Dark Side of Industrialization on Environmental Sustainability and Climate Change: A Case-based Approach

Bhumika Gupta
Associate Professor of Human Resource Management
Institut Mines-Telecom Business School
Rue Charles Fourier, Evry
Paris
FRANCE
Email: bhumika.gupta@imt-bs.eu

Shikha Bhardwaj
Assistant Professor of Human Resource Management
Indian Institute of Management Sambalpur
Burla, State of Odisha
INDIA
Email: shikhab@iimsambalpur.ac.in

Jasmeet Kaur Lamba
Professor and Associate Dean
Jindal School of Business
Jindal Global University
Sonipat, State of Haryana
INDIA
Email: jasmeet.kaur81@gmail.com

Anubha Singh
Professor and Vice-Chancellor
Alliance University
Bengaluru, State of Karnataka
INDIA
Email: anubha@alliance.edu.in

Abstract

Economic growth in the world economies has been a result of increased industrialization and digitalization. It has given rise to various innovative technologies and fast and improved methods of production. This rapid industrialization has also led to dramatic changes in the pattern of demand from the society worldwide. These changing directions have significantly given rise to the use of such products and methods which lead to extreme environmental impacts. These environmental impacts have brought about a dynamic revolution in the market which has significant impact on financial and

environmental safety and security of the markets today. There is an urgent need to focus attention on adapting cleaner and renewable production practices to give a greener environment to the future generations. This may convert our fast-growing polluted economies into low carbon economies targeting sustainable economic growth and development. Against this backdrop, this paper is an attempt to enhance the empirical and theoretical framework of the subject. The research addresses various issues that the world is going through. The issue needs to be monitored at international standards. The main causes of global warming and its effects are further explained throughout the research article with an intention of creating economic prosperity.

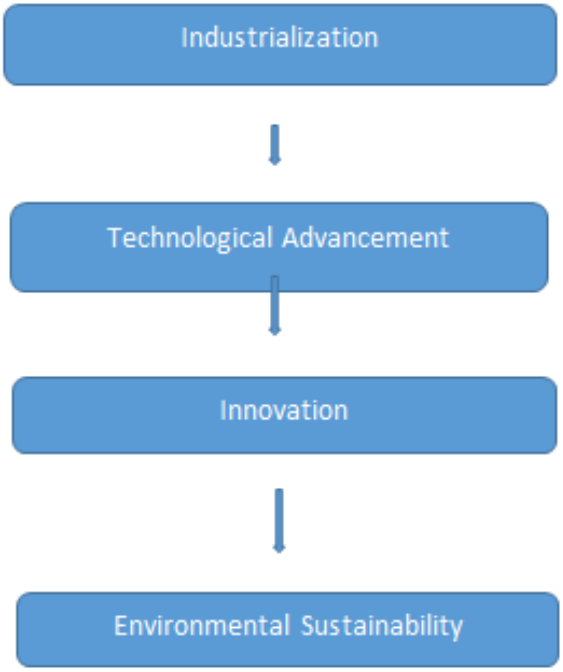
Keywords: Environmental shocks, Sustainable Development, Climate change, Natural and man-made disaster, Technology, France and India.

Introduction

The concept of climate change has been a concern area for researchers and scientists from early 18^{th} century. During the industrial revolution, the enormous amount of carbon-dioxide (CO_2) emission from factories and industries has impacted the socio-economic landscape worldwide. This matter of concern found their place in several discussions, forums, conferences, and British poetry. Soon industrialists, policy makers and practitioners realized that the rise of Industrial growth and carbon dioxide indeed, has more dangerous effect on society, than just annoying few neo-romantic poets or artists by destroying the picturesque green British countryside with soot and smoke.

Economic growth in the world economies has been a result of increased industrialization and digitalization. It has given rise to various innovative technologies and fast and improved methods of production. This rapid industrialization has also led to dramatic change in the pattern of demand from the society worldwide. These changing directions have significantly given rise to the use of such products and methods which lead to severe impact on environment sustainability (as shown in Fig 1).

Figure #1: Flow of industrialization to environmental sustainability
Flow of industrialization to environmental sustainability



These environment sustainability issues have brought about a dynamic revolution in the markets which has significant impact on financial and environmental safety today. In some of the empirical studies these risks have also been termed as "economic and physical scarcity", especially water shortage and climate change. What the world economy needs today is a sustainable society with least environmental impact vis-a-vis set environmental goals, resource conservation, and sustainable management practices. According to reports the three major environmental risks are water shortage, climate change and natural and man-made disasters.

