A Synthesized Approach to Disasters and Sustainability

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PREFACE

In our previous work on worldwide adversities—including all types of disasters, terrorism, climate changes, financial crises, and environmental degradation—we suggested that guaranteeing sustainable development requires changes in ideology.

In this book, we focus on natural disasters and sustainable development while continuing our argument that the most significant change is not in disaster responses but in ideological change from a selfish society to a benevolent one. We also follow a synthesized approach to disasters and sustainability to integrate other discipline theories into economic and sustainable development theories.

The idea to write this book came after attending many conferences in developing countries, where I had opportunities to hear comments from the conference attendants on the contradictions between what developed countries had asked the developing countries to do concerning sustainability and what the developed countries did. For example, the developed countries had guided developing countries to avoid trashing the environment, but the former dumped tons of waste and toxic substances onto the latter's shores and land.

I wish to thank the conference attendants for pointing out the problems of current capitalism and inspiring me to seek a solution. Thanks also go to the Editor and Editorial Team for helping to publish this book.

LIST OF ABBREVIATIONS

AIC: Akaike Information Criterion
ASEAN: Association of Southeast Asian Nations
CDRI: Community Disaster Resilience Index
CSR: Corporate social responsibility
CRED: Centre for Research on the Epidemiology of Disasters
CWDO: Climate Watch Data Organization
DESINVENTAR: Disaster Inventory (*Inventario de Desastres* in Spanish)
DRR: Disaster Risk Reduction
ECLAC: Economic Commission for Latin America and the Caribbean
EM-DAT: Emergency Events Database
FAOUN: Food and Agriculture Organization of the United Nations
FEMA: Federal Emergency Management Agency
IFRC: International Federation of Red Cross and Red Crescent Societies
ILO: International Labor Organization
IPCC: Intergovernmental Panel on Climate Change
JTWC: Joint Typhoon Warning Center
MBS: Mortgage-Backed Securities
NCDC: National Climatic Data Center
NOAA: National Oceanic Atmospheric Administration
ODRR: Office for Disaster Risk Reduction
OECD: Organization for Economic Cooperation and Development
PVO: Private volunteer organization
PNPO: Private non-profit organization
RESET: Ramsey Regression Specification Error Tests
SDGs: Sustainable Development Goals
SEI: Stockholm Environment Institute
SFDRR: Sendai Framework for Disaster Risk Reduction
SGMM: System Generalized Method of Moments
SSUR: System Seemingly Unrelated Regression
SVI: Social Vulnerability Index
UCM: Unobserved Components Model
VIF: Variance Inflation Factors
WDI: World Development Index
WGI: Worldwide Governance Indicator
WMO: World Meteorological Organization

INTRODUCTION

BASIC CONCEPTS

Despite the great concern worldwide about the various damages caused by disasters, there is no consensus on the term "disasters," especially "natural disasters." For example, some authors (the World Bank Group, 2010) emphasize that "earthquakes, droughts, floods, and storms are *natural hazards*." Still, deaths and damages caused by these natural hazards are the "*unnatural disasters*" that "result from human acts of omission and commission." In other words, they implied that natural disasters are nonexistent.

Most researchers tentatively consider the words "disasters," "hazards," and "emergencies" to convey similar meanings, whereas "technological" and "manmade" are roughly identical. The only exception is when the researchers classify disasters into four types and separate technological disasters from manmade ones, which they define as social unrest and economic crises.

There is no mutual agreement on the main types of disasters either. Some researchers divide them into just two categories (natural and man-made). Some classify them into three (natural, technological/manmade, and hybris). Others divide them into four (natural, technological, manmade, and complex).

There is also no consensus on what constitutes each type of disaster. Some researchers and organizations, including the Emergency Events Database (EM-DAT), incorporate all epidemics and pandemics into the natural disaster group, leaving only animal or insect infestations, lack of food or clean-water accesses, and fractured infrastructure in the complex disaster group. In contrast, the International Federation of Red Cross and Red Crescent Societies (IFRC, 2024) places epidemics into the hybrid/complex disaster group and provides the following definition from their website:

> "Some disasters can result from several different hazards or, more often, to a complex combination of both natural and man-made causes and different causes of vulnerability. Food insecurity, epidemics, conflicts and displaced populations are examples."

(IFRC, 2024)

Given these disagreements, reviewing several concepts used in this book is crucial.

Hazard

The Cambridge Online Dictionary defines a hazard as

> "Something that is dangerous and likely to cause damage:
>
> *a health/fire hazard*
>
> *The busy traffic entrance was a hazard **to** pedestrians".*
> (Cambridge Dictionary, 2024).

