2 Biodiversity & Habitat

Biodiversity is the foundation for human health. By securing the life-sustaining goods and services which biodiversity provides to us, the conservation and sustainable use of biodiversity can provide significant benefits to our health. In contrast, the continuing loss of biodiversity on a global scale represents a direct threat to our health and well-being. Without a global environment that is healthy and capable of supporting a diversity of life, no human population can exist." (UN CBD, 2010). Today, the loss of biodiversity is happening faster everywhere, even among farm animals, such that "some scientists have termed this the 'sixth great extinction episode' in Earth's history" (IPBES, 2013). Scientists estimate we're now losing species at 1,000 to 10,000 times the natural rate, with literally dozens going extinct every day. It could be a scary future indeed, with as many as 30 to 50% of all species possibly heading toward extinction by mid-century (Chivian, 2008).

Protecting species and conserving habitats are linked objectives, thus the Biodiversity and Habitat issue category tracks the protection of terrestrial and marine areas as well as the species that conservation policies aim to protect. The suite of indicators under this issue category places national efforts to protect habitat and species in global context, showing the significance of a country's policies at the global scale (EPI, 2016). OIC countries performance on the Biodiversity and Habitat issue category is shown in Figure 2.8.

Figure 2.8: OIC Countries Performance in the Biodiversity & Habitat Issue Category



Source: EPI, 2016.

As the figure reveals, OIC countries as a group score 65.0 on the Biodiversity & Habitat issue category, a score well beyond other country groups. Analyzing Biodiversity & Habitat in OIC countries by geographical location reveals that except for OIC countries is East Asia who as a group registers a score of 86.4; the remaining geographical groups of the OIC perform at a level that is below the world average. This weak performance points to the need for OIC countries to focus on expanding and improving the quality of protected areas already under management.

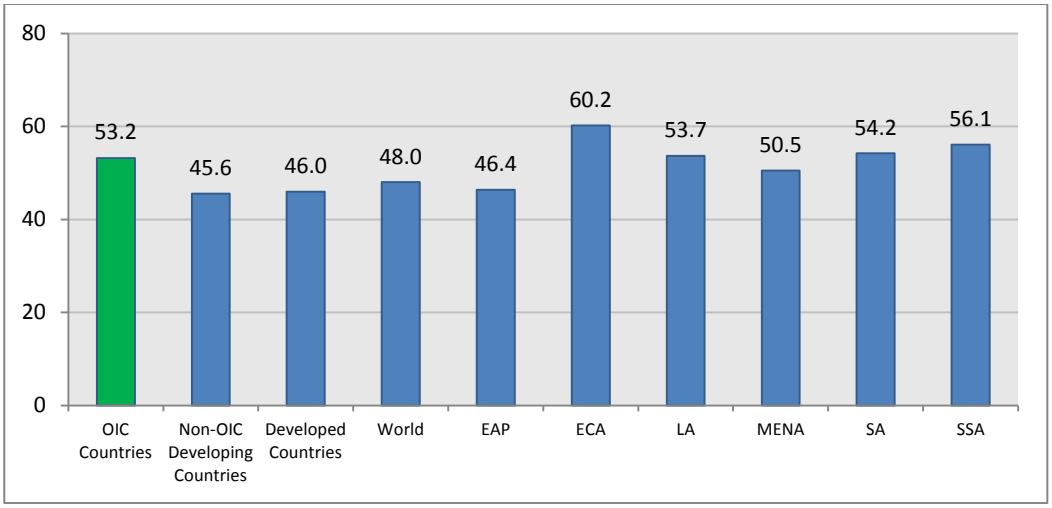
2.3.3 Fisheries

Sustainable Development Goal 14 is to "Conserve and sustainably use oceans, seas and marine resources" (UN, 2015). This is recognition of the ocean's critical importance to human societies; unfortunately, humankind use of the sea is unsustainable at the current level. The oceans today contain half the fish that they did in 1970, and overfishing is the primary cause for this collapse (World Wildlife Fund, 2015). This highlights the importance for countries to measure and track their fishing practices.

The Fisheries issue category assesses the percentage of a country's total catch — within its exclusive economic zone — that comes from overexploited or collapsed fish stocks. Overexploitation occurs when a fish stock is harvested at levels that exceed the species' capacity for reproduction and replacement. The percentage of fishing stocks overexploited and collapsed is an approximation for the sustainability of fishing practices, showing which countries have harvested or continue to harvest marine species at unsustainable rates (EPI, 2016).

OIC countries performance in the Fisheries issue category is shown in Figure 2.9. Fisheries are one of the environmental issues in which OIC countries perform better than other country groups. OIC countries as a group score 53.2 in this issue category in comparison to 45.6 in non-OIC developing countries, and 46.0 in developed countries. This indicates that OIC countries engage in less exploitative and unsustainable use of the sea. At the OIC regional level, the scores are rather consistent and do not show a great variety according to geographical location except for OIC country in East Asia who score below the world average.

Figure 2.9: OIC Countries Performance in the Fisheries Issue Category



Source: EPI, 2016.

2.3.4 Forests

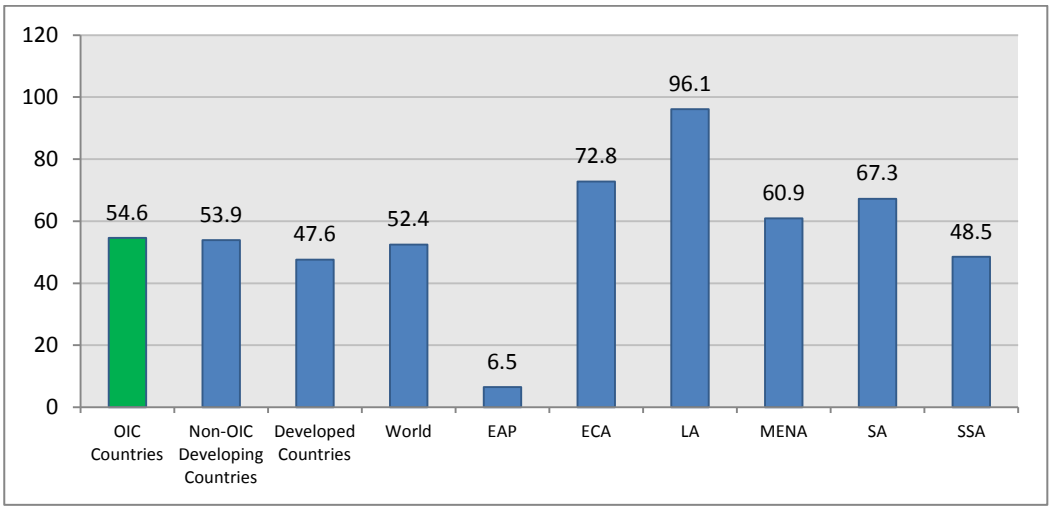
Forests cover about a third of the earth's land area and are essential to the health of our environment. For example, trees and forests absorb and store much of the carbon dioxide that otherwise would be contributing to climate change. Forests are home to about 80% of remaining terrestrial biodiversity. Forests also regulate water cycles, maintain soil quality, and reduce the risks of natural disasters such as floods (World

Bank, 2013). Despite the vital role that forests play, they are under threat. Unsustainable timber harvesting, urban sprawl, agricultural expansion, and mining and mineral exploitation all threaten global forests. The world has lost an average of 180,749 km^2 (18.1 million hectares) of forest annually since 2000 (Hansen et al, 2013).

The Forests issue category consists of a single measure - Tree Cover Loss. The Tree Cover Loss indicator describes the total area of tree loss from 2000 to 2014, benchmarked against the country's tree cover baseline extent in 2000. The EPI evaluates tree cover loss in areas with at least 30% canopy cover; this tree density threshold is a bottom limit of what is considered a forest (EPI, 2016). OIC countries performance on the Forests issue category is shown in Figure 2.10.

The figure shows that OIC countries as a group perform better than other country groups; however, the aggregate score for OIC countries masks a lot a variation among OIC geographical locations. OIC countries in East Asia have a score of 6.5 indicating that deforestation in these countries is a serious issue. Globally the annual rate of forest loss has recently accelerated in many tropical countries and OIC country follow this global trend closely. Tropical forests have been lost at high rates in Malaysia, Indonesia, Cote d'Ivoire, and Sierra Leone. This highlights the need to take steps to halt the destruction of forests in the before mentioned countries through anti-deforestation measures such as conservation initiatives and the effective enforcement of forest laws (the challenge of deforestation is discussed in more details in the next chapter of this report).

Figure 2.10: OIC Countries Performance in the Forests Issue Category



Source: EPI, 2016.

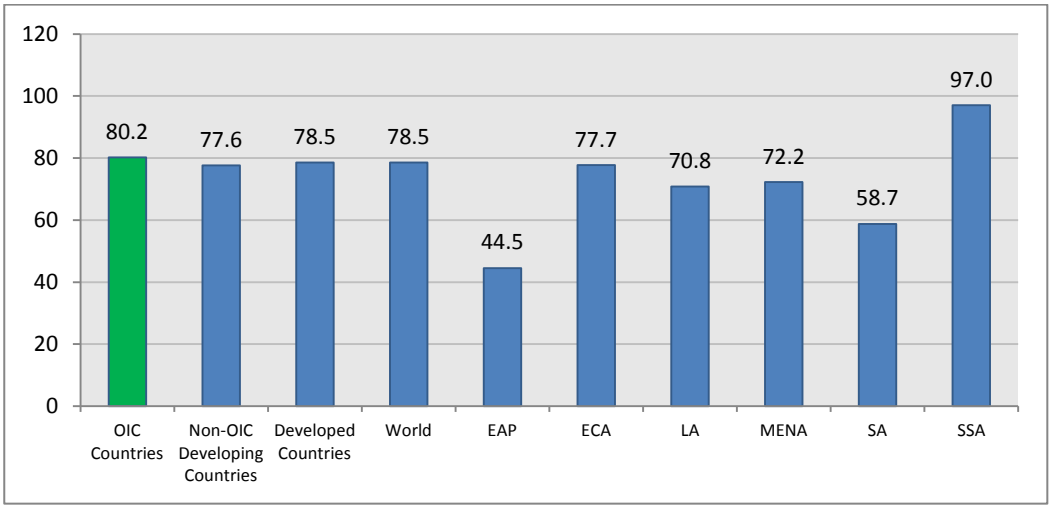
2.3.5 Agriculture

Agricultural activities have direct impacts on the environment. From local to global scales, agriculture influences essentially all major environmental issues: soil quality, water quality and availability, air quality, carbon pollution and climate change, habitat fragmentation, deforestation, and biodiversity loss (Aneja et al., 2009). One of the main ways that agriculture affects the environment is through the use of fertilizers with nitrogen being one of the key ingredients of fertilizers.

The Agriculture issue category tracks nitrogen use efficiency to assess how well countries match fertilizer inputs to crops. Two indicators are used in this issue category: nitrogen use efficiency (NUE), which measures the ratio of nitrogen inputs to outputs in crops, and nitrogen balance (NBALANCE), which measures excess nitrogen released to the environment as a result of an overuse of fertilizer application (EPI, 2016). Increasing nitrogen use efficiency (NUE) directly enhances crop productivity while decreasing nitrogen runoff and associated environmental degradation. Nitrogen (N) application is a ubiquitous method for intensifying agricultural production – thereby reducing the pressure to convert other land cover types, like forests and wetlands, into croplands. But too much N can be harmful. N not taken up by crops enters the environment through nitrogen leaching, ammonia volatilization, and nitrous oxide emissions. This nitrogen pollution has negative impacts on air and water quality, leads to ozone layer depletion, and exacerbates climate change (Galloway, 2003).

OIC countries performance in the Agriculture issue category is shown in Figure 2.11. As the figure shows, OIC countries as group perform very well in the Agriculture issue category with a score of 80.2 which is higher than the score observed in other country groups. However, when conducting the analysis at the OIC regional level, the analysis shows that OIC countries in East Asia who register a score of 44.5 and OIC countries in South Asia who register a score of 58.7 are underperforming in matching fertilizer inputs to crops. This shows that these countries have a big opportunity to improve in balancing two interlinked objectives: Feeding their growing population while minimizing nutrient loss and associated environmental damage

Figure 2.11: OIC Countries Performance in the Agriculture Issue Category



Source: EPI, 2016.

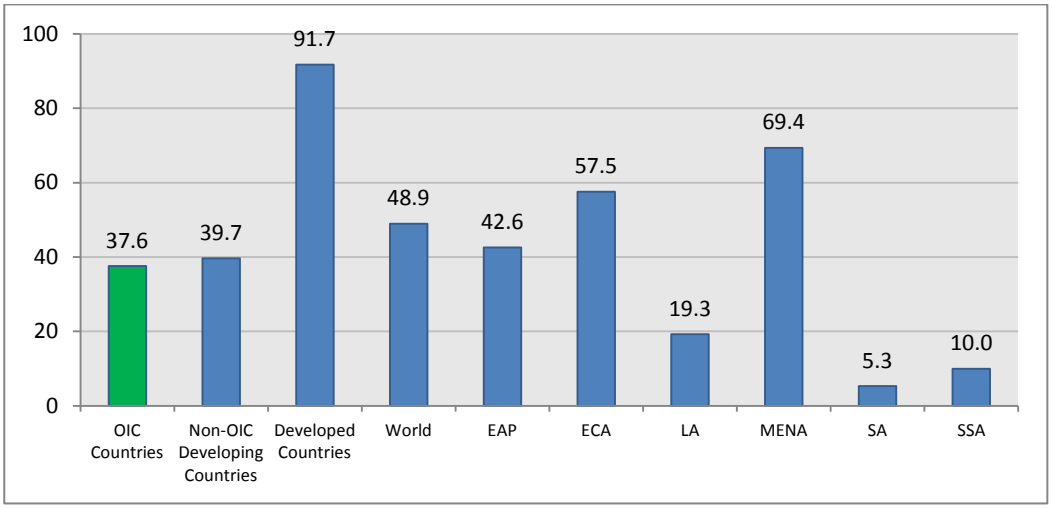
2.3.6 Water Resources

The Water Resources issue category tracks the proportion of wastewater from households and industrial sources that is treated before it is released into the environment. Untreated sewage released into a watershed disrupts and damages downstream ecosystems. Wastewater is comprised of any water degraded by anthropogenic influences such as domestic graywater (e.g., water from baths, sinks, washing machines, and kitchen appliances), blackwater (e.g., water from toilets), as well industrial wastewater that often has chemical contaminants, surface water, and storm water runoff. Wastewater contains nutrients and chemicals that pollute natural water systems, resulting in algal blooms, faunal endocrine disruption, and a host of other environmental impacts (EPI, 2016).

OIC countries performance in terms of Water Resources category is shown in Figure 2.12. As the figure reveals, OIC countries as a group lag in performance behind other country group with a score of 37.6 compared to 39.74 in non-OIC developing countries and 91.7 in developed countries. This indicates that the proportion of waste water that is treated is low in OIC countries. At the regional level, OIC countries in the MENA and in Europe and Central Asia score higher than the world average on the Water Resources category issue. On the other hand, the remaining regional groups of the OIC perform below the world average. This is especially true in OIC countries in South Asia (score of 5.3), Sub-Saharan Africa (score of 10.0) and OIC countries in Latin America (score of 19.3). In these countries increasing the proportion of waste water that is

treated will contribute to the health of aquatic systems and provides health benefits for local residents.

Figure 2.12: OIC Countries Performance in the Water Resources Issue Category



Source: EPI, 2016.

3. Major Environmental Issues

As elaborated in the previous section, OIC member countries as a group have exhibited comparatively low environmental performance. The situation is particularly bleak in low income and least developed member countries. High environmental vulnerability of these countries is stemming from their geographical location, poor infrastructure, wide spread land degradation, high prevalence of conflicts, and low capacities (both financial and technical) to adapt and mitigate the negative impacts of climate change. In this context, this chapter investigates the major issues that OIC countries, as a group, are encountering in the domain of environment.

3.1 Climate Change and Greenhouse Gas Emissions

Climate change is one of the most crucial contemporary environmental challenges with serious negative social and economic consequences. According to the findings of the International Panel on Climate Change (IPCC), an elevated level of a greenhouse gas (GHG) emissions is the primary driver of climate change. These gases accumulate in the lower atmosphere and absorb the long wave terrestrial radiations, which are normally supposed to return to the space in order to keep the balance of the earth temperature. As a result, earth temperature is rising, timing and amount of rainfall is changing, level of precipitation become highly variable, and occurrence of extreme weather events like

floods, draughts, cyclones and storms is more often compared to the past. Changes in these important variables have severe negative implications for human beings as they affect negatively the availability of basic necessities like food and water and deteriorate the health conditions.

The IPCC research also found that increasing concentration of greenhouse gases in the atmosphere is resulting from human activity. The most abundant and significantly effective GHG's are carbon dioxide (CO2), methane (CH4), and chlorofluorocarbons (CFCs). Concentration of these gases in the air is considerably increasing due to: combustion of fossil fuels, deforestation, increase in waste, transportation, and use of various chemical sprays for different purposes. To tackle the problem of climate change, therefore, concerted effort should be made towards reducing the GHG emissions.

3.1.1 Greenhouse Gas Emissions

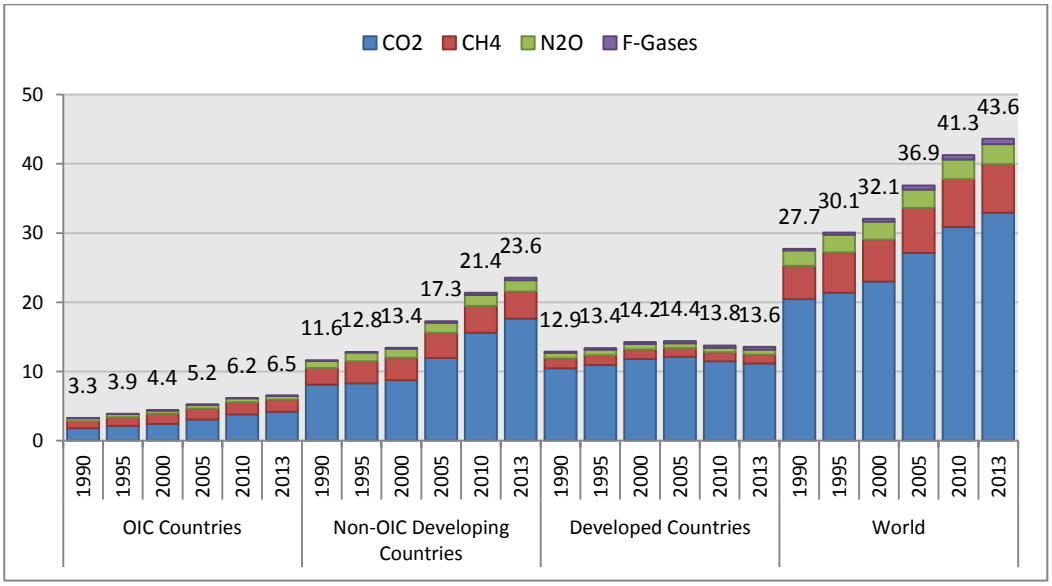
The Kyoto Protocol recognizes six kinds of greenhouse gases (GHG) including: Carbon dioxide (CO2); Methane (CH4); Nitrous oxide (N2O); Hydro-fluorocarbons (HFCs); Perfluorocarbons (PFCs); and Sulphur hexafluoride (SF6). According to the latest estimates, global GHG emissions have increased from 27.7 thousand Metric tons of carbon dioxide equivalent ($MtCO_2e$) in 1990 to 43.6 thousand $MtCO_2e$ in 2013. Non-OIC developing countries also registered significant increase from 11.6 thousand $MtCO_2e$ in 1990 to 23.6 thousand $MtCO_2e$ in 2013. In line with the global trends, GHG emissions have doubled in OIC countries since 1990. Starting from a very low emission rate of only 3.3 thousand $MtCO_2e$ in 1990, OIC countries recorded 6.5 thousand $MtCO_2e$ GHG emissions in 2013. Nevertheless, despite an increasing trend, OIC countries, as a group, have recorded the lowest rate of GHG emissions since 1990.

As shown in Figure 3.1, carbon dioxide is the main contributor to the global emissions and most of the increase since 1990s. CO_2 is mainly generated from burning fuel for domestic use, transportation and industry. Indeed, the consumption of fuel is much higher in newly industrialized emerging economies and oil exporting countries. This indicates the large amounts of emissions generated from these countries. CO_2 emissions in OIC as a whole is low compared to the global emissions. It is also well below Non-OIC developing and developed countries' total emissions. In 2013, CO_2 emissions accounted for around two-third (64%) of the total GHG emissions in OIC countries. This ratio was significantly lower than the shares of other country groups. Nevertheless, share of CO_2 in OIC total emissions has witnessed comparatively sharp increase of 7 percentage points since 1990.

During 1990-2013, GHG emissions increased by 101% in OIC countries, while it increased by 103% in non-OIC developing countries and 57% in the world. Developed countries, on the other hand, have managed to control their GHG emissions and witnessed an increase of only 5% compared to their level in 1990. As of 2013, global GHG emission has remained highly concentrated in developing countries which accounted for 69% of global GHG emissions. Being a substantial part of the developing countries, OIC countries accounted for 15% of the world and 21% of the developing countries total GHG emissions in 2013. Many studies concluded that in most of the developing countries including OIC countries, GHG emissions and economic growth (by means of GDP) were coupled, indicating that the economic growth subsequently increases the GHG emissions. The growth of economy will require more energy input, which -when the sources of energy are fossil fuel- generates an increase of GHG emissions.

At the national level, many OIC countries have witnessed significant increase in GHG emissions during the last two decades. During 1990-2013, 23 OIC countries registered over 100% increase in emissions; whereas 18 countries witnessed 50% to 96% increase in GHG emissions since 1990. On the other hand, only one member country (Albania) recorded declining trend with 29% decrease in GHG emissions since 1990.

