

# The Function of Civil Engineers in Mitigating the Effects of Environmental and Social Changes in the Philippines

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**Abstract:-** This examines how climate change is affecting the Philippines' harsh weather, rising sea levels, agricultural losses, and migratory pressures. Despite having low global per capita emissions, the people living in these Southeast Asian coastal or archipelago nations still face a few of the worst consequences of global climate change. The ethical issue is also addressed at the local level. It seeks to provide a deeper understanding of the contradictions of extra measures resulting from climate damage and explain how they should live their lives regardless of climate rules.

**Keywords:-** Disaster Management, Risk Assessment, Engineering, Emergency Operation Plans.

## I. INTRODUCTION

The Philippines' natural environment is changing due to factors like global warming, the phenomenon of "warm island effect" in large cities, forest loss, desertification, and river erosion. Unusually high temperatures, powerful storms and typhoons, unusually heavy rainfall, and extreme tidal surges are all being caused by these variables. Our social surroundings are changing together with the natural environment, making them more susceptible to inevitable natural calamities. These include densely populated urban areas, a fall in rural population, living near disaster-prone areas, contemporary city inhabitants' lack of collaboration and communication, as well as their poor infrastructure for catastrophe resilience. The characteristics of natural disasters change along with the social and environmental contexts. As our social scenes advance with urbanization and natural shifts, they progressively confront increased dangers from characteristic calamities. Developing cities regularly battle with insufficient foundation and crisis arranging, whereas diminishing country populaces cruel less individuals are This briefly examines current herbal mishaps throughout the globe as well as related subjects. The author also addresses the duties of engineers and the fundamental idea of the legislation for global disaster prevention. They have all had disproportionately high death tolls and billion-dollar economic losses as a result of this problem, even though they have relatively low emissions per capita. They have all consistently been in the top 10 for the previous many years on the global weather danger index, which is evidence of this (Eckstein et al., 2021).

The facts of the climate trade with the Philippines are examined in this article 80 along with the moral issues it brings up. This introduction is followed by a review of the literature describing the preliminary studies on climate exchange carried out in the Philippines. It accomplishes this by providing insight into each person's personal development and social advancement.

The impact of the weather disaster is next quantified by facts and visuals in this chapter, which is followed by an application of many ethical frameworks to laws and regulations enacted by extraordinarily high presidential levels. The essay concludes with suggestions on how to become more involved in the fight against climate trading and reducing the injustices that go along with it.

## II. LITERATURE REVIEW

Many researchers examine how weather patterns are affected by catastrophic weather events and increasing sea levels, which regularly cause Filipino residents to relocate. Bohra-mishra et al. (2017) and Mosuela and Matias (2015) both concentrate on the implications inside the Philippines. Beech (2020) seeks to offer a more thorough, personalized, and intimate understanding of the ways that climate change impacts Philippine life. Hoffman and Muttarak (2017) talk on education and preparedness for disasters.

Individuals inside the worldwide network, along with those in the US and Canada, have contributed to this disaster by offering beneficial resources like relaxed immigration laws. Transnational networks and economic mobility, according to Mosuela and Matias (2015), encourage collaboration and mitigate the consequences of weather exchange. Mosuela and Matias (2015) start out by giving historical statistics on how the Philippines' weak financial growth, geographic position, and unequal resource distribution make the country highly susceptible to catastrophic weather events and climate change. On average, the Philippines is hit by twenty typhoons a year, many of which, like Typhoon Haiyan in 2013, result in significant damage and fatalities. Migration is important in the Philippines because residents are under pressure to leave the nation because of turmoil; by leaving, they would be able to acquire financial possessions and then be transferred back to their families.

The research conducted by Bohra-mishra et al. (2017) on the demographic and gender dimensions of weather migration in the Philippines has garnered recognition. Migration is proven to be caused by temperature variations and an increase in storm frequency. Men from younger generations who were educated were the most frequent categories of migrants. Unlike migration that is especially related to weather, emigration appears to be largely driven by women. The researchers also discovered a link between emigration and low agricultural production, with rural residents having a higher migration rate than urban residents.

An evaluation of the education and preparedness for natural disasters in the Philippines was finished by Hoffman and Muttarak (2017). They found that the ability of the Filipino people to react correctly to disasters is influenced by education. Those who had received an education were better able to handle it without experiencing a catastrophe. The scientists also discovered that there are still notable disparities in the Philippines based solely on social and educational situations, even when wealth is no longer a deciding factor. People in the Philippines started becoming more widely distributed when it comes to being prepared.