Today, the geopolitics of climate is profoundly affected by the convergence of the diverse crises currently sweeping the world and this current framing is in total failure. Increased number of Air and water contamination cases, natural disasters like hurricanes and famines, health pandemic like COVID are a few examples of dark side of industrialization worldwide. The present study highlights the concept of technology advancement and their subsequent environmental risks in the light of sustainable development. In the view of above, due to lack of optimum financial resources and technological incapability, the undertakes four research objectives (RO)

RO1: To explore and understand different aspects of environment sustainability in published research

RO2: To recognize difference between natural and man-made disaster evidenced through cases studies

RO3: To investigate challenges in environment sustainability, steps taken as response to changes and their subsequent dark side on economy

Thus, the research article may potentially contribute in three ways -i) by defining the interplay of environment, technology, and sustainable development through literature review, ii) by demonstrating the catastrophic effect of technology on environment empirically through cases, and iii) by highlighting the dark side of these changes and potential steps taken by stakeholders i.e. government, individual, society and community. The subsequent section of paper covers literature review, research methodology, finding and discussion, implications, and conclusion.

Literature Review

What, why and how of environmental sustainability

Environment sustainability is largely observed in quality supply of air and water, temperature change, climatic stability, and ecological balance. *First*, let us understand the climate change and its causes. Climate change or global warming, as it is popularly known, is due to increase in greenhouse gases in the atmosphere. The primary greenhouse gases in Earth's atmosphere are carbon dioxide, water vapor, methane, and ozone. These gases absorb the infra-red heat radiation from the sun thus increasing the temperature of the atmosphere. They have accumulated in the earth's atmosphere over the last 150 years. They prevent the sun's radiation from going back into space. Ninety percent of it is absorbed by the Earth's oceans.

Second, fluctuation in temperature due to rapid industrialization the last two centuries have seen 40% increase in the greenhouse gases resulting in increase in average temperature of the earth by more than 2^{0} F. The increase in earth's temperature have caused shrinking of glaciers, reduction of polar ice caps, rise in sea level, and extreme climatic changes resulting in extreme climatic conditions, floods and droughts etc. endangering human lives and created hardships to survive on earth for many species. The increase in temperature may create severe problems for the many sectors like agriculture, construction, and energy, consequently damaging the economic growth. As temperature is rising constantly the human health is also at large risk. The health factor leads to a decrease in productive capacity of a human being and overall impacts all economic activities. Hence, increase in maintenance cost of these economic activities may create severe financial challenges for a country.

Third, water shortage is one of the top priority emerging issues of the countries. As Rulla (2016) mentioned that water scarcity could lead to conflict between communities and nations as the world is still not fully aware of the water crisis many countries may face in near future. Further, the U.N. Intergovernmental Panel on Climate Change (IPCC) report predicts a rise in global temperature of between 0.3 and 4.8 degrees Celsius (0.5 to 8.6 Fahrenheit) by the late 21st century particularly countries like India in the months of May

and June. Many sectors of an economy need water as a major source of production and create a lot of pressure within the ecosystem. This pressure and stress is much likely to be exacerbated by climate change. Contracting, Backlund (2008) reveals that heavy downpours can increase the amount of runoff into rivers and lakes, washing sediment, nutrients, pollutants, trash, animal waste, and other materials into water supplies, making them unusable, unsafe, or in need of water treatment. Owning to imbalanced water supplies and frequent climate change, the overall impact on economy, people and society at large may be labelled as the major risk to the environment.

As per recommendations from UN Water, water is fundamental to the three dimensions of sustainable development, including social needs, economic development and environmental limits, and a cross-cutting driver. Clean water and sanitation are also the 6th sustainable development goal. This goal clearly states that "in 2011, 41 countries experienced water stress – 10 of which are close to depleting their supply of renewable freshwater and must now rely on alternative sources. Increasing drought and desertification is already worsening these trends. By 2050, it is projected that at least one in four people will be affected by recurring water shortages." The predictions are alarming and need immediate attention from different economies of the world to ensure safe and affordable drinking water by 2030.

Few more researchers wrote about the industrialization pattern and its impact on the climate and sustainability. As mentioned by Patnaik (2018) the increase in industrial activities with a limited land mass has directly resulted in environmental sustainability through green approach. It calls for a suitable development plan and unified framework in coherence with the environment, after careful evaluation of prevailing requirements. The biggest problem as mentioned in an article by Emily (2021) is the contamination of drinking water due to inverse effects of industrialization. The toxins are mixing with the water supply and contaminating all the sources in all forms whether solid, liquid, or gaseous state. Nwozor et al (2016) have mentioned few consequences like high temperatures and extreme weather conditions along with changing human lifestyles and philosophies all owing to industrialization. And the link between climate change and industrialization is always argumentative but clearly visible.