Figure 3.1: GHG Emissions (Thousand $MtCO_2e$), 1990-2013

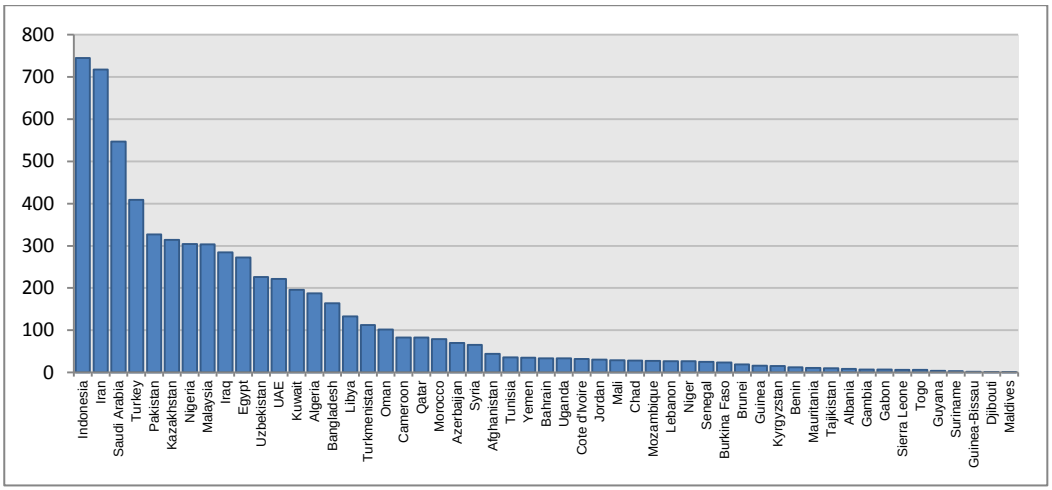


Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

Across OIC countries in 2013, GHG emission ranged from a low of one $MtCO_2e$ in Maldives to a high of 744 in Indonesia (Figure 3.2). Ten OIC countries have registered

GHG emissions lower than 10 $MtCO_2e$. In contrast, eight OIC countries registered GHG emissions higher than 300 $MtCO_2e$. Three of these eight countries are ranked among the top-20 CO_2 emitters in the world. In 2013, Indonesia was ranked 10th globally followed by Iran (ranked 13th), and Saudi (ranked 16th). The top-10 emitters in OIC countries accounted for nearly two-third of total OIC emissions in 2013. Among these countries, Indonesia accounted for the highest share of 11.4% followed closely by Iran (11.0%), Saudi Arabia (8.4%), Turkey (6.3%), and Pakistan (5.0%).

Figure 3.2: GHG Emissions (Thousand $MtCO_2e$), 2013



Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

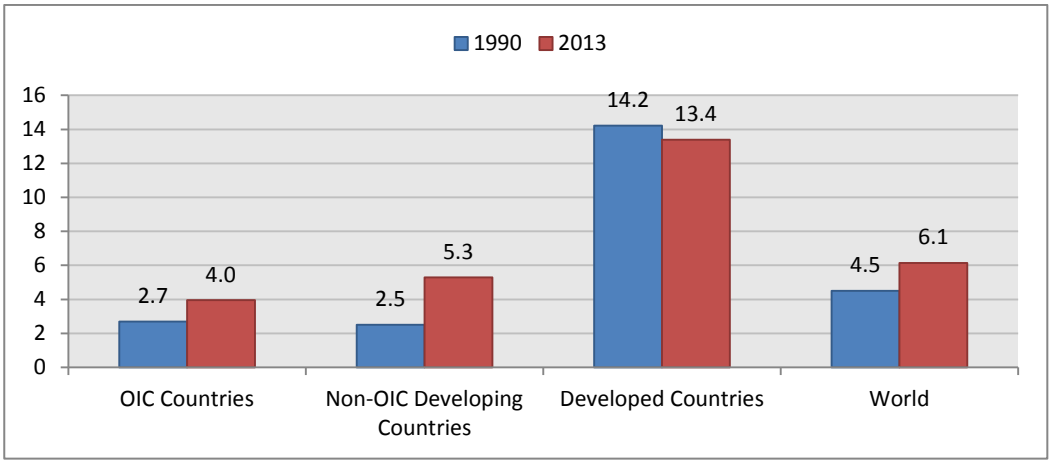
3.1.2 GHG Emissions per Capita

Given the fact that countries with relatively small economies and/or small population are more likely to emit less GHG and vice versa, it is important to assess a country's performance by looking at GHG emission per-capita. This indicator tells us how much, on average, a person emitted GHG within a specific period of time. In general, a positive relationship has been observed between emissions per capita and income per capita. This is because of the fact that higher rate of energy consumption pattern/lifestyle has a direct relationship with the performance of a country on the GHG per capita emissions.

As shown in Figure 3.3, per capita GHG emissions have witnessed an upward trend across the developing world. As of 2013, developed countries recorded the highest per capita GHG emissions of 13.4 ton CO2e, while the averages of world and non-OIC developing countries were 6.1 and 5.3 ton CO2e, respectively. With average per capita GHG emissions of 4.0 ton CO2e, OIC countries recorded lower emissions compared to

other groups. This fact is similar with the total GHG emissions data that also shows OIC average was below the world, developed and non-OIC developing countries averages.

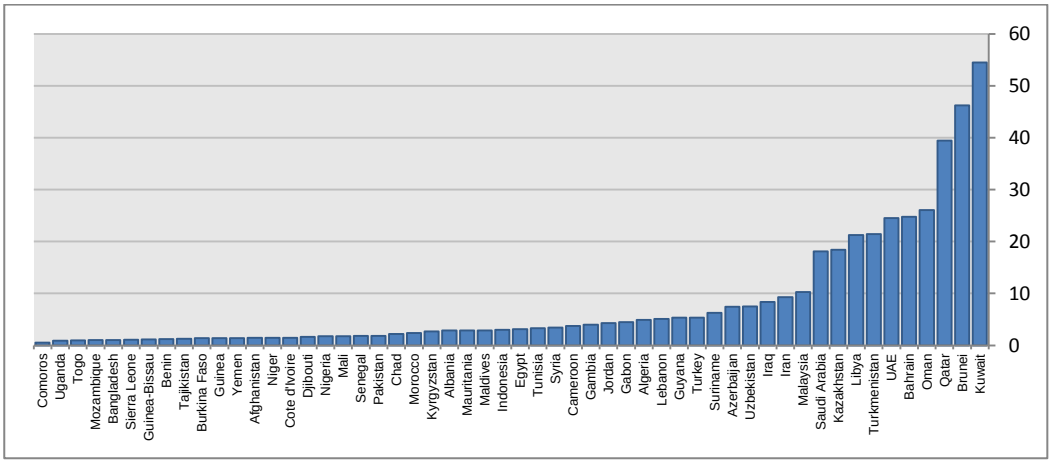
Figure 3.3: GHG Emissions per Capita (Tones CO_2e), 1990 vs 2013



Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

At the individual country level, per capita emissions were comparatively very high in OIC member countries classified as high and upper middle income countries by the World Bank. The per capita GHG emissions vary greatly across the OIC countries ranging from 0.5 ton CO2e in Comoros to 54.5 in Kuwait (Figure 3.4). In Top-10 OIC countries, per-capita GHG emissions were above the average of the developed countries. Three OIC countries with the highest GHG emission per-capita (Kuwait, Brunei, and Qatar) were also ranked among the top emitters worldwide in 2013.

Figure 3.4: GHG Emissions per Capita (Tones CO_2e), 2013



Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

3.1.3 Greenhouse Gas Emissions by Sectors

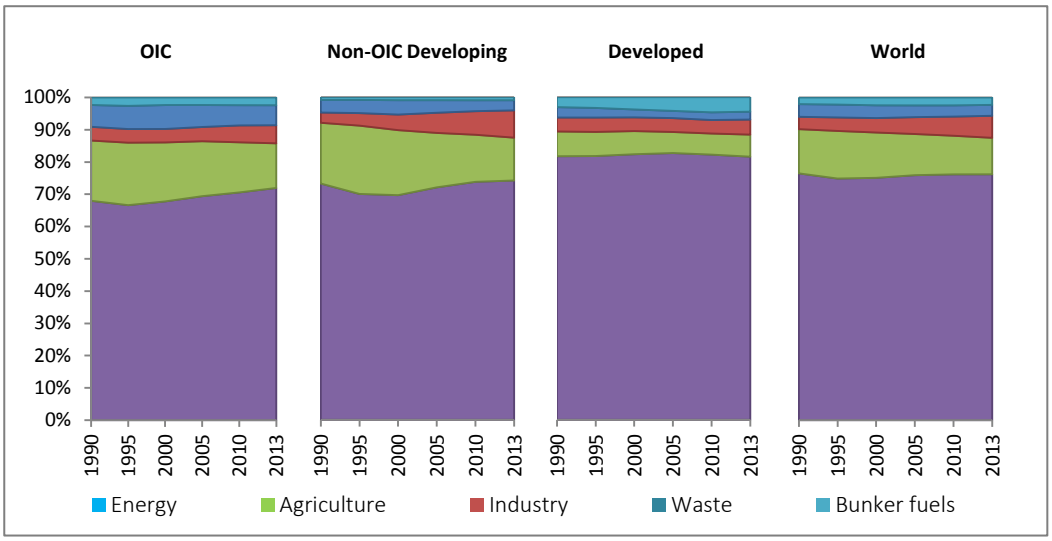
The greenhouse gas emissions are caused by a variety of anthropogenic activities related mostly with production and consumption of goods and services. The analysis of major sources of GHG emissions reveals that five sectors emit almost all of the GHG across the world. These sectors include: Energy, Agriculture, Waste, Industrial Process and Bunker Fuels.

The breakdown of GHG emissions by main source sectors shows that energy sector is responsible for the bulk (76%) of GHG emissions globally, followed by the agriculture (11%), industry (7%), waste (3%) and bunker fuels (2%). OIC member countries also exhibit a similar sectorial emission profile in 2013 (Figure 3.5). Energy sector is responsible for 72% of OIC GHG emissions in 2013. The share of energy sector has witnessed an increasing trend since 1990. Agriculture is the second most important source sector with 14% in 2013. In 1990 this source sector was more dominant with a share of 19%. Greenhouse gas emissions from industry and waste contribute with 6% each to OIC total in 2013.

At the individual country level, energy sector accounted for more than 70% of the total GHG emissions in 22 OIC member countries (Figure 3.6). Among these countries, Kuwait, Brunei and Libya recorded over 95% of total GHG emissions originating from the energy sector. The share of agriculture in GDP varied substantially among the OIC countries, with the highest share of 60.2% in Somalia and the lowest shares below 1.0% in Qatar (0.2%), Bahrain (0.3%) and Kuwait (0.6%). On the other side of the spectrum, energy sector contributed only 10% and 12% of total GHG emissions in Niger and Cameroon, respectively.

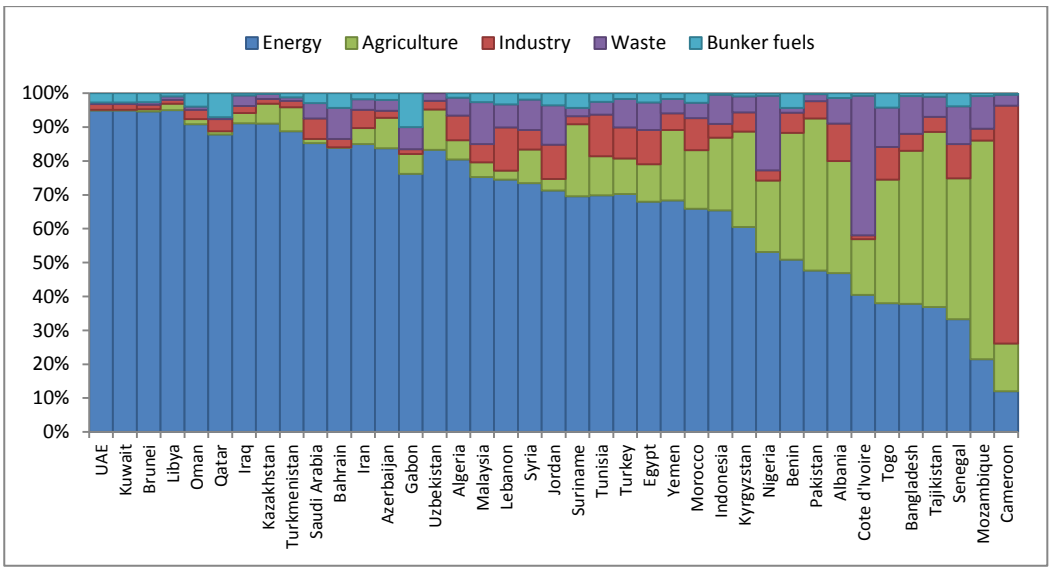
In contrast, agriculture continued to be the leading source sector for GHG emissions in 10 OIC countries (Figure 3.6). Nine of these countries are located in Sub-Saharan African region where agriculture sector still plays a major role in the economic activity. Among these countries, Mali, Burkina Faso, Niger and Guinea-Bissau are ranked at the top with more than 80% of GHG emissions originating from the agriculture sector. In general, the share of energy sector remained the major source of GHG emission among the high income and fuel exporting OIC countries whereas; contribution of agriculture in emissions remained dominant across the low and lower middle income member countries.

Figure 3.5: Greenhouse Gas Emission by Sectors, 1990-2013



Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

Figure 3.6: Greenhouse Gas Emission by Sectors, 2013



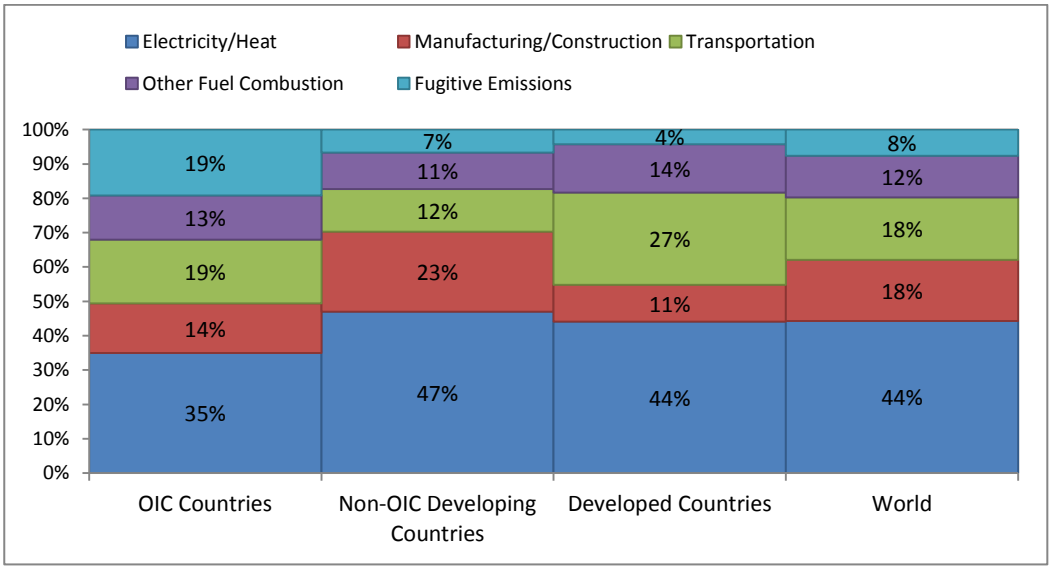
Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

In general, it can be seen from Figure 3.6 that the energy sector contributed significantly to the GHG emissions across the world. However, the energy sector itself consists of several sub-sectors such as heat/electricity, manufacturing/construction, transportation, other fuel combustion, and fugitive emissions.

As shown in Figure 3.7, electricity/heat generation subsector emitted the most energy-related GHG in all country groups. However, OIC's average in this sector is significantly lower than other country groups with GHG emissions reaching only 35 % (1681 $MtCO_2e$), far below the other country group's shares. This could be explained by low electrification rate in OIC countries and good renewable energy practices for their electricity generation adopted in OIC countries, while the former one seems more reasonable explanation for OIC countries.

Another sub-sector that needs to be mentioned is fugitive emissions sector. These emissions are usually originating from pressurize equipment due to leaks or other unintended releases of gases, mostly from industrial activities. These leaks mostly occur through valves, pipe, connections/joint, seals, or related equipment. In this subsector, OIC share is higher than world and developing countries average, while developed countries average was the lowest one. This state of affairs underlines the need and importance of improved detection and monitoring of fugitive emissions to control and reduce GHG emissions in OIC countries.

Figure 3.7: Share of Energy Emissions by Sub-sectors, 2013



Source: Climate Analysis Indicators Tool: WRI's Climate Data Explorer

3.2 Pollution

3.2.1 Air Pollution

Air Pollution has severe impact on people's health and on ecosystems. This makes air pollution one of the major challenges facing humanity today. Air pollution can be classified into following two areas:

Indoor air pollution: indoor air pollution is caused by cooking and heating using solid fuels (i.e. wood, crop wastes, charcoal, coal and dung) in open fires and leaky stoves. Such inefficient cooking fuels and technologies produce high levels of household air pollution with a range of health-damaging pollutants, including small soot particles that penetrate deep into the lungs. In poorly ventilated dwellings, indoor smoke can be 100 times higher than acceptable levels for fine particles. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth (WHO, 2016a). According to WHO, over 4 million people die prematurely from illness attributable to the household air pollution from cooking with solid fuels; more than 50% of premature deaths due to pneumonia among children under 5 are caused by the particulate matter (soot) inhaled from household air pollution; and 3.8 million premature deaths annually from non-communicable diseases including stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer are attributed to exposure to household air pollution (WHO, 2016,a).

Outdoor air pollution: WHO estimates that in 2014, 92% of the world population was living in places where the WHO air quality guidelines levels were not met; ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 3 million premature deaths worldwide in 2012; and some 88% of those premature deaths occurred in low- and middle-income countries (WHO, 2016b).

As well as the health impacts mentioned above, air pollution causes significant damage to ecosystems. Ground-level ozone damages agricultural crops, forests and plants, reducing their growth rates. Nitrogen oxides (NOX), Sulphur dioxide (SO2) and Ammonia (NH3) harm soil, lakes and rivers by acidifying them and causing loss of animal and plant life. Ammonia and NOX also disrupt land and water ecosystems by introducing excessive amounts of nutrient nitrogen – a process known as 'eutrophication'.

The state of air quality in OIC countries and their performance on the EPI Air Quality issue category was covered in Chapter two of this report. The analysis in Chapter two revealed that OIC countries lag other country groups in the Air Quality issue category indicating that air pollution in OIC countries is a serious challenge that needs to be

addressed. For this reason there is a need to analyze the Air Quality issue category in details by looking at the different indicators used in evaluating this issue category.

This category includes four key indicators (Table 3.1): Air Pollution- Average Exposure to PM2.5 (fine particulate matter in micrograms per cubic meter (µg/m3); Health Risk Exposure to PM2.5; PM2.5 Exceedance (an average of the percentage of the population exposed to PM2.5 levels at 10 µg/m3, 15 µg/m3, 25 µg/m3, and 35 µg/m3; Household Air Quality – Indoor Solid Fuel Usage; and Average Concentration of NO2 (in parts per billion).

Table 3.1: Air Quality Issue Category Indicators

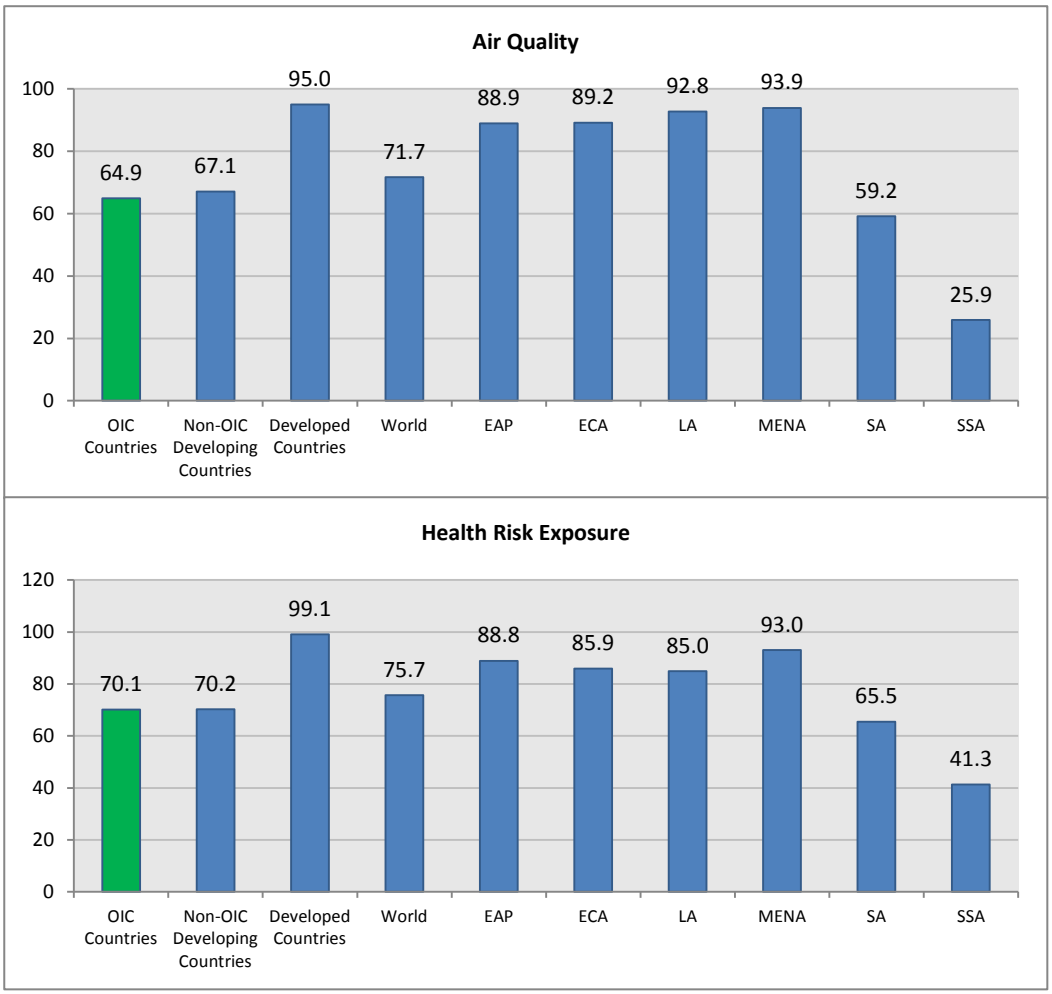
Issue Category	Indicator	Indicator - Long name
Air Quality	Household Air Quality	Percentage of the population using solid fuels as primary cooking fuel and Health Risk from PM2.5 exposure
	Air Pollution - Average Exposure to PM2.5	Population-weighted exposure to PM2.5 (three-year average) and Health Risk from PM2.5 exposure
	Air Pollution - PM2.5 Exceedance	Proportion of the population whose exposure is above WHO thresholds (10, 15, 25, 35 micrograms/m3)
	Air Pollution - Average Exposure to NO2	Population weighted exposure to NO2 (three-year average)

Source: EPI, 2016.

