

RESILIENCE INTO DISASTER RISK MANAGEMENT

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ABSTRACT

RESILIENCE INTO DISASTER RISK MANAGEMENT

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Natural hazards always put human life in jeopardy and in order to protect ourselves from the effects of them, numerous disaster risk management techniques are used and it has been a critical concern for a long time. Many international institutions are dealing with beneficial programs and frameworks to decrease the detrimental effects of hazards. A recent terminology “resilience” plays an important role in this theme and resilience projects/programs are used in many continents nowadays. This thesis is oriented first to explain what resilience means and how it can be applied to financial disaster risk management. Then financial instruments that are used in financial hazard risk management are illustrated and resilience ideas in different continents are described. Main aim of the thesis is to investigate the resilience concept and its applicability in Türkiye with a focus on disaster risk reduction. The results of the analysis can provide useful recommendations for people who are interested in financial disaster risk management.

Keywords: Disaster, hazard, resilience, risk

ÖZ

DAYANIKLILIĞIN AFET RİSK YÖNETİMİNDEKİ YERİ

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Doğa kaynaklı afetler insan yaşamına her daim bir risk unsuru olmuştur ve toplum kendisini olumsuz sonuçlardan koruyabilmek için çeşitli risk yönetim teknikleri geliştirmiştir. Bu tehlikelerin yaratabileceği olumsuzlukları önlemek adına pek çok uluslararası kurum ve kuruluş, kullanışlı programlar ve çerçeveler yaratmıştır. Günümüz dünyasında çoğu coğrafyada uygulanan bu programlarda "Dayanıklılık" terimi alanın anahtar sözcüğü olmuştur. Bu tezde öncelikle dayanıklılığın kelime anlamı açıklanmış olup takibinde ise finansal risk yönetiminde nasıl rol oynadığı anlatılmıştır. Daha sonra, finansal risk yönetiminde faydalanan araçlar tanımlanmış ve farklı kıtalardaki dayanıklılık tanımı detaylandırılmıştır. Tezin ana odağı dayanıklılık konseptini Türkiye bazında ele almak ve afet risk azaltımı alanında uygulanabilirliğini değerlendirmektir. Analiz sonuçları finansal risk yönetimiyle ilgilenenlere faydalı bilgiler sağlayabilir.

Anahtar Kelimeler: Dayanıklılık bonusu, afet, risk

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LIST OF ABBREVIATIONS

| | |
|----------|--|
| ACRE | Agriculture and Climate Risk Enterprise |
| ADB | The Asian Development Bank |
| ADPC | Asian Disaster Preparedness Center |
| AFAD | The Disaster and Emergency Management Authority |
| AP EGO | The Amundi Planet Emerging Green One |
| ARC | African Risk Capacity |
| CAB | Climate Awareness Bond |
| CARE | Climate Adaptation and Resilience for South Asia |
| CAT | Catastrophe Bonds |
| Cat-DDOs | Catastrophe Deferred Drawdown Options |
| CBI | Connecting Business Initiative |
| CBRT | Central Bank of Turkiye |
| CCRIF | The Caribbean Catastrophe Risk Insurance Facility |
| CDRM | Comprehensive Disaster Risk Management |
| CERC | Contingency Emergency Response Components |
| CME | Chicago Mercantile Exchange |
| CREWS | Climate Risk & Early Warning Systems |
| CRM | Climate Risk Management |
| CRP | City Resilience Program |
| CSO | Civil Society Organizations |
| DFID | Department for International Development |
| DMC | Developing Member Country |
| DRFIP | Disaster Risk Financing and Insurance Program |
| DRM | Disaster Risk Management |
| DRR | Disaster Risk Reduction |
| EBRD | The European Bank for Reconstruction and Development |
| EIB | European Investment Bank |
| ERI | Economic Resilience Initiative |