The Oxford Online Dictionary, on the other hand, defines hazard as

> "Something that can be dangerous or cause damage.
>
> *Everybody is aware of the hazards of smoking".*
> (Oxford Learner's Dictionary, 2024)

Based on these definitions, we can deduce that a "natural hazard" is any natural situation that *might cause* deaths, injuries, and property damage to human beings, society, and the ecosystem.

Disasters

There is no consensus on what a disaster is either. In the current literature, most researchers consider an emergency the same as a disaster. The Federal Emergency Management Agency (FEMA), an agency of the United States Department of Homeland Security (DHS), defines a disaster as

> "…an occurrence of a natural catastrophe, technological accident, or human-caused event that has resulted in severe property damage, deaths, and/or multiple injuries. As used in this Guide, a "large-scale disaster" is one that exceeds the response capability of the local jurisdiction and requires State, and potentially Federal, involvement. As used in the Stafford Act, a "major disaster" is "any natural catastrophe [...] or, regardless of cause, any fire, flood, or explosion."
> (FEMA, 2024).

Based on this definition, we define a "natural disaster" as any natural hazard that *directly causes losses,* such as deaths, injuries, and property damage to human beings, society, and the ecosystem. Similarly, a technical disaster is any technical accident that causes substantial harm, and a complex disaster is any combination of these two disaster types.

Disaster Impact Assessments

At least one author (Albala-Bertrand, 1993, 14) defines the "disaster direct impact" as losses to capital stock and labor, whereas the "indirect impact" is losses to functional flows.

This definition might confuse my reader because we have defined a disaster as any natural hazard that directly causes losses to human beings, society, and the ecosystem in the above section. In other words, there is no disaster if there is no loss. If there is a loss, then a disaster exists, regardless of whether the losses are to capital stock and labor or to functional flows such as income, school enrollments, and so on. This fact is especially true if we look at the feedback effects of these variables.

EM-DAT website indicates its data on disaster losses as follows.

> "*Death:* Number of people who lost their lives because the event happened.
>
> *Missing:* The number of people whose whereabouts since the disaster is unknown, and who are presumed dead (official figure when available).
>
> *Total deaths:* Sum of death and missing.
>
> *Injured:* People suffering from physical injuries, trauma or an illness requiring immediate medical assistance as a direct result of a disaster.
>
> *Homeless:* Number of people whose house is destroyed or heavily damaged and therefore need shelter after an event.
>
> *Affected:* People requiring immediate assistance during an emergency, i.e., basic survival needs such as food, water, shelter, sanitation, and immediate medical assistance.
>
> *Total affected:* Sum of injured, homeless, and affected.
>
> *Estimated Damage:* The damage to property, crops, and livestock.

> The value of estimated damage is given in US$ (‘000). For each disaster, the registered figure corresponds to the damage value at the moment of the event, i.e. the figures are shown true to the year of the event.”
> (EM-DAT, 2004)

As such, when we mention “total deaths,” “total affected,” and “estimated damage” caused by overall disasters, we refer to the above definitions and data from the EM-DAT website.

For a disaster to be reported in the EM-DAT database, the website also stipulates:

> “…at least one of the following criteria must be fulfilled:
>
> - Ten (10) or more people were reported killed.
> - Hundred (100) or more people reported affected.
> - Declaration of a state of emergency.
> - Call for international assistance.”
>
> (EM-DAT, 2024)

We, therefore, define disaster losses as anything that happens at the onset of a natural hazard, such as mortalities, injuries, people being affected, and property damages measured in US dollars.

These losses directly affect the consumers, producers, society, and states across territories or over time. They can also indirectly affect these agents through interaction with other factors such as education, climate change, and the ecosystem.

On the other hand, there are direct feedback effects of education and indirect impacts of education on disaster losses. For example, a country can reduce the number of deaths from a disaster directly through its increase in the number of school enrollments and indirectly through the interaction of education with employment.

To assess disaster impact, one must go through an impact assessment process, in which we quantify the direction (favorable or adverse) and roughly the magnitude of the effects. Although we will provide methods to interpret the exact magnitudes in the following chapters, we hereby wish to caution the readers that it is better to understand these numbers as approximate only, for quantitative methods are to estimate the effects instead of accurately calculating them as often done in mathematics due to the data incomprehensiveness and the characteristic of the quantitative methods themselves.

For some of the direct impact caused by hurricanes for certain regions, we utilize the original information on the number and intensity of the

cyclones from the Annual Tropical Cyclone Reports (hereafter called the Report) provided by the Joint Typhoon Warning Center (JTWC) of the NOAA posted the information on the US National Climatic Data Center (NCDC) website.

