Chapter 5
Economic Growth and Hazard Risk Reduction

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Abstract Risk and risk dynamics associated with economic activities have been largely relevant in explaining the susceptibility of economies to hazardous and disastrous conditions. This chapter discusses the interplay of the environment and economic activities that predisposes economies to hazardous conditions, as well as viable and plausible options to mitigate or check the fallouts of this nexus.

Keywords Environment · Development · Economic activities · Sustainability · Growth · Hazard · Disaster

1 Introduction

Hazards and disasters are usually used interchangeably as they relate to human lives or sustenance. However, a closer valuation of the two issues reveals that hazards are more of a potential phenomenon that poses threat to humans, life and the environment as a whole, while disaster is contextualized as a negative disruption that results in unmanageable loss of life, economic wealth and environmental quality (Cioccio & Michael, 2007). And mitigation, resilience and adaptation to the unpredictability of disasters depend a lot on a number of factors ranging from economic conditions to social and governance systems (Toya & Skidmore, 2007; Kim & Marcouiller, 2016). Kim and Marcouiller (2016) observe that the countries with strong economic resilience and economic conditions prior disaster face lower losses after disaster. As a result, given that disasters are unpredictable, strong economic conditions can largely check the vulnerability of economies to impending damages. Kim and Marcouiller (2016) further note that in addition to prevailing economic conditions, existing social structures and social capital advance the resilience and local adaptation in cases of disasters.

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According to Strömberg (2007), components categorized as hazardous conditions are embedded in human activities within the environment which include socio-economic activities such as manufacturing and construction works, population growth and technological discoveries to mention a few. It is expected that economic activities yield income for economic agents, and an increase in production or income over a period of time is termed economic growth. Restating that an economy is withstanding shocks from possible disasters, economic growth is an inevitable phenomenon. However, as laudable as economic growth appears, economic activities of resource extraction, processing and utilization that lead to economic growth have their hazardous bearing on the environment which spurs disasters (Wisner et al., 2012), thus questioning the extent and relevance of growth in an economy. Little wonder, environmental economists have begun to advocate for economic growth that is less material intensive (Panayotou, 2016).

Given the interrelated nature of economic activities and hazards, Taohidul Islam and Chik (2011) observe that hazards and natural disasters strike developed and developing countries alike, and it usually results in huge destruction and human misery. A cursory look at global statistics revealed that between 2000 and 2019, there has an average of 300 disasters[1] yearly. Except for 2008 where less than 300 disasters occurred, in 2019 alone, a total of 409 natural disasters occurred with the Asian Pacific region experiencing the highest natural disasters given their size and vulnerability. Similarly, Africa has extensively witnessed flood records of about 1.7 thousand natural disasters from 1970 to 2019. According to *Statista*, Africa shares 60% of the total natural disaster's cases within the period. Hence, the difference in the magnitude of effects has been largely attributed to the abilities of economies to check hazardous conditions from resulting in disasters (Dynes, 1999). The earthquake that occurred in Portugal, Lisbon precisely, where about 60,000 lives were lost in 1755, was rebuilt to withstand future disasters within a year owing to the wealth recorded by Portugal then; also, the economic, political, and institutional restructuring accounted for a national rebounce (Dynes, 1999). Strömberg (2007) argued that it is not sufficient to possess wealth from resources as noticeable in developing economies; rather, the ability to transform wealthy or growth-experiencing economies to plan, innovate and mitigate disastrous conditions is the difference we see in the extent to which hazards impact on national economies, which incidentally is also a reflection of the level of development of a nation.

Disasters are related to the management of nature and its resources. Therefore, the extent to which people wield, utilize and mitigate hazardous conditions will not only enhance sustainable livelihoods but also reduce the imminence of disasters. From an economic perspective, which is the crux of this chapter, there have been debates on the economic growth-environmental hazard trade-offs or possible pay-offs – which basically involves the wherewithal to reinvest natural resources used up in other forms of capital to generate more productive, more sustainable ventures – generally referred to as *weak sustainability* (Adejumo & Adejumo, 2014; Adejumo,

[1] See https://www.statista.com/statistics/510959/number-of-natural-disasters-events-globally/

2019; Massa-Sánchez et al., 2020). The quest for economic growth via resource exploitation introduces hazards that could result in disasters if unchecked. For instance, exploitation of natural resources like mining for oil, gold, copper, etc. for further production or exportation is usually at a cost to the environment and the economy where such occurs.