OIC countries performance on the household air quality indicator is shown in Figure 3.8. Cooking with solid fuels over open fires or in simple stoves exposes households to daily pollutant concentrations that lie between those of second-hand smoke exposure and active smoking. A measure of solid fuel use is a proxy for household air pollution and serves as an estimation of its impacts on health (EPI, 2016).

These two graphs are based on the percentage of population using solid fuels as primary cooking fuel and an assessment of health risk associated with household air quality. As the figure reveals, OIC countries perform worse than other country groups on the household air quality indicator (Figure 3.8). At the OIC regional level, the analysis reveals that the challenge of household air quality is a formidable challenge in members located in SA and SSA regions who score very low on this indicator. On the other hand, other OIC regional locations perform quite well and above the world average.

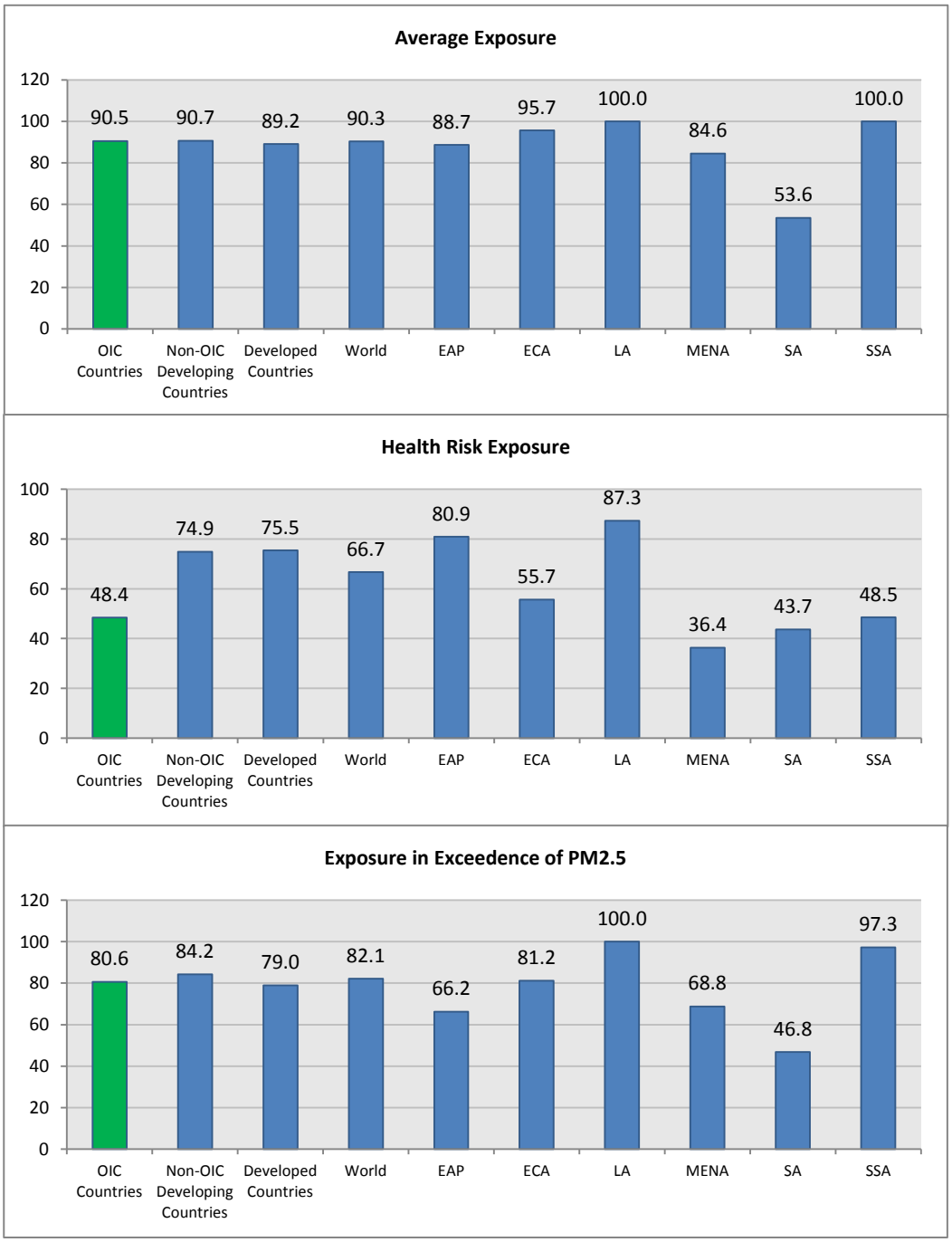
Figure 3.8: Household Air Quality



Source: EPI, 2016.

Particles smaller than 2.5 microns in diameter, known in shorthand as PM2.5, are fine enough to lodge deep into human lung and blood tissue. They place exposed populations at risk of heart and lung diseases, ranging from stroke to lung cancer. In severe cases, this pollution contributes directly to fatalities (Goldberg, 2008). Airborne particulates originate from a variety of sources. PM2.5 is generally the product of combustion, whether anthropogenic, like car emissions and coal burning, or through forest fires and volcanoes. For vulnerable populations, including youth and elderly, high concentrations of PM2.5 can be a particularly virulent killer. The leading cause of child mortality ages one to five worldwide is pneumonia, and fine particulates are a major global contributor to its incidence (WHO, 2016c).

Figure 3.9: Air Pollution: Exposure to PM2.5



Source: EPI, 2016.

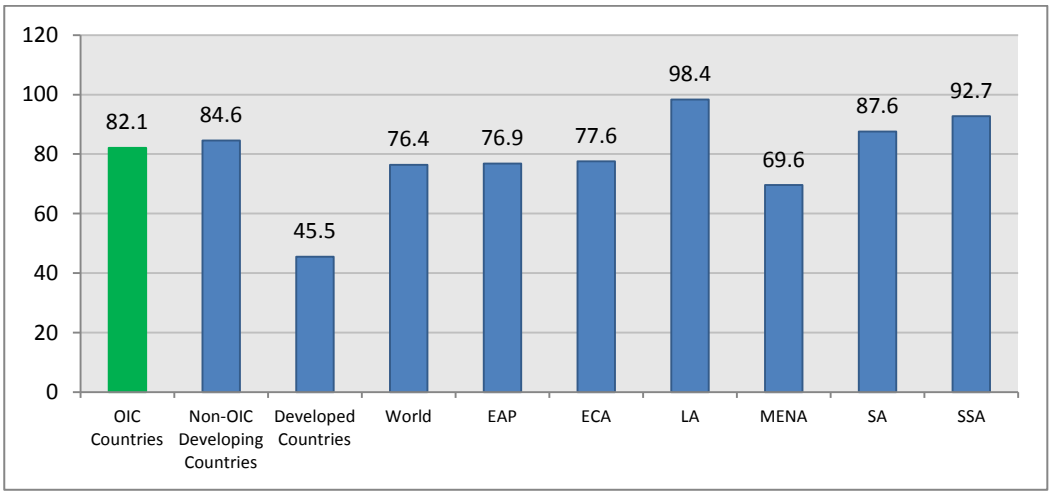
OIC countries performance on the Air Pollution - Average Exposure to PM2.5 indicator is shown in Figure 3.9. The upper part of the figure is based on the population-weighted exposure to PM2.5 (three-year average), while the lower part of the figure is an assessment of the health risks associated with PM2.5 exposure. The last graph shows is based on the proportion of the population whose exposure is above WHO thresholds (10, 15, 25, 35 micrograms/m3).

As the above graphs reveal, when it comes to exposure to fine particles, OIC countries perform lower than non-OIC developing countries but better than developed countries. However when it comes to health risk exposures, OIC countries performance is sub-standard. This is especially true for OIC countries in the MENA, South Asia, and Sub-Saharan Africa.

OIC countries performance on the Air Pollution - Average Exposure to Nitrogen dioxide (NO_2) indicator is shown in Figure 3.10. NO2 is produced as a result of road traffic and other fossil fuel combustion processes. Strong associations between NO2 and mortality have been identified in multi-city studies around the world (Geddes et. al, 2015). Health risks of NO2 come from itself or its reaction products including Ozone (O3) and secondary particles (WHO, 2003). According to the United States Environmental Protection Agency, direct exposure to NO2, ranging from 30 minutes to 24 hours, can cause airway inflammation and diminished respiratory function for people with asthma (United States Environmental Protection Agency, 2015).

NO2, when combined with volatile organic compounds (VOCs), forms ground-level ozone or smog observable in many cities. Inhalation of ozone leads to increased incidence of acute respiratory illness in susceptible populations including children, the elderly, and people with lung diseases. Small particles are formed when NO2 reacts with ammonia, moisture, and other compounds. If inhaled, these particles can penetrate deeply into the lungs, causing respiratory disease and aggravating existing heart disease (United States Environmental Protection Agency, 2015).

Figure 3.10: Air Pollution: Average Exposure to NO2



Source EPI, 2016.

As the data reveals (Figure 3.10), the level of Air Pollution - Average Exposure to NO2 in OIC countries is higher than non-OIC developing countries but lower than developed countries. At the OIC regional level, the analysis shows that Air Pollution - Average Exposure to NO2 is an issue in OIC countries located in the MENA which scores below the world average. As for the remaining OIC geographical locations they all record scores above the world average.

3.2.2 Water Pollution

Allah, may he be glorified and exalted, says in the holy Quran: '*We have made from water every living thing*' (The Noble Quran, 21:30). Water flows through our planet and through our bodies providing the source of life and the basis for social and economic development. For this reason water pollution is a serious challenge threating our source of life and our social and economic development. The challenge of water pollution has made its way to the sustainable development agenda with SDG target 6.3 stating: '*By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally*' (UN, 2017). There are many sources for water pollution, but of the most important water pollution sources in the world in general and in developing countries -including OIC countries- in specific are: sewage and wastewater.

Sewage

The OIC Water Vision identifies access to sanitation services as one of the major challenges which is still facing many OIC countries (OIC Water Vision, 2012). This should not come as a surprise as access to sanitation services has a wide range of impacts ranging from ecosystems to health to the economy; for example, sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhea that kills 525,000 children under five each year (WHO, 2017,d).

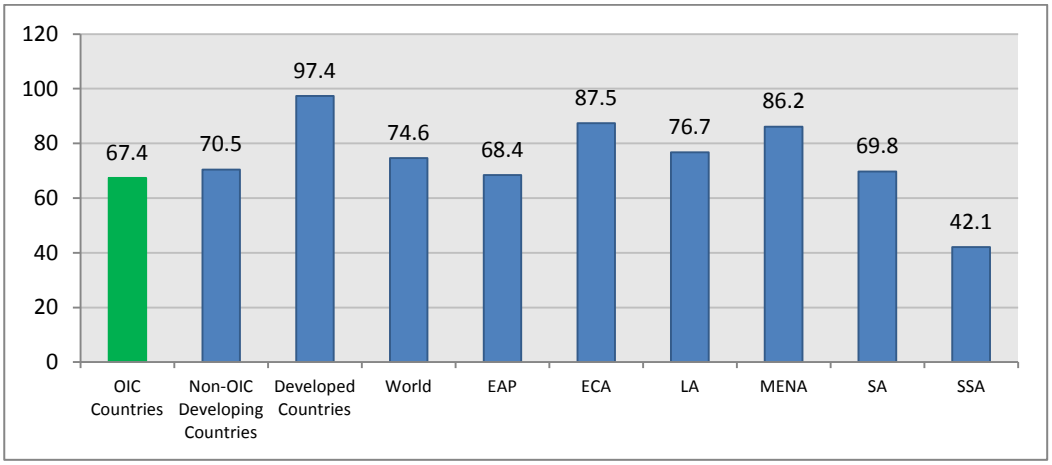
Sewage needs to be safely managed in order to eliminate water pollution. In order to safely mange sewage, improved sanitation facilities are needed. According to the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation; improved sanitation facilities are those designed to hygienically separate excreta from human contact (WHO-UNICEF JMP, 2017). Improved sanitation facilities include: Flush or pour flush to piped sewer system, septic tank or pit latrine - Ventilated improved pit latrine - Pit latrine with slab - Composting toilet.

OIC countries performance on the EPI Water and Sanitation issue category was discussed in Chapter two. This issue category is composed on two indicators (EPI, 2016). By zooming on the unsafe sanitation indicator and by analyzing the percentage of population without access to improved sanitation facilities the challenge of water pollution originating from sewage can be put into proper perspective.

OIC countries performance in providing access to improved sanitation facilities to the population is shown in Figure 3.11. As the data reveals, OIC countries perform weaker than other country groups with a score of 67.4 compared to 70.5 in non-OIC developing countries and 97.4 in developed countries. This indicates that the percentage of the population in OIC countries that have access to improved sanitation facilities is relatively low. At the OIC regional level the challenge of access to sanitation facilities is gravest in OIC countries located in Sub-Saharan Africa, East Asia, and South Asia.

The analysis indicates that OIC countries have a big room to improve in managing sewage safely by providing the population with access to improved facilitation services. Increasing the percentage of population with access to sanitation facilities will help OIC countries reduce water pollution and maintain healthy drinking water supplies, minimize their population’s contact with dangerous bacteria and viruses, and diminish other environmental threats associated with improper sewage management. The goal should be to provide 100% of the population with safely managed sanitation services as required by SDG 6, Target 6.2 (UN, 2017).

Figure 3.11: Access to Sanitation Facilities (% of Population)



Source: EPI, 2016.

Wastewater

Directly assessing water pollution and water quality remains elusive. According to EPI (2016); the second best option is to rely on drivers of water quality, specifically the treatment of wastewater. Wastewater is the water that has been used by households and industrial facilities that, without treatment, no longer serves a useful purpose. Graywater, blackwater, and the slurry of industrial and agricultural wastewater flows into natural water systems, if untreated, carries harmful chemicals into the environment, damaging ecosystems and threatening human health. Sound wastewater management requires a system for collection — normally through sewage pipes — and treatment at different stages, which are described below (EPI, 2016).

OIC countries performance in wastewater treatment was discussed in Chapter two. The analysis showed that OIC countries, as a group, treat a lower proportion of the wastewater they generate than other country groups. This has serious implication for OIC countries as untreated wastewater leads to high pollution levels, eutrophication of water bodies, high coliform bacteria counts, and hypoxia and fish-kills (EPI, 2016). By not treating most of their wastewater, OIC countries are missing an opportunity to increase water availability (SESRIC, 2015). Additionally, wastewater pollution leads to eutrophication and algal blooms, which occurs when a body of water is enriched with chemical nutrients, causing certain plant species such as algae to proliferate at the expense of others. Eutrophication can cause fish die-offs as some types of algae deplete the water of oxygen. Killing fish harms ecosystem health and also causes economic hardship for human communities that subsist on aquatic resources (UNEP, 2010).

3.3 Desertification and Deforestation

3.3.1 Desertification

Desertification is one of the major environmental challenges and threats for sustainable development across the world. According to the UN Convention to Combat Desertification (UNCCD), desertification is a form of land degradation in arid, semi-arid and dry sub-humid areas. It is primarily triggered by the removal of vegetation from the land surface. A significant proportion of the vegetation loss is due to human activities (like cutting down trees, over grazing by farmed animals etc.) and climatic changes (like warming, droughts etc.). As a result, the soil losses important nutrient, thus making land infertile and unusable for farming.

Globally, around 25% of the total land, or 3.6 billion hectares, is decertified. Every year around 12 million hectares of productive land become infertile and unusable for farming due to desertification and droughts. With over one billion effected people, desertification costs an estimated US$42 billion in lost incomes (UNCCD, 2014). According to the UNCCD, 169 out of 194 members of the UNCDD are affected by the desertification. In case of business as usual scenario, an estimated 60 million people be permanently displaced from the decertified areas to North Africa and Europe. By considering its magnitude and intensity, in 2007, the UN General Assembly has declared 2010-2020 as the United Nations Decade for Deserts and fight against Desertification.

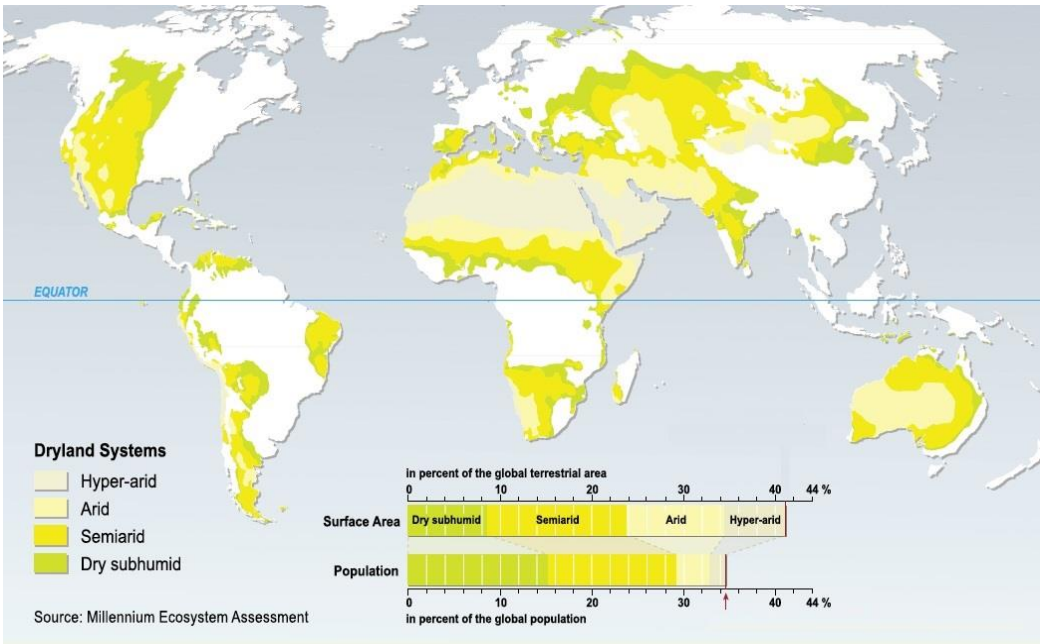
Drylands

The level of desertification is particularly high in drylands covering over 40% of the earth's land surface, including 15% of Latin America, 66% of Africa, 40% of Asia and 24% of Europe. Dryland systems cover a substantial portion of land area in OIC countries (Map 3.1). Desertification is a huge problem especially in arid and semi-arid areas where most of the member countries are facing severe pressures on land and water resources. These pressures are expected to increase in the face of expanding populations and urbanization associated with economic development. Furthermore, climate change is likely to shift and expand the drylands. According to the findings of some climate model simulations for Africa, dryland area will shift and expand in several OIC member countries located in SSA region, including Benin, Burkina Faso, Mali, Nigeria and Senegal (Cervigni and Morris, 2016).

Among the OIC regions, situation is particularly alarming in Sub Saharan Africa region with significant proportion of hyper-arid and arid lands, which are mostly unsuitable for agricultural activities. Member countries in MENA region also have substantial coverage of hyper-arid and semi-arid areas. Some member countries are particularly vulnerable due to high prevalence of dryland systems. At least 90% of the surface area of Burkina Faso, Egypt, Iraq, Kazakhstan, and Turkmenistan is classified as drylands. As

shown in Map 3.1, vulnerability to desertification is largely high and very high especially among the OIC countries located in Central Asia and Sub-Saharan Africa. Majority of member countries located in high vulnerability regions are facing multiple challenges related with climate variability, poor infrastructure, wide spread land degradation, and conflicts.

Map 3.1: Dryland Systems



Vegetation cover

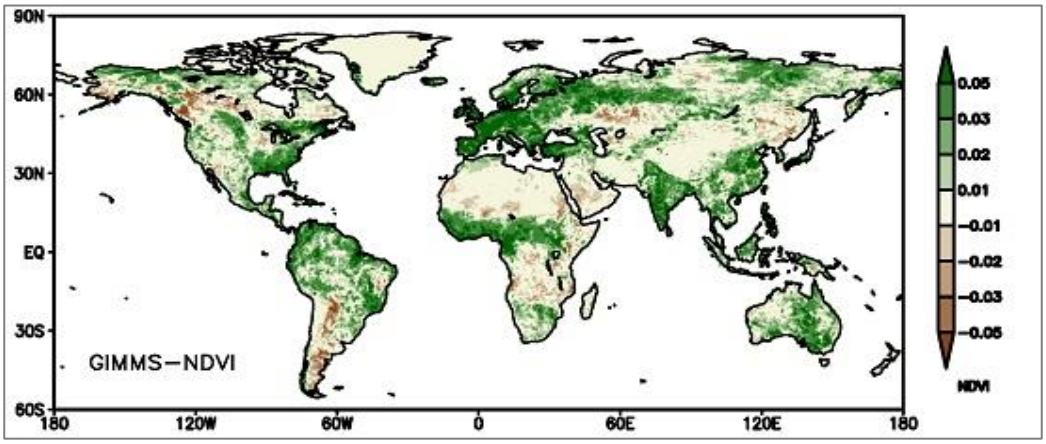
Vegetation is one of the key components of our ecosystem. It reduces soil erosion, generates soil organic carbon and helps to maximize the water-holding, therefore, it restores the landscape and re-green the ecosystem. As mentioned earlier, desertification is primarily caused by loss of vegetation. Therefore, vegetation cover is an important indictor to analyze the desertification vulnerability of a country/region. Normalized Difference Vegetation Index (NDVI) is used in remote sensing measurement to determine the density of green on a patch of land. The following map shows spatial distribution of the NDVI trends for the period of 1982–2012 (Map 3.2). According to the results, around 67% of the global land area has positive NDVI values for this period (Rafique et al., 2016).

