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## Setting an Agenda for Entrepreneurial Governments: A Global Baseline Assessment of Disaster Risk Reduction Investment

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**Abstract**— Disaster scholars and practitioners have argued that disaster risk reduction (DRR) is a legitimate investment and there are multiple dividends that are associated with DRR. This paper argues that there is a need for a new policy framing that DRR investment is imperative that will generate dividends for governments and society at large. Under the auspice of the Sendai Framework for disaster risk reduction, governments around the world and international communities are urged to develop DRR strategies to not only aimed at reducing mortality and disaster losses but also provide multiple benefits to the society including achieving Sustainable Development Goals. This research aims to develop a global scale baseline of investment in disaster risk reduction worldwide. A total of 222 countries and territories are included in this study to assess their relative investment in DRR. We define DRR investment as an aggregation of three distinct investment: financial investment, social investment and early warning system investment. The study generated a global index that measures disaster risk reduction investment committed by the countries. The findings suggest that investment in disaster risk reduction remains low in high risk but low to middle - income countries in contrast to higher income countries such as the OECD group. Insights from our research suggests that the concept of entrepreneurial government is needed in order to be more ambitious in triggering, facilitating and initiating investment in disaster risk reduction in a broader framework.

**Keywords**—*disaster risk reduction, DRR investment, DRR dividends, political will, entrepreneurial governments*

### INTRODUCTION

Despite efforts to achieve a substantial reduction of the impacts of a disaster, economic losses are still rising. There is an increase in monetary losses from USD 50 billion per year in the 1980s to an estimated USD 200 billion per year in the last decade (World Bank, 2013). From 1978-1998, the total of global economic loss due to ‘natural’ catastrophe was reached USD 1,313 billion and from 1998–2017 it increased to USD 2,908 billion (CRED, 2018). A data from insurance industry suggests that total economic loss since 1980 reached at least USD 5,200 billion, where more than 70 per cent of such loss were not insured (MunichRe, 2020). According to (SwissRe, 2019) the combination of disaster catastrophic loss in 2018 and 2019 were USD 316 billion, where only 47 per cent was insured. Governments’ social protection programs, charity and humanitarian industries have limitations in bearing the burden of the uninsured losses. This suggests that the affected population will obviously bear the costs.

The measures from ex-ante disaster risk reduction (DRR) to ensure resilience in all levels of society are critical in securing development gains and poverty eradication (Tanner & Surminski, 2016). Investment in disaster risk reduction can safeguard development efforts to last for years into the future by avoiding direct damage, save lives and reduce indirect impacts (Ye, et al., 2016). Practitioners and scholars argued that mitigation and prevention of disasters are the best strategy in long-term investment (BOND, 1999). Therefore, political commitments to invest in ex-ante DRR is needed (Tanner et al., 2015).

Investment in DRR has become a new imperative as the 3<sup>rd</sup> priority of the Sendai Framework – “*investing in disaster risk reduction for resilience*”. The framework underlines that private and public investments in DRR and prevention through structural and non-structural measures are crucial to improve the resilience of countries, communities, persons and their assets. However, it is inaccurate to view that investment in DRR should be associated only with private sectors (Jain, 2015). Nevertheless, according to the evidence of the recent history of technological progress such as internet and digital technology, governments were genuine investors (Mazzucato, 2013). We therefore argue for governments to be more entrepreneurial by investing in DRR for long term gain of the societal security and protection from calamities.

Literature suggests that investment in DRR requires long-term political commitments (UNDRR, 2015). However, many investors are often reluctant to invest in DRR since policymakers are so attentive in a short time horizon (Ishiwata & Yokomatsu, 2018). Politicians views the cost of investment in DRR as overpriced in comparison to the expected returns (Michel-Kerjan et al., 2013). In low and middle income countries where limited resources and many other pressing needs exist, DRR related programmes will have to compete with other essential investments like education, health and infrastructure, all of which would generate higher and shorter lifespan returns (Tanner, et al., 2015). In addition, policymakers are reluctant to commit significant funds to risk reduction because of current and future fiscal constraints, other development priorities, and even the uncertainty of an occurrence of an event (McDermott, 2016).

Unfortunately, there is no global baseline on the current level of DRR investment. This research aims to develop a global baseline of investment in DRR worldwide. The overall objective of this study is to identify and explore the trend of investment in DRR by analysing DRR investment in three domains: monetary and economic investment; social resilience investment and early warning system investment. To determine the trend of investment in DRR, we introduce our own assessment in the Section Assessment Frameworks.

## LITERATURE REVIEW

### Definition of Investors of Disaster Risk Reduction

Negative and positive investment connotations depend on the eye of the beholder. External direct investment can be an oxymoron as it can either increase or decrease communities’ vulnerability to disasters. For example, investment demands for space and as a result forced relocation can be involved and as a result, communities can be forced to occupy marginal spaces that can be the breeding grounds of hazards and risks. However, investment can be defined as the allocation of exogenous or endogenous resources that address underlying causes of social economic vulnerability and disaster risks.

This research debates whether investors can be all: governments, private sectors and any independent individuals. Historically speaking, governments are investors in many domains ranging from social protections to technological research such as internets (Mazzucato, 2013). Furthermore, it also disputes whether education and health are key domains of social investment where governments play significant role yet dominant, while private sectors and non-governmental organisations have also roles to play in such sectors. These three parties are known as triadic model of governance across all sectors (Lassa, 2019). Likewise, monetary, financial as well as technological investment in DRR are shared by all parties.