### III. METHODOLOGY

#### A. Socio Demographic Profile

Research on the gender and demographic aspects of weather migration in the Philippines and its causes was done by Bohra-Mishra et al. (2017). There are typhoons and temperature swings that occur frequently enough to cause migration. It's likely that the majority of the migrants were educated men from the younger technology generation. Surprisingly, girls outnumber boys in emigration, with weather being the primary motivator of departure. Due to the fact that rural populations move at a far higher rate than urban ones, the scientists also concluded that emigration and low agricultural output were associated.

The study conducted by Hoffman and Muttarak (2017) on education and preparation for disasters in the Philippines is now finished. They deduced that instruction makes it easier for Filipinos to respond appropriately to calamities. Individuals who had received information were not only spared from experiencing a disaster, but were also better prepared to deal with one. The authors also pointed out that, although wealth is no longer a determining factor, there are still large disparities across the Philippines based just on social and educational conditions. Some used to administer preparation with an additional dash of flippancy in the Philippines. This facilitates understanding of the steps that ought to be taken on a local and national level to guarantee everyone's safety.

#### B. Mean Annual Temperature

The long-term average temperature is a key indication of weather trade, according to the IPCC (2015). Earth's surface temperature will rise due to greenhouse gas accumulation in the surrounding atmosphere. Frequency of weather occurrences is increasing along with the rise in temperatures. Extended droughts and excessive floods are posing difficulties to agricultural output (IPCC, 2015). Over time, populations may face pressure to relocate as a result of natural catastrophe risk, erratic food production, and a lack of resources for sustenance.

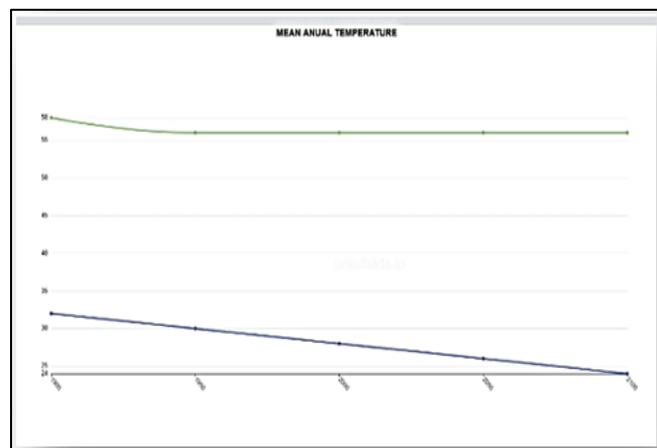


Fig 1: Temperatures Rose from Below 26°C in 1990 to Just Above 26°C in 2015. Projections Suggest a Rise of about 1°C by 2100 Under Low Emissions, and about 3.7°C Under High Emissions.

Based on data from the Worldwide Fitness Enterprise (2015a and 2015b) and the United Nations Substructure Conference on Climate Change, this displays real annual temperatures (°C) in the Philippines. A high estimate of emissions is shown by the orange dot, whereas accurate and smooth recorded data is shown by the blue line.

Low worldwide emissions are projected for the area without experience. The yearly temperature in the Philippines increased from much below 26°C in 1990 to just above 26°C in 2015. According to projections from the UN Framework Conference on Climate Change and the Sector Health Enterprise Corporation (2015a), the average yearly temperature of the Philippines will rise by about 1°C in the scenario of low global emissions between 1990 and 2100, but by about 3.7°C in the case of high global emissions.

#### C. Elevated Ocean Levels

Because warmer water expands, sea level rise is another significant sign of changing weather patterns. Additionally, it is a common task for countries in Southeast Asia, most of which 87 coastline villages house people threatened by sea level rise. Significant economic losses and population displacement will also result from this.