The regions with greatest increase in NDVI are predominantly located in the Northern Hemisphere (e.g., Western Europe, India, China and South Sahel region), followed by

those in the Southern Hemisphere (e.g., Amazonian region and Eastern Australia). Despite these general increasing trends, some regions of Northern Hemisphere also showed significant decrease in NDVI such as northern Sahel region, Boreal region of North America, Northern China. The major decrease in the Southern Hemisphere was found in South America (e.g., Argentina, and Chile).

Among the OIC member countries, Sahel region is facing a kind of vicious cycle generated from both human and natural factors. The occurrence of droughts in the Sahel has been really catastrophic causing reduced productivity, leading to low vegetation cover that increased albedo, reducing water recycling and monsoon circulation, and soil erosion (Millennium Ecosystem Assessment, 2005). On the other hand, human activities such as unsustainable land use practices, including overstocking, overgrazing, deep ploughing and mono-cropping also led to loss of vegetation and desertification.

Map 3.2: NDVI trends for the period of 1982–2012



Source: Rafique et.al, 2016

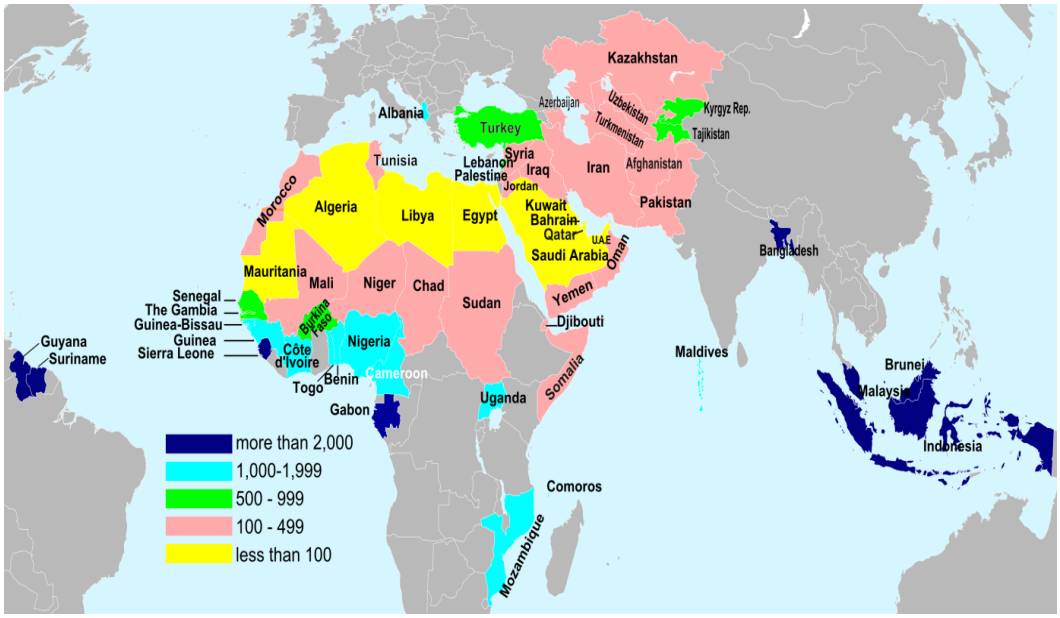
Water Scarcity and Land Productivity

Desertification and water scarcity are inter linked. Usually, high incidence of water scarcity triggers and further aggravates the impacts of desertification through various channels like land and soil quality, soil structure, organic matter content and soil moisture levels. On the other hand, desertification and droughts have negative impacts on the quality and availability of water resources. According to some estimates (UNCCD, 2012), by 2030, almost half of the world population may be living in areas subject to intense water scarcity. The impacts are going to be catastrophic especially in some arid and semi-arid areas with up to 700 million displaced people due to water scarcity by 2030.

The scarcity of water resources is main characteristic of OIC member countries located in dryland systems. These countries are suffering from high level of aridity with average precipitation in depth lower than 500m per year. In fact, 10 OIC countries from MENA have an average of precipitation in depth less than 100m per year (Map 3.3). Though precipitation scenarios vary among OIC regions, according to the predictions dry regions will be drier and humid ones will be more humid. It is predicted that there will be a decrease in precipitation in MENA and SSA regions, whereas an increase in precipitation is foreseen in East Africa, and Southern and Central Asia.

These changes in precipitation will affect the levels of water storage in lakes and reservoirs, as these are sensitive to climate variability. This could cause major problems for lakes, such as Lake Chad, which has already decreased in size by about 50% in the last 40 years. For the Niger River basin there is a predicted 10% change in precipitation, potential evaporation and runoff. In MENA, the average annual runoff will decline by as much as 27% by 2050. This will aggravate the water shortage problem and lead to more dependency on desalinated and treated wastewater.

Map 3.3: Average Precipitation in Depth in OIC Member Countries (m/yr), 2013-2017*



Source: FAO/AQUASTAT Online Database. * Latest year with available data

According to the latest estimates (SESRIC, 2015), absolute water scarcity is observed in 14 OIC countries, namely Kuwait, United Arab Emirates, Qatar, Saudi Arabia, Yemen, Maldives, Bahrain, Libya, Jordan, Palestine, Algeria, Djibouti, Oman and Tunisia. Chronic water shortages are observed in six OIC countries, namely Egypt, Syria, Burkina

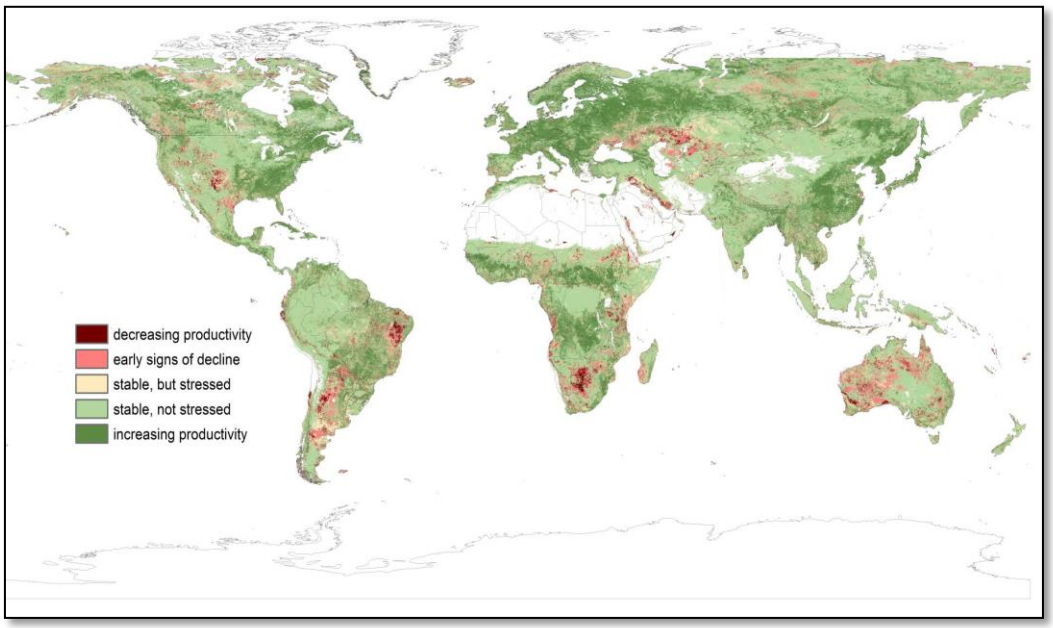
Faso, Morocco, Lebanon and Sudan. Finally, six OIC countries experience regular water stress, namely Pakistan, Somalia, Uganda, Comoros, Nigeria and Uzbekistan.

Loss of trees, vegetation and water scarcity are rapidly degrading dryland across the OIC member countries. Globally, about 2% of the productivity of drylands is lost each year. Growing human population is putting increased pressure on land cover in the drylands. Conversely, people displacement and migration from drylands to other suitable areas is highly noticeable.

Loss of land productivity and droughts are predominant manifestation of land degradation. As shown in Map 3.4, there five categories of land productive capacity dynamics, indicating areas of negative or positive change or stability of land productive capacity. It can be interpreted as indicator of change or stability of the land's apparent capacity to sustain the dynamic equilibrium of primary productivity during the 15 year's period (1999-2013).

With the existing climate change scenario, globally by 2030, water scarcity in some arid and semi-arid places will displace between 24 million and 700 million people (UNESCO, 2009). An influx of migrants in other countries may reduce the ability of the local population to use ecosystem services in a sustainable way. Such migration are pressuring especially big cities and towns by competing for scarce natural resources, causing social, ethnic, and political strife. Desertification-induced movement of people also has the potential of adversely affecting local, regional, and even global political and economic stability.

Map 3.4: Land Productive Capacity Dynamics in 1999-2013



Source: Joint Research Centre, European Commission, 2014

3.3.2 Deforestation

Technically, deforestation means conversion of forest to other land use or the permanent reduction of the tree canopy cover below the minimum 10% threshold (FAO, 2015). Deforestation is main driver of desertification. Caused mainly by the human activities, deforestation has been happening throughout human history with substantial increase during the last couple of decades. Major deforestation activities are related with agriculture, fuel use (firewood, charcoal), timber harvesting, growing human populations, war, and animal husbandry. Forest area can be increased through afforestation or by the natural or manmade expansion of forests.

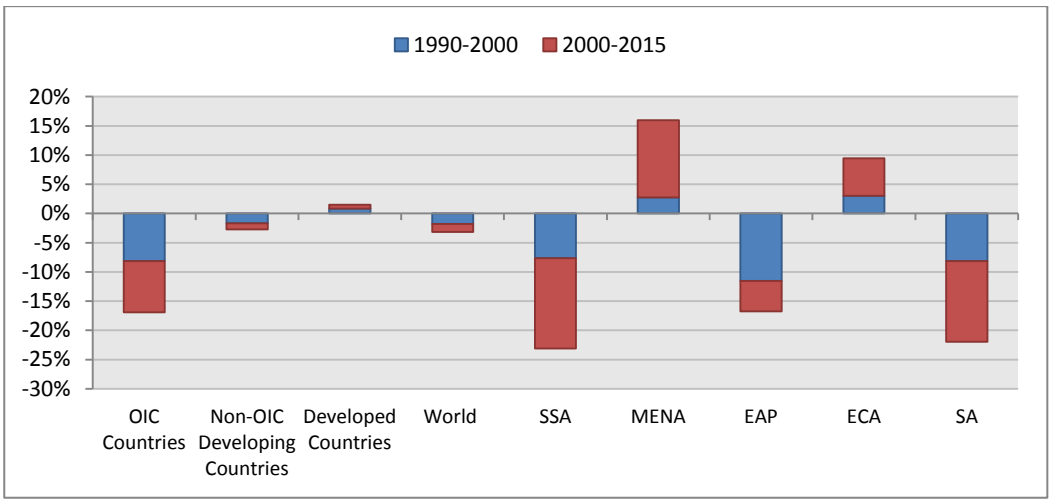
According to UNCCD (2012), 40% of the Earth's land is covered with open and closed forests and of this 42% is dry forest. However, the planet lost about 2.3 million of square kilometers of forests according to the result of change detection through Landsat images taken from 1999-2012 of which growth deforestation is highly visible. The annual rate of deforestation is estimated to be around 13.7 million hectares per year.

Forest loss and gain

During the period 1995-2015, OIC member countries have incurred significant losses in forest area (Figure 3.12). Since 1990, OIC countries lost around 667000 sq km of forest area. In other words, OIC countries lost 25600 sq km forests annually, an area about the size of Albania. OIC member countries witnessed significantly higher loss of forest area compared to other groups. During the same period, member countries in SSA region reported the largest net loss of forests (23%) followed by SA (22%) and EAP (17%). On the contrary, MENA and ECA regions reported forest gain of around 16% and 9%, respectively. Among the MENA countries, Morocco, Algeria and Tunisian reported substantial forest gains whereas; forest area remained unchanged in 6 countries. In the ECA region, Turkey, Uzbekistan and Azerbaijan recorded substantial forest gains whereas Kyrgyzstan and Kazakhstan recorded high rates of deforestation. Among these countries, Turkey was the most successful with 11, 7150 sq km of forest area gained during the last 25 years attributed mainly to large-scale afforestation schemes and activities.

Over the last 25 years, deforestation rate has witnessed exponential increase in Asia and Africa especially during the period of 2000-2015 (Figure 3.12). Forest loss is driven mainly by the rapid urbanization and socio-economic transformation in these countries. In general, OIC countries as a group recorded comparatively very high rate of forest loss in both intervals.

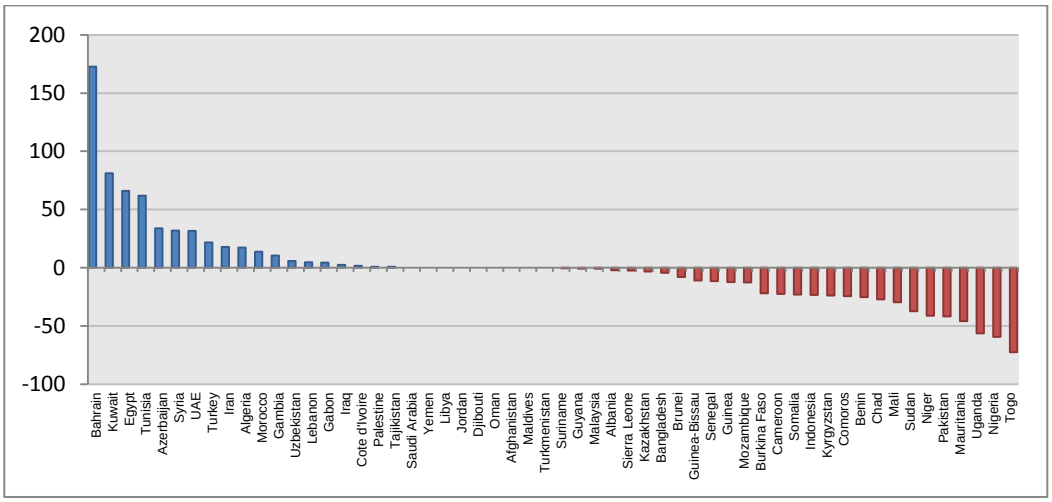
Figure 3.12: Forest Area Gain/Loss, 1990-2015



Source: World Bank, WDI Database, 2017

At the individual country level, 28 OIC members recorded forest losses ranging from 1% in Surinam, Guyana and Malaysia to 73% in Togo (Figure 3.13). Among these countries, more than a quarter (25%) of forest area was lost in ten member countries namely: Togo, Nigeria, Uganda, Mauritania, Pakistan, Niger, Sudan, Mali, Chad and Benin. Majority of these countries are from the SSA region. On the opposite side of the scale, 19 member countries witnessed expansion in forest area. Among these countries, a substantial gain of over 60% was recorded in four countries namely: Bahrain, Kuwait, Egypt and Tunisia.

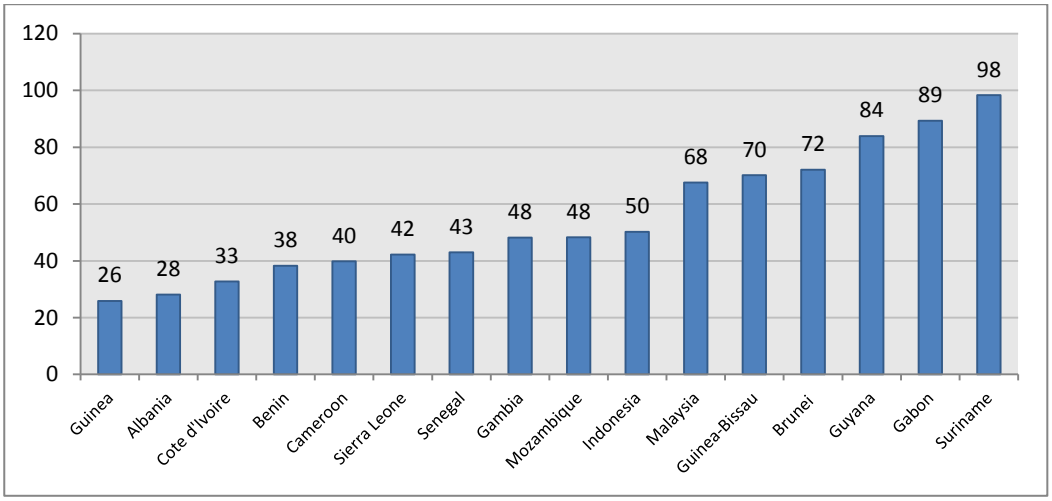
Figure 3.13: Growth of Forest Area (%of land area), 1990-2015



Source: World Bank, WDI Database, 2017.

As of 2015, only 16 OIC member countries have forest covering more than a quarter (25%) of their land area (Figure 3014). Among these countries, around half of the total land area is covered by forest in 7 countries, namely Suriname, Gabon, Guyana, Brunei, Guinea-Bissau, Malaysia and Indonesia. These top 7 OIC countries are also characterized by the low deforestation and are ranked among the top High Forest Cover, Low Deforestation (HFLD) countries in the world. According to the definition of HFLD, a developing country with more than 50% forest cover and a deforestation rate below 0.22% per year is classified in this category. On the opposite side of the scale, less than a quarter (25%) of land area is covered by the forest in the rest of 40 OIC member countries with available data.

Figure 3.14: OIC Countries with Most Forest Coverage (> 25% of land area), 2015



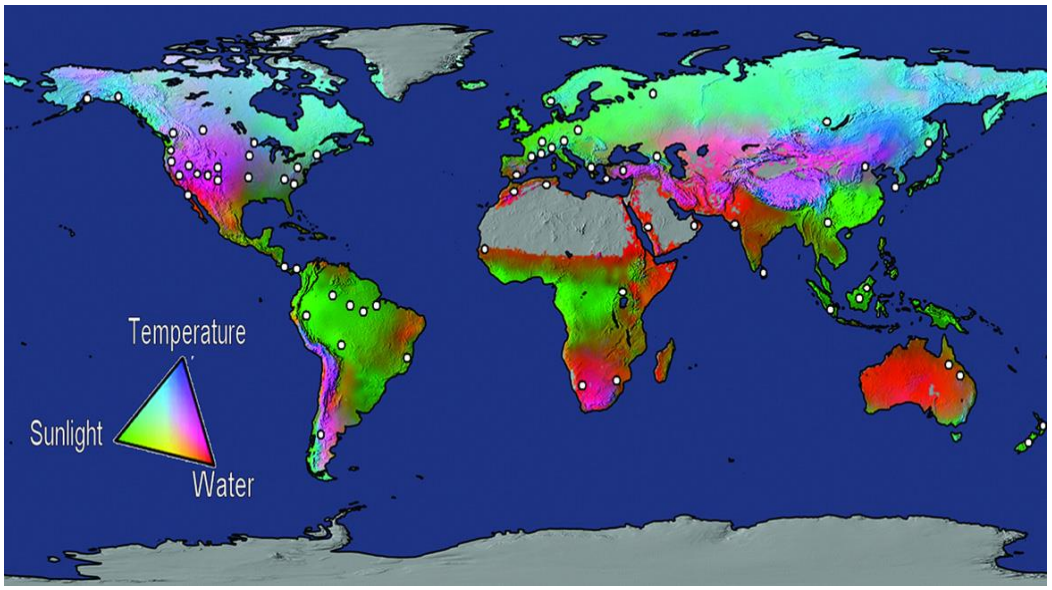
Source: World Bank, WDI Database, 2017

Forest Mortality

Forest mortality due to drought and heat stress is pervasive in the present climate change impact. Allen et al. (2010) had done an analysis between the forest type affected by mortality and the categorized duration of the mortality-triggering drought (seasonal event vs. multi-year drought) with a Chi-square analysis, comparing number of observed triggering droughts (by drought and forest type) versus expected number of triggering droughts. According to the result of the analysis, it is clear that drought and heat-driven forest mortality often is documented in relatively dry regions (red/orange/pink), but also occurs outside these regions (Map 3.5).

In the SSA region of OIC, increased tree mortality is linked to high incidence of drought and heatwaves. In Sahel region, long-term decreases in precipitation linked to climate change have caused a die-off of forest species whereas; forest mortality in Asia and Pacific countries such as Indonesia, Malaysia, Brunei, and Pakistan has been triggered by severe El Nino droughts (Map 3.5).

Map 3.5: Forest Mortality in the World



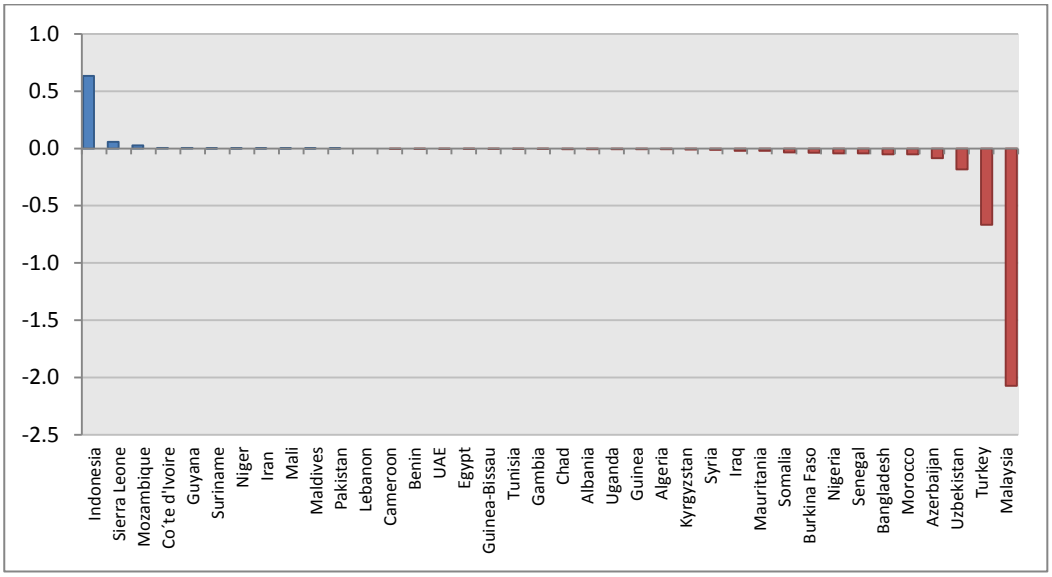
Source: Allen Et.all (2010). *Note: White dots indicate documented localities with forest mortality related to climatic stress, drought and high temperatures.*

Carbon sequestration

Carbon emissions and removals from forests area are an important indicator of the contribution of forests to the global carbon cycle. It is estimated that 300 million tons of carbon is losing to the atmosphere from drylands as a result of desertification each year, about 4% of total global emissions from all sources combined (MEA, 2005).Therefore, carbon sequestration are highly needed that can mitigate global warming. Carbon sequestration is the process by which CO2 sinks (both natural and artificial) remove carbon dioxide from the atmosphere, primarily as plant organic matter in soils.