Weil (2009) referred to the experience of Spain after Europe's discovery of the new world. Through the trade of gold with America, Spain exported gold to other countries within Europe in exchange for manufactured products and incidentally became very rich. Spain sold gold to most European economies, and these economies developed via innovations and investment in physical and human capital; Spain later suffered from economic sustainability when the resource flow from America ceased. This phenomenon which is referred to as Dutch diseases is a skewed or detrimental relationship between resources utilization and growth sustainability and is a form of economic hazard that could result in disaster especially in economies where resource utilization has not been re-harnessed into other forms of productive capital (like human, social and physical capital) or translated into economic wealth for mitigating environmental challenges and ensuring sustainability. Another instance, Nigeria, which is an oil-rich state, earns most of its foreign income and foreign capital courtesy from the mining of oil. However, despite the economic wealth that results from this resource, the pervading poverty of Nigerians is still an issue and to crown it is the destruction of the environment via mining activities. Incidentally, the displaced agricultural activities that have given way to mining are indicating hazards for environmental and economic sustainability.

Meanwhile, the challenge for sustainable development lies in the utilization of all forms of resources and still mitigating or avoiding hazards or potential disasters. Also, another issue is the ability for economies to translate environmental disruption to optimal and sustainable economic wealth such that instead of experiencing an environment-economic trade-off, pay-offs would occur. In other words, the extent to which economies transform economic growth to sustainable growth as far as environmental and economic sustainability is concerned is contextualized as *green growth* which is far-reaching for sustainable development and more appreciated by ecologist and environmental economist.

The rest of the chapter is sectionalized to include a conceptual clarification and a brief overview of literature of the growth-hazard relations. This is followed by a discussion on the drivers of and adaptive options for the growth-hazard relations and the conclusion of the chapter.

2 Conceptual Clarification

Chang et al. (2012), by distinguishing between vulnerability and hazard, expanded on the thoughts of risk dynamics as it relates to natural occurrences. Risk in itself relates to the interplay between hazard and vulnerability, while risk dynamics is a function of the changes that occur via hazard or vulnerability (Eslamian et al., 2021). As shown in Fig. 5.1, hazard constitutes likelihood events such as

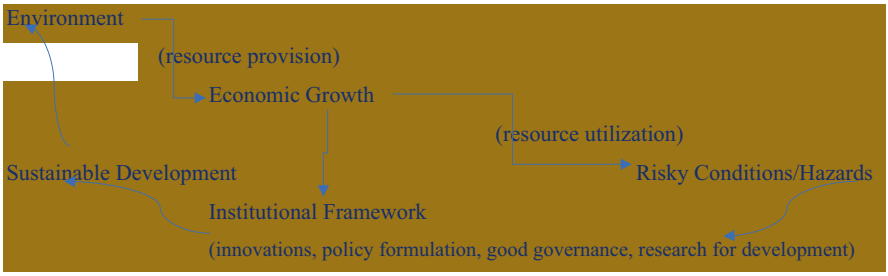
Source: Chang et al. (2012)

Fig. 5.1 Hazard risk and risk dynamics. (Source: Chang et al. (2012))

earthquakes, storms and tsunamis; and vulnerability is passed as the propensity for an event that augments or predisposes to risky or hazardous possibilities such as population growth, demographic changes, social changes, economic growth, urbanization, expansion of built areas, infrastructures and construction activities (Chang et al., 2012). In other words, while explaining natural and environmental phenomenon to apply to disaster and risk dynamics, economic growth is categorized as a condition of vulnerability such that the management of or changes that occur to growth can be an indication of propensity to experience losses especially when it is related to a particular hazard.

In the parlance of economic sustainability, an assessment of being prone to risk, plausibility of disasters or hazard-related conditions are contingent on the degree of susceptibility of an economy (i.e. level of income or income per capita) through relations with climate conditions or the environment as well as institutional framework.