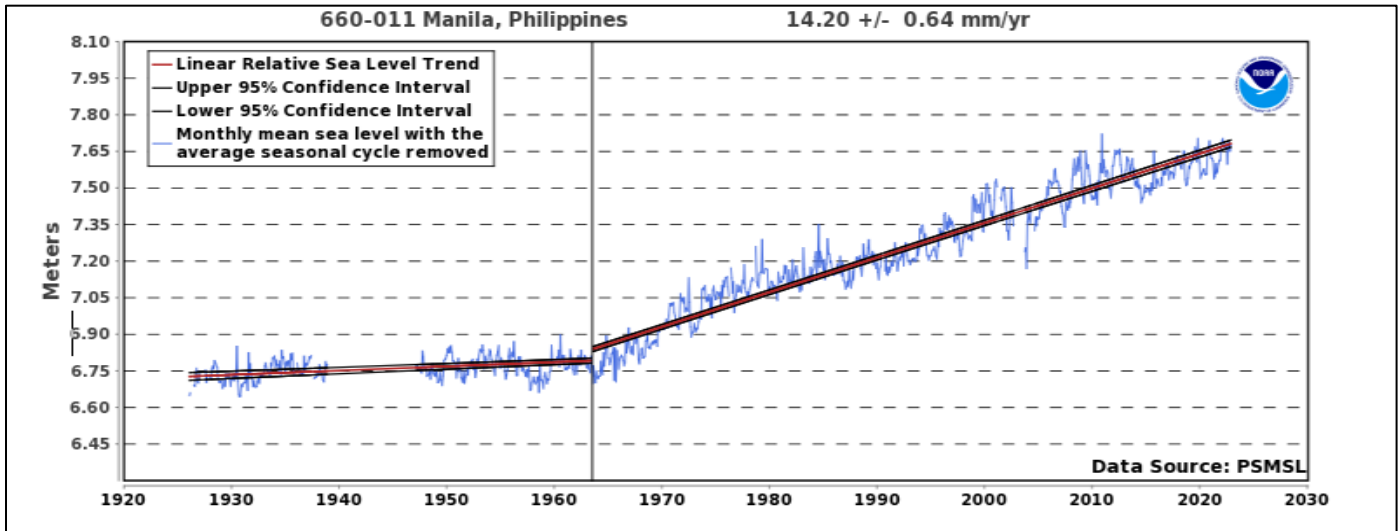


Fig 2: Rise in Sea Level in Manila from 6.96 Meters in 1970 to 7.65 Meters in 2017. According to the National Oceanic and Atmospheric Administration (NOAA) Report from 2017, Manila's Sea Level is Rising at an Average Rate of 14.54 Millimeters Per Year. Projections Suggest that by the end of this Century, sea Levels in Manila could Increase by Approximately 4.77 feet (1.46 Meters).

This displays the sea level rise in relation to neighboring land. Data indicates that Manila, the capital of the Philippines, grew from around 6.96 meters in 1970 to approximately 7.65 meters in 2017. As per the National Oceanic and Atmospheric Management report of 2017, there is an average 14.54-millimeter anticipated rise in sea level in Manila every year. In addition, during the course of a century, Manila's sea level is predicted by the national Oceanic and Atmospheric administration (2017) to rise by 4.77 feet.

*D. Climate Change Consequences*

Alternative weather outcomes include extreme weather occurrences, fluctuations in precipitation, and population dispersion. Numerous metrics, such as the number of displaced women and men, GDP losses, and fatalities, may be used to quantify this.

*E. Extreme Weather Events*

Based on ratings from the long-term weather hazard index (CRI), the top ten places in the world impacted by extreme weather occurrences between 2000 and 2019. Philippines comes in at number four. With 0.93 fatalities per 100 people, the Philippines has considerably superior data on herbal failures. The Philippines' GDP was negatively impacted by an extra 0.54 percent. Since 2000, the Philippines, which comes in at number 318 on the ranking, has had the most range of extreme weather events of any nation.