Among the OIC member countries, in 2015, Indonesia recorded the highest level of net CO2 emissions/removals from forest land followed by Sierra Leone, and Mozambique (Figure 3.15). The higher carbon foot print of Indonesia is largely due to massive forest clearing for palm oil plantations. As of 2015, majority of the Top-10 net emissions/removals countries are from the SSA region. On the opposite side of the scale, Malaysia recorded the lowest net CO2 emissions/removals from forest land in 2015. Among other members, Turkey, Uzbekistan, Azerbaijan, Morocco, and Bangladesh also recorded the lowest net CO2 emissions/removal.

Figure 3.15: Net CO2 Emissions/Removals from Forest land in OIC Countries, 2015 (billion giga grams)



Source: FAOSTAT, 2017

3.4 Natural Disasters

Disasters are not random and do not occur by accident. They are the convergence of hazards and vulnerable conditions. Environmental issues have also constitutive relations with the natural disasters. Environmental degradations such as melting glaciers, denuded slopes, expanding deserts contribute to the increase the risk of natural disasters such as floods and droughts.

Global studies indicate that more than 80% of the natural disasters are hydro-meteorological; e.g. floods, droughts, desertification, cyclones, storms and fires etc. (Sena & Woldemichael, 2006) Therefore, environmental degradation and climate change intensify the frequency and severity of hydro-meteorological hazards. On the other hand, natural disasters can cause drastic environmental changes and if severe enough, even mass extinctions.

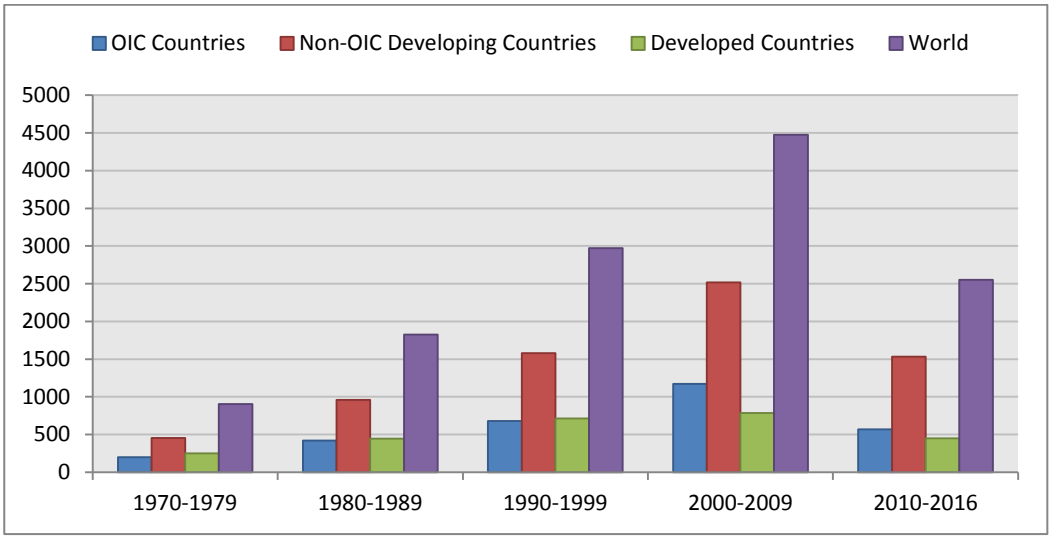
In order to discuss the natural disaster as a part of the environmental issues in OIC countries, this section starts with an overview of the trends in occurrence and impacts of natural disasters for the period of 1970-2016. This section also assesses the risks of and vulnerabilities to these disasters. While touching on all types of natural hazards, the main purpose is to draw a picture on natural disasters which are mostly related with environmental issues.

3.4.1 Prevalence and Impacts

Frequency of Disasters

During 1970-2016, the number of natural disasters around the world significantly increased from 903 occurrences in the 1970s to 2553 during the 2010-2016. The number of natural disasters per year at the world also increased from 81 incidents in 1970 to a record of 297 in 2016 (Figure 3.16). The increasing trend in the number of natural disasters was mostly driven by the increase in incidences of floods, storms, and epidemics; possibly in direct relation to the impacts of global warming.

Figure 3.16: Natural Disaster Trends, 1970-2016



Source: EM-DAT/ OFDA-CRED International Disaster Database

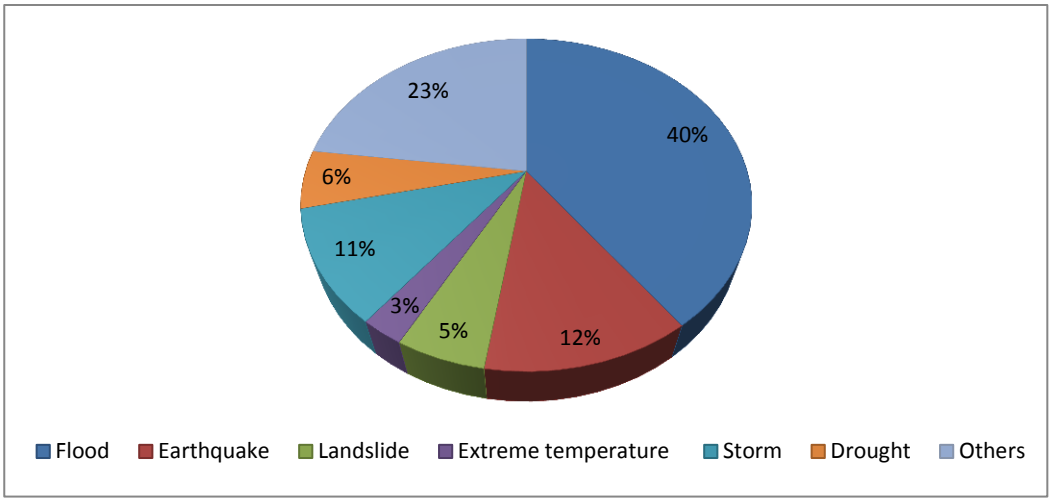
As other country groups, OIC countries experienced a steeper upward trend in the occurrence of natural disasters during the last four decades, significantly increasing from 199 incidents in the 1970s to 1740 between 2000 and 2016 (Figure 3.16). 3040 occurrence of natural disasters have been recorded in OIC since 1970. This corresponds to a 24% share of OIC countries, as a group, in the aggregate number of disaster incidents in the world during 1970-2016. The number of natural disasters per year also increased in OIC countries from 13 in 1970 to a record high of 135 in 2000 and lower to 63 in 2016.

The major drivers of such a fast increase in the number of natural disaster incidents in OIC countries were floods, earthquakes, storm, drought, landslide and extreme temperature respectively in order of frequency (Figure 3.17). In aggregate terms, 1.194

floods, 372 earthquakes and 327 storms are recorded as the most frequently observed natural disasters during the period between 1970 and 2016.

In the OIC region, the disasters related with the environmental issues, such as floods, droughts and extreme temperatures frequently observed during the period under study. This fact proves the importance of environmental degradations in the region. Particularly, high number of occurrence of flood, drought and extreme temperature (in total 1441 occurrence are observed during the period 1970-2016) demonstrates that the climate change, especially global warming, is becoming important threat for OIC region.

Figure 3.17: Types of Natural Disaster, 1970-2016

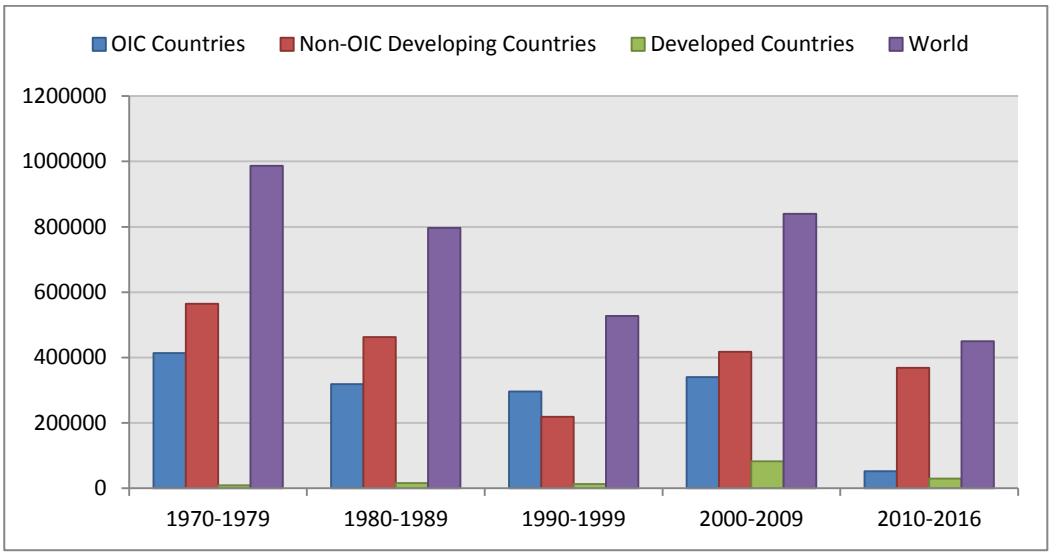


Source: EM-DAT/ OFDA-CRED International Disaster Database

Fatal Impacts

The severe patterns are observed with regard to fatal impacts of natural disasters in OIC (Figure 3.18). Since 1970, more than 1.4 million people were killed by natural disasters in OIC region, corresponding to 39.4 % in the world. The share of OIC countries in the world, regarding the number of people killed by natural disasters, fluctuated over the decades, hitting a record high of 56% in 1990s but decreasing to 40% after 2000s. It is noteworthy that while OIC countries experienced only one fifth of total number of natural disaster incidents, they accounted for almost two fifth of total number of people killed by natural disasters in the world during 1970-2016.

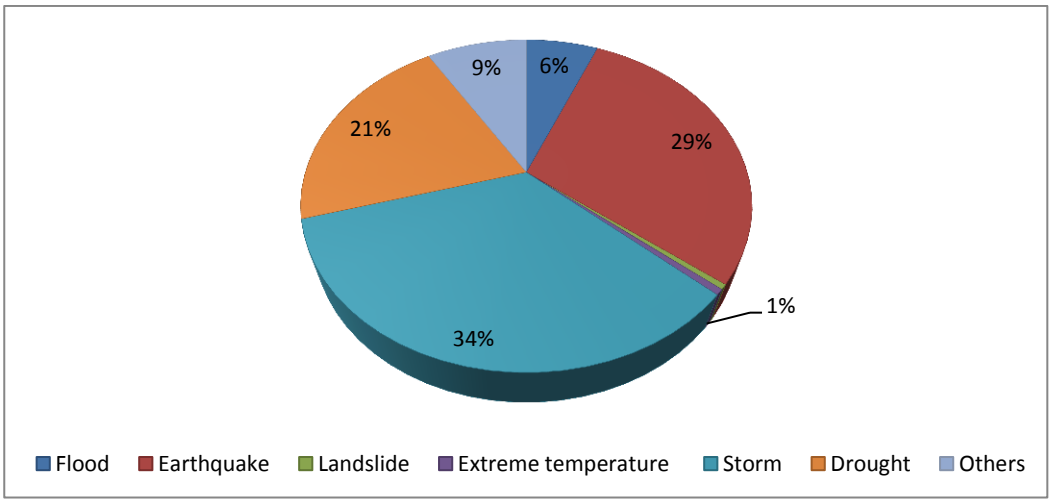
Figure 3.18: Deaths Caused by Natural Disasters, 1970-2016



Source: EM-DAT/ OFDA-CRED International Disaster Database

Considering the fatal impacts of different types of disasters in OIC country groups, storm was the deadliest natural disaster type during 1970-2016 (Figure 3.19). It killed 481389 people. The natural disasters which are related with the environmental degradations have also led high number of deaths in the OIC regions (Figure 3.19). For example, since 1970, more than 302000 people have died in OIC region because of drought and extreme temperature.

Figure 3.19: Fatally Affected People in OIC (by type of Natural Disaster), 1970-2016



Source: EM-DAT/ OFDA-CRED International Disaster Database

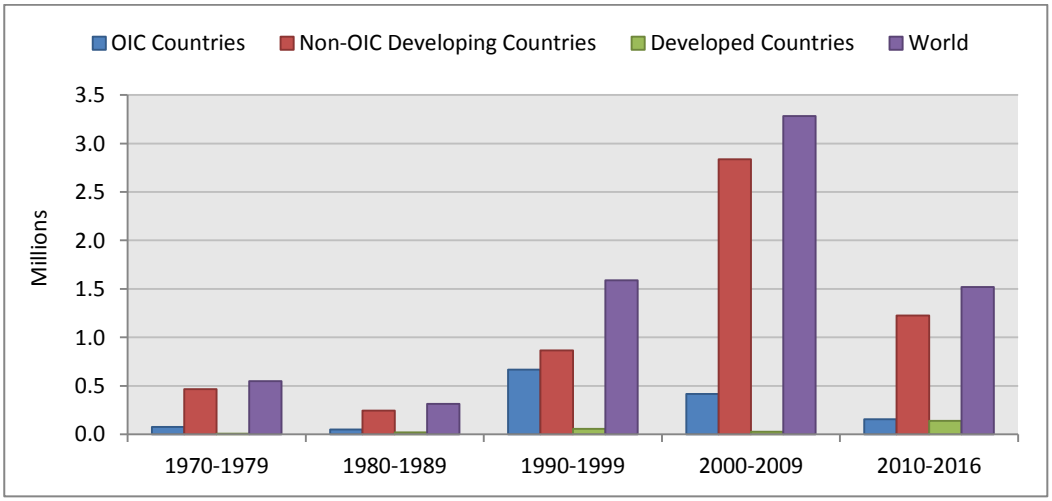
Non-fatal Impacts

The non-fatal impacts of natural disasters in OIC, in comparison to the other country groups, are reported in Figure 3.20 and Figure 3.21. These figures refer to the number of people who have been injured and homeless by a disaster.

According to Figure 3.20, while the number of injured people, because of natural disasters in OIC countries, decreased during the last two decades during 2010-2016, 154.669 people injured in OIC region due to the natural disasters. This corresponds to the OIC share of 10.2% in total number of injured people due to the natural disasters in the world during the same years. This proves that the OIC countries should continue to work on the risk management and vulnerability reduction policies.

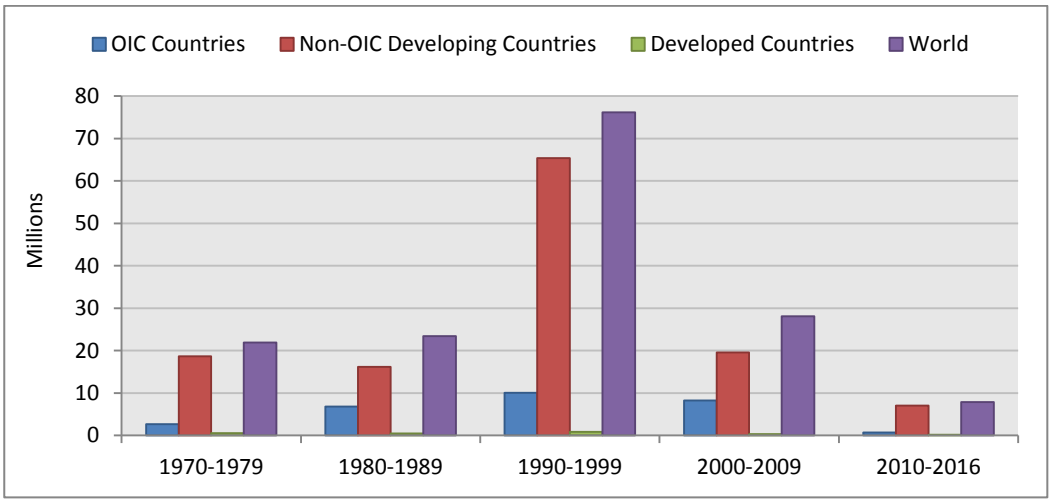
When it comes to the analysis on the number of homeless people because of the natural disaster, more than 28 million people were become homeless because of natural disasters in OIC region (Figure 3.21). This number fluctuated over the decades, hitting a record high of 10 million in 1990s but decreasing to 8 million during the years between 2000 and 2009. Even though the number of homeless people in OIC has been on decline over the last decades, the magnitude of people affected is still undeniably high. To give a clearer picture, more than 70 thousand people were become homeless in 2016 due the natural disasters in OIC countries.

Figure 3.20: Number of Injured People due to Natural Disaster



Source: EM-DAT/ OFDA-CRED International Disaster Database

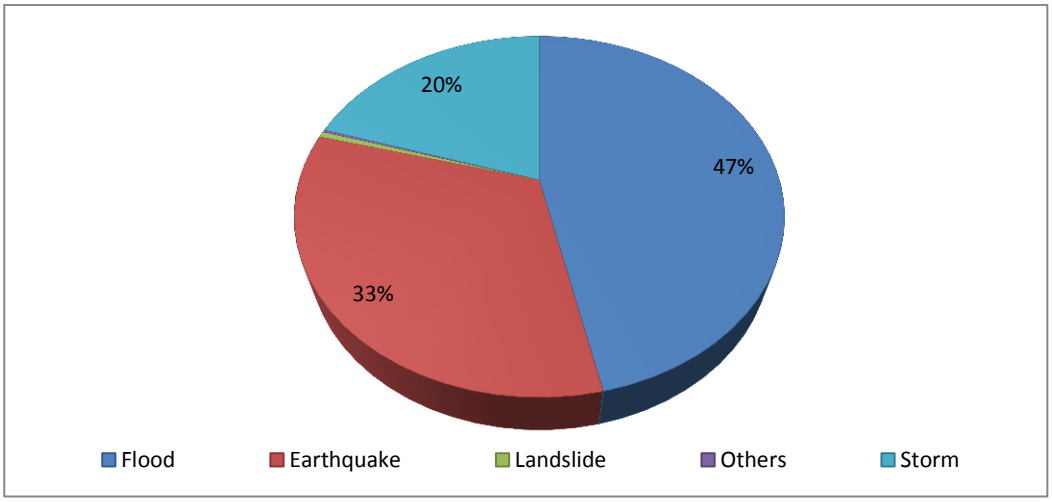
Figure 3.21: Number of Homeless People due to Natural Disasters



Source: EM-DAT/ OFDA-CRED International Disaster Database

As clearly shown in Figure 3.22, floods non-fatally affected more than 13 million people in OIC over the years during 1970-2016. It is followed by earthquakes with 9.7 million and landslides with 5.9 million people being affected. This numbers also proves that the natural disasters related with environmental degradation are important to consider for OIC countries, where the floods, extreme temperature and droughts have remained as the important threats.

Figure 3.22: Non-Fatally Affected People (by type of Natural Disaster)

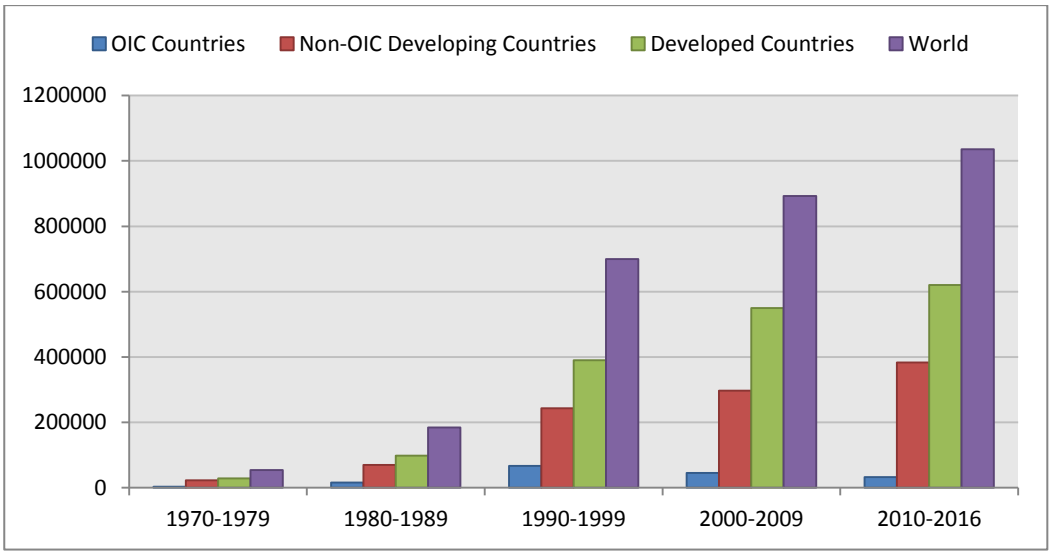


Source: EM-DAT/ OFDA-CRED International Disaster Database

Economic Impacts

Economic costs of natural disasters in OIC and other country groups during 1970-2016 are reported in Figure 3.23. It shows that the cost of damages substantially increased in OIC countries from US$ 3 billion in the 1970s to record high of US$ 67 billion in the 1990s. Between 2000 and 2016, the economic impact of natural disasters was also accounted as US$ 77 billion. Over this period, the share of OIC countries in the world increased from 6% in 1970s to record a high of 10% in the 1990s. During the period after 2000, however, the proportion decreased to 4% (Figure 3.23). In aggregate, OIC countries together accounted for 5.7% of total cost of damages by natural disasters in the world during 1970-2016.