Weil (2009) expanded on the implications of the environment for economic growth by drawing inference on the nexus between human working conditions vis-à-vis climate conditions. Specifically, Weil compared workers' productivity vis-à-vis the climate in temperate and tropical regions and noted that those in temperate zones are more productive. Following the tenets of human physiology, people in warm climates cannot work hard because they will overheat. Also, noting that the substantial part of the energy released by working muscles takes the form of heat, as a result, the heat must be dissipated by the coolness of the weather if workers are to survive, be productive and contribute meaningfully to economic growth. Hence, as shown in Fig. 5.2, to minimize risky conditions and hazards, activities that birth economic growth should be structured with feedback mechanisms that are targeted



Source: Author's readings

Fig. 5.2 Resource utilization and growth – role of institutions. (Source: Author's readings)

at stabilizing (through institutional frameworks) the environment for more productivity and sustainability.

3 Theoretical and Empirical Debate

Several studies have argued from varying perspectives the nexus between development and hazard-related issues. The Rostow's stages of economic growth are an important historical model which captures the pattern of growth that has led economic vulnerability. The five stages include the *traditional society* which engages more in agriculture and has no scientific inclination; the *preconditions for take-off* that involve an outward looking economy; the *take-off* tilts towards industrialization; the drive to maturity involves high standards of living and more use of technology; and the *age of high mass consumption* that involves mass production and consumption (Todaro & Smith, 2012). The existing components of economic growth are reflective of the age of high mass production and consumption. Most production processes involve heavy construction like underground drills, use of fossils and emission of greenhouse gases which are not just hazardous but disaster-prone as well. But, the global challenge of climate change and clamour for green growth has begun to challenge the pattern of economic growth (Ekins, 2002).

From a demographic perspective, rising population or population growth has been classified as a hazardous condition, while overpopulation is a cause of disaster. The case cited by Hamilton (1988) in the flood plain of Ganges and Brahmaputra river in Bangladesh showed that in addition to the high rates of deforestation, overpopulation of the delta region which is typical of non-absorbing surfaces and increase in infrastructure is a major cause impeding rapid run-off and eventual flooding. Taohidul Islam and Chik (2011) also added that Bangladesh suffers frequently from disasters like floods, cyclone storms, tidal surges, river bank erosion, and earthquakes. Meanwhile, from an institutional perspective, Ahrens and Rudolph (2006) argued that governance failures are largely accountable for increases in disasters due to lack of plan and functional structures to mitigate plausible usual or

unusual hazards that occur via socio-economic activities. Also, social structures, income inequality, ethnic fractionalization, and religious heritage have been identified as critical determinants of hazards (Toya & Skidmore, 2014).

The effects of natural disaster or unfavourable climate conditions are thought to be more pronounced in developing and smaller economies which are usually reflected via large output declines (Noy, 2009). This is because developing economies are characterized by corrupt and less accountable governance systems, failed institutions, and strained financial systems. Therefore, Toya and Skidmore (2007) argued that as economies develop, economic losses reduce and that as countries earn higher income, higher educational attainment, greater openness, more complete financial systems and smaller government involvement, fewer losses from disasters occur. Similarly, Noy (2009) added that countries with a higher literacy rate, better institutions, higher per capita income, higher degree of openness to trade and higher levels of government spending are better able to withstand the initial disaster shock and reduce negative spillovers into the macro-economy.

Another dimension to the disaster-growth nexus is the time dimension of the effects on such disasters. Chang et al. (2012) argued that disasters such as earthquakes, storms and floods occur sparsely and their probabilistic distribution could shift over decades or centuries due to climate change, technological developments or environmental modifications from human socio-economic activities; however, changes in vulnerability such as economic growth are seen to occur more quickly. And as result, it is expected that the effects of vulnerabilities are short-lived and can be easily mitigated, while hazards are expected to have more far-reaching effects. Empirical studies have shown conflicting evidences on the subject matter. For instance, Noy (2009) noted that natural disasters have significant and adverse impact on the macro-economy in the short run which could result in slowdowns in production. In contrast, Crespo Cuaresma, Hlouskova and Obersteiner (2008) via a cross-country and panel data analysis found evidence of a positive correlation between the frequency of natural disasters and the long-run economic growth. Therefore, in view of environmental threats, these evidences in literatures enable to draw inferences on factors associated with vulnerabilities vis-à-vis the pursuit of economic growth.