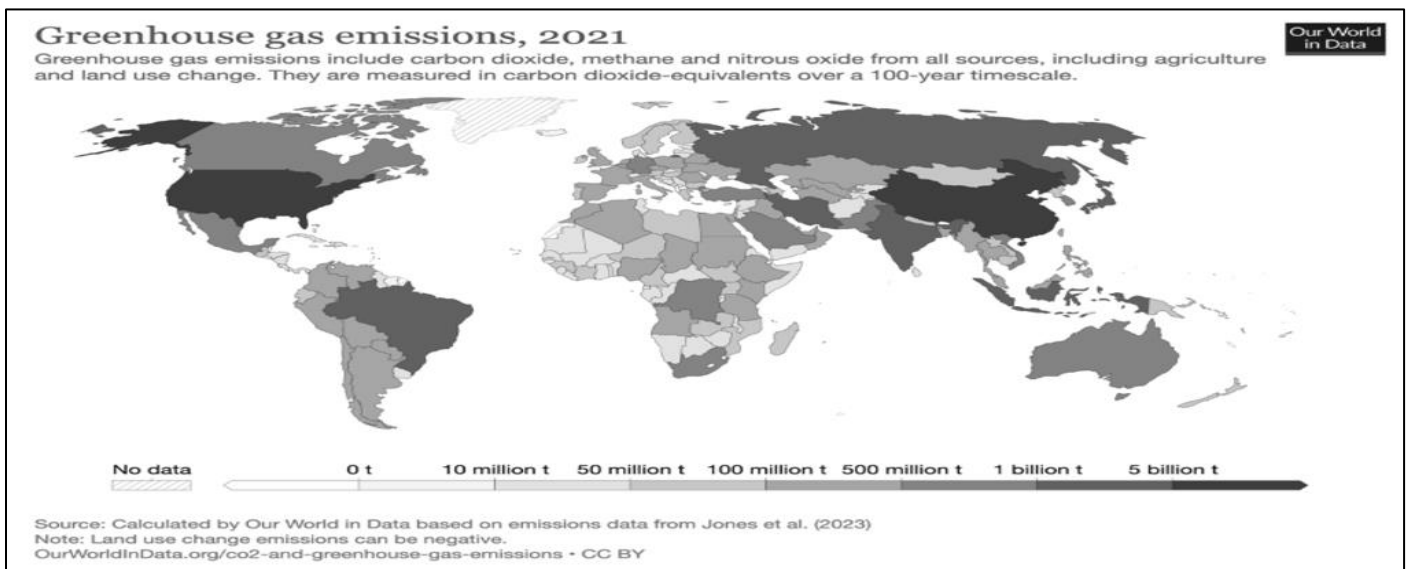


Fig 3: Philippines Ranks Fourth Globally for Extreme Weather Impact from 2000 to 2019, with 0.93 Fatalities per 100 people and a 0.54% GDP loss. It also Ranks 318th for the Frequency of Such Events

To be clear, weather change is not the cause of every extreme climate action. Nonetheless, it is tested to amplify their occurrence and exacerbate their severity (IPCC, 2015). Parent 10 below sets out the extensive style of deaths owing

to excessive climate activities, Parent 11 is a breakdown of the percentage of these deaths for each year between 1990 and 2017 in terms of all deaths.

#### F. Rainfall Adjustments

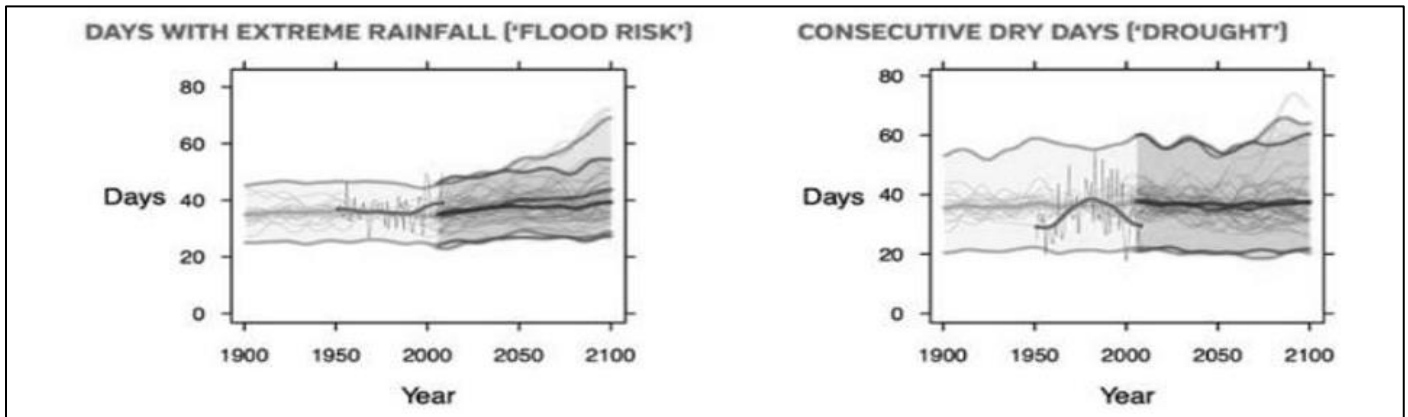


Fig 4 and 5: Flood Risk and Drought, Philippines (1990-2100)

Source: World Health Organization and United Nations Framework Convention on Climate Change (2015a)

*Historical data from 1950 to 2015 and future projections from 2015 to 2100. With high emissions, flood days are predicted to increase by nine, and drought days by seven by 2100.*

Variations in rainfall are a consequence of climate change, as was previously indicated, and this has an impact on agricultural and food production output. Apart from the factual documented days of intense precipitation and a run of dry days between 1950 and 2015, the chart shows expected days with excessive emissions in orange and minimal emissions in green for the years 2015 to 2100.