Direct impacts caused by climate changes and environmental degradation comprise temperature, rainfall, sunshine, humidity, deforestation, and greenhouse emissions. Data for these variables are from the World Bank Climate Knowledge Portal, individual countries that make Nationally Determined Contributions to the Climate Watch Data Organization (CWDO) following the Paris Agreement, and national statistics.

Detailed discussions on data will appear in Chapter 2 when we set a model for quantitatively analyzing disaster impact.

Vulnerability

Oxford Online Dictionary defines vulnerability:

> "…the quality or state of being exposed to the possibility of being harmed or attacked, either physically or emotionally".
> (Oxford Learner's Dictionary, 2024)

We adapt this definition and define the following five types of disaster vulnerability in our book.

(i) Physical vulnerability: Given the same level of disaster exposure, some people or animals will be severely affected while others might come out unharmed. The young, elderly, and those with weakened immune systems will be the most susceptible to any disaster.
(ii) Sociopolitical vulnerability: certain groups in society are more susceptible to harm caused by hazards than other groups due to social injustice such as discrimination or income inequality. People are exposed to more significant harm at the expected levels due to political instability, weak governance, or specific government policies.
(iii) Sectoral vulnerability: The primary sector, especially the agricultural subsector, is more vulnerable to specific natural hazards such as droughts, floods, and hurricanes, whereas manufacturing sectors are more vulnerable to chemical hazards.
(iv) Structural vulnerability: Buildings constructed with weak designs and materials cannot resist extreme pressures, and population density prevents pollutants from dissipating quickly.

Disaster Resilience

We do not run into conflicts in defining resilience. Accordingly, there are two main types of resilience.

(i) Inherent disaster resilience is the built-in strength of an individual, a building, or a road to deal with disasters.

(ii) Adaptive disaster resilience is the ability of consumers, producers, communities, and states to adapt to and recover from repeated disasters, including the shocks and stresses caused by any disaster.

Resilience can be a built-in characteristic or comes with processes of training. It ensures that a disaster will not compromise long-term prospects for conducting all activities in a nation and worldwide.

Increasing disaster resilience is crucial for sustainable development and requires mastering disaster management skills, which depends on accurate damage and risk assessments.

Disaster Risk

By general agreement, the word "risk" refers to the possibility that something harmful occurs.

Theoretically, risk is the expected loss from an event or the probability of harmful consequences such as deaths, injuries, property damage, and economic, social, or political system disruptions.

Disaster risk is the expected loss associated with the social inability to manage a hazardous event that might lead to adverse results. The natural hazard risk is the possibility of enduring more substantial damage when the likelihood of the occurrence rises or when a person or community is more vulnerable to this type of hazard.

Risk assessments help individuals, communities, and governments decide the magnitudes of preventive measures such as insurance, financial reserves, and emergency preparedness.

Naturally, reducing vulnerability and increasing resilience, especially adaptive resilience, will help a nation reduce its risk of disaster losses.

Disaster Management

By general agreement, disaster management comprises four phases: mitigation, preparedness, response, and recovery.

Mitigation is a sustainable strategy that aims to decrease the probability of a disaster in the future. Examples include building a dam across a river to control flooding or zoning vulnerable regions to reinforce their infrastructure.

Preparedness is also a sustainable strategy. It involves activities immediately before a disaster to protect capital and the environment for future use.

Disaster responses are the humanitarian acts of households, businesses, communities, and states to reduce losses after a disaster, such as providing food and financial aid for the disaster regions.

The recovery phase also includes humanitarian efforts to assist households and businesses in rebuilding facilities, replenishing lost capital, and evaluating current strategies to deal with disasters in the future involving all residents, communities, and governments. When discussing the lessons learned from current practice, future prevention will come into the picture. Thus, the mitigation phase with zoning to reinforce resilience will close the loop of the management circle.

Outline of the Book

We now provide the plan of our book.

In Chapter 1, we first define our book's scope. We then present the need for an integrated approach to study the multiple-feedback effects among socioeconomic and ecopolitical factors using a combination of quantitative and qualitative analyses. Last, we introduce the primary theory and practices of sustainability and unsustainability.

Chapter 2 discusses existing research related to disasters and sustainable development. Next, we introduce a general model with a system of equations to serve as the theoretical framework for all model-search processes in the subsequent chapters. Last, we discuss data sources and select socioeconomic-ecopolitical indicators for sustainability analyses performed in this book.

Chapter 3 estimates the two-way causality between disaster losses and households, including consumption, education, and consumer health. The chapter then performs the model search process.