### **Financial Investment as a Proxy to DRR Investment**

Financial investment in a nutshell does not equals DRR investment. It could be in fact creating incentives that lead to environmental degradation, pollutions and environmental disasters. Business investment in industrial sector can also contribute to climate change that eventually trigger present and future disaster risks. However, the logic of DRR investment remains the same as investment that generally used in business world.

The capital investment theory asserts that investment decisions based upon the investment where the return is higher than the cost of capital and if competition between two or more investors took place, the one with the most top performance is preferable (Cooremans, 2011). Investors would choose opportunities associated with less risk while producing high returns. Cost-benefit analysis (CBA) is an approach that weighs investment decisions based on cost and profit. CBA asserts that investments whose benefits exceed the price should be accepted. If competition between two or more proposals took place, the one with the highest benefit to cost should be considered (Rogers & Tsirkunov, 2010). These two principles applied to disaster risk and resilience investment.

Financial investment is as an allocation of resources to assets with the expectation to produce a dividend over a time frame (Trumka, 2015). This can be in the form of insurance policies, foreign direct investment (FDI) etc. FDI can foster DRR related technology transfers as highlighted by the Sendai framework as a mechanism that can assist in reducing disaster risk. In general, there is an appealing concept that governments should pursue or adopt DRR policies as it has shown to attract foreign direct investment flows. The logic is simple, thus FDI provides employment, which become a source of income for the country and its people. In doing so, the capacity of the people to protect themselves from the impacts of natural hazards and the ability to reduce disaster risk enhanced.

Previous studies suggested a good association between disaster risk and foreign direct investment (FDI) levels in a country (Anuchitworawong & Thampanishvong, 2015; Tsai & Wachter, 2015). We use FDI as a proxy for DRR investment with care as we are mindful of the fact that FDI can be a source of perils such as deforestation, carbon consumption, driving urbanisation and climate change.

Tierney (2012) argued that when foreign direct investment aids in driving rapid urbanization fails to improve wages and living conditions, it increased vulnerability of the people to overcome the disasters. Foreign direct investment with high technology-based including robotic-based production might not generate employment and as a result, access to livelihoods can be diminished. On the other hand, based on a recent study on foreign direct investment in Ghana, FDI flows leads to high levels of employment (Abor and Harvey, 2008). FDI can facilitate large-scale productions, hence, there is a need to increase the labour force to ensure and maintain high production. This activity provides people with a source of income and enhances their livelihoods. When combining with the right social investment policy, the people can increase their capacity to cope with, protect themselves and their assets and reduce disaster risk. By having a source of income, people can purchase insurance, adopt the building code into the construction of their houses etc.

### **Dividends of Disaster Risk Reduction**

Tanner, et al. (2015) outlined an analytical method to improve the business case for investment in building resilience known as the triple dividend of resilience. The World Bank has strongly advocated the concept of triple profit of resilience with a focus on development under the auspice of disaster risk management (Fung & Helgeson,

2017). This concept outlines triple benefits of investment: (1) It avoids losses when a disaster occurs; (2) it unlocks development potential by stimulating economic activity by reducing disaster-related investment risks; and (3) it generates social, environmental and economic co-benefits associated with an investment.

Disaster risk reduction (DRR) must be seen as investment that will generate dividends. The first dividend, saving lives and avoiding losses, is a primary objective of disaster risk reduction measures. The benefit of this dividend is visible when disaster strikes. World Bank (2014) asserts that the benefits of investment in risk reduction should be measured in terms of avoided losses would have occurred and made the investment out of place. Ishizawa et al. (2017) conducted a study in Tabasco where they compared the damage and losses of two flood events, where one had structural and non-structural investment measures, and the other had none. In the comparison of the floods of 2007 and 2010, the rainfall level of 2010 was higher than in 2007. However, the impact of the flood was higher in 2007. The investment was allocated mostly towards the infrastructure for the protection of the population and productive areas. The second to that was a reconstruction of protective hydraulic infrastructure. The 2010 flood damage and loss amounted to an estimated USD\$ 585 million, while in 2007 the loss and damage accumulated to USD\$ 2.9 billion. The impact was reduced to 80%, since the investment in DRR measures took place.

The second dividend relates to the ability of an investment to unlock development potentials by stimulating economic activity by reducing disaster-related investment risks. The benefit from this dividend is visible as a result of the presence or absence of catastrophic events. The existence of background risk from potential future disasters is discouraging households and firms from long-term investments in productive assets, entrepreneurship restriction and planning horizon shortened. Thus, development opportunities are lost (Tanner, et al., 2015). By reducing background risk and aiding household and firms to manage it effectively, DRR measures enable the yield of economic benefits.

The third dividend relates to the co-benefits of DRR investment. These co-benefits include economic, social and environmental co-benefits such as improved social cohesion, better environmental quality, reduced vulnerability to poverty etc. Keating, et al (2017) outlined that resilience and DRR investment enable the benefit that not only tackle the disaster and climate risks but also be a driver for achieving development goals. In order to the decision-makers account for co-benefits, measures have been designed to facilitate both DRR and development goals (Tanner, et al., 2015). For example, the use of multi-use designs in physical disaster risk management infrastructure. In Papua New Guinea, resilient infrastructure for health and education is designed to facilitate communal gathering and evacuation centres. In some parts of Japan and Philippines schools have been designed with additional shelter facilities to serve as community evacuation centres (Shaw & Takeuchi, 2012).