4 Economic Growth-Hazard-Disaster Nexus in Developing Economies

Given the variations in environment and resource utilization, the preceding section expands on the mechanisms that could shape the relationship between economic growth and disaster-related occurrences. One would expect that natural disasters should lead to a reduction in economic activities and growth; however, studies have shown otherwise. For instance, Loayza et al. (2012) note that disasters can lead to economic recession but not necessarily; besides, the impacts of disasters differ among disaster types and different sectors. Also, Loayza et al. (2012) observe that moderate disasters (like moderate floods) steer growth in positive directions, while

Fomby, Ikeda and Loayza (2013) note that severe disasters have greater impacts on growth than moderate disasters; Fomby et al. (2013) observe that natural disasters are not alike with regard to growth response. They further note that some disasters have positive effects on economic growth; and the duration of growth response to disaster depends on the type of natural disaster and the sector of economic activity – whether agricultural or non-agricultural sector.

Therefore, an issue of interest is what accounts for the relationship between economic growth and disaster-related occurrences? And what measures can check the vulnerability of economic growth in the presence of hazards or looming disaster?

4.1 Technological Advancement

According to Skidmore and Toya (2002), a plausible explanation for the relationship that exists between disasters and growth is the ability to introduce and utilize better technologies into the economy where disaster has been faced. The use of more sophisticated technology coupled with physical and human capital will cause growth to rise. This is consistent with the Schumpeter concept of 'creative destruction' where newer technologies otherwise known as innovations are utilized to displace existing order or old methods of production. This context of creative destruction has been employed in explaining how economies evolve and surmount the limitations posed by nature and still achieve economic growth especially in the long run. However, where there are no resources or technical know-how to replace the fallouts from natural disasters, economic growth will be challenged.

Thus, where there are positive shocks in production techniques, productivity is enhanced, growth rate is sustained, and the rippling effects from hazards or potential disasters are to a large extent doused (Okuyama et al., 2004). This is typical of the findings of Skidmore and Toya (2002) where a positive relationship is identified between the frequency of climatic disasters and productivity growth for a cross section of 89 developed and developing countries. Therefore, just like Skidmore and Toya (2002), Crespo Cuaresma et al. (2008) submitted that 'disasters provide opportunities to update the capital stock and adopt new technologies', while Skidmore and Toya (2002) noted that a plausible association between total factor productivity (TFP) growth and climatic disasters may just be picking up the substitution of physical for human capital in disaster-prone countries.

4.2 Diffusion and Absorption of New Technologies

Recapitalization and utilization efforts are two different issues especially among developing economies. While disasters could birth the process of recapitalization and purchase of foreign technology, the ability to assimilate and domesticate such technologies within local economies will to a large extent determine growth effects. Crespo Cuaresma et al. (2008) noted that catastrophic risk has negative effect on the

volume of knowledge spillovers between industrialized and developing countries and that one major process by which knowledge spillovers or technology absorptions are actualized is through the presence of multinational enterprises (MNEs) in host economies (Damijan et al., 2003; Crespo & Fontoura, 2007). Therefore, to mitigate hazards, adaptability and suitability of technology must be ascertained if expected growth via technological development or diffusion will yield any gain environmentally or resource redistribution that will foster sustainability.

4.3 Natural Resource Utilization

Activities leading to economic growth that engineer hazards could explain the positive co-movement of the hazard-growth nexus in the long run. For instance, in Nigeria, the main source of external income, which is crude oil, is from an environmentally destructive activity. The activities of oil mining in the Niger-Delta region of the Nigerian state have left in its wake an upturn of the traditional agricultural economic activity. It is such that the natural fishing and farming operations of the local farmers have been upturned by mining which destroys top soil layers, as well as oil spillage which destroys water bodies (Aigbedion & Iyayi, 2007). These not only constitute health hazards through aggravating erosion, sinkholes and the contamination of soil, groundwater, and surface water by the chemicals emitted from mining processes but foster disasters such as landslide, subsidence, flooding and tremor. However, following the principles of weak sustainability, economic gains can be redistributed for greater gains and mitigate the effects of resource exploitation and utilization (Dietz & Neumayer, 2007).