Chapter 4 focuses on the feedback effects between disaster losses and businesses: productivity, investment, and trade.

Chapter 5 is devoted to disaster losses and social crises, such as income inequality, gender or racial discrimination, and environmental degradation.

Chapter 6 introduces disaster management in a network of households and small businesses in local communities.

In Chapter 7, we add large corporations to the network.

Chapter 8 discusses the government's role in a network of social and political factors.

Chapter 9 examines the international coordination in disaster responses.

Chapter 10 posits that the root of unsustainable activities is evident in capitalism “as is.”

Chapter 11 introduces our idea of “inclusive capitalism” that involves everyone's participation and increases individual responsibilities, business ethics, and social interdependency.

Chapter 12 draws the lessons learned from all discussions involved in the book.

With this plan in mind, let us continue discussing disasters and sustainable development.

PART I

METHODOLOGY

CHAPTER 1

OVERVIEWS

1.1 Research Approach

This book focuses on natural disasters, that is, natural hazards that lead to harmful effects, as defined in our Introduction Section. Henceforth, when we use the term "disaster," as in "disaster losses," we refer to "losses caused by natural disasters," and so on. According to the United Nations (UN) Office for Disaster Risk Reduction (DRR), natural disasters alone—including hydrological, meteorological, geophysical, biological, and climatological disasters—account for roughly 60 percent of all disasters, an attestation of their large impacts on humans and ecosystem (UN Office for DRR, 2024).

Since sustainability is an issue of a development process, we narrowed the spatial scope of our disaster-impact assessment to events in developing countries for quantitative analyses. Mingling developed countries with developing ones in a quantitative analysis usually leads to inconclusive results because the former often have enough resources to replenish the capital losses in disasters by increasing to the point of causing output and productivity to rise shortly after a disaster, rendering the average results insignificant for a group of all countries and making it hard to conclude those for the latter.

In the later chapters, we will enclose problems and examples of developed countries in our qualitative analyses. The reasons are plentiful:

(i) These developed countries produced the ideology of original capitalism practiced in developing countries.
(ii) According to our belief in inclusive capitalism for global sustainability, the former is responsible for helping the latter in their catch-up and development process.
(iii) The developed countries have set many good examples for the developing countries to learn about forming networks of local communities to cope with disasters and enhance sustainability processes.

The following section discusses several questions raised by this book's author.

Question 1

> Some readers might ask, "Is it better to examine the disasters' economic impact separately from its social and political effects concerning sustainable development?"

We argue that the study of economic development should go hand in hand with the study of social and political conditions in a country for two reasons:

(i) Sustainable development supports economic growth, which, in turn, must guarantee a prosperous society in the future. A nation cannot prosper in the future unless it maintains community solidarity and peacefully exists with international communities. Governments worldwide must coordinate to foster appropriate public policies and improve institutional governance to ensure this global harmonious coexistence.
(ii) Maintaining a healthy ecosystem for future generations is a crucial aspect of sustainable development. However, environmental protection requires the cooperation of all agents: the states, local and international communities, households, and businesses, including the financial system. Hence, examining the multifaceted effects of disasters is better than focusing solely on their economic impact. For this reason, we want to incorporate social and political issues into our analyses.

Question 2

If the readers concur with our response to question 1, what is the best method for investigating feedback impacts for all factors?

We argue that combining quantitative and qualitative analyses is the best approach. Interdisciplinary research involves many fields of study. Quantitative research best suits specific issues, while qualitative case studies are better than quantitative ones for other issues. In addition, any field can successfully combine these two approaches if we carefully address any problem in the research process. The following section addresses any concerns regarding quantitative analyses.

(i) There are complaints that secondary data are unreliable so that quantitative studies will provide misleading results. To this concern, we argue that most qualitative studies also use secondary data, a common problem. With new data science methods coming into the academic world, cleaning and manipulating the data used in a study has become much more sophisticated and reliable these days than in the past.

(ii) There are cautions that the two main techniques used in quantitative analyses need to provide valid results. Let us discuss these two techniques one by one.

The first technique comprises simulation methods such as input-output, social accounting, or general computational equilibrium. The critics point out that since they are simulations, they only report *possible* effects instead of actual impacts. Also, when the simulation provides a possible result, say, income increases two years after a natural hazard occurred, we cannot say for sure that the result is thanks to the hazard itself (otherwise, we will pray for the hazard to come regularly), or it is thanks to the generous aids from all private and government sectors, nationally and internationally, to help the affected regions recover from the disaster. We are not an expert at this simulation technique and so cannot defend it against all complaints.