This illustrates the risk of drought and floods in the Philippines, respectively. By the year 2100, the Philippines' flood days are predicted to rise by nine and seven, respectively, if global emissions do not decrease. Luckily, it is expected that drought days will occur regularly.

#### G. Ethical Origins and Structures

Many ethical questions about extreme degrees are brought up by climate change. Subrationally, special businesses are neglected in matters of coverage. The distribution of consequences and exclusion from decision-making processes alone may cause inequities that affect whole nations; this is a global issue that transcends national boundaries. First, at the international and subnational levels, there is a great deal of variance in the sensitivity to climate change in trade. Proposed a more equitable distribution of resources could help address the issue. Neil Adgar, and Saleemul Huq (2006, p.) discuss it. As stated in Lauren Hartzell-Nichols and Stephen M. Gardiner (2012, paragraph 2), are skewed vulnerabilities: globally the most vulnerable areas, those with the lowest emissions in the past, and those whose emissions tiers stay relatively low, at least for the next few to three years.

W. Neil Adgar, Saleemul Huq, and Jouni Paavola (2006, p. 263) also talk about the problem of "distributive justice," which is the uneven distribution of the effects of climate trade in different spatial dimensions. State-wide, the Philippines has low global carbon emission stocks. For example, the climate movement Tracker shows that although the Philippines is making progress, the US is not doing nearly enough to reach the two°C target. However, as mentioned in section IV, all of the nations are in the top ten places in the world with the least amount of climate risk (see table 1 above). While it is challenging to determine how much emitting nations must contribute to mitigation, the differences are clear.

In order to manage climate change, these nations' inhabitants must also manage migration. In all of these countries as well as many others, the effects of the climate trade on rural companies have been disproportionate. Longer days significantly enhance the incidence of out-migration in the Philippines' rural areas, according to Bohra-Mishra et al. (2017, p. 300). The most plausible reason for this increase is the decline in agricultural output. In a similar vein, Curran and Meijer-Irons (2014) elucidate in their essay why agriculture is the backbone of the Philippine economy both domestically and internationally, and why rural people bear the brunt of accountability for the nation's agricultural output. Furthermore, researches by Curran and Meijer-Irons indicate that ecological challenges amplify political dissatisfaction and increase the desire to immigrate. These findings support the authors' assertion that rural organizations are primarily sensitive to weather uncertainties because of their agricultural dependency. Considering individuals who are ignored while assessing weather options and suggestions on a subnational diploma is the ethical component. The rural settlements are typically disregarded at initially, despite the fact that they would emit very little. For example, the United States of America's intentions to offer mitigation and edition are

outlined in the Philippines' National Weather Exchange Motion Plan 2011–2028. The Migration Plan talks about how migration could make things less safe, but it's vague and doesn't address how climate change would affect agricultural productivity.

The biodiversity approach and motion plan and the 2010 national disaster chance discount and management regulation are just two examples of the steps the Philippine. The United Nations Framework, Nationally Determined Contributions that have been thoughtfully created. The amount of people forced to relocate because of climate change is no longer recognized.

According to David Rotman (2013), choices are often made without considering future generations. However, striking a balance between the effects on present and future populations is imperative. Any nation's modern population may be at risk from hasty, rash, or too ambitious decisions. The excellent standard of living must be preserved for next generations at the same time. The other moral component is that wealthy countries often fall short of rising ones.

This is referred to as "procedural justice" by Paavola, Adgar, and Huq (2006, p. 264), who also explain why international agreements on weather exchange, poor developing nations are not treated as equal participants. They also point out that those developing countries are prevented from advancing their interests by long-standing injustices. These inequalities can also be better understood in light of the colonialism, dependency, and organization theories of development. Huan Qingzhi (2017, p. 91) states that "The conference framework presents the calmest assessment of ecological imperialism in global carbon politics."