### **Willingness to Invest in Disaster Risk Reduction**

The current promotion of triple-dividends and co-benefits of DRR tends to maintain the view of the need to make a case about 'presenting' maximum utility value of DRR investment to the governments with the aim to gauge commitments. Tangible multiple dividends from DRR investments can be more appealing to governments (Tanner et al. 2015). As a result, governments might be able to be more ambitious in creating enabling conditions for DRR investment.

However, from the behavioural economic perspective, decisions to choose the best option amongst uncertain and risk scenarios is not up to the maximum utility value. For example, a prospect theory of Kahneman & Tversky (1979) proposed a behavioural model that illustrates how people (including politicians and decision makers) decide between alternatives that involve risk and uncertainty, known as the prospect theory. Prospect theory asserts that people tend to think in terms of benefits and losses rather than in terms of their net assets (Levy, 1992). Kahneman & Tversky (1979) stated that people often treat gains in a different way than losses. This means people including politicians and governments adopt risk-seeking behaviours when facing losses, and risk-averse behaviours when facing gains. The theory suggests that investors tend to choose perceived benefits since the loss triggers more emotional impact. Montesano (1990) notes that risk-averse is human behaviour, in which, when exposed to uncertainty, attempts to lower that uncertainty. In simple terms, investors would choose investment opportunities with low and known risk rather than high and unknown risk since they are more sensitive to losses compared to gains.

From investment perspective, vulnerability and risk can be seen as potential market for DRR as the logic suggests that the higher the risk and vulnerability, the higher the demands for DRR investments. The question is, does the level of disaster risk and vulnerability affect the commitment of investors? Asgary and Levy (2009) argued that under jeopardize and uncertain conditions, disaster managers, investors and policymakers tend to make irrational decisions by leaning towards less uncertain prospects. Investors are risk-averse when it comes to dealing with investing in countries or areas with high levels of disaster risk.

Disaster occurrence has a slightly negative impact on foreign direct inflows into the country (Anuchitworawong and Thampanishvong, 2015). Disaster risks are discouraging foreign direct inflows (Escaleras and Register, 2011). On the contrary, countries that adopt policies such as building codes, multi-hazard early warning systems, hazard sensitive zoning etc. which emphasise on reducing disaster risk will likely to enhance their attractiveness to foreign direct investment.

### **Catastrophic Insurance as Investment**

Insurance premiums are high for countries where the level of exposure, vulnerability and disaster risk are high (UNESCAP, 2015). Pooling the risk across a vast geographical region enhances the capability to access international capital and reinsurance markets, which, as a result, lowers premiums and transaction cost. Mahul et al. (2015) provided three reasons why developing countries or countries with low economic activities, with narrow base revenue and heavily relies on aid and are net importers, should pool their risk into one portfolio. Firstly, it is because their national finance resource is limited and lacking. This limitation becomes a barrier for their investing capability in disaster risk reduction mechanisms. Secondly, risk transfer is limited as well. In developing countries such as the Small Island Developing States (SIDS), they are small in geographical size, which, as a result, leads to lacking in economic diversification. Lastly, they are associated with small economies. The rise of national debts in aftermaths of disaster directly correlates to these countries' low economy. This restricts their options available for post-disaster finance. Disaster risk amongst island countries correlates imperfectly due to its widely spread geographical location.

Accordingly, the pools variability will be less than the combined variability by a single country (Mechler & Hochrainer, 2011). The real correlation between individual countries varies from 0 to 88% for hurricanes in the Caribbean (Mechler & Hochrainer, 2011). However, because of the insurance pool, the coefficient of variation, for example; the ratio between the standard deviation and the expected loss, estimated to reduce by a factor of three when countries risks are combined. Risk pooling enables countries to purchase catastrophe coverage at an affordable and lower cost than the cost of buying insurance individually.

A recent report by World Bank revealed that the capital requirements to sustain a 1 in 250-year disaster, which drives catastrophe risk pricing, are being reduced by 65%. Small Island Developing States (SIDS) aggregate their catastrophe risks into a single portfolio in order to significantly reduce the price of disaster coverage (World Bank, 2014). Prior to COVID-19, our general understanding was that the probability of a major disaster hitting member countries all at once within a year is low. The diversification among member countries creates a more stable and less capital-intensive portfolio, resulting in reinsurance being less costly, which will lead to fewer insurance premiums. Lastly, the creation of this instrument within the support of international institutions and donors would create incentives and peer pressure to help overcome internal political resistance to the purchase of insurance policies (Mechler & Hochrainer, 2011).

### **Social Investment**

Social investment is about investing in people and conducted by designing strategies and policies that strengthens and enhances the people's health, skills, education and overall, their livelihood (Cherrier et al., 2013). Social investment is a tool that addresses the social vulnerability to disasters. Social investment can be in any form of investments in social development including education that aimed at improving social and human capital as well as its well-being (Van Vliet & Wang, 2015).

Disaster affects the marginalized groups who have lack access to resources and means of protection which are available to people with higher social -status (Wisner et al., 2009). Social investment is to ensure that all people in society are accessing the similar standard social resources (e.g. education and health). As a result, marginalized groups also enable to access the safe water or sanitation services. Social investment can save the marginalized groups from living below the poverty line. Overall, by investing in improving the livelihood of the people's, our ability to withstand, adapt and recover from disasters will perform better and more efficiently also improve significantly.