The second technique comprises regression estimations. The critics agree that this technique estimates *actual* effects instead of possible ones. Moreover, the results are the individual impacts, holding other factors constant, so if income decreases one year after a natural hazard occurs, we know that the result is due to the hazard instead of other factors. However, the critics point out that this regression approach has six classic assumptions, so there is no guarantee that the results will be valid when the regression process violates one of these assumptions.

Since we know the regression technique quite well, we argue that researchers do not have to guarantee that these assumptions hold. With updated techniques, they can test these assumptions individually and employ sufficient corrections for any violation. The regression technique should give reliable results when the technical problems are addressed.

(iii) The critics also warn that the authors often interpret the regression technique based on economic theory, which is unsuitable for disaster studies. They point out correctly that when households and businesses face a disaster, their concerns are recovering from the

losses and reconstructing damaged property instead of maximizing their utility (for the households) or profit (for the businesses).

We acknowledge this is a correct comment and will not rely on this economic maximization theory. Instead, we will develop our general model in Chapter 2 based on hypotheses common to any field of study. Next, we will go through the model-search process in the subsequent chapters employing the "test-test-test" approach. Finally, we will be exceptionally prudent in interpreting the results and reinforcing our comments with qualitative studies.

In brief, we believe that quantitative research is reliable, providing that the author:

(i) Clean up and correct all data used in the analyses.
(ii) Employ appropriate techniques to test all classical assumptions, as well as perform sufficient corrections for any violation of these assumptions
(iii) Provide prudent interpretations and combine the above quantitative analyses with qualitative case studies.

Question 3

We hope the readers will allow us to use the regression technique for our quantitative analyses in this book by now. So, the next question is: Why do we study the relationship between natural disasters and sustainable development?

There are three reasons:

(i) Natural hazards destroy wildlife habitats, and the natural environment is preserved for a nation's future development. Although some of this destruction is temporary, some is permanent.
(ii) The disaster's impact on a nation depends on the country's development characteristics. For example, a category four hurricane in the Pacific Ocean might cause long-term and significant losses to low-income countries due to their high vulnerability to natural hazards. In contrast, the same hurricane might cause only short-term losses of about one year to a high-income country. By the next year, this high-income nation will be ready to fight against a new hurricane with new resources and infrastructure.

(iii) Since disaster vulnerability depends on poverty levels, developed countries have the responsibility to help developing countries prepare to deal with natural hazards, reduce vulnerability, strengthen endogenous resilience by building stronger infrastructure, and increase exogenous resilience by transferring techniques and adaptation experiences to developing countries.

Question 4

If the readers agree with our arguments that natural disasters and sustainable development are related, the next question is: Do unsustainable practices exacerbate disaster losses?

Unsustainable practices can cause environmental degradation, leading to global warming and climate change. We need to review several existing articles on climate change and disasters.

(i) Concerning the link between climate changes, the increasing intensity of natural hazards, and rising losses, researchers discovered a sea-surface temperature (SST) when a tropical storm transforms into a hurricane (Michaels, Knappenberger, and Davis 2006, 2-3). The authors report that when the SST exceeds 28.25^0 C, the direct relationship between global warming and the hurricanes' increasing intensity becomes evident.
(ii) Other researchers perform simulations of these two Pacific region variables to verify this hypothesis (Knutson, Sirutis, Garner, Held, *et al*. 2007, 1549-1554). They show that the power of the Pacific hurricanes appears to increase due to rising temperatures.
(iii) Still others (Bender, Knutson, Tuleya, Sirutis, et al. 2010, 455-457) apply the above concept to the Atlantic region. They confirm the correlations between global warming and the intensity of hurricanes.
(iv) An author (Chang 2010, 2-3) investigates disasters in the Northeast Asian region and shows some evidence of the link between high temperatures and the hurricanes' rising frequency (called cyclones in Northeast Asia). Since the above authors provide 28.25o C as the nexus threshold for the correlation between the two variables, Chang's finding makes sense because Northeast Asia likely has SST exceeding this threshold. Chang also analyzes Hurricane Vamei as a case study. Vamei wreaked havoc on Malaysia in December 2006, bringing heavy rainfalls. The author believes these high rainfalls resulted from rising

temperatures and recommends several measures to decrease global warming damage.

(v) A group of authors (Mendelsohn, Michaels, Knappenberger, and Davis 2012, 205-209) examine the nexus between climate change and disaster frequencies worldwide. They find that each region's climate pattern determines the increasing frequency of high-intensity hurricanes in selected ocean basins.