An example of how certain Western countries uphold and extend their exclusionary hegemony or global hierarchical supremacy based on the concept in their domestic capitalist economies and politics is the Kyoto Protocol. This supports Paavola, Adgar, and Huq's (2006) claim that developed nations are more powerful than developing ones in international climate agreements, using the resource of hypothesis on current energy dynamics. The Philippines is now making every effort to lower greenhouse gas emissions, guided by the helpful resource of best practices from the most successful nations.

Additionally, in 2020, the US Commercial Enterprise Agency for International Development (USAID) funded climate trade with the Philippines to the tune of \$14.7 million and the US to the tune of \$5 million (climate connections, 2020a and 2020b, respectively). According to Calmfors et al. (2019, p. ), developed countries are seeking guarantees of steady financial inflows because superior countries have not fulfilled their commitments to provide climate financing.

But looking back, the Philippines lost financial assets worth more than three billion dollars year on average between 2000 and 2019 as a result of climate trade-related consequences. These losses were caused by the climate trade. The Philippines has the monetary resources to address

climate change by itself, but given the previously cited global disparities, it is questionable if assistance from the wealthier countries would be sufficient.

#### *H. Ethical Frameworks and Recommendations*

While there are many ways to tackle the problem of climate-related injustices, some ethical stances may be more appropriate for addressing certain levels of the issue. The Markkula middle for completed ethics (2009) identifies the five most crucial ethical processes. The Philippines' recommendations for both domestic and global climate trade are in line with the utilitarian school of thought, which aims to strike the maximum beneficial balance between favorable and unfavorable results. For instance, the Philippines is using an electrical area reorganization plan to handle specific difficulties and is trying to promote lower emissions at the same time as it is looking to give its inhabitants with adequate financing. In order to achieve their own national goals and resolve a global issue, the international sites in the Paris settlement must find a balance.

If wealthy, industrialized nations have the financial capacity to significantly reduce their emissions, then further binding restrictions might be placed on them in order to potentially execute the common well approach internationally. Paavola, Adger, and Huq (2006) assert that relativity and contexts rely on the idea that historically colonized areas of the world that lack proper commerce and infrastructure must get ninety-five percent growth to keep their people alive. Furthermore, countries with incredibly low emissions per person—usually those in the global South—should no longer be held to the same standards as nations with comparatively high emissions per person—typically those in the global North. To achieve the unusual peak the global South must be included in the formulation of global goals, and the global North will probably contribute more than its set share.

An analysis of the intergenerational implications of climate change from the perspectives of rights, fairness, and justice might be beneficial. The Markkula Center states that the goal of the rights approach is to protect the rights of all individuals who suffer the worst conceivable consequence. while the justice technique concludes that everyone must be treated fairly and equitably. connects to Paavola, Adger, and Huq's (2006) cosmopolitan notion of social equity, which maintains that justice must always be accessible to everyone, everywhere, and at all times.

As stated in the preceding subsection, profits should be generated to benefit the present population, but they should also include the aspirations of future generations. Future generations want to be recognized as viable contenders for the same rights and respect by using strategies like to these. Degrading their surroundings and decreasing their likelihood of survival and capacity for decision-making is unethical. These elements provide the groundwork for long-term sustainability-promoting climate policies and initiatives.

**IV. RESULTS AND DISCUSSION**

*A. Role of Civil Engineer*

The first aspect of engineers' work in mitigating natural disasters is the advancement of technology in infrastructure improvement. This entails developing soft soil, high-performing systems, and rescue and caution-oriented buildings.

In second place is the actual building of infrastructure that is highly resilient to natural disasters. The engagement in rescue operations and the repair and reconstruction work following natural disasters are the tierce positions held by civil engineers.

*B. Diversity of Role*

When creating an improvement plan for a place, policy makers and planners must consider how vulnerable the area is to various threats. Construction sports regulations and standards need to be carefully established, especially for vulnerable areas. All of the data must be examined by the

authorities before any project is approved. At the layout and monitoring stages, it is necessary to insist on a third-party check or peer review. Before authorizing building use (BU), the local authority must ensure that the project complies with all regulations or standards.