To summarize, the concepts mentioned in the paper here are some definitions as defined by the business dictionary in 2017, as shown in table 1.

Table # 1
Popular definitions of the concepts

Terms	Definitions
Environmental risk	actual or potential threat of adverse effects on living organisms and environment by effluents, emissions, wastes, resource depletion, etc., arising out of an organization's activities

Environmental Sustainability	The maintenance of the factors and practices that contribute to the quality of environment on a long-term basis
Man-made disasters	A disastrous event caused directly and principally by one or more identifiable deliberate or negligent human actions. Also called human-made disaster. Compare with natural disaster.
Climate change	The climate change phenomenon refers to seasonal changes over a long period with respect to the growing accumulation of greenhouse gases in the atmosphere.
Sustainable development	Economic development characterized by low growth rate, absence of pollution, and greatly diminished environment impact.

While we study further, it is essential to understand that why it is important to achieve sustainable development. Sustainable development is the aim of developing and satisfying the needs of present world without compromising the need and development of future generation with a guarantee of equal economic growth, Availability of natural resources, with well-being of the society. Sustainable development stands on three pillars comprising of Economic Sustainability, Environmental Sustainability, and social Sustainability.

Environmental Sustainability is the major concern as everything from food to rain depends on environment and how to use it in a sustainable way. The concept of Environmental Sustainability was appeared first on the Brundtland Report in 1987, which was the warning of the negative environment caused by the humans in the form of man-made disaster. This report came up with the strong evidence and hold high importance because it highlighted the threats to the human life, the beauty of the environment and the depletion of the endangered species. Environmental sustainability advocates the use of recycled and renewed everything. The approach of "recycled and renewable" consists of waste and energy resources to reduce the usage of toxic material, the protection of natural habitats of species, to ensure better and healthy living of the people and environment, adding beauty to the nature. Thus, a robust system to protect all these factors needs urgent attention from stakeholders.

Research Methodology

To achieve our RO 2 & 3, we performed an inter-case analysis on actual problems faced by different countries at different time periods. The case-based approach helps in analyzing the critical issues in sustainable Development and potential risks related to environment. It also illustrates the need of environmental sustainability under sustainable development. As widely used case study approach is most suitable when -i) a complex phenomenon is understudy, ii) to establish relationship between multiple variables and validate it empirically, and iii) a topical research area is addressed. Given the situation, case-based study helped in demonstrating complex phenomenon such as environmental sustainability.

While we undertook the case studies to understand the environmental instabilities due to technological advancement, we had deep reflections like why environment is getting degrades? why we are making environmental laws under sustainable Development? who is responsible for creating all these environmental problems? On one side, the population is increasing at a rapid growth and people are over utilizing the natural resources without refilling the utilized resource and on other hand, the chain of environmental degradation is multifold. The below-mentioned cases answer these critical questions and validates a higher need of environment sustainability.

Alaska Earthquake, Good Friday Quake, 1964

On the eve of Good Friday on March 27, 1964, a very powerful earthquake hit the United States of America. The earthquake was the strongest in the history of USA. It came on the day of Good Friday hence was named as "Good Friday Quake". The velocity was of 8.4-9.4 which was measured on a Richter Scale. The city Anchorage, South Alaska was badly hit by the earthquake. Thus, resulted in creation of powerful tsunami which reached the height of 100 feet. It not only destroyed the Gulf of Alaska but also the cities of British Columbia, Canada and Hawaii. This natural Disaster killed thousands of people and also damaged the Property of billions.

Bhopal Union Carbide Factory, 1984

This is also known as "BHOPAL GAS TRAGEDY" which happened on December 2, 1984. The Union carbide pesticide plant in Bhopal, Madhya Pradesh, India. The factory leaked 40 metric tons of toxic Methyl Isocyanate (MCI), which about caused 2,259 casualties and nearly 100,000 injuries to the life of the people and crops. The Union Carbide is owned by the Dow Chemical Corporation. This was the biggest Chemical accident in the history. The aim of the project was to provide job and prosperity in Bhopal, but the plant bought dead of nearly 30,000 people. These are not the exact numbers; the count still goes on. Till now the effects can be seen in Bhopal.