Government' spending on the health and education sector is a measure of commitment directed towards building its human and social capital (Cherrier et al. 2013). Ideally, the educated and healthy persons would perform much better at the workplace than the uneducated and unhealthy person. Furthermore, A well-educated person will perform well in the workplace and life as well, thus improving his/her standard of living (Hemerijck, 2017).

### **Enabling Environment**

Institutional quality and good governance do not only serve as pull factors for investment in general as well as DRR investment in particular. Rule of law, regulatory quality, transparency, accountability and participation are good predictors of how likely a government can succeed in implementing DRR including resilient infrastructures.

(Lassa, 2011; Ahrens & Rudolph, 2006; Lassa et al., 2019). Without eliminating corruption, quality of infrastructures might be compromised and not able to withstand next big earthquakes.

Likewise, strong corruption control can improve investment opportunities in general and in disaster risk reduction programmes in particular. In addition, effective bureaucracy and transparency enable to attract ‘ease of doing businesses’ in countries that offer a conducive environment for conducting business (Jayasuriya, 2011). Research suggests that easiness in business is directly correlated with FDI inflows (Jayasuriya, 2011). This implies that a high ranking in simplicity in conducting business is an excellent indicator for a conducive environment for investment (World Bank, 2019).

## ASSESSMENT FRAMEWORK AND METHODS

We provide a global assessment framework adjusted from previous works (e.g. Lassa, 2011; Lassa et al., 2019) that will serve as a method to assess global baseline of DRR investment. This framework assumes that DRR investment is a venture in vulnerability and risk reduction where each government or country is to address its social and economic vulnerabilities. Economic vulnerability measures include income, financial assets as well as risk transfers. Social vulnerability reduction can be in the form of social protection, social development measures and access to environmental quality including water and sanitation. We also include early warning system (EWS) investment data in our general framework. However, the findings on EWS investment will not be presented in this article due to lack of space.

<b>Disaster Risk Reduction Investment Assessment Framework</b>			
<b>Financial Investment</b>	<b>Social Investment</b>	<b>Early Warning System Investment</b>	<b>Enabling Environment</b>
Proxy indicators: <ul style="list-style-type: none"> <li>• Foreign Investment</li> <li>• Development Assistance</li> <li>• GDP</li> <li>• Insurance penetration</li> </ul>	Proxy indicators: <ul style="list-style-type: none"> <li>• Access to Education</li> <li>• Access to health</li> <li>• Access to water and sanitation</li> </ul>	Proxy indicators: <ul style="list-style-type: none"> <li>• Internet access</li> <li>• Access of mobile phones</li> <li>• Public awareness</li> <li>• Disaster monitoring</li> <li>• Risk assessment</li> </ul>	Proxy indicators: <ul style="list-style-type: none"> <li>• Easiness of doing business</li> <li>• Government effectiveness</li> <li>• Rule of law</li> <li>• Corruption control</li> <li>• DRR budget allocation commitment</li> </ul>

**Figure 1.** Disaster Risk Reduction Investment Assessment Framework (Source: Authors)

Figure 1 outlines the Framework of the assessment. Table 1 provides a detailed list of indicators being used to assess DRR investment from 222 countries and territories.

The enablers of DRR investment depends on several features of institutional quality (Lassa, 2011) such as good governance (the rule of law, regulatory quality, government effectiveness and corruption control), ease of doing business (measured by the number of days required to get business permit and/or duration to get electricity connection) (Table 1), existence of national risk assessment mechanisms and disaster loss databases and relevant in-country knowledge and skills exist. The framework assumes that with these enabling environment serves as

key variable in that it attracts potential investors, which means investment in disaster risk reduction can go forward.

**Table 1.** Variables and indicators of DRR investment

Variable Index	Indicators	Source of data
Financial investment	Foreign direct investment (FDI)	UNCTAD World Investment Reports
	Official development assistance (ODA)	World Bank Development Indicators
	Gross domestic product (GDP) per capita	IMF datasets
	Life & Non-life Insurance penetration & density	Swiss Re
Social Investment	% of population access to safe drinking water service	World bank development indicators
	% of population access to safe sanitation service	World bank development indicators
	% of GDP spend on education	World bank development indicators
	% of population employed	World bank development indicators
	% of GDP spent on Health	Human development index, UNDP
Early warning system investment	% of population access to internet	World bank development indicators
	Mobile subscriber per 100 people of population	World bank development indicators
	Public awareness	HFA data 3.4
	Disaster monitoring system and dissemination	HFA data 2.2
Enablers of investment	Existence of national risk assessment	HFA data 2.1
	Government effectiveness	World bank governance dataset
	Regulatory quality	World bank governance dataset
	Rule of law	World bank governance dataset
	Corruption control	World bank governance dataset
	Budget allocation	HFA data 1.2
	Time required to start a business	World bank development indicators
	Time required to get electricity	World bank development indicators
	% of GDP spend on research and development	World bank development indicators
Scientific and technical journals publications	World bank development indicators	
Independent variable	Disaster risk Index	United Nations University
	Disaster loss	EM-Dat

Source: Authors [Note: HFA refers to Hyogo Framework for Action's and its progress reports' Note: indicators from 1.1 to 5.4]. For HFA, the timeframe is 2013–2015; World Governance Statistics 2015, Human Development Index 2015. Global Insurance datasets 2015. Data on Insurance Penetration is based on data from Swiss Re.