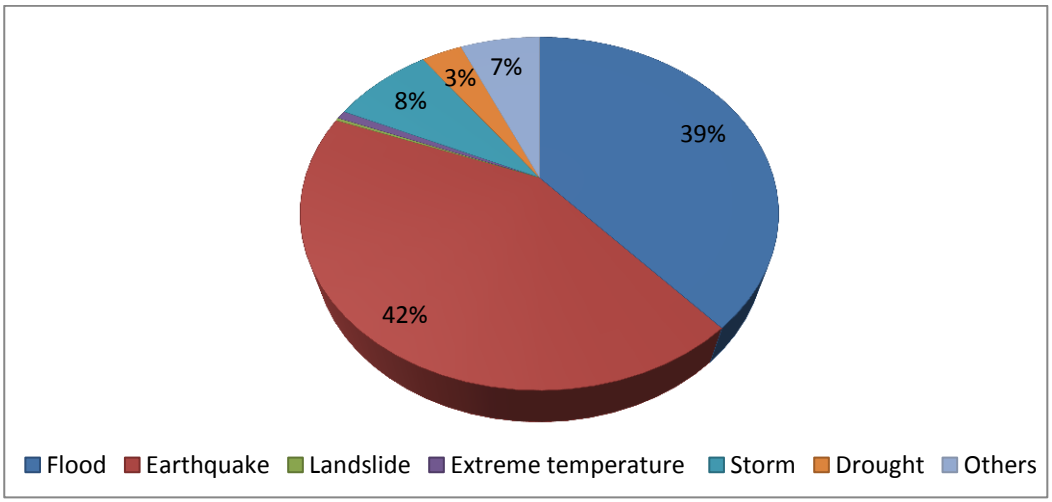
Figure 3.23: Cost of Damages (1000 US$)



Source: EM-DAT/ OFDA-CRED International Disaster Database

As far as cost of damages by natural disasters are concerned in monetary terms, earthquake, with almost US$ 70 billion damages during 1970-2016, accounts for 42.5% of total economic damages of natural disasters in OIC countries. It is followed by flood with 38.6%, amounting to US$ 62.9 billion (Figure 3.24).

Figure 3.24: Cost of Damages by type of natural disasters in OIC, 1970-2016



Source: EM-DAT/ OFDA-CRED International Disaster Database

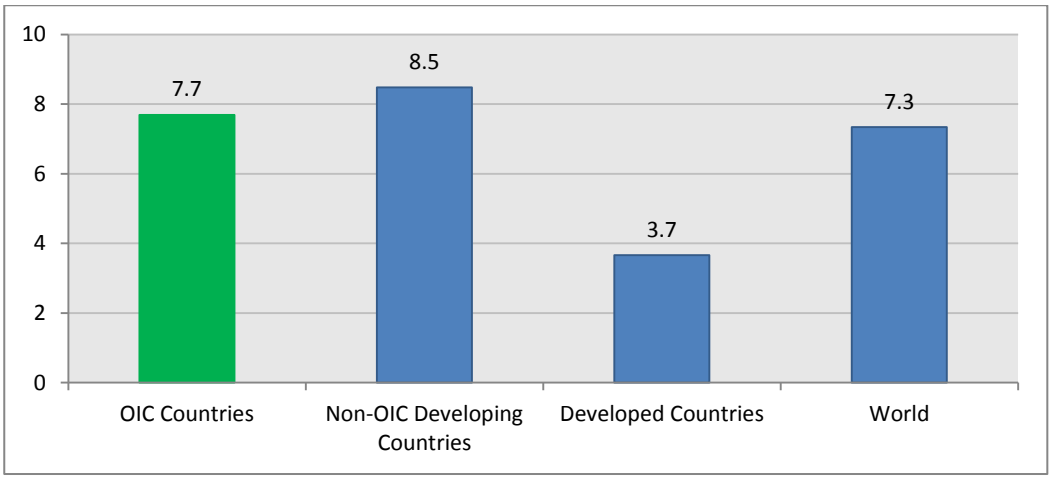
3.4.2 Risks and Vulnerabilities

Assessing the risks induced by being prone to hazards and the risks induced by vulnerabilities are integral parts of disaster risk assessment. The "vulnerability" 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 (UNISDR, 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. This is particularly true if one considers the fact that 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.

In this context, the World Risk Index (WRI), developed by the United Nations University Institute for Environment and Human Security (UNU-EHS), measures the likelihood that a country or region will be affected by a disaster. WRI is comprised of four main components, namely, exposure to natural hazards, susceptibility, coping capacities, and adaptive capacities – where the latter three components aim at measuring the vulnerability of the population.

Figure 3.25 gives the distribution of different country groups with respect to their WRI scores. according to the figure, while the average WRI score in OIC region (7.7) is lower than the non-OIC developing countries (8.5), the risk index in OIC region, on average, is higher than the global average of 7.3 and the average of developed countries (3.7) (Figure 3.25).

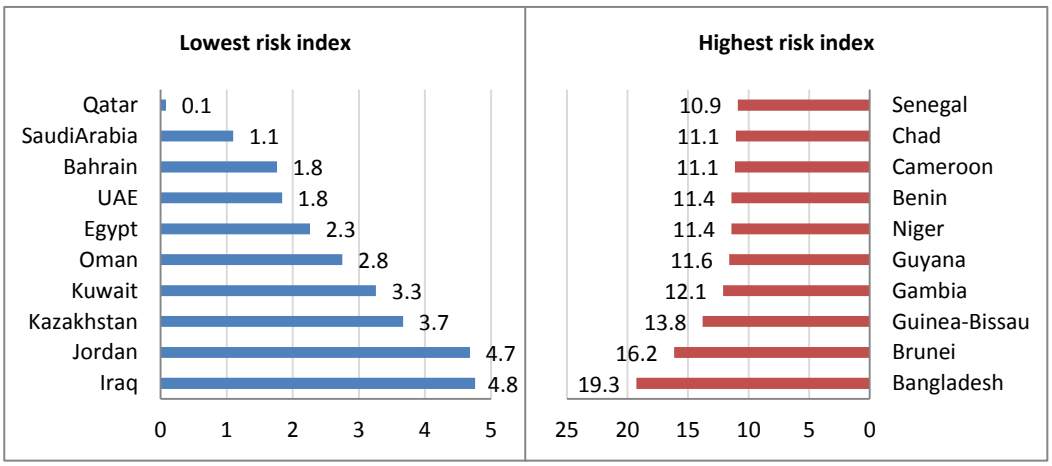
Figure 3.25: World Risk Index, 2016



Source: UNU-EHS, 2016

Figure 3.26 shows the OIC countries, which has highest and lowest risk index in 2016. The 2016 index ranks Qatar the least risky with an index value of 0.1 whereas Bangladesh is ranked the most risky with a score of 19.3, followed by Brunei Darussalam, Guinea-Bissau and Gambia.

Figure 3.26: OIC Countries with Lowest and Highest Risk Index, 2016



Source: UNU-EHS, 2016.

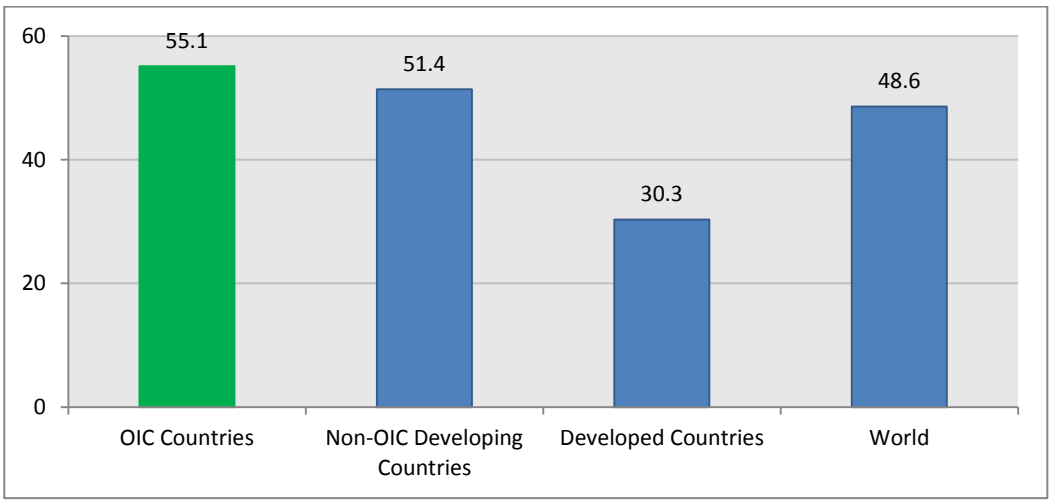
3.4.3 Vulnerability to Natural Hazards

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.

Vulnerability encompasses conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility of a community to the impact of hazards. In other words, vulnerability amplifies the tolls taken by natural hazards and leads them toward becoming disasters. In the dataset provided by the UNU-EHS, vulnerability refers to social, physical, economic and environmental related factors that make people or systems more vulnerable to the impacts of natural hazards and to the impacts of climate change.

Figure 3.27, in this regard, reveals an important fact: OIC, according to the UNU-EHS database, is much more vulnerable to disasters than physically exposed to them. As marked in the figure, the vulnerability rate of OIC accounted 55, which is higher than the all country groups and world average.

Figure 3.27: Vulnerability, 2016

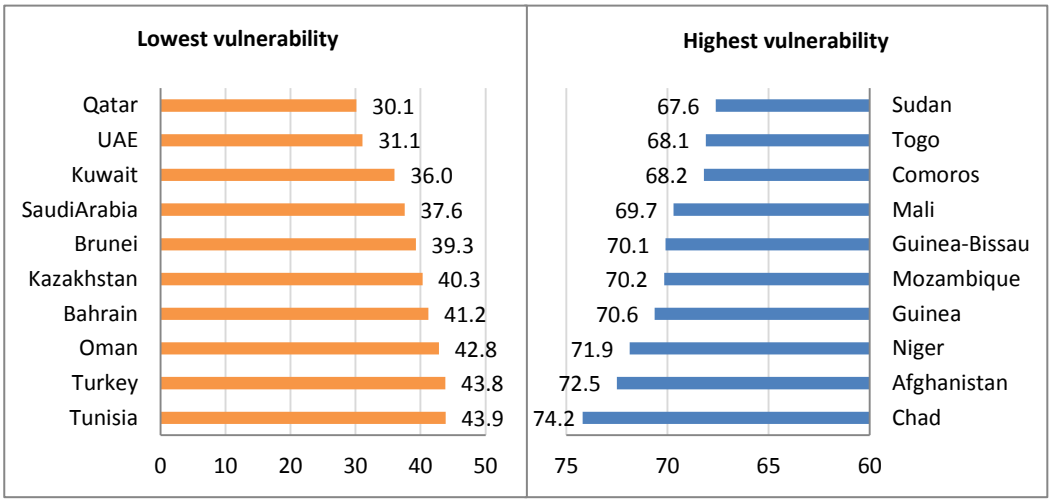


Source: UNU-EHS, 2016.

As shown in Figure 3.28, the most vulnerable OIC countries to natural disasters are Chad, Afghanistan, Niger, Guinea, Mozambique and Guinea-Bissau respectively with the scores over 70. On the other hand, Qatar is ranked as the least vulnerable country

among the OIC member to the natural disasters with the score of 30.1, which is lower than the average of developed countries.

Figure 3.28: OIC Countries with Lowest and Highest Vulnerability Index, 2016



Source: UNU-EHS, 2016.

3.4.4 Susceptibility

Susceptibility refers to the conditions of exposed communities or other exposed elements which make them more likely to experience harm and to be negatively affected by a natural hazard or by climate change. Therefore, susceptibility describes structural characteristics and framework conditions of a society. In UNU-EHS dataset, public infrastructure, housing conditions, nutrition, poverty and dependencies, and economic capacity and income distribution represents susceptibility.

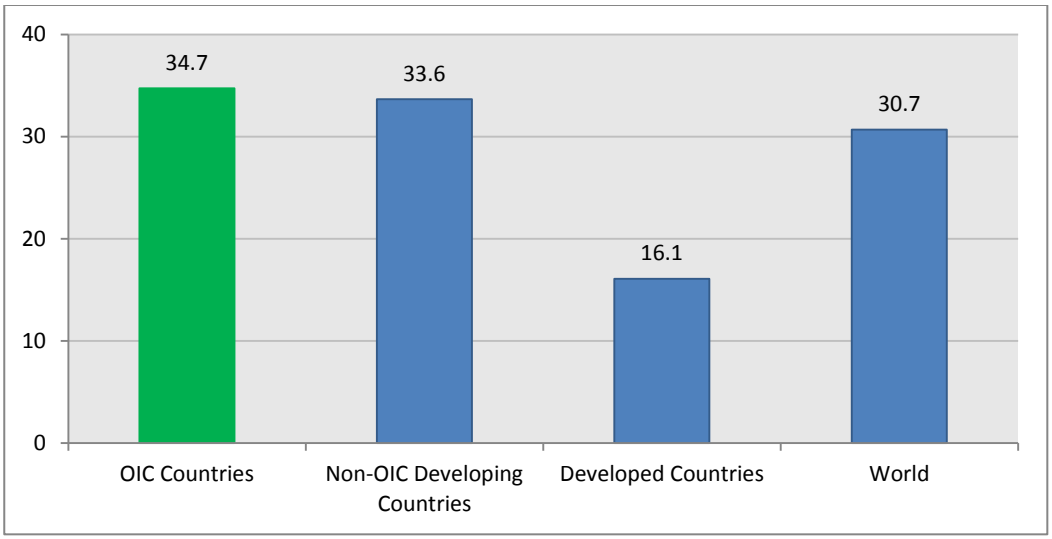
Susceptibility of human lives to natural disasters can simply be measured by the land density of population. High population growth rates result in increased population density, resulting in increased susceptibility – thus, vulnerability – to natural disasters. During the last two decades, the population density in OIC countries, measured by people living in each square km. of land area, has increased by almost a half (SESRIC, 2014). OIC countries in South Asia (SA) region, followed by those in East Asia and Pacific (EAP), have on average the highest population densities – a situation which helps natural hazards in these regions, once triggered, easily turn into natural calamities (SESRIC, 2014).

The susceptibility of humans can be mitigated by ensuring a better dispersion of the productive assets and population within the country, and putting in place more effective protection measures. However, it is without doubt that a better

understanding of the level of susceptibility to natural disasters in OIC region requires the in-depth analysis of a broader spectrum of indicators including those related to the relative size of arable and dependency on agriculture, the quality of public infrastructures, spatial distribution of the population and economic assets, quality of urban planning, etc.

To be able to give an overall picture of susceptibility in OIC, the distribution of different country groups based on the susceptibility component of the WRI is depicted in comparative perspective. According to Figure 3.29, OIC, as a group, is a highly susceptible region with the score of 34.7 which is higher than the world average and non-OIC developing countries, also almost double than developed country group average.

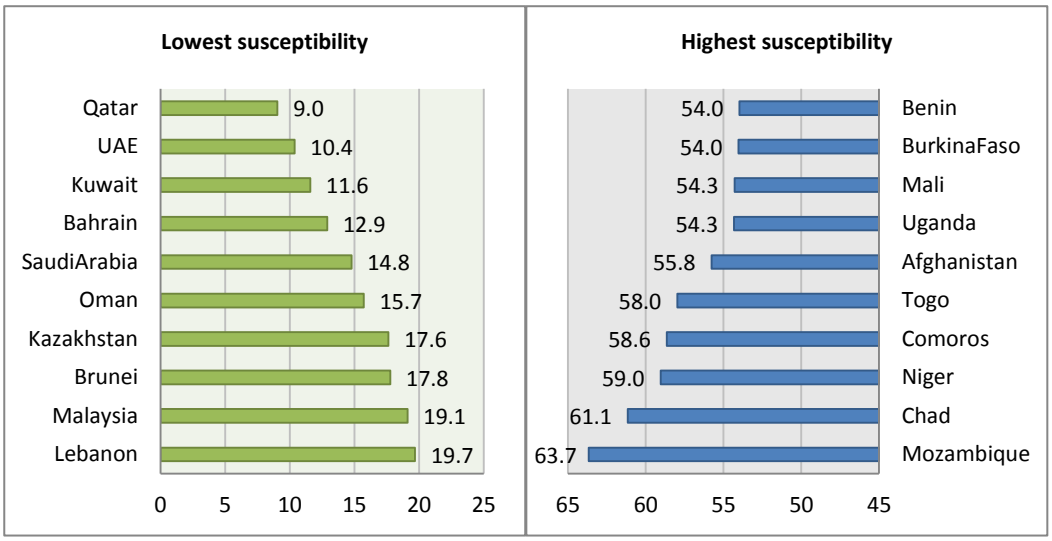
Figure 3.29: Susceptibility, 2016



Source: UNU-EHS, 2016.

When analyzing the susceptibility at the individual country level, 6 OIC countries namely: Qatar, UAE, Kuwait, Bahrain, Saudi Arabia and Oman were ranked as the least susceptible countries among the OIC members. Their susceptibility was scored less than developed country average. On the other hand, some members from SSA, namely Mozambique, Chad, Niger, Comoros and Togo, were marked with the highest susceptibility index among the OIC countries.

Figure 3.30: OIC Countries with Lowest and Highest Susceptibility Index, 2016



Source: UNU-EHS, 2016.

3.4.5 Coping Capacities

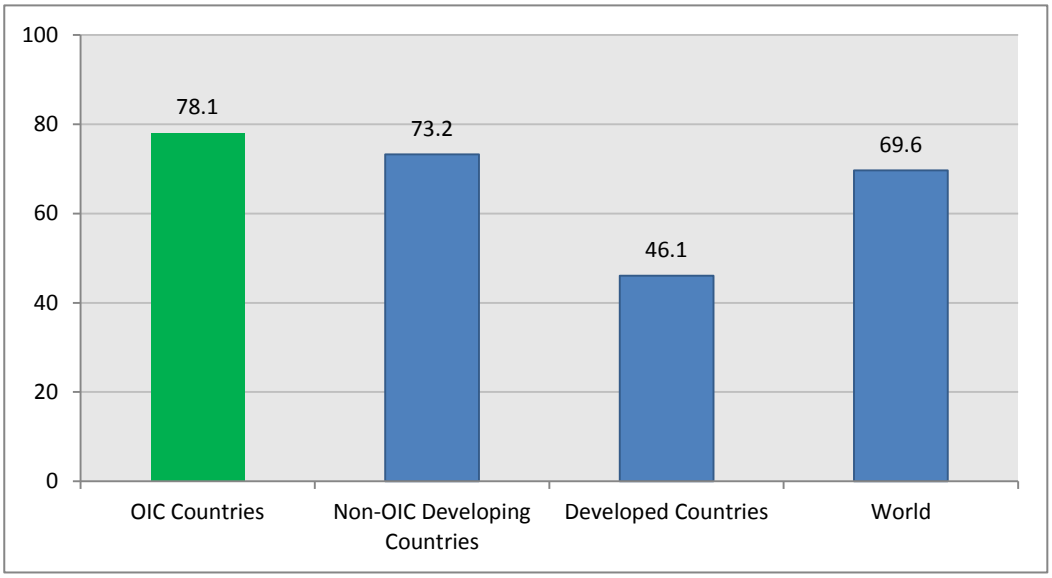
The quality of a country's capacities and conditions for disaster management appears to have a significant influence on the underlying drivers of risk. When similar numbers of people are affected by hazards of similar severity, wealthier and poorer countries generally experience radically different losses and impacts. Whereas relative wealth is a key determinant, other factors also play roles in the social construction of risk. Countries with higher income, lower inequality and lower corruption have been found to experience fewer casualties from disasters. Drivers of inadequate capacities for risk management include, among others, badly planned and managed urban and regional development. In this connection, coping capacities and adaptive capacities refer to the ability of societies to use their own resources and their long-term strategy in preventing the natural hazard events.

Controllable environmental factors, such as depletion of air, water, and soil, deforestation, and variety of others determine the extent of a society's ability to cope with the adverse effects of triggering events and develop adaptive capacities against them. Therefore, apart from its determining role on the severity of natural hazards, environmental sustainability also plays an essential role in determining the level of vulnerability to natural disasters. Environmental changes are directly related to natural ecosystem change, shift in disease patterns, and degradation of natural resources, deforestation, and some other environmental changes which have a significant impact

on the vulnerability patterns. According to SESRIC (2014), a significant majority of the OIC land area, and therefore population, is exposed to poorly-managed environmental conditions and the progress over the last decade has been modest.

In view of the above analysis, Figure 3.31 shows the dispersion of OIC based on its score in the Lack of Coping Capacities Sub-index of the WRI – as compared, again, to other country groups. The index reveals the grievous fact that OIC, as a group, is associated with the severe lack of coping capacities with the score of 78.1, which is higher than the other country groups and the global average of 69.6.

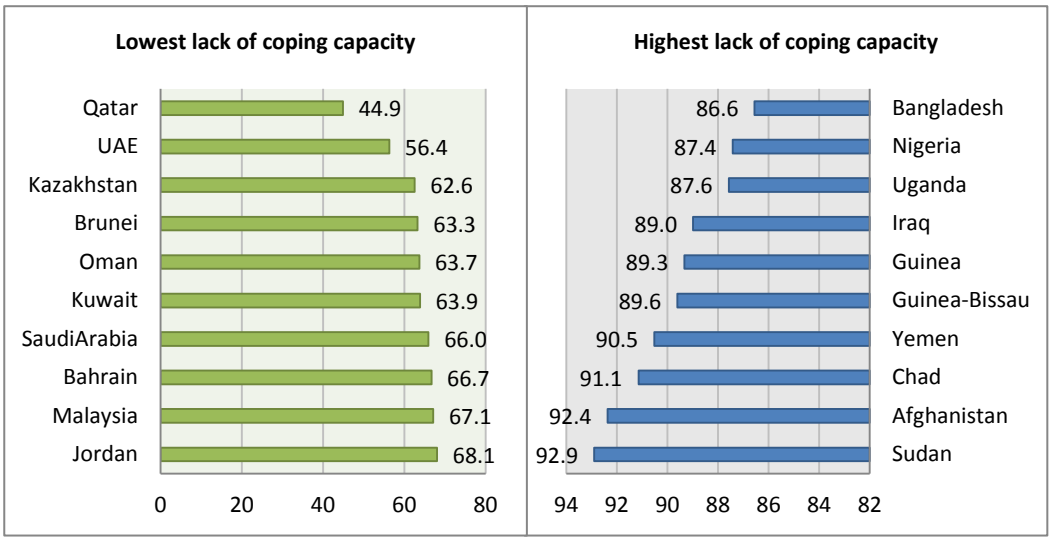
Figure 3.31: Lack of Coping Capacities, 2016



Source:UNU-EHS,2016.

At the individual country level, there is a huge disparity among the OIC countries regarding lack of coping capacities (Figure 3.32). Among OIC members, the lowest lack of coping capacity was observed in Qatar with the score less than 50, while Sudan, Afghanistan, Chad and Yemen had the highest lack of coping capacity with the scores over 90.