Both the cases demonstrate human intervention with nature. The desire to be powerful and resourceful in the competitive environment has made man greedy. As humans became technically advanced, they started with new inventions. Those inventions were first recognized and applauded but later, as soon as the population grew in numbers, they started extracting the natural resources in a greater amount like the digging of coal from earth, cutting trees and burning the natural habitat for shelter. These are man-made disasters, whereas disaster out of human control are natural disasters. The natural disaster and man-made disaster are interlinked and sometimes are interdependent for its cause. Natural disaster affects the man-made developments and structure, which can further lead to more serious problems. For instance, flood which is a natural disaster which destroys the crops, damage dams, property, and ultimately human life. Similarly, earthquake which occur due to the movement of tectonic plates leading to the shifting of earth's crust leading to the man-made disaster of nuclear reactor for instance the eruption of the coolant pipes which leads to a serious loss of coolant accidents (LOCA).

Results

In response to man-material and natural disasters, four pillars leading to sustainable development process are largely utilized in economy. These are public policy actions, safer construction and urban planning, community participation, and culture of prevention. These pillars act as a response and coping mechanism against disaster.

Based on literature review and case studies, we identified two main challenges of environmental sustainability, steps taken by stakeholders and their dark sides on economy as shown in table 2.

Table # 2
Synthesis of case-based content

Challenge	Steps taken by stakeholders	Dark side
1. **Climate change** - Emission of greenhouse gases - Melting ice Global warming due to industrialization	-Top to down community-based approach -Recognition at domestic and national level -Adaptations at multiple levels -Introduction of Kyoto Protocol in Doha 2012 conference -G20 summit enforcement of the principles of UNFCCC	**1. Growth and inflation** – -Droughts, and floods might reduce crop yields, and this would lead to increase in food price squeezing consumer income. -With the rising of temperature many areas of the world will be uninhabitable, and this will lead to mass migration. -Global warming is likely to increase the severity of weather events and natural catastrophes. **2. Agriculture and livestock** -Poor environmental conditions will increase the cost of production and increase the price of goods. -The low latitude regions will suffer most due to global warming, environment in the high latitude areas may become friendly for agriculture and lead to migration of people to these regions. -Variation in the rainfall pattern, percentage of atmospheric carbon dioxide and ozone concentration, changes in pesticide and disease prevalence and extreme events caused by environmental factors will affect yielding rate. **Health** -Climate change include heat and cold mortality and morbidity, food, water and
2.**Water shortage** - Depletion of water sources - Ecosystem imbalance - Increase in diseases - Loss of agriculture, animals, and species	-2015 Un-water Annual international Zaragoza conference. -Water and sustainable development: from vision to action initiatives -First international conference on water security	

		vector borne-disease deaths and wellbeing and changes in pollution and production of various allergens. -The potential risk to health infrastructure and to occupational health becomes very high. **Economic activity** -The industry based on tourism, energy, and agriculture are highly affected. -The totality of tourists per year depends on the on the climate of the home country and the per capita income. -The variation in the household demands for gas, electricity and oil from less energy consumption for heating and increase in energy consumption for cooling have led to a change in demand for output of these energy products. **International trade** -The comparison of global climate impacts can be used to analyse the international links between different regions. -In the multilateral case a climate change affecting one particular region has an effect on the international trade pattern an all the interdependent economies such as India, China, Brazil etc.

Conclusion, Discussion and Managerial Implications

To reduce the threat multiplier effect on overall growth of an economy, a proper financial investment structure is the need of the hour to provide and maintain water related ecosystems, water distributaries, rivers, forests and wetlands to fight against scarcity of water. The developed economies like Germany, USA and France must support various less developed economies to encourage water efficiency and bring in some new and innovative technologies for water conservation. The stress on climate change and water consumption is bound to increase with increase in production as well as population which will further lead to shortage of water. As World Bank Senior Director (2017) mentioned that the "Targeted investments to improve the management and delivery of water are key as we seize the opportunities provided by the $75 billion commitment to IDA, the World Bank's fund for the poorest and conflict-affected countries,". He also mentioned that "In several countries in the

region, we are supporting the reconstruction and recovery efforts of governments. For example, we are working with Baghdad to restore water supply and sanitation infrastructure damaged by conflict."