| | |
|---------|--|
| EU | European Commission |
| FAO | The Food and Agriculture Organization |
| FONDEN | Fondo de Desastres Naturales (Natural Disaster Fund) |
| FRM | Flood Risk Management |
| GDP | Gross Domestic Product |
| GBP | Green Bond Principles |
| GB-TAP | Green Bond Technical Assistance Program |
| GCBP | Green Cornerstone Bond Program |
| GCF | Green Climate Fund |
| GFDRR | Global Facility for Disaster Reduction and Recovery |
| GIIF | Global Index Insurance Facility |
| GLoSI | The Global Library of School Infrastructure |
| GRIFF | Global Risk Financing Facility |
| GWE | Global Weather Enterprise |
| HFA | Hyogo Framework for Action |
| HSE | Health, Safety, and Emergency |
| IDA CRW | The International Development Association's Crisis Response Window |
| IDB | Inter-American Development Bank |
| IFC | International Finance Corporation |
| IIF | InsuResilience Investment Fund |
| IPCC | Intergovernmental Panel on Climate Change |
| JHF | Japan Housing Finance Agency |
| JICA | The Japan International Cooperation Agency |
| LCR | Latin America and the Caribbean Region |
| MDB | Multilateral Development Bank |
| MDTF | Multi-Donor Trust Fund |
| MoEUCC | Ministry of Environment, Urbanization, and Climate Change |
| MoTF | Ministry of Treasury and Finance |
| MSME | Micro, Small and Medium Enterprises |
| NGO | Non-governmental Organization |
| OECD | The Organization for Economic Co-operation and Development |
| OGM | The General Directorate of Forestry in Turkiye |
| PDSI | Palmer Drought Severity Index |
| PSF | Premium Support Facility |

| | |
|--------|---|
| SECURE | Stand-by Emergency Credit for Urgent Recovery |
| SFDRR | Sendai Framework for Disaster Risk Reduction |
| SIDS | Small Island Developing States |
| SPV | Special Purpose Vehicle |
| SPI | Standardized Precipitation Index |
| TAF | Technical Assistance Facility |
| TCIP | Turkish Catastrophe Insurance Pool |
| TSKB | The Industrial Development Bank of Turkiye |
| TULIP | Turkiye Resilient Landscape Integration Project |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNDRR | United Nations Office for Disaster Risk Reduction |
| UNHCR | United Nations High Commissioner for Refugees |
| UNICEF | United Nations Children’s Fund |
| RIMES | Regional Integrated Multi-Disaster Early Warning System |
| RMS | Risk Management Solutions, Inc. |
| VND | Vietnamese Dong |
| WFP | World Food Programme |
| WHO | World Health Organization |

CHAPTER 1

INTRODUCTION

Natural hazards have become more frequent and intense in recent years, resulting in considerable loss of human life and devastation of physical capital. [97] For instance, many governments and public services are overexposed and underinsured due to earthquakes and wildfires. Officials in countries and regions are dealing with how to handle rapid development, meet demand for new services and infrastructure, and respond to the consequences of hazards in vulnerable communities.

According to Intergovernmental Panel on Climate Change, natural hazard losses and damages are anticipated to increase in the future, because of climate change and the increased hazard risk and susceptibility of our societies.[112]

From an economic standpoint, Bertrand (1993) studied the effects of globalization on hazards, and he concluded that the economic effects of natural hazards should be analyzed locally in 1993. [10] On the other hand, the direct consequences (human deaths, property losses, injuries etc.) caused by the initial effect of natural hazards may lead to indirect consequences (of capital and potential wages) at the macro level in terms of decreased production and/or agricultural yield, thereby impacting the country's GDP in the long run. For instance, according to National Centers for Environmental Information, a magnitude 9.1 earthquake hit Japan caused 18,000 dead and overall cost was \$ 220 billion in 2011. Also, in accordance with the Internal Displacement Monitoring Centre, a magnitude 7.1 earthquake struck Central Mexico and resulted over 370 death. 10,000 to 20,000 houses were damaged and the Evaluación de Riesgos Naturales (ERN) estimated the direct economic loss of the earthquake as \$4 to \$5 billion. [87]

Short term consequences

Natural hazards are predicted to cause economic disruption in the short term as a result of the direct and indirect consequences they generate. According to Panwar and Sen (2018) there are two types of direct consequences: [96]

- 1- Human deaths, injuries or disabilities are all examples of loss of labor.
- 2- Physical asset loss (damage to factories, houses, and infrastructure) is loss of capital.