Figure 3.32: OIC Countries with Lowest and Highest Lack of Coping Capacities, 2016



Source: UNU-EHS, 2016.

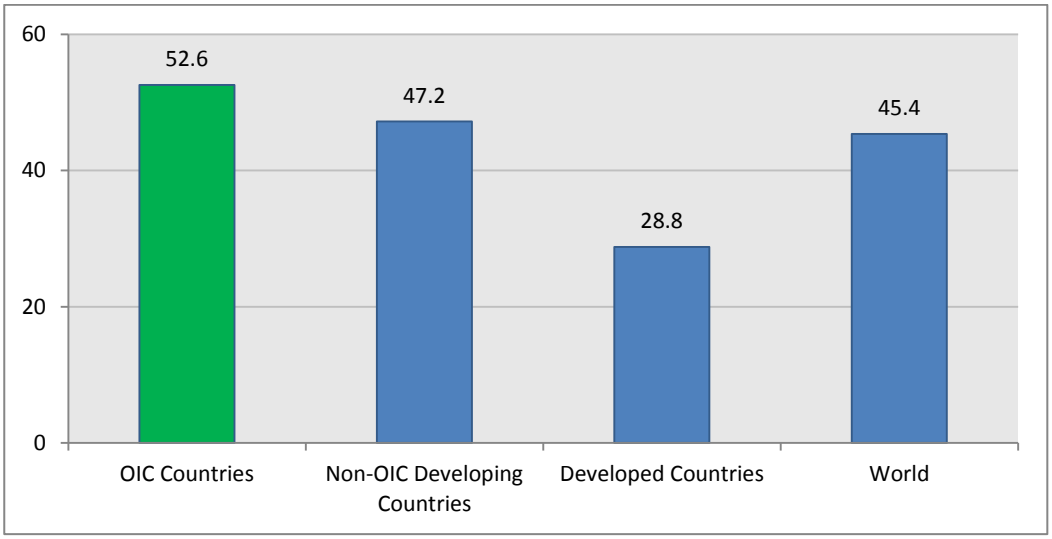
All in all, most OIC countries still rely on the traditional disaster management structures that are mainly international post-disaster response and relief agencies, and lack the capacities for effective risk reduction. This grim fact is reflected in the poor risk reduction capabilities indicated by the Risk Reduction Index. According to a study (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 coping capacities and are the most at the risk of human and capital losses due to disasters.

3.4.6 Adaptive Capacities

Adaptation is defined as a long-term strategy that not only aims to promote change and transformation but also encompasses measures and strategies dealing with and attempting to address the negative impacts of natural hazards and climate change in the future (UNISDR, 2012). For instance, in order to be able to survive with the changing environmental conditions, a farmer who aims to adapt to drought, may need to change his calendar of cropping or perhaps the crops themselves.

Similar to earlier figures where other two sub-components of WRI were reported, Figure 3.33 provides the distribution of different country groups and OIC, based on the extent to lacking adaptive capacities. It should be noted from the figure that OIC exhibit the most pessimistic look in this type of capacity. OIC, on average, scored a number of 52.6 which is higher than the other country groups and world average.

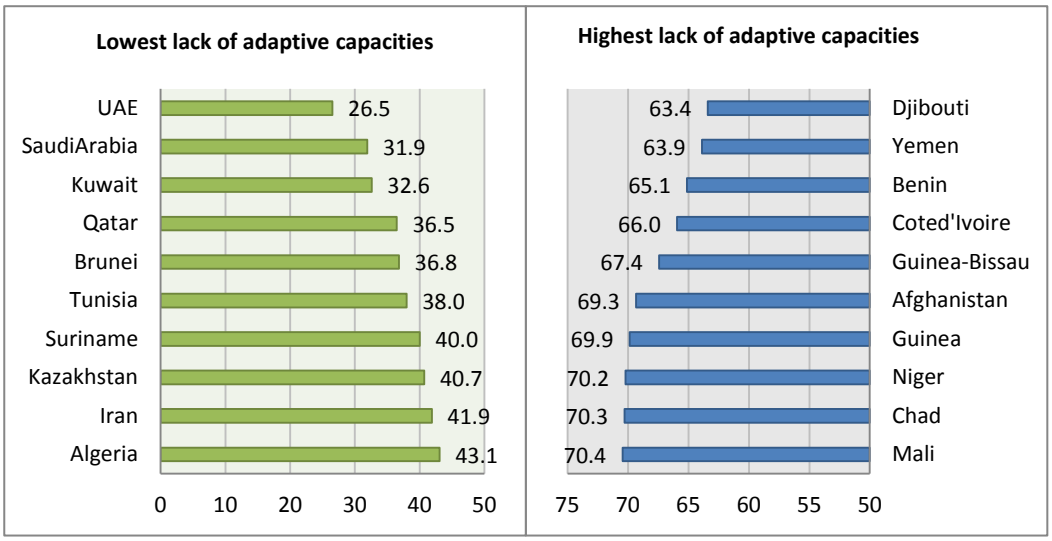
Figure 3.33: Lack of Adaptive Capacities, 2016



Source: UNU-EHS, 2016

Figure 3.34 shows OIC countries with lowest and highest lack of adaptive capacities. According to the data, OIC countries from the Middle East, including UAE, Saudi Arabia, Kuwait and Qatar were the countries with the lowest lack of adaptive capacity in 2016. On the opposite side of the scale, Mali, Chad, Niger, Guinea and Afghanistan recorded the most pessimistic results for adaptive capacity.

Figure 3.34: OIC Countries with Lowest and Highest Lack of Adaptive Capacities, 2016



Source: UNU-EHS, 2016

4. Adaptation and Mitigation Mechanisms

Majority of the conventional environmental issues like climate change, deforestation, desertification etc. are global in nature. Therefore, it requires bilateral, regional and international collaborative efforts to address these challenges.

4.1 Multilateral Environmental Agreements

Historically, climate change has got the most attention as the top environmental issues. The first recognition of climate change as a serious environmental issue was during the First World Climate Conference held on 12-23 February 1979 in Geneva. Afterwards, a number of intergovernmental conferences were held to raise international concerns regarding climate change. These conferences were attended by the policy-makers, scientists, and environmentalists to make a united call for a global action.

The main international agreement in this area is the United Nations Framework Convention on Climate Change (UNFCCC). It was adopted at the Rio Earth Summit in 1992 and is regarded as a fundamental road map for all countries to work together to limit global temperature increases and climate change. Since adoption, it has been ratified by 195 countries. In order to ensure required decrease in GHG emissions, the

signatories of the convention adopted the Kyoto Protocol on 11 December, 1997. The protocol introduced legally binding emission reduction targets for the developed countries and it entered into force on 16 February, 2005. During the first commitment period of 2008-2012, developed countries were expected to cut their emissions on average by 5% against the 1990 level. The second commitment period of the Kyoto Protocol began on 01 January, 2013 and will end in 2020. The 2015 Paris Agreement is the latest global agreement on climate change adopted on 12 December, 2015. In line with its predecessor, it also defines specific goals, targets and policies needed to cut the GHG emissions and limit global warming below 2°C. This agreement is covering the period from 2020 onward.

Over the years, global community has made significant progress in bringing together diverse stakeholders to deal with climate change. However, despite improvement, global community failed to make a significant dent in GHG emissions which are the prime cause of global warming and therefore climate change. Developed countries, the major emitters of GHG, failed to uphold their commitments to cut emissions under the Kyoto Protocol regime, while due to their failure developing countries, especially the emerging one, are reluctant to consider any proposal to reduce their increasing contribution to total GHG emissions. It is worth noting that the USA, top GHG emitter in the world, has never signed the Kyoto Protocol while Canada pulled out of it before the end of first commitment period. On the other hand, Russia, Japan and New Zealand are not taking part in the second commitment period. Therefore, it is quite evident that the global targets on cutting GHG emissions to limit the global warming below 2°C will remain largely unmet during the second commitment period as well.

Among the OIC member countries, there is a widespread awareness about the problem of climate change and its negative consequences. They actively participate in the climate related summits, treaties, events, and projects. They have also developed their national and regional adaptation and mitigation strategies and strive hard to get technical and financial support from the international community to implement these strategies.

Ratification of UNFCCC

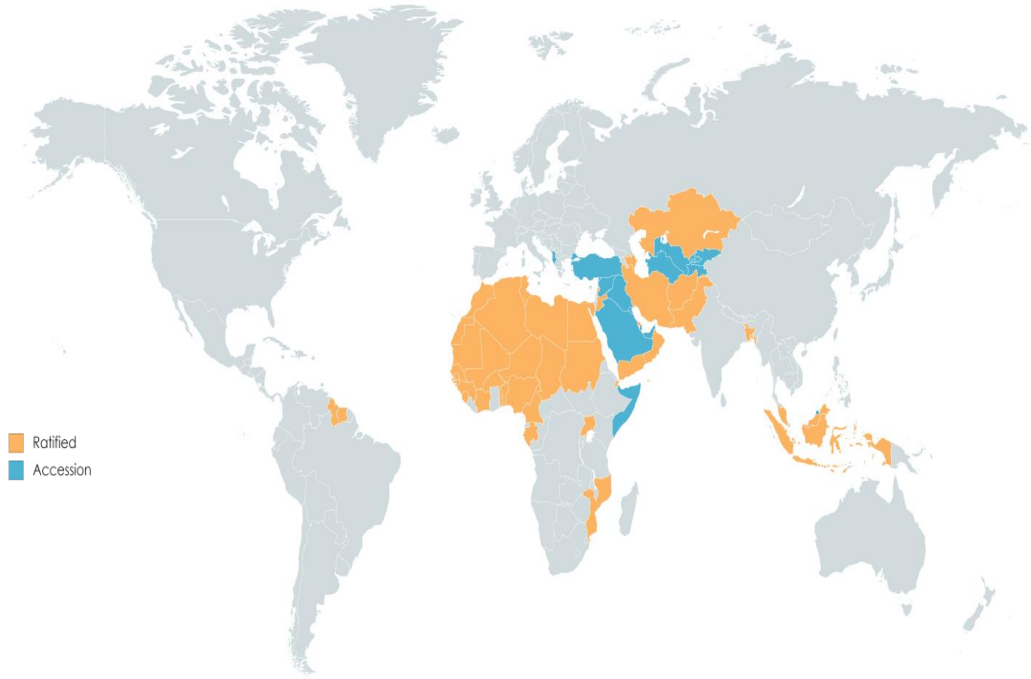
The UNFCCC states that developing countries are not obliged to reduce GHG emissions. However, they are expected to enhance climate-friendly (low carbon) technologies in their economic development with the financial support of developed countries. In this regard, most of the OIC member countries have ratified the Convention to express

their concern about negative impacts of climate change and showed their willingness to precede necessary policies as principally financial support will be provided for that.

As of September 2017, 42 OIC countries have ratified the convention whereas; 14 members are the state of accession (Map 4.1). Majority of oil-exporting countries are in the state of accession because the concept of "using low-carbon technology" implies reduction in using oil for transportation and industry, which can cause significant decline in their national income since export of oil is their sole or main source of earnings.

As required from Non-Annex I countries to submit a national communication reports, 45 OIC member countries have submitted their first National Communication Reports including GHGs inventory, vulnerability assessment and adaptation and mitigation measures for tackling climate change. Moreover, 22 OIC-LDCs have submitted their National Adaptation Plan in order to receive financial support for adaptation activities.

Map 4.1: Ratification of UNFCC



Source: UNFCCC

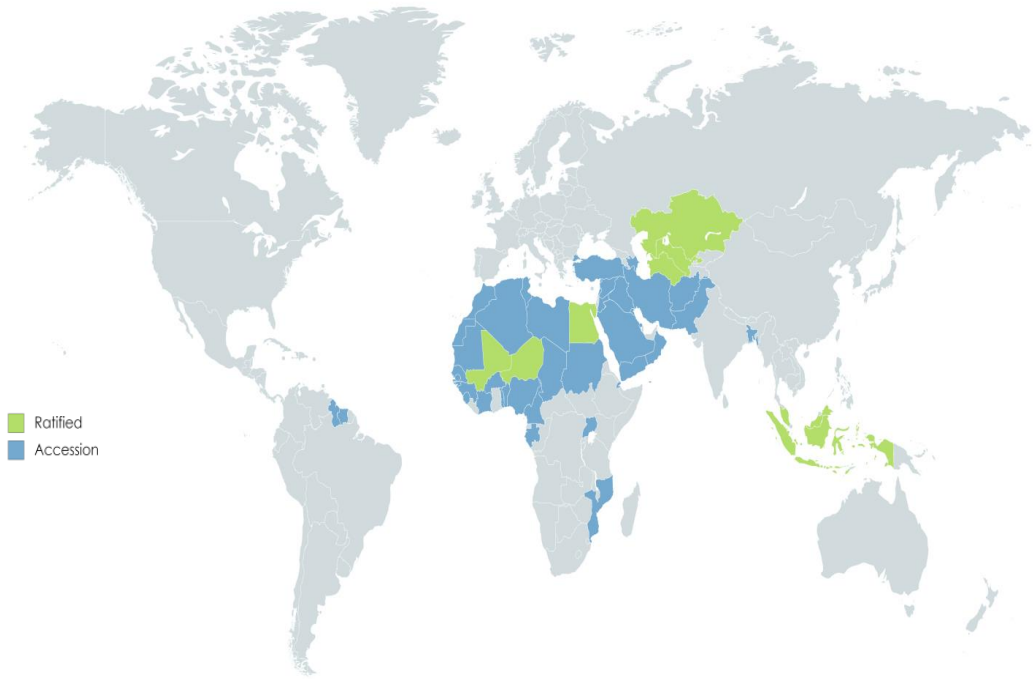
Ratification of Kyoto Protocol

The principle of "common but differentiated responsibilities among industrial countries, both developed and developing countries", which was introduced in Kyoto Protocol, lead to different interpretations. Industrial developing countries insist on their right for economic development and the historical responsibility of the developed countries for global warming, while developed countries claim that developing countries have a big share of generated GHG emissions and this share will increase significantly in the future. As of September 2017, 10 OIC member countries have ratified the Kyoto Protocol whereas; 46 members are in the state of accession.

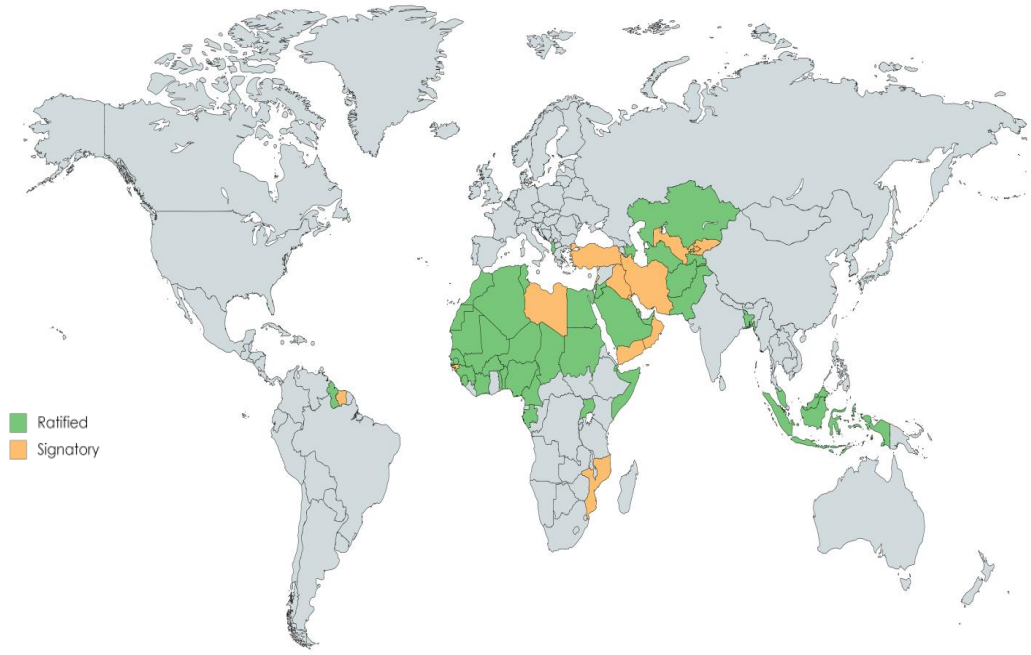
Ratification of Paris Agreement

The Paris Agreement is considered as an historic international deal on climate change. It was adopted on 12 December, 2015 in Paris and it entered into force on 4 November 2016. As of September 2017, out of 196 signatories of the Paris agreement 166 have ratified it. Among the OIC countries, 43 members have ratified it whereas; 13 members have status of signatory.

Map 4.2: Ratification of Kyoto Protocol



Map 4.3: Ratification of Paris Agreement



Source: UNFCCC

4.2 Adaptation and Mitigation Mechanisms

Adaptation and mitigation measures are integral parts of an effective strategy to address the climate change. In general, adaptation to climate change involves deliberate adjustments in natural or human systems and behaviors to reduce the risks to people's lives and livelihoods. On the other hand, mitigation of climate change involves actions to reduce greenhouse gas emissions and sequester/store carbon in the short term, and making such development choices that will lead to low emissions in the long term. In other words, mitigation reduces the rate and magnitude of climate change and its associated impacts, whereas adaptation reduces the consequences of those impacts by increasing the coping ability of humans and ecosystems.

Adaptation

Adaptation is a key building block of UNFCCC's response to climate change. It involves many dimensions, including: capacity building, disaster risk management, research and assessment, and economic diversification. In this regard, all countries are expected to prepare their vulnerability assessments, prioritization of action, financial needs assessments, capacity building and response strategies, and integration of adaptation

actions into sectoral and national planning. Adaptation is particularly important for the developing countries especially due to their high vulnerability to the climate change.

All Least Developed Countries (LDC) are supposed to prepare their national adaptation plans of action (NAPA) and submit their priority projects to the UNFCCC secretariat for financing. As of September 2017, 50 countries had completed and submitted their NAPAs to the UNFCCC secretariat (UNFCCC, 2017). Among the OIC countries, 22 LDC have submitted their list of priority adaptation activities/projects to get financing for the implementation of their NAPAs. In general, priority sectors/areas addressed in the NAPAs are agriculture and food security, water resources, coastal zones, and early warning and disaster management.

According to the UNFCCC's NAPA priorities database, 48 LDCs have submitted over 500 projects. Around half (49%) of these projects were submitted by the 21 OIC countries (Table 4.1). Among these OIC countries, Mauritania, Guinea and Sierra Leon submitted more than 20 projects. The implementation of these 248 projects in OIC countries required around 250 million US$. Most of these funds are expected to be spent in five OIC countries: Bangladesh (18% of total financing), Senegal (14%), Mali (11%), Sierra Leon (7%) and Yemen (7%).

Mitigation

Mitigation measures aim to reduce GHG emissions by using climate-friendly and climate-resistant technologies, shifting to green energies, enhancing GHGs storage, and reducing deforestation. In order to stabilize GHG emission into the atmosphere, several mitigation efforts need to be taken. These mitigation efforts should be targeted at diversifying the economy from a high GHG emission one to a low carbon economy through application of low carbon technology and lifestyle.

A report by Gerstetter and Marcellino (2009) identified the barriers of technological innovation in three folds: lack of funding, market barriers and regulatory environment barriers. Developing countries, including OIC members, are more likely to encounter difficulty in all three barriers. Lack of funding is subject to financing the low carbon technology. The market barriers are related with costs in implementation of the technology. Finally, the regulatory environment means regulations, policies, and institutions required to get smoothen market penetration of low carbon technology.

Table 4.1: NAPA Priority Projects

Country	Number of Projects		Cost of Projects (Million US$)	
	Total	Share of Total OIC-LDC	Total	Share of Total OIC-LDC
Afghanistan	2	1%	4.4	1%
Bangladesh	19	8%	77.3	18%
Benin	5	2%	15.6	4%
Burkina Faso	12	5%	5.9	1%
Chad	10	4%	14.0	3%
Comoros	13	5%	4.5	1%
Djibouti	8	3%	7.4	2%
Gambia	10	4%	15.1	3%
Guinea	25	10%	8.2	2%
Guinea Bissau	14	6%	7.2	2%
Maldives*	11	4%	23.0	5%
Mali	19	8%	49.8	11%
Mauritania	26	10%	20.2	5%
Mozambique	4	2%	9.2	2%
Niger	15	6%	N/A	N/A
Senegal	4	2%	59.2	14%
Sierra Leone	24	10%	30.1	7%
Somalia	3	1%	18.7	4%
Sudan	5	2%	15.1	3%
Togo	7	3%	19.1	4%
Yemen	12	5%	29.9	7%

Source: UNFCCC

It has been obvious that most GHG emissions are generated from energy sector through the burning of fossil fuels. However, the mitigation efforts in this sector were still limited. Renewable energy still has a small portion globally with less than 2% from the total global primary energy consumption. This fact shows that market penetration of low carbon technology is still very low. This economic barrier will make it difficult to perform carbon reduction initiatives.

Policy makers are not oblivion to the economic barrier as this features prominently at the international climate negotiations arena where market mechanisms to mitigate the effect of climate change are discussed. The Kyoto protocol nested three market mechanisms notably: Clean Development Mechanisms (CDM), Joint Implementation (JI), and International Emission Trading (ET). Those three mechanisms not only allow

industrialized countries to meet their emissions reduction target, but also allow technological transfer and economic incentives for developing countries to implement low carbon technology effort (climate change mitigation efforts). CDM as one of the three Kyoto's market mechanisms is regarded as the driver of climate change mitigation effort in developing countries.

As of January 2014, over 11,000 CDM projects had been submitted and 67% of them registered, 21% failed to register, and 12% still in process (UNEP Risø Centre, 2015). From the total of 110 countries, only 93 countries have a minimum of 1 project registered, but most of the projects are hosted by China and India both accounting for 70% of the projects. However, OIC countries currently host a total of 573 projects or 6.7% of total ongoing projects (registered projects + in the process of registration projects) with total expected annual reduction reach 103,004.36 ktCO2 eq. (0.1 billion CERs). World total issuance had reached 1.36 billion CERs with total investment reaching US$ 418 billion (Michaelowa et al., 2014).