In addition, the Environment-Linkages model (which is an operating system that prints a list of environment variables or run utility in an altered environment without having to modify the current existing environment) suggest that market damages from the selected set of impacts are projected to gradually increase over time and rise faster than the global economic activity. If no further climate change action will be undertaken, the effect of the selected impacts on the global annual GDP are estimated to increase over time to likely levels of 1.0% to 3.3% by 2060, with central projection being around 2-3 %. This reflects uncertainty in the equilibrium climate sensitivity (ECS)- a measure indicating how sensitive the earth's climate reacts to increasing level of Carbon Dioxide using a likely range of 1.5C to 4.5C. As the temperatures continue to increase to 4C above the pre-industrial levels by 2100, AD-DICE estimations assume that GDP may be hurt between 2% and 10% by the end of the century relative to the no-damage baseline scenario. As these projections suggest that if the greenhouse gases are emitted at the predicted rate until 2060, the world will suffer from economic damages in the range 1% to 6% by the end of the century even if the emission falls to zero by 2060.

Further recognizing the various scary challenges posted by the various economists around the world for climate change, the focus has now shifted to various public policies and governmental measures. The governments of all major economies must take measures to curb down the production levels of such industries which are a natural threat to the environment. These measures must be adaptive and flexible depending on the countries financial stress and reliability. If the country is a developing, then these measures may take external funding like United Nations etc. With the drastic and often irreversible damage being done due to the result of global warming, climate is becoming a major factor in the world economy. The urgent need to reduce greenhouse gases which is creating an unprecedented damage to the earth finds itself clashing with the need of economic growth. The idea of GDP growth and a zero-greenhouse gas emission world finds themselves of the opposite ends of a coin. The impact of global warming on agriculture provides an interesting conundrum to this view. Agriculture is expected to be the hardest hit when it comes to climate change and its effect. As hurricanes, floods, droughts, earthquakes, and other natural calamities begin to occur more and more due to global warming, the agriculture sectors of various countries would be seriously damaged. The developing and underdeveloped countries which are primarily agrarian economies are expected to be the hardest hit for they lack the mechanisms to control these natural disasters and safeguard their agrarian industry.

Global warming will also affect health and lead to growth of vector borne diseases and pollution will be causing various allergies in large scale. Tourism as an industry will also be hit hard due to the same cause as rising of earth's temperature will lead to lesser snowfall in regions like Alps where people expect to see snowfall. Even though in the current world scenario there are many countries going through poverty due to lack of economic growth, and with millions earning less than one dollar a day worldwide, it's a dire necessary to make

economic growth and create global prosperity. However, the world should embark on this cause at the expense of climate change. With the frightening projections made by research about the earth's declining ecosystem due to climate change and greenhouse emission its high time that changes and economic policies to address this issue for better future.

The most comprehensive solution to the environmental risk is to make use of the natural resource effectively and efficiently like water for our industrial production processes. The limitless productive capacities of various economies will overall keep on impacting the environment and also impact the sustainability of various other resources. The water shortage has already led to huge climatic impacts. Some drastic controls need to be taken now to curb the climate change as well. Policy makers, water managers and proper technicians are the people who can build in sustainable future for our generations. The innovative techniques of production and highly competitive policies are to be set in place to curb these risks and settle the climate change impacts. Proper management of water resources is also pivotal today.

After analyses of various driving and restraining forces of industrialization, it is evident that environmental sustainability and climate change has suffered a lot due to technological advancement. Though, the core of research article is environment sustainability under the purview of sustainable development goals, it is observed that people are still unclear with damages arising from advance technology, climate change and water shortages. The conservation of such resources requires awareness, education and empowerment among individuals, communities, and governments. The research had its own limitations, yet it highlighted an urgent issue for larger benefit of societies and economy. The role of stakeholders in formation of policy and regulations to conserve resource is crucial towards better environment.

References

Backlund, P., Janetos, A. and Schimel, D., 2008. The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. *Synthesis and Assessment Product 4.3. Washington, DC: US Environmental Protection Agency, Climate Change Science Program. 240 p.*

Bendimerad, F., 2003, April. Disaster risk reduction and sustainable development. In *World Bank Seminar on The Role of Local Governments in Reducing the Risk of Disasters, Held in Istanbul, Turkey* (Vol. 28, pp. 57-75).

Berrittella, M., Bigano, A., Roson, R. and Tol, R.S., 2006. A general equilibrium analysis of climate change impacts on tourism. *Tourism management*, *27*(5), pp.913-924.

Bigano, A., Bosello, F., Roson, R. and Tol, R.S., 2008. Economy-wide impacts of climate change: a joint analysis for sea level rise and tourism. *Mitigation and Adaptation Strategies for Global Change*, *13*(8), pp.765-791.