### Financial Investment Variables

This study employs Foreign Direct Investment (FDI), Official Development Assistance (ODA), insurance penetration and density also gross domestic growth and per capita to calculate the level of financial investment in disaster risk reduction. Insurance can be considered as an indirect measure of investment in DRR (Mahul et al., 2015). Financial investment embodies a culture where the amount of returns decide moving forward. The indicators for the financial investment variable represent the culture of weighing profits against the cost. For example, decisions by institutions to direct FDI into one's country will be base on the level of risk associated with that country and the institution, whereas, if the associated risk is low and returns are high, the investment will sure to take place (Eggertsson, 1990).

#### *Official Development Assistance (ODA)*

Official development assistance refers to foreign government supports that aims at promoting the welfare and economic development of recipient countries. Assistance includes grants, provision of technical support and soft loans. The assistance may be delivered from donor to recipient, bilaterally, or channelled through multilateral



development agencies such as the United Nations and the World Bank. Countries eligible for ODA, are developing countries with per capita incomes below USD 12,276. There are currently 150 countries that are recipients of ODA, and it is updated periodically by the Organization for Economic Co-operation and Development (OECD). Developed countries allocate 0.7% of their gross national income (GNI) to ODA (OECD, 2019).

### *Insurance Penetration*

This study employs insurance penetration and density as an indicator to measure the level of investment in disaster risk reduction. As mentioned above, insurance enhances our degree of resilience and promotes disaster risk reduction activities (Weingärtner et al., 2017). Insurance penetration measures the degree of development of the insurance sector in a country in a particular year whereas insurance density defined as the ratio of premium underwritten in particular to the total population (Ćurak et al., 2009). The insurance density indicator indicates the financial capacity of individuals in the country to purchase insurance to protect them financially from the effects of disasters and reduce disaster risks.

### *Gross Domestic Product (GDP)*

Gross Domestic Product (GDP) is one of the measures that illustrates the economic health of the country. Investment is a component of GDP. The equation that calculates GDP states that GDP is the sum of consumption, investment, government expenditure and net export (Callen, 2018). Gross domestic product (GDP) by definition “measures the monetary value of all goods and services which are produced within the geographical boundaries of a given country in a given time frame” (IMF, 2018). A country with the high gross domestic product (GDP) is associated with high production rates, which leads to citizens having higher income and hence are spending more on various goods and services such as healthcare, education, insurance etc. Most Governments has an objective to increase their gross domestic product (GDP) to enhance the prosperity of citizens (Baily, 2011).

### **Social Investment**

Overall, the aggregated indicators provide a numerical value for the social investment variable. This numerical indicator illustrates the degree of investment in improving human capital, people’s standard of living and wellbeing and social capital.

While traditionally social investment focuses on education and health access (Hemerijck, 2017), in this research we also include access to water and sanitation as proxy indicators to measure DRR investment to reduce social vulnerability (Table 1). The following indicators are employed to measure the social development investment variable: access to health services and education; employment rate of people aged 15 and above; also the access of people to safe water and sanitation. These indicators can measure the degree of people’s wellbeing.

## Enabling Environment for Disaster Risk Reduction Investment

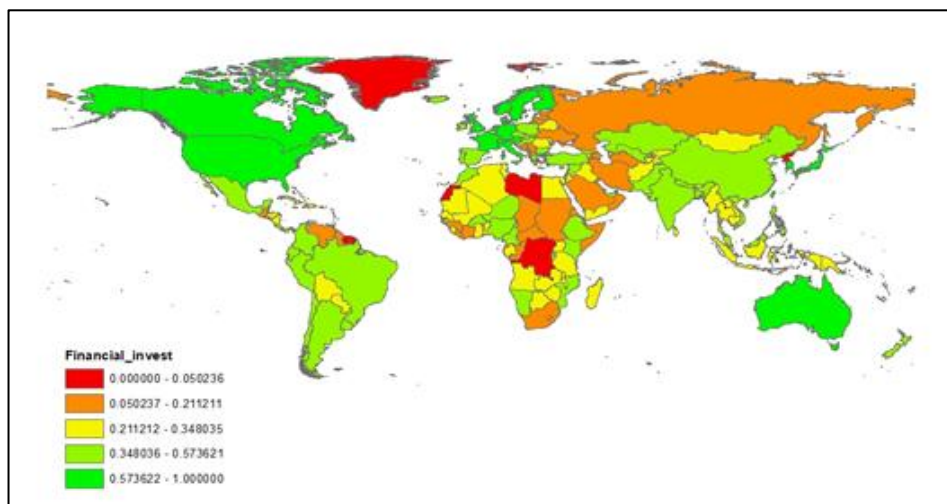
Institutional quality is a good predictor of disaster risk governance including public and private investments in DRR (Lassa, 2011). Variables such as rule of law and regulatory quality can create confidence of investors in disaster risk reduction. Clean government and effective bureaucracy can enhance trust and cooperation in public and private investments. Therefore, this paper argues that DRR investment depends on the commitment from the government to reduce - and if possible - eliminate systemic corruption. Such type of government is more likely to develop effective mechanisms and processes to reduce social and economic vulnerability.