4.4 Population Growth

Population growth has been categorized as a naturally hazardous phenomenon. Meanwhile overpopulation can transcend a natural hazardous condition into a disaster if unchecked, as well as increase the potential for loss in disaster event. Strömberg (2007) found highly significant positive coefficients between population growth and disaster-related occurrences in China and India. With a population that grew by 1.2 billion in India and China and 1.8 billion in other sampled countries between 1960 and 2000, Strömberg (2007) noted that an increase of population of ten million is associated with an average increase in the number of disasters by 0.9 in other countries and 0.3 in China and India. Despite this population-disaster nexus, Strömberg (2007) argued that locational advantage if consolidated on can be a cause and an aversion of hazards. For instance, Dynes (1999) argued that if the people of a particular location are lightly lodged or well-spread, the propensity to damage can be averted and should disasters occur, the aftermath or effects can be minimized.

4.5 Overconcentration of Economic Activities/ Rapid Urbanization

Urbanization in itself is a reflection of development, but the ability to reorganize economic activities in urban centres is critical to actualizing resilience. Apart from people seeking for better access to better livelihoods with supportive infrastructures present in the urban areas, people with modern high income-generating economic activities find it worthwhile to reside in urban centres (Bloom et al., 2008). This attraction to the urban centres could evolve a natural hazardous condition; however, studies have argued that urbanization is not the challenge but inadequate planning. For instance, Rumbach (2011) argued that the extent of planning (such as consolidating on informal economies or suburbs to sustain urban centres) is what determines the extent of vulnerability or resilience of Kolkata an urban area in India. Also, Odiase, Wilkinson and Neef (2020) examined the resilience of the Nigerian community to natural hazards in Auckland and equally noted, in addition to planning and reorganizing economic activities, other areas – social, communication, disaster competency and physical resources – for government intervention to enhance the resilience of entrants in vulnerable urban regions.

5 Sustainable Adaptive Options for Growth-Hazard Relations for Developing Economies

Following the discourse on the growth-hazard nexus is the need to chart a course for advancing and sustaining economies in the face of hazardous or potential disastrous possibilities. Therefore, in addition to some views gathered from evidence-based studies, inferences for plausible course of actions for confronting and mitigating hazards are itemized in turns.

5.1 Financial Plan and Mainstreaming

The ability to make provisions for exigencies, for instance, via national budgets, facilitates rapid responses and reduces the effects of hazard-related issues. For instance, Noy (2009) noted that countries with more foreign exchange reserves and higher levels of domestic credit, but with less-open capital accounts, appear more robust and better able to endure natural disasters, with less adverse spillover into domestic production.

5.2 Flexible Institutional Structure

Ahrens and Rudolph (2006) argued that if a country's governance structure enables the implementation and enforcement of public policies conducive to a country's economic and social development, can sustainable livelihoods be achieved and susceptibility to disasters be reduced? Accountability, participation, predictability and transparency are identified as the key features of a governance structure that fosters development and supports risk reduction.

Beyond ensuring the establishment of institutions to check hazards, it is imperative to ensure these structures are not bedeviled by bureaucracies especially in hazardous situations of looming disasters. This issue bothers on an improved structure to mobilize human, physical and financial resources for mitigations of risk and even reconstruction where disasters occur. It is one thing to plan; it is another thing to actualize timely, need-based and appropriate implementations when disasters occur. For instance, a flexible institutional structure that brings about ease in securing approval for funds should be engineered. Also, just like Rumbach (2011) argued, a fusion of formal and informal systems through a flexible governance planning structure can co-locate and co-evolve disaster resilient systems.

5.3 Reinvestment and Diversification

Catching in on the principles of weak sustainability discussed earlier in this chapter, reinvesting funds generated via hazardous-prone economic activities for other productive activities can help disaster-prone areas to make up and diversify the economy, thereby reducing overdependence on natural resource-based income, agitations and conflicts, as well as preserve the ecosystem.

5.4 Knowledge Spillover/Human Capital Development

Crespo Cuaresma et al. (2008) argued from the Schumpeterian notion of creative destruction that disasters present opportunities to appraise the stock of current and adopt new technologies. However, in mitigating the challenges that arise from disasters, asymmetry in technical know-how could determine the extent of knowledge spillovers between developed and developing economies. Crespo Cuaresma et al. (2008) added that only countries with relatively high levels of development benefit from capital upgrading through trade after a natural catastrophe.