Bigano, A., Hamilton, J.M. and Tol, R.S., 2006. The impact of climate change on domestic and international tourism: a simulation study.

Bosello, F., Eboli, F. and Pierfederici, R., 2012. Assessing the economic impacts of climate change-an updated CGE point of view.

Bosello, F., Roson, R. and Tol, R.S., 2006. Economy-wide estimates of the implications of climate change: Human health. *Ecological Economics*, *58*(3), pp.579-591.

Brandes, L.J., Ruyssenaars, P.G., Hoen, A., Te Molder, R., Nijdam, D.S., Olivier, J.G.J., Peek, C.J., Van Schijndel, M.W., Coenen, P.W.H.G., Vreuls, H.H.J. and Van den Berghe, G., 2007. *Greenhouse gas emissions in the Netherlands 1990-2005. National inventory report 2007* (No. MNP--500080006). Netherlands Environmental Assessment Agency MNP.

Climate Watch. 2022. *http://cait.wri.org.* Accessed May 2022.

Château, J., Dellink, R. and Lanzi, E., 2014. An overview of the OECD ENV-linkages model: version 3.

Chima, R.I., Goodman, C.A. and Mills, A., 2003. The economic impact of malaria in Africa: a critical review of the evidence. *Health policy*, *63*(1), pp.17-36.

De Bruin, K.C., Dellink, R.B. and Tol, R.S., 2009. AD-DICE: an implementation of adaptation in the DICE model. *Climatic Change*, *95*(1), pp.63-81.

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, Terese (T.C.) Richmond, K. Reckhow, K. White, and D. Yates,

2014: Ch. 3: Water Resources. Climate Change Impacts in the United States: The Third National Climate Assessment, J.

M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 69-112. doi:10.7930/

J0G 4 4N 6T.

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, Terese (T.C.) Richmond, K. Reckhow, K. White, and D. Yates, 2014: Ch. 3: Water Resources. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 69-112. doi:10.7930/ J0G 4 4N 6T. On the Web

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, Terese (T.C.) Richmond, K. Reckhow, K. White, and D. Yates, 2014: Ch. 3: Water Resources. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 69-112. doi:10.7930/J0G 4 4N 6T.On the Web

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, Terese (T.C.) Richmond, K. Reckhow, K. White, and D. Yates, 2014: Ch. 3: Water Resources. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 69-112. doi:10.7930/ J0G44N6T.

Patnaik, R., 2018, March. Impact of industrialization on environment and sustainable solutions–reflections from a south Indian region. In *IOP Conference Series: Earth and Environmental Science* (Vol. 120, No. 1, p. 012016). IOP Publishing.

Mgbemene, C. A. Nnaji, C. C. Nwozor, C. 2016. Industrialization and its backlash: focus on climate change and its consequences. *Journal of Environmental Science and Technology*, 9 (4), pp. 301-316.

Sustainable development and climate change. 2013. *https://www.indiabudget.gov.in/budget2013-2014/es2012-13/echap-12.pdf* . Accessed May 2022.

Tol, R.S. and Dowlatabadi, H., 2001. Vector-borne diseases, development & climate change. *Integrated Assessment*, *2*(4), pp.173-181.

UNDP Seoul policy Centre for knowledge exchange through SDG partnerships. 2022. *Goal 6: Clean Water and sanitation.* http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-6-clean-water-and-sanitation.html. Accessed 2022

UN-Water, 2014. A Post-2015 Global Goal for Water: Synthesis of key findings and recommendations from UNWater, January. https://www.un.org/waterforlifedecade/pdf/27_01_2014_un-water_paper_on_a_post2015_global_goal_for_water.pdf

Vafeidis, A.T., Nicholls, R.J., McFadden, L., Tol, R.S., Hinkel, J., Spencer, T., Grashoff, P.S., Boot, G. and Klein, R.J., 2008. A new global coastal database for impact and vulnerability analysis to sea-level rise. *Journal of coastal research*, *24*(4), pp.917-924.

Water Management is Key to Sustainable Development and Stability in the Middle East and North Africa. 2017.http://www.worldbank.org/en/news/press-release/2017/05/14/water-management-is-key-to-sustainable-development-and-stability-in-the-middle-east-and-north-africa. Accessed 2022.

Zhongming, Z., Linong, L., Xiaona, Y., Wangqiang, Z. and Wei, L., 2013. World Energy Outlook Special Report 2013: Redrawing the Energy Climate Map.