Creating an enabling environment depends on the commitment from the government to adopt good governance framework (Kaufmann, et al., 2008) in public administration and management both in the context of general public affairs and disaster mitigation administration in particular (Ahrens and Rudolph, 2006; Lassa et al., 2019); In theory, good governance creates conducive environment for effective disaster risk reduction through mobilization of political commitment and facilitating the broad participation and partnership to ensure that political, economic and social priorities are based on wide consensus in society. The views and voices of the most vulnerable and poorest are more likely to be heard in the decision-making process (Kaufmann, et al., 2008).

## FINDINGS

### Financial Investments in Disaster Risk Reduction

The aggregation of indicators (on table 1) for the financial investment variable is averaged to construct an index for financial investment in disaster risk reduction. The Pacific, Africa and Asia are regions associated with a low degree of financial investment. While the OECD countries and Europe are associated with high degrees of financial investment, Greenland is shown to be associated with a low degree of financial investment, and this is due to lack of available data throughout the datasets to quantify the indicators. As a result, Greenland is shown on the map (Figure 2) to experience a low degree of financial investment.



**Figure 2.** Distribution of financial investment in DRR (Source: Authors)

*Note: There are five indicators employed in this study to quantify the variable of financial investment as presented in Table 1 and 2. The weighting of each variable is treated as equal.*

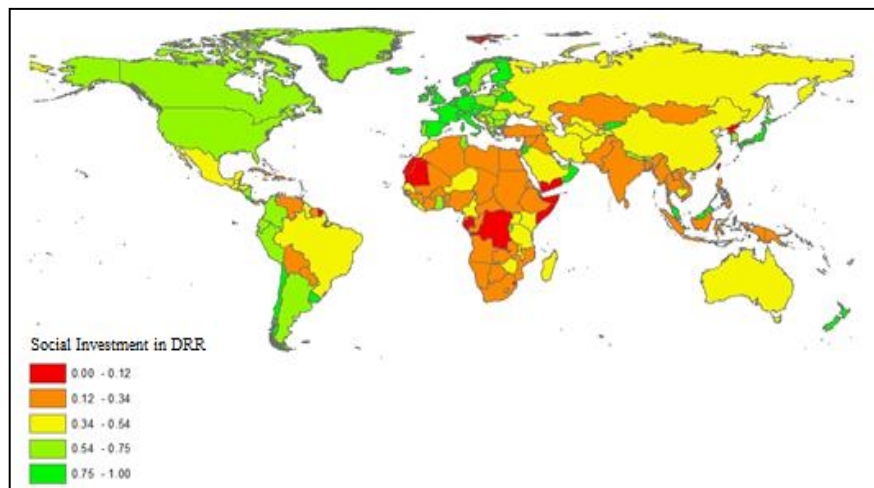
**Table 1.** Top ranked countries for respective indicators in the financial investment variable (Source: Authors)

Total capital inflow [FDI + ODA]	GDP per capita	GDP growth	Insurance penetration	Insurance density
1. USA	1. Luxembourg	1. Liechtenstein	1. Taiwan	1. Hong Kong
2. China	2. Liechtenstein	2. Guinea Bissau	2. Hong Kong	2. Switzerland
3. Hong Kong	3. Switzerland	3. Ethiopia	3. South Africa	3. Denmark
4. United Kingdom	4. Norway	4. Ghana	4. South Korea	4. Luxembourg

Table 2 shows that the OECD and developed countries dominate the high ranks of each indicators. However, developing countries are seen to be pursuing the efforts of building their respective economies, and this is evident with Ethiopia, Ghana and Guinea Bissau. Moreover, the top 20 countries in the financial investment dimension are dominated by the OECD countries with USA come at first and Switzerland at second, third is Hong Kong and fourth is an OECD member country, Denmark. Moreover, Africa dominates the lowest 20 countries in the financial investment dimension (e.g. Equatorial Guinea, Liberia, Sudan, Chad Central African Republic etc.) and Pacific countries (Tonga, Kiribati, Vanuatu, Federates state of Micronesia, Marshall Islands etc.).

### Social Investment Indicators for Disaster Risk Reduction

Social investment has the aim to enhance the standard of living of people around the world. This approach targets education, health, employment and sectors which may contribute to enhancing the standard of living. The Social investment numerical value is the average of the aggregation of the indicators (Table 1). The OECD countries and Europe are associated with high degrees of social investment, while Africa, Pacific and South East Asia and Eastern South America are associated with low degrees of social investment as show on map (Figure 3).



**Figure 3.** Social investment proxy for DRR (Source: Authors)

*Note: There are five indicators employed in this study to quantify the variable of financial investment as presented in table 1 and 3. The weighting of each variable is treated as equal.*

The Table 3 shows global picture of social investment, and it is evident that developing countries are putting a lot of effort into ensuring the standard of living of their citizens are enhanced. Moreover, this is evident with the Marshall Islands, Belize, Sierra Leone and Rwanda being ranked high in spending on health and education even

though they are labelled as weak and developing countries. The rich and developed nations such as Qatar, Kuwait, USA etc. dominate the indicator of accessing safe water and sanitation.