(vi) Another group of authors (Estrada, Botzen, and Tol1 2015, 880-882) focus on the disaster losses in the North Atlantic basin. They find that levels of disaster losses increase with global warming. For example, they analyze the losses caused by disasters in the United States (U.S.). Although the government and private sectors in the U.S. are often well prepared to cope with disaster losses, the economy still endures severe damage. The authors estimate between 10 billion and 14 billion in disaster losses due to climate changes in 2005 alone.

As you see, those authors show evidence that climate change increases disaster intensity and probability. Since climate change occurs because of unsustainable practices, this book will show that these practices also increase disaster losses.

Additionally, these authors do not offer a satisfying solution to the problem. This book will analyze the deep root of this problem and offer a possible solution.

Unlike existing scholars, who usually use one-way analyses to show the effects of unsustainable practices on disaster losses, we will use systems of equations for feedback effects to control biases caused by the possible two-way causality that usually occurs but has not been used often in quantitative analyses.

Last Question

Assuming that we will successfully show you the unsustainable practices that increased disaster losses in a two-way causality analysis, you might want to ask, “Is the current capitalistic system sustainable? If not, is there any system in the world that can serve as a model for developing countries?”

We argue that the original capitalism introduced by developed countries in the Western world and currently practiced in most developing countries needs to be revised. A system encouraging profit-seeking activities based solely on the incentive of human greed and selfishness will

automatically lead to national and international disintegrations. The problem worsens when negative shocks such as natural hazards occur.

This book recommends an "inclusive capitalism" system with improved governance and increasing responsibilities by all individual households, businesses, governments, local communities, and international communities for sustainability. We will provide examples of problems and lessons learned from worldwide incidents.

1.2 Primary Theories and Practices of Sustainability

The textbook definition of sustainability is the human ability to coexist with its biosphere. The current use of resources, technological development direction, and institutional change guarantee the future's needs. Accordingly, sustainability calls for the interconnection of the following fields: economics, environmental studies, sociology, and political science. The following section discusses the primary theories and practices of sustainability that affect disasters and reverse causality issues.

Coase Theorem

Sustainability theories came with an analysis of property rights (Coase 1960, 1-44). Being the first author who wrote about the need and the efficiency of privatizing common property, he provided an argument to support his idea and stated it as a theorem (Coase 1960, 21):

> …When there are conflicting property rights, bargaining between the parties involved will lead to an efficient outcome regardless of which party is ultimately awarded the property rights, as long as the transaction costs associated with bargaining are negligible.

In 1991, Coase won a Nobel Prize in Economics for this contribution. Since then, economic textbooks have taught us that only private agents can efficiently manage private properties. For economic agents to manage their property successfully, the government must assign a property right to a private agent. Any property that belongs to a community is a curse.

This problem is also evident in Asia, where people have a proverb, "No child takes care of a shared father." The situation is "the tragedy of the commons". An example comprises two factories sharing a stream, two ranches sharing grazing land, and so on (Lloyd 1833, 4-40). The individual users, who act according to their self-interest, will damage the resource. By "commons," he meant shared and unregulated properties such as rivers, community parks, or a dormitory lounge.

Lloyd also provided a hypothetical example of unregulated grazing on shared land in Great Britain and Ireland (Lloyd 1833, 12).

> If a person puts more cattle into his own field, the amount of the subsistence which they consume is all deducted from that which was at the command, of his original stock; and if, before, there was no more than a sufficiency of pasture, he reaps no benefit from the additional cattle, what is gained in one way being lost in another. But if he puts more cattle on a common, the food which they consume forms a deduction which is shared between all the cattle, as well that of others as his own, in proportion to their number, and only a small part of it is taken from his own cattle. In an enclosed pasture, there is a point of saturation, if I may so call it, (by which, I mean a barrier depending on considerations of interest,) beyond which no prudent man will add to his stock. In a common, also, there is in like manner a point of saturation. But the position of the point in the two cases is obviously different. Were a number of adjoining pastures, already fully stocked, to be at once thrown open, and converted into one vast common, the position of the point of saturation would immediately be changed.

Without government regulation, the common-property owners would freely use it until they completely depleted the grazing. Therefore, any property should be either nationalized or privatized for sustainable development.

Addressing the Problem

In 2009, Elinor Pollution and Oliver Williamson won the Nobel Prize in Economics for challenging common-property problem. Ostrom conducted various case studies in the Philippines, Nepal, India, Europe, and Latin America. These regions show evidence that residents in a community can successfully manage their common properties over a long time by coming to collective agreements on the users' rights and responsibilities. Success depends on the interaction of all stakeholders. Ostrom and her students then performed empirical analyses on numerous datasets to support their observations. According to the Nobel committee, Ostrom has presented evidence that the active participation of joint-property owners in making and enforcing rules is crucial.