5.5 Social Capital

Social capital involves a network of usually homogenous groups confronting and consolidating issues for onward development. Toya and Skidmore (2014) showed a panel data evidence of another important determinant of trust to the frequency of natural disasters. They noted that frequent naturally occurring events such as storms require (and provide opportunity for) societies to work closely together to meet their challenges. While natural disasters can have devastating human and economic impacts, a potential spillover benefit of reducing disaster exposure may be a more tightly knit society.

5.6 Evolving Urbanization-Resilient Approach

Taking into consideration the peculiarities of different urban systems, it is pertinent to evolve mechanisms that synthesize economic activities with population growth in urban societies. For instance, studies have shown that mechanisms such as need-based planning, utilizing improved building codes and restricting occupancy in disaster-prone areas are relevant in sustaining urbanization (Chang et al., 2012; Rumbach, 2011). Chang et al. (2012) conducted a case study of population growth vis-à-vis seismic hazard and transportation system for the metropolitan area of Vancouver, Canada; and it was seen that reduction in the rate of casualty can be largely attributed to building code upgrades and changes in new construction. It is such that re-arrangement of residences, infrastructures and workplaces cause risk to reduce and allow for spatial redistribution that can prevent earthquakes and other natural occurrences following careful city planning approach.

5.7 Resilient-Relevant Infrastructures

According to the United Nations, resilience is contextualized as 'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions' (UNISDR, 2009). Therefore, in consonance with SDG9 9 which states to 'build resilient infrastructure to promote sustainable industrialization and foster innovation', it has become imperative for governance to go beyond just provision of social amenities but amenities that are hazard-compliant.

Gallego-Lopez and Essex (2016) noted that infrastructural resilience should be designed to cater for sudden shocks that are being disaster resilient and climate change responsive, as well as incorporate the fallouts from economic activities like

pollution and deforestation that deplete the natural environment. For instance, in mitigating flood disasters, Ahmad and Simonovic (2000) clamoured for the construction of flood storage reservoir. Some other resilient infrastructure investment relevant for development in developing economies can be undertaken within transport, agriculture (such as irrigation), energy, water, communications and the clean environment.

5.8 Frugal Innovations

According to Bouckaert, Opdeeeck and Zsolnai (2011), the economics of frugality involves low material consumption in the process of executing economic activities. Fukuda and Watanabe (2011) noted that due to low investments, developing economies suffer from an autarky cycle between consumption and GDP, thereby causing a high attitude of consumptions via imports and resource exploitation or utilization. Therefore, Fakube and Wantabe argued that one possible trigger for inducement of investment by growth in these economies can be frugality. Also, Anthon (2010) added that the less of resources that are consumed either at firm or household levels will not just result in reducing the hazards that people are exposed to but also foster sustainable livelihoods. Thus, a frugal approach to mitigating hazard for developing economies could include reducing the insatiable thirst for imported products that leaves in its wake pollution and evolve an indigenous approach to production where local resources are utilized efficiently with little or no waste.

6 Conclusions

The Intergovernmental Panel on Climate Change (IPCC) in its fifth assessment report on climate change adaptation notes that appropriate adaptation is a reflection of adequate information as it pertains to risk-related conditions and vulnerabilities (IPCC, 2014). Though inexhaustive, a review of literature has been able to show dimensions via which economic activities (such as high imports, resource overutilization, inappropriate planning and failed institutions) in developing economies generate hazardous conditions which in some instances trigger disastrous occurrences.

To address some of growth-hazard issues in developing economies, a drift from the regular approach to evolving systems is advocated. Some of the suggestions via empirical studies include flexible institutions, financial mainstreaming of climate change conditions, improved social systems that harnesses social capital, resilient infrastructural investments and a frugal approach to socio-economic activities.

Globally, the associated risk and vulnerability with current economic growth components and pattern can be tagged *resource driven*. While developing economies generate numerous gains from resource extraction, developed economies

contribute to economic vulnerabilities through resource overutilization for industrialization. In order to confront the disasters or the dynamics embedded in risk from economic activities, policy efforts should be directed at recognizing thresholds for resource extraction and utilization for global economic growth. Moreover, arguing from the Rostow's stages of economic growth, it appears the world economy is at the stage of *high mass consumption*. Therefore, a more radical policy effort should be directed at attenuating the environmental impacts of mass consumption driving resource extraction and utilization across the global economy. Finally, to mitigate propensity to disasters, global economic growth should pursue growth pattern that reflects global commitment to environmental sustainability.

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