**Table 2.** Top ranked countries in respective indicators for the social investment variable

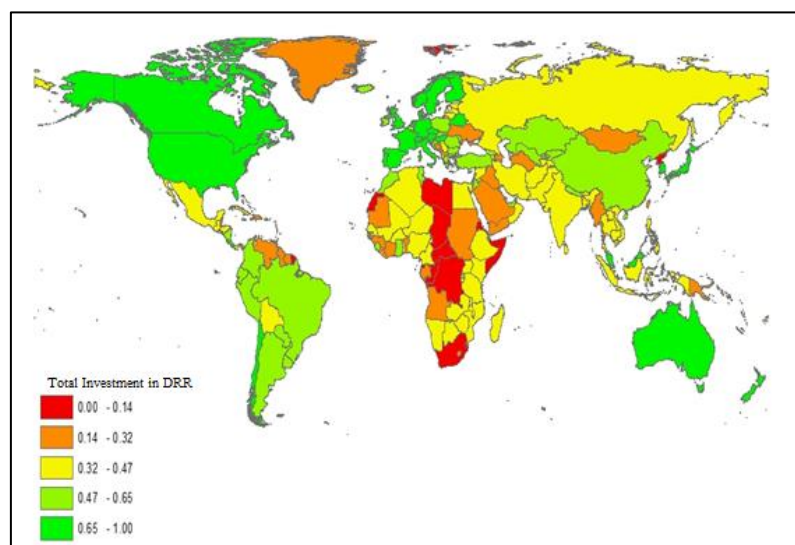
Access to safe water (% of population)	Access to safe sanitation service (% of population)	Government spending on education (% of GDP)	Employment rate (% of population over 15 years old)	Government spending on Health (% of GDP)
1. New Zealand	1. Andorra	1. Costa Rica	1. Qatar	1. Marshall Islands
2. Kuwait	2. Kuwait	2. Belize	2. Rwanda	2. Sierra Leone
3. Monaco	3. Monaco	3. Bhutan	3. Cambodia	3. United State of America
4. Singapore	4. Singapore	4. Kyrgyzstan	4. Madagascar	4. Liberia

(source: Authors)

Moreover, by averaging the aggregated indicators, the result showed that the top 10 countries in the social investment dimension are dominated by the OECD countries and Europe, with Switzerland ranking the highest following the Netherlands and Japan. Countries dominate the lowest group from Africa (e.g. Sudan, Gabon, Congo, Somalia, Mauritania etc.), Asia (e.g. Myanmar, Vietnam, Sri Lanka, Yemen etc.) and Pacific Islands (e.g. Samoa, Tuvalu, Kiribati etc.).

### Total Investment in Disaster Risk Reduction

This study assumes that investment in disaster risk reduction is the aggregation of financial, social and early warning system investments. The map (Figure 4) illustrates the global distribution of investment in disaster risk reduction. The developed and OECD countries dominate the highest ranks followed by Asia, Caribbean and Latin America while African and Pacific Island countries dominate the lowest ranks.



**Figure 4.** Total investment in DRR (Source: Authors)

*Note: There are five indicators employed in this study to quantify the variable of financial investment as presented in Table 1 and 3. The weighting of each variable is treated as equal.*

Table 4 below shows the rankings of countries regarding its level of investment in disaster risk reduction. One group is the ten countries ranked the highest and the other group is the ten countries with the lowest rank. Overall, developing and least developed countries are experiencing a lesser degree of investment while developed nations

such as OECD and European countries are experiencing a high degree of investment in disaster risk reduction. Although developing and least developed countries rank at the bottom, there is a positive sign that they are dedicating a lot of effort into investment in disaster risk reduction. Moreover, this is evident in the rankings of the respective indicators shown on (table 2, 3 and 4) with countries such as Costa Rica, Fiji, Marshall Islands, Belize etc. being ranked on the top.

**Table 4.** Top and bottom ranked countries in total disaster risk reduction investment (Source: Authors)

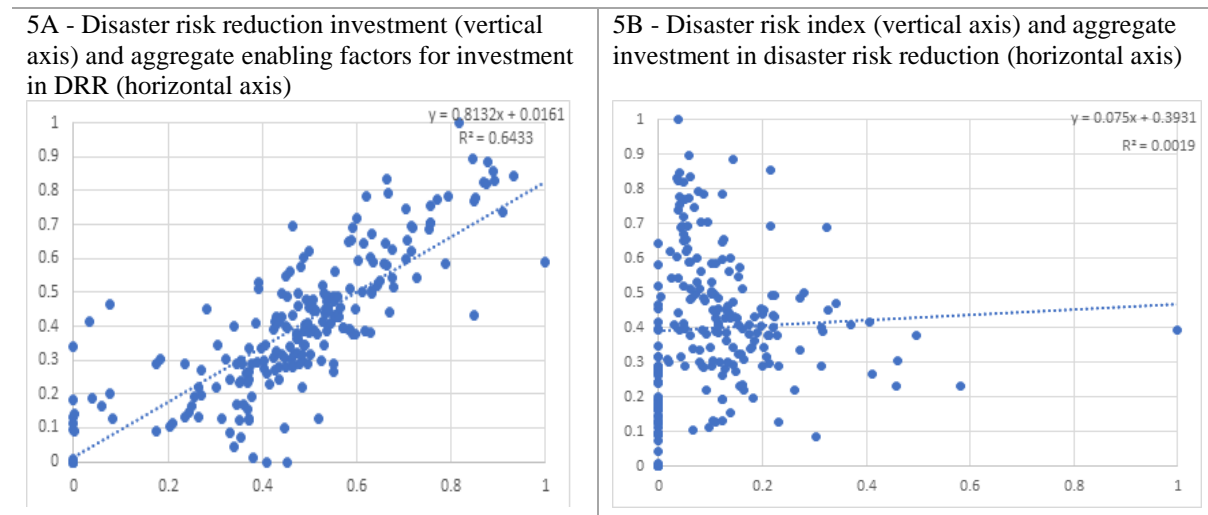
High ranked countries		Bottom ranked countries	
Switzerland	1	French Guiana	0.00
United Kingdom	0.8960	America Samoa	0.0301
Netherlands	0.8863	Guam	0.0187
Japan	0.8562	French Polynesia	0.0262
Germany	0.8454	Suriname	0.0497
United States of America	0.8359	Libya	0.0502
Finland	0.8301	Chad	0.0899
Norway	0.8249	Kiribati	0.0908
Denmark	0.8186	Equatorial Guinea	0.0920
Italy	0.7936	Eswatini	0.1036
New Zealand	0.7859	Eritrea	0.1048
Malaysia	0.7848	Tuvalu	0.1100