Williamson did a counter version of Ostrom's hypothesis on the joint properties among the businesses. He combined economics, organization theory, and contract law to show that firms can develop efficient solutions for their common properties. As the Nobel Committee wrote, Williamson has provided a theory of why some economic transactions occur within

businesses while others occur among them in the marketplace. Williamson found that successful management of common properties, in this case, among the businesses, helps to solve market failures by mitigating transaction costs and uncertainty.

The theory of public properties stipulates that governments can successfully manage nationalized resources or public properties by developing and implementing rules and regulations. The government then rewards residents who follow the rules on nationalized resources and punishes those who do not.

From this theory comes the concept of "externalities". A negative externality is any private activity that incurs a cost to society. For example, a fertilizer factory discharges chemical waste into a river, or a car emits carbon dioxide into the air. A positive externality is any private activity that benefits society, for example, a homeowner who plants a beautiful garden. The government can distinguish the negative externalities from positive ones and reward or punish accordingly.

Governments can also use incentive schemes. For example, they can impose taxes or sell pollution permits to negative-externality culprits and give “green” credits to positive ones.

Thus, there seem to be three kinds of ownership related to sustainable development: the nationalized/public, the private, and the common properties.

Nevertheless, there are three problems with the theories concerning public and private properties.

(i) Costs and benefits are difficult to measure. For example, how much a fertilizer factory upstream should compensate a bottled-water factory downstream is hard to calculate. Because of this measurement problem, private agents do not have any basis for negotiating. How much the price of a pollution permit is also challenging to come up with, not to say that many scholars do not like the idea of selling pollution permits in the first place. They believe this method encourages environmental degradation if a firm can afford it.

(ii) Most researchers agree that social costs are reciprocal. For example, the above fertilizer factory is not entirely responsible for the social harm of filthy water. If the bottled water factory had not decided to build its facilities downstream, it would not have suffered from contaminated water. Also, the bottled water factory might emit smoke into the air as well. Coase (1960) argued that the government should not impose any tax because the social harm

worsens if only one offender pays for the pollution. In the above example, if the fertilizer factory must pay tax, it will reduce its production quantity or buy the necessary technology to reduce its waste. With less contaminated water, more factories move into the area. These new producers increase the social cost of pollution, which would require a tax increase. Thus, the government is punishing the law-abiding agent who pays the taxes.

(iii) Private firms are not happy to follow the rules or negotiate with each other. They lobby instead. Lobbying activities reduce the quality of regulations and government effectiveness. Private industries that succeed in lobbying automatically enjoy favorable treatment at other sectors' sacrifices, creating social injustice. If a private company cannot lobby, it secretly violates the regulations. Moreover, secret agents can make bribery attempts and, if successful, lead to corruption, further causing environmental degradations that increase disasters' frequency and intensity.

In brief, current researchers seem to solve only the "tragedy of the common," thanks to Elinor Ostrom and Oliver Williamson (2009). The above example complicates matters if the upstream and downstream companies are in different countries. Across-border efforts require nations to find the most sustainable development solutions for all regarding environmental and natural resources. Since they have not found satisfactory solutions to the "tragedies of the public and private properties," we must gather and look for them.

Moreover, global sustainability is open to more than guaranteeing enough natural resources and a clean environment for future economic growth. There are also the following issues:

(i) The health issues that affect people's well-being need to be brought into the equation.
(ii) Young people's education for human development needs to be included.
(iii) Sustainable development should guarantee a long-term growth of social equality and justice.

UN Conferences

The sustainability concept made a turning point at the 1992 UN Conference on Environment and Development in Rio de Janeiro, Brazil (henceforth called the 1992 Conference). Although the 1992 Conference is

not a professional meeting to present a theory on sustainable development, it is an aspiration for the theorists to do so. For the first time, the conference emphasized social inequality as an internal problem arising from the development process. Thus, the importance of a prosperous society in the future entered the sustainability theory. The conference then signed the "Rio Declaration on Environment and Development" and the "Agenda 21" with three crucial points emerged:

(i) the agreement on the three pillars of sustainable development: economy, society, and environment.
(ii) the emphasis on the need of the developed countries to finance and transfer technology to developing countries.
(iii) establishing an international partnership among developing and developed countries to solve global problems in development jointly.

The 1992 Conference defined the new sustainability theory by stipulating its three dimensions. Twenty years later, The UN Conference on Sustainable Development in Rio de Janeiro, Brazil, on 20-22 June 2012 (henceforth called the Rio-20 Conference) followed up with this new stipulation. The conference established clear and practical steps for implementing this ideological development process.