At the individual country level, Indonesia hosted 168 CDM projects accounting for 28.3% of total OIC's projects followed by Malaysia (27%) and Pakistan (7%). The OIC member countries in Middle East and Africa were among the least participants in CDM projects.

Table 3: Top-OIC CDM Host Country

Host Country	Number of CDM Projects		Expected Annual Reduction (ktCO2 eq.)	
	Total	Share of Total OIC	Total	Share of Total OIC
Indonesia	168	28.3%	21,872.03	21.2%
Malaysia	161	27.2%	9,923.67	9.6%
Pakistan	42	7.1%	7,818.04	7.6%
Egypt	24	4.0%	4,669.52	4.5%
Iran	24	4.0%	10,728.15	10.4%
Morocco	18	3.0%	2,260.66	2.2%
Uganda	18	3.0%	1,253.58	1.2%
Uzbekistan	18	3.0%	8,680.04	8.4%

Source: UNEP Risø Centre

Actual emissions reductions indicator is a percentage of country/region emissions covered by Certified Emission Reduction (CER) units. The expected emissions reduction from CDM projects compared to the actual emissions gives a precise figure for the emissions reductions achieved through CDM compared to the actual emissions, i.e. to

what extent CDM is supporting the emissions reduction efforts in a given host country/region.

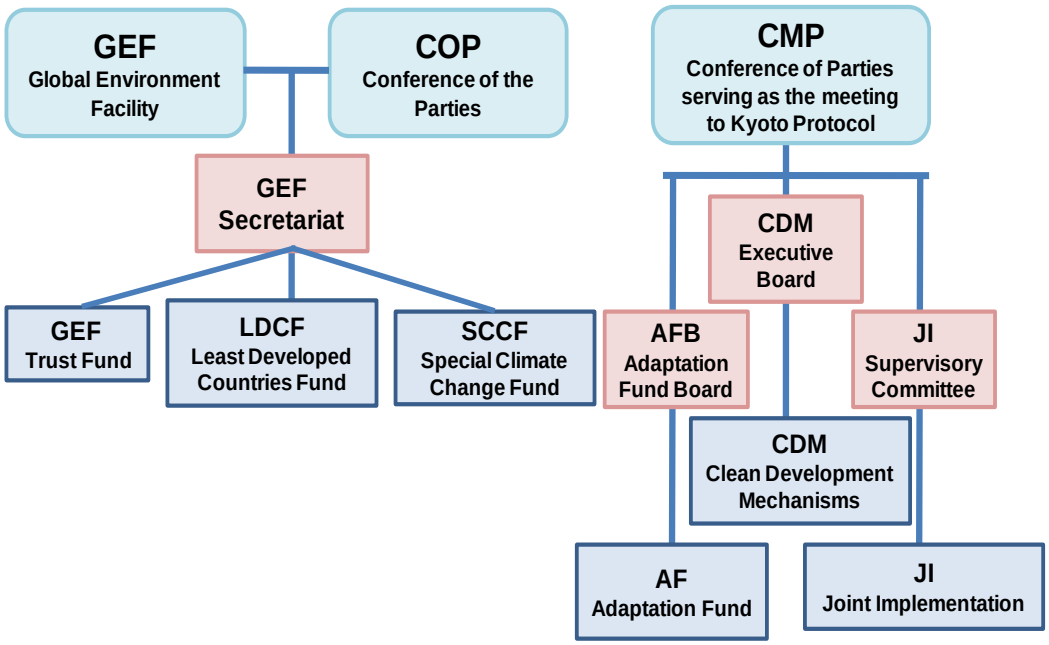
As of May 2014, OIC actual emission reductions from CDM projects were relatively low, reaching 2.7% of OIC's total CO2 emissions. This indicator provides more factual comparison since it gives a rough estimate of the OIC's domestic emissions reductions effort. At the individual country level, the top countries based on their actual emissions reduction are Morocco (32.8%), Sierra Leone (15.5%), Bangladesh (11.6%), Albania (9.2%) and Malaysia (5.1%).

Financing mechanisms

The financial supply for mitigation and adaptation actions involves private finance, public finance and national policies. Since the developing countries need financial assistance for mitigation, adaptation and technology transfer; the Climate Change Convention, Kyoto Protocol and other bilateral initiatives provide funds to some extent for these activities in addition to previously mentioned resources. Annex II Parties are obliged by the Climate Change Convention and Kyoto Protocol to provide financial assistance to the developing countries to implement the Convention. The Global Environmental Facility (GEF) is assigned by the Parties of the Convention to operate the financial mechanism for most of the funds.

The funding for mitigation, adaptation and technology transfer is available under the Convention through the GEF Trust Fund, the SCCF and the LDCF, these all depend on voluntary contributions from donor countries, and from the Adaptation Fund, which is financed with the proceeds of the 2% levy on CERs issued for CDM projects. Moreover, funding is also available from the international carbon market established under the Convention and its Kyoto Protocol, which includes the CDM and JI.

Figure 4.1: UNFCCC Funding Mechanism



Source: UNFCCC

According to the latest estimates (UNFCCC, 2016), global flow of climate finance was recorded at 741 billion in 2014. This amount was 15% higher than its level in 2011-12. During the same year, over 80 billion US$ of finance flow was reported from developed countries to developing countries. Almost half of these funds came from the public sector, including 23.9 billion US$ channeled through bilateral, regional and other channels. The mix of instruments used to channel these funds include: grants (35% of the bilateral, regional and other finance), concessional loans (20%), and non-concessional loans (10%).

Across the developing world, mitigation-focused finance represented more than 70% of the public finance in 2014 whereas; adaptation finance provided to these countries accounted for about 25% of the total climate finance. It is worth noting that more than 80% of investments made by the multi-lateral development banks were focused on mitigation in 2014. The regional allocation of climate funding across the developing world reveals that Asia received the highest share followed by the Africa and Latin America and the Caribbean.

According to the UNEP (2016), international adaptation related public finance has been increasing since 2010. It was recorded at 25 billion US$ for the year 2014 compared to

only 4.4 billion US$ in 2010. Around 90% of these funds were utilized in developing countries to sectoral projects. Among the different sectors, water and waste water management attracted around half of the total funds followed by the agriculture and land use sector (12%). The region which benefitted the most was East Asia and the Pacific (46% of the total) followed by sub-Saharan Africa (14%), Latin America and the Caribbean (12%), and South Asia (9%).

According to the estimations of UNFCCC (2007/08), the additional investment needs for adaptation in 2030 range between 50-170 billion USD excluding the costs of operating, maintenance and reduced energy costs. More than 50% of the investment for adaptation is required in developing countries, particularly for maintaining human health and water supply. On the other hand, over 200 billion US$ additional funds are needed to finance the mitigations related project and activities in 2030. Over half of the additional global investment and financial flows would be needed in developing countries, where around 68% of the global emission reductions are projected to occur. This optimism is mainly due to the fact that mitigation opportunities are more prevalent in these countries owing to the rapid economic growth of large developing countries, relatively inefficient energy use, and low-cost mitigation options in forestry sector.

5. Concluding Remarks and Recommendations

The OIC member countries as a group are highly vulnerable to environmental changes induced by the increasing anthropogenic activities. The situation is particularly alarming in low income and least developed member countries. Despite all progress in adaptation and mitigation process, a significant number of member countries remained exposed to major environmental challenges like climate change, pollution, land degradation and deforestation. Against this backdrop, this chapter distils relevant policy recommendations and proposals to address the major environmental challenges in OIC countries.

Climate Change and GHG Emissions

Undoubtedly, change to low carbon economy is an urgent need for sustainable development. However, there is no generic formula that can be applied to solve the GHG emissions problems in all OIC countries. Like elsewhere, GHG emissions problems in different OIC countries are specific to their own local conditions. The sectorial GHG emissions profile can be used as a tool to know which sectors emitted more, thus finding the bottleneck of the problems. For example, OIC's fossil fuel producer countries were among the countries that emitted more than 80% of their GHG emissions from energy sectors. So, a mitigation effort in agriculture sector will have less beneficial in these countries. A reverse condition applied in some OIC's African

countries where most of their GHG emissions came from the agriculture sector. An agriculture sector mitigation effort is more appropriate in these countries.

It has been obvious that most GHG emissions are generated from energy sector through the burning of fossil fuels. However, the mitigation efforts in this sector were still limited. Renewable energy still has a small portion globally with less than 2% from the total global primary energy consumption. This fact shows that market penetration of low carbon technology is still very low. This economic barrier will make it difficult to perform carbon reduction initiatives.

In order to stabilize GHG emission into the atmosphere, several mitigation efforts need to be taken. These mitigation efforts should be targeted at diversifying the economy from a high GHG emission one to a low carbon economy through application of low carbon technology and lifestyle. This mitigation measures cannot be implemented without tackling barriers and obstacles. A report by Gerstetter and Marcellino (2009) identified the barriers of technological innovation in three folds: lack of funding, market barriers and regulatory environment barriers. Developing countries are more likely to encounter difficulty in all three barriers. Lack of funding is subject to financing the low carbon technology. The market barriers are related with costs in implementation of the technology. Finally, the regulatory environment means regulations, policies, and institutions required to get smoothen market penetration of low carbon technology.

Policy makers are not oblivion to the economic barrier as this features prominently at the international climate negotiations arena where market mechanisms to mitigate the effect of climate change are discussed. The Kyoto protocol nested three market mechanisms notably: Clean Development Mechanisms (CDM), Joint Implementation (JI), and International Emission Trading (ET). Those three mechanisms not only allow industrialized countries to meet their emissions reduction target, but also allow technological transfer and economic incentives for developing countries to implement low carbon technology effort (climate change mitigation efforts). CDM as one of the three Kyoto's market mechanisms is regarded as the driver of climate change mitigation effort in developing countries. Market based mechanisms like CDM can play crucial roles in climate change mitigation effort in several ways (Burniaux *et al*., 2009):

- Increasing the cost-effectiveness of GHG mitigation in industrialized countries;
- Reducing emission's leakage[1] from industrialized to developing countries;
- Providing an increase of low carbon clean technology to developing countries.

The Energy and Resources Institute (2012) argued that CDM has made a good impact on the various forms of sustainable development in host countries. Its effort was further acknowledged by UNFCCC (2012) when it mentioned that almost all CDM projects claims they got huge sustainable benefits in their project.

Air Pollution

All the analysis done in this section points out to an important fact which is: the major air pollution issue in OIC countries is related to indoor air pollution and to biomass burning. This conclusion is supported by the literature review which points out that while air pollution in developed countries is primarily the product of industrialization and urbanization, air pollution in many developing countries commonly has a different source: biomass burning. The combustion of organic refuse, charcoal, wood, animal dung, and agricultural waste, such as straw, nut shells, and rice husks, is prevalent in rural and urban areas of the developing world, and the consequences may be felt far from the burn sites. For example, massive forest and peat fires in Indonesia have led to severe cross-boundary air pollution impacting Singapore (EPI, 2016).

The policy focus in OIC countries should be on addressing indoor (household) air pollution. Cooking and heating requirements should be met while emissions are reduced through the use of modern stoves; cleaner fuels, such as liquid petroleum gas and electricity; improved ventilation; and reducing exposure. Table 5.1 gives possible interventions in order to reduce indoor air pollution. These interventions are divided into three areas which are: changing the source of pollution; improving the living environment; and modifying user behavior.

[1] Leakage is where mitigation actions in one country or economic sector result in another country's or sector's emissions increasing, e.g., through relocation of polluting industries from Annex I to non-Annex I countries (Barker *et al.*, 2007)

Table 5.1: Interventions for Reducing Indoor Air Pollution

Changing the source of pollution	Improving the living environment	Modifying user behavior
Improved cooking devices ○ Improved stoves without flues ○ Improved stoves with flues	**Improved ventilation** ○ Smoke hoods ○ Eaves spaces ○ Windows	**Reduced exposure by changing cooking practices** ○ Fuel drying ○ Pot lids to conserve heat ○ Food preparation to reduce cooking time (e.g. soaking beans Good maintenance of stoves, chimneys and other appliances
Alternative fuel-cooker combination ○ Briquettes and pellets ○ Kerosene ○ Liquefied petroleum gas ○ Biogas ○ Natural gas, producer gas ○ Solar cookers ○ Modern biofuels (e.g. ethanol, plant oils) ○ Electricity	**Kitchen design and placement of the stove** ○ Kitchen separate from house reduces exposure family (less so for cook) ○ Stove at waist height reduces direct exposure Reduced exposure of the cook leaning over fire	
Reduced need for fire ○ Retained heat cooker (haybox) ○ Efficient housing design and construction ○ Solar water heating ○ Pressure cooker		**Reduced exposure by avoiding smoke** ○ Keeping children away from smoke (e.g.in another room if available and safe to do so

Source: WHO,2006

To make the above interventions effective awareness is a prerequisite. Households should be made aware of the health risks of indoor pollution and the available solution to address the issue. Involving women and providing them with solutions that meets their needs is paramount if interventions are to succeed. Committing financial resources in the form of aid or micro-credit are needed in order to overcome the financial barriers faced by poor people. Appropriate policy instruments should be deployed for effective indoor population reduction initiative and programs (Table 5.2).

Table 5.2: Policy Instruments for Effective Indoor Air Pollution Reduction Interventions

Policy Instruments	Examples
Information, education and communication	○ Health professionals ○ Community ○ Schools ○ Media
Taxes and subsidies	○ Tax on fuels and appliances ○ Subsidy on fuels and appliances Regulation and legislation
Regulation and legislation	○ Air quality standards ○ Design standards for appliances
Direct expenditures	○ Public programme for provision of appliances ○ Funding of finance schemes
Research and development	○ Surveys ○ Development and evaluation of interventions ○ Studies of health impacts ○ Research capacity development

Source: Bruce et al, 2006

The focus on indoor air pollution should not divert the attention of OIC countries from addressing out door air pollution. High rates of urbanization and industrialization in many OIC countries has resulted in outdoor air pollution becoming a serious issue similar to the case in the industrialized world. In this regard, the recommendations of the Organization for Economic Co-Operation and Development are very relevant. The OECD recommends that its member countries:

- Should pursue policies to control more effectively air pollution resulting from emissions of oxides of sulphur and nitrogen, hydrocarbons, and particulate matter, from stationary and mobile sources in their countries in order to achieve environmentally acceptable levels of ambient air quality and deposition of pollutants;
- Should achieve this objective by an appropriate combination of some or all of the following means:
    - More efficient use of energy;
    - The use of less-polluting fossil fuels;
    - Increased use of non-fossil energy sources, to the extent that these are compatible with other policy goals;
    - The use of newer and environmentally more benign combustion technologies;
    - Stricter control of air pollutant emissions;

- Should develop consistent emission control strategies on a regional or national basis, and coordinated internationally where appropriate, which might include emission standards for various categories of polluters, regional or national emission ceilings, or other effective and efficient means of reducing emission levels;
- Should co-operate to improve the availability and quality of data on air pollutant emissions from different categories of polluters;

Finally, it should be emphasized that air pollution ignores national borders and can be carried very long distances by wind. For this reason cooperation at the regional level, OIC level and at the international level are required to face the challenge of air pollution.

Water Pollution

When accessing the main drivers of water pollution; namely sewage and untreated wastewater, OIC countries as a group perform rather poorly in comparison to other country groups. This highlights the need to provide improved sanitation facilities to the population especially in rural areas where access to sanitation facilitates is significantly lower than urban areas (OIC, 2015). Also the low proportion of wastewater that is treated in OIC countries points to an area for improvement by investing in wastewater treatment facilities.

For the most part, water pollution originates from municipalities, the agricultural sector and the industrial sector. For this reason, to improve water quality, water pollution control aspects have to be incorporated in urbanization, agriculture, and industrial policies. The focus in the policies should be on preventing pollution rather than reacting to pollution as cleaning water bodies is generally much more expensive than applying measures to prevent pollution from occurring.

The OIC Water Vision provides a road map for dealing with the water challenges facing OIC countries which is applicable to the challenge water pollution. The OIC water vision recommends starting with small but significant steps, building confidence and experience, creating institutional and financial mechanisms and demonstrating success. The Vison's 6 "In"s framework: Information, Innovation, Institutions, Incentives, Investment and Infrastructure is a useful framework for identifying areas for development. Taking account of these the OIC Water Vision proposes the following 'start-up' activities:

- Exchange and knowledge sharing;
- Collaborative activities amongst OIC knowledge centers in research, or policy and management support;
- Capacity building and outreach development;
- Forums and summits.

Desertification and Deforestation

The Clean Development Mechanism (CDM) is a market-based flexibility mechanism of the Kyoto Protocol which allows emission reduction projects. However, unfortunately, afforestation/reforestation projects currently account for only 1% of CDM projects. Therefore, increasing CDM projects in deforestation affected member countries will be a good option to reduce OIC GHG emission f. Adopted in 2010, Tunis Declaration on Enhancing the Efforts of the Islamic World towards Environment Protection and Sustainable Development also stressed the need for the prompt establishment of a coordination mechanism for the Islamic countries, in order to enhance the local anti-desertification programs. In this regard, the declaration urged member countries to benefit from the Adaptation Funds and Clean Development Mechanisms under the UNFCCC.

"REDD+" is a mechanism developed by the UNEP to encourage developing countries to carry out forest-based climate change mitigation actions. It includes, cutting emissions through reducing deforestation and forest degradation, forest conservation, sustainable management of forests and enhancement of forest carbon stocks. OIC countries should implement national level REDD+ strategies especially in SSA and EAP regions. Successful implementation of REDD+ initiatives will not only mitigate climate change but also reduce the rate of deforestation and biodiversity loss while at the same time providing forest dependent communities with alternative sources of income. On a broader level, it will result in conservation and sustainable management of large areas of forests for the benefit of mankind.

Though there are global biosphere rehabilitation activities in different sectors, an integrated large scale restoration/rehabilitation movement is highly needed in this regard. This movement based on reforestation, desertification control, sustainable agriculture and using agroforestry and permaculture can reduce the degraded ecosystems to mitigate floods, droughts, erosion and other effects of extreme weather conditions at a large scale. Among the OIC member countries, SSA and MENA region countries should give priority to developing their carbon sink potentials through afforestation and reforestation programs, climate resilient technologies and other

related activities to sequest sufficient carbon dioxide into biomass and soils. It will not only help in dryland restoration but also address various socio-economic problems stemming from unsustainable use of natural resources in these countries.

Integration of land and water management is a key method for the prevention of desertification. Local communities play a central role in the adoption and success of effective land and water management policies. They can play role in aridity reduction, pastoral and agricultural land use and so on. Therefore, by increasing institutional and technological capacity of the local communities and enhancing their access to markets and financial capital can lead to sustainable use of land use. It is well known that prevention is a much more effective way to cope with desertification, because subsequent attempts to rehabilitate the desertified areas are costly and tend to deliver limited results. In order to enhance the local institutional capacities, SESRIC has organized a number of training courses in several member countries within the framework of its Environmental Capacity Building Programme (Environment-CaB). This type of training program should give priority to the African member countries to enhance their local institutional and technological capacities.

Collaborative Partnership on Forests (CPF) is a policy forum and partnership on all types of forests, including dry forests. OIC countries can control the problems of desertification and deforestation by implementing internationally agreed actions on forests in collaboration with the Intergovernmental Forum on Forests (IFF) and the Intergovernmental Panel on Forests (IPF). The UNCCD's 10-year strategic plan is an important platform for galvanizing common actions to highlight drylands as indispensable, yet exhaustible capital. Cooperation within the UN system regarding mainstreaming drylands and related issues of desertification, land degradation and drought can be useful from developing a structured approach with a clear understanding of the contributions and expectations from different member countries and institutions.

The expansion of agricultural land is the major driver of the depletion of primary tropical and sub-tropical forests. Around 70 to 80 % of expansion of cropland leads to deforestation. That expansion is driven by poorly-designed agricultural practice, changes in consumption patterns and population dynamics. It is found that, net depletion of forests is higher in Sub-Saharan African member countries. Therefore, improved land management practices should be taken into consideration during the expansion of arable land.

Natural Disasters

While the occurrence of natural hazards cannot be stopped, disaster risk and adverse impacts can be minimized by reducing social, economic and environmental vulnerability and improving prevention and preparedness for response. In this context, a number of actions can be taken to effectively reduce natural disaster risks, particularly related to the environmental degradations.

For the policy side of the issue, effective governance is crucial to identifying disaster risks and implementing schemes to reduce vulnerabilities and risks. In that regard, it is important to prepare planning frameworks (e.g. National Disaster Risk Management Framework or a National Disaster Management Plan) to elaborate the arrangements for implementation policy and to define responsibilities of ministries and other stakeholders, and prepare disaster risk maps accompanied by an analysis of the socio-economic and environmental conditions in different regions of the country. New policy agenda to promote and mainstream the implementation of prudential environmental management strategies for mitigation of disaster risks and adverse effects of climate change, e.g. protection and remediation of forests, rangelands, mangroves, water bodies and other such resources are also significant for the OIC countries, alongside the promotion of sustainable water resources management.

For most of the OIC states, it is vital the elevation of sustainable use of rangeland as well as riverine, coastal and urban lands and their effective management through, inter alia, reforestation, soil conservation, reforestation, soil conservation, communal management arrangements, reduction in livestock populations, and introduction of alternative livelihoods sources, introducing resilience frameworks, implementing land-zoning wherever possible, conservation and remediation of natural habitats and construction of relevant infrastructure such as river and coastal dikes. The OIC countries also need to work on the policies to remote climate change adaptation through cutting-edge multidisciplinary approaches such as Integrated Coastal Zone Management (ICZM).

Another main determinant of the success in disaster risk management is the level of awareness and participation. A lack of awareness of hazards and vulnerability can build complacency, leading to ignorance for risk reduction. Social protection of vulnerable communities also plays a key role. In this context, to promote public awareness, participation and social protection, OIC countries can organize public awareness campaigns on risk reduction related to specific hazards and risks regularly, at least once a year, for example during the International Day for Disaster Reduction.

More critically, preparing capacities for disaster risk reduction requires a sound analysis of existing capacities and gaps, risks, well-developed early warning systems, contingency planning, stockpiling of equipment and supplies, coordination mechanisms, public information, and associated training and field exercises. The policies to establish national and local databases to collate developmental and disaster risk information and to produce analysis of hazards, risks and vulnerabilities are highly essential for OIC countries to promote information, knowledge sharing and capacity development in those countries.

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