### Enabling Environment in Disaster Risk Reduction Investment: Correlation Analysis

This section demonstrates the result of two scatter plot analysis as well as correlation analysis: First, simple regression between enabling environment (aggregate value) and total DRR investment index; Second, simple regression between enabling environment (aggregate value) with disaster risk (based on data from World Risk Index from United Nations University).

Figure 5A shows that there is high correlation between overall investment in disaster risk reduction and the enabling factors for investment in disaster risk reduction. The  $R^2 = 0.643$  indicates that there is high correlation between the two variables (Significant at 0.01). This suggests that enablers of investment do have high association with total investment in disaster risk reduction in a country. The data suggests that once again, Europe, OECD and developed countries dominate the highest-ranked group in the aggregation of the indicators for the enabling environment of investment while countries of Africa, Pacific and South East Asia occupies the lower ranks.

Figure 5B shows the scatter plot analysis between risk index and disaster risk reduction investment. The data suggests that the association is weak ( $R^2 = 0.0019$ ). Therefore, it is difficult to suggest that high disaster risk index is adequately associated with experiencing a downfall in the rate/level of FDI inflows. Such result is similar to the previous analysis by Lassa et al. (2019), where the degree of political commitment in DRR investment does not show stronger association with level of risks.



**Figure 5.** Scatter Plot Analysis A and B.

## DISCUSSION

The study shows that countries associated with high levels of disaster risk reduction investment are countries which have high institutional quality and good governance. While countries with a low level of investment in disaster risk reduction are associated with countries having poor governance and low institutional quality (Lassa, 2011; Lassa et al., 2019). In addition, corruption is an end-product of poor governance, Kaufmann, et al. (2008) highlights that corruption discourages investment in disaster risk reduction.

Previous global assessment (e.g. Lassa et al., 2019) suggested that private and public investments in DRR have been predictable as the lowest in the Pacific as the region indicated the lowest commitments in DRR investment followed by Latin America and the Caribbean states, Africa and Asia in general (0.32). However, the relatively small population in the Pacific (e.g. about 10 million people) could be the reasons for lack of attractiveness from private investment due to both market size and isolation. As a result, Pacific remains low in terms of penetration of general and disaster insurances. Thus, it might cause low public investment in social development, disaster mitigation and low economic performance due to weak tax system in the region that directly affect the capacity of government in conducting the investment.

Our data suggests that OECD countries are experiencing a high level of investment in disaster risk reduction in terms of both social and financial investments. Intuitively speaking, their institutional performance and good governance features such as the rule of law, regulatory quality and government effectiveness have been the key factors in attracting investment (Lassa, 2011). On the other hand, the least developed and developing nations are experiencing a low level of investment in disaster risk reduction due to having poor governance.

This suggests that implementing the commitment to meet the target of Sendai Framework by 2030 should also consider that key DRR actors must also work together with all the relevant stakeholders to fix some of the institutional problems including bad governance practices. Good disaster risk governance and good governance, in general, eliminate corruption thus enhancing the degree of trust and cooperation between investment parties. As a result, it attracts investors towards reducing disaster risk and into the country.

## CONCLUSION

DRR advocates promotes the same key message that investment in DRR saves lives and avoids disaster losses while unlocks development potential by stimulating economic activity thanks to reduced disaster related investment risks and lastly it generates social, environmental and economic co-benefits associated with the investment.

Nevertheless, without understanding the quality of enabling environment including institutions and governance, the general belief among its advocates that investment in DRR is always bring higher benefit over cost (in terms of CBA) is probably on overrated statement. Our study reinforces the findings from the previous research that quality of institutions and good governance impacts the degree of investment in disaster risk reduction.

One must ask not only why is investing in disaster risk reduction important but also how can government invest more in both financial and social investments as well as enabling environments that underpins DRR investment in general. The triple dividends of resilience concept (Tanner & Surminski, 2016) offers one of the best possible explanation as to why we governments should invest in DRR. In the history of both public policy and development studies, executive governments used to be the key driver behind ground breaking investment such as the birth of internet and many more (Mazzucato, 2013).

In fact, investment in DRR not only requires government institutions to create enabling environment for investment but also demand governments to be the investors but not in the gesture of crowding out private investment. Our findings imply that the countries that are more friendly to financial investment and highly committed to social investment (as well as investment in early warning system) tend to have more resources that enable them to invest in broader dimension of DRR policies including disaster mitigation.

Lastly, the method and framework provided in this study can serve as a guide into measuring the global progress beyond Sendai Framework Priority 3 – Investing in DRR for resilience, government and International community should design policies and strategies to promote and ease the efforts to invest in disaster risk reduction because the benefits outweigh the cost.

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