The Rio-20 Conference achieved seven initiatives.

(i) The decision to develop a set of Sustainable Development Goals (SDGs).
(ii) The adoption of ground-breaking guidelines on green economy policies.
(iii) The decision to establish an inter-governmental process for sustainable development financing.
(iv) The agreement to strengthen the UN Environment Program on several fronts.
(v) The consensus to establish a high-level political forum for sustainable development.
(vi) The request to the UN Statistical Commission to work with other relevant organizations in launching a program measuring GDP progress to help policy decisions.
(vii) Adopting the 10-year framework program on sustainable consumption and production patterns.

Financial Capital

The sustainability theory on financial capital also has shortcomings that need modifications. The early theory followed one-size-fits-all principles before 1998. The theory postulates that developing countries should open their financial market by practicing governmental deregulations, cultivated in capital liberalization and free trade. Financial liberalization, followed by trade openness, will theoretically lead to economic growth that benefits social and cultural development. Capital liberalization belongs to the so-called "Washington Consensus" (henceforth called the Consensus), initially applied to Latin American countries and lately spread to Asian nations.

John Williamson, an economist from the Institute for International Economics in Washington DC, described the Consensus (Willianson 1990, 14-18) with ten policy recommendations summarized below:

(i) Fiscal discipline: avoiding large fiscal deficits relative to GDP.
(ii) Public expenditure priority: redirection of public spending from subsidies ("especially indiscriminate subsidies") toward broad-based provision of key pro-growth, pro-poor services like primary education, health care, and infrastructure investment.
(iii) Tax reform: enlarging the tax base, including taking capital flight, and adopting moderate marginal tax rates.
(iv) Financial liberalization: interest rate reform, allowing market-determined fluctuations and positively moderated real rates. Eliminate any preferential interest rates.
(v) Exchange rate policy: maintaining a competitive real exchange rate.
(vi) Trade liberalization: import liberalizing by eliminating quantitative restrictions (licensing, etc., and imposing low and relatively uniform tariffs.
(vii) Foreign direct investment (FDI): abolishing barriers to FDI inflow and allowing free competition between domestic and foreign firms.
(viii) Privatization: eliminating state enterprises by privatizing them to increase production efficiency.
(ix) Deregulation: abolishing regulations that impede market entry or restrict competition, environmental and consumer protection grounds, and relaxing government controls on financial institutions.
(x) Property rights: providing legal protection of property rights to all residents, including informal sectors.

This Consensus presents policy reforms that the International Monetary Fund (IMF), World Bank (WB), and US Treasury implemented in developing countries as conditions for obtaining their funds and assistance.

Most of the criticism directed at Williamson is misleading. He conceptualized the policies used by the above institutions instead of developing them himself. Moreover, rule (ix) only calls for capital relaxation instead of capital liberalization. Williamson also countered that his summarized rules are only recommendations instead of requirements for Latin American countries.

Even Joseph Stiglitz, the former Chief Economist of the WB and Chair of the Council of Economic Advisers, only directed his criticism to the one-size-fit-all policies that the above institutions had applied to most developing countries instead to the Consensus pe se (Stiglitz 2008, 41-55). He emphasized that the policies were inappropriate for some Latin American countries, not to mention Asian countries. Shari Spiegel, the Chief of the Policy Analysis & Development Branch in the Financing at the UN, also pointed out that Williamson had distanced himself from the "market fundamentalism" ideology with the view that one should leave the market system "as is" so that the market will adjust and solve most problems itself.

For Latin American countries, there was recovery in the early 1990s, followed by crises later in the decade. For the transition economies of East and Central Europe, the "shock therapy" imposed by the Consensus had not brought their GDP back to the 1989 levels after decade-long efforts. Many African countries following the Consensus could not rise during the 1990s either. There were numerous financial and monetary crises in Latin America, Russia, Turkey, and East Asia during this period and early 2000s that questioned the effectiveness of the Consensus.

The 1997-98 Financial Crisis, which wreaked havoc on numerous Asian countries, further revealed the shortcomings of the fiscal disciplinary and capital liberalization policies imposed on these countries. Reacting to the crisis, the IMF required the Asian nations to receive assistance packages to reduce government spending, allow insolvent financial institutions to fail, and aggressively raise interest rates. These "structural adjustments" caused the affected Asian economies to plunge into deep recessions.

Trying to counter the Consensus's failure, Gobind Nankani, the former vice president for Africa at the WB, stated in his study that one cannot rely on a unique set of rules for universally applicable policies (Nankani 2005, 10-15). The decision-makers must avoid a single formula, and the impossible finding of "best practices" for all counts must be avoided. For