Following the completion of the improvement artwork, it is the responsibility of the home's tenants to ensure proper maintenance. A structural engineer should be consulted if any additions or changes to the structure's form are required. Furthermore, in disaster scenarios, civil engineers are essential for rescue operations, damage assessment, and structural retrofitting. It is important for civil engineers to stay current on research and developments in manufacturing technology, production material advancements, and analysis and planning techniques. Attending conferences, education programs, seminars, and workshops is a convenient way to achieve this goal. It is imperative for civil engineers to use valuable resources from specialized engineering fields to enhance the planning, implementation, and operation of their infrastructure and construction projects.

Table 1: Overcoming Hazards Due to Major Disasters

Category	Natural Disasters	Man-Made Disasters
<b>Definition</b>	Disasters caused by natural forces	Disasters resulting from human activities
<b>Examples</b>	Earthquakes, hurricanes, floods, volcanic eruptions	Industrial accidents, oil spills, nuclear accidents
<b>Causes</b>	Geophysical, meteorological, or climatic events	Human error, negligence, technological failures
<b>Impact</b>	Can cause widespread environmental and societal damage, loss of life, and economic disruption	Often leads to environmental contamination, health hazards, and significant economic costs
<b>Predictability</b>	Generally less predictable and harder to control	Often preventable with proper safety measures and regulations
<b>Mitigation</b>	Preparedness and early warning systems, building regulations	Safety protocols, regulations, and emergency response plans

The table compares natural and man-made disasters, detailing their causes, effects, predictability, and mitigation. Natural disasters, like earthquakes and storms, stem from natural forces, while man-made disasters, such as pollution and industrial accidents, result from human activities. Man-made disasters can often be prevented with improved safety measures, whereas natural disasters are generally unpredictable. Both have significant societal impacts and require distinct management strategies.

**V. CONCLUSION**

Throughout conclusion, favorable rates of human advancement have been seen throughout the Philippines. However, the adverse effects of climate trade have hindered and will persist in impeding its growth. Rising global temperatures, sea levels that are encroaching on densely populated cities, an increase in the number of fatalities from

increasingly severe and frequent natural disasters, altered weather patterns, and an increase in the cost of providing for internally displaced people as a result of any combination of those changes are all consequences of those countries' rising per capita GHG emissions.

However, the effects are exacerbated by the use of emissions from exceptional countries, especially from relatively developed nations that produce more greenhouse gases than their true percentage. The Philippines is no longer afforded the opportunity to occupy the same place at the table in global weather decisions. Moreover, several organizations that serve rural residents and the next generation are overlooked in national policies. These disparities reflect moral issues that may be examined from a number of angles, including what constitutes the community's best interest, what strikes a noteworthy balance between good and evil, and what upholds the human rights of all involved.

The international community has to do a better job of updating weather reports on impoverished nations as we go forward. Lower-income but higher-income nations should exert pressure on high-earnings nations to reach legally-binding objectives for reducing greenhouse gas emissions, to enhance climate mitigation efforts, and to establish models of funding for global expansion.

Non-governmental groups may also be able to boost the flow of resources to developing countries, provided that they pay attention to the people on the ground and avoid placing restrictions on those who benefit. They are known for upholding laws that consider and protect all affected populations. In addition, they offer financial aid, low-cost or free process education, help with applying to universities, housing support for people who have been relocated, and support for everyone impacted by the climate trade. There are plenty of chances for those nations to collaborate in this way.

Engineering has played a pivotal role in formulating engineering regulations and specifications, as well as in enhancing engineering resources, apparatus, and techniques to be employed in reducing the consequences of technological and natural hazards in built environments. knowledge, designed-risk reduction options on my own no longer guarantee protection against dangers related to herbs and other sources of danger. Consequently, an integrated.

Preferred is a multi-risk mindset that incorporates financial, social, and environmental issues into threat discounting. Engineering experts who support risk management will increasingly need to work across disciplines and with a wide range of actors and stakeholders.

Our fundamental understanding of natural dangers, their effects, and how susceptible the built environment is to them has been aided by engineering. increased comprehension of the ways in which herbal dangers impact natural risk evaluations, more efficient techniques for averting and managing catastrophes, and the development of preparatory plans.

As settlements become more intricate and interconnected and as new risks (such as the effects of weather exchange, water shortages, and terrorism) develop, engineering will continue to play a role in reducing threat. Engineers may need to use newly developing risks and their skills to create cutting-edge, potent methods for averting, preparing for, and responding to failure in the future.

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