These direct consequences might result in a reduction in expected productivity, such as industrial or agricultural output, as well as a loss of anticipated work hours (wages). Because the foregone earnings would have been included to the country's GDP if the catastrophe had not occurred, the loss of anticipated wages and consequent decline in expected output could have an indirect consequence on the country's economic growth. The negative effects of relatively extreme natural hazards are observed to be much stronger, as large-scale devastation and damage produced by such occurrences are more likely to slow or even freeze the economy in a lower-level equilibrium. In line with the studies of Barro (2006); Jones and Olken (2008), Gabaix (2012) and many other current research in this field concludes that natural hazards have a negative influence on short-term economic growth. [60] Since the location of storms is constrained by geophysical limitations, cyclones occur frequently and regularly which impact the same population as previous catastrophes according to Hsiang and Jina. Earnings does not recover immediately after a cyclone and storms lead in a cumulative of income losses over time in populations where they occur regularly. Even though, there exists a huge decrease in that population's average growth rate after a cyclone. [60]

Natural hazards have been proven to make developing countries more vulnerable to economic shocks than developed ones, because of their inadequate capacity to deal with the financial and economic impacts of such occurrences. In addition to this, countries who have higher per capita income, better policy structures, higher education level, greater trade access, and more successful ex ante hazard risk financial systems are better able to absorb the economic shocks caused by natural hazards. In contrast to the conclusions that hazards have negative effects on economic growth, some research show that natural hazards could have a positive effect in the short to medium term. Reinvestment in stocks and enhanced technology following a terrible event may help to accelerate growth. A few older research approve this argument, while other more recent studies have revealed that positive effects of natural hazards are limited to specific economic sectors (e.g., agriculture) and hazard types (e.g., earthquakes)

Long term consequences

Natural can have a detrimental, positive, or even no effect on long-term economic growth and development. It is predicted that they have a detrimental impact on long-term economic growth, just as they do on short-term economic growth. As it is stated above, the impact is greater in developing nations since resources generated for hazard response and recovery could be used for other social welfare projects. Furthermore, hazards that occur on a regular basis can generate an atmosphere of uncertainty and limit a country's long-term investment possibilities.

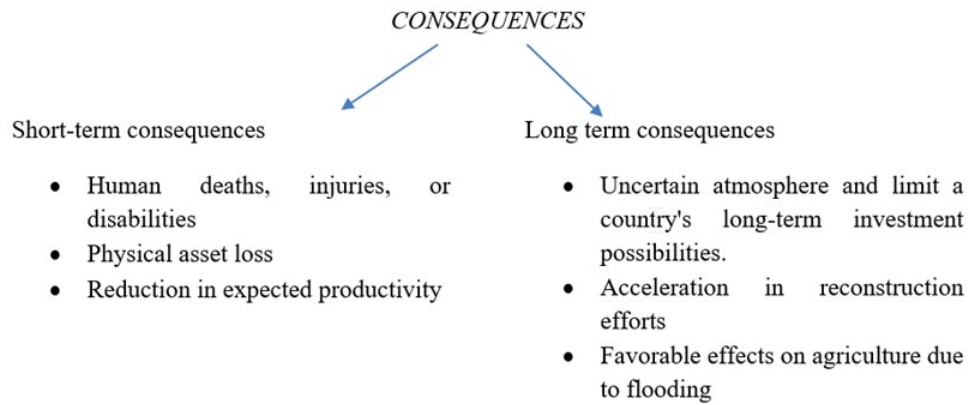
Bertrand (1993) analyzed the effects of 28 natural hazards on 26 nations between 1960 and 1979. For most situations, he discovered that GDP growth rises following a hazard, which he attributed, at least partly, to the substitution of destroyed capital with more efficient investment. He has concluded that growth of GDP gains a positive rise in response to a danger or catastrophe, which he partially tied to the replacement of destroyed or damaged capital with investments that are more efficient. [10]

Economic models can describe the long positive impact of natural hazards. Such models suggest that after a negative shock, growth in a hazard-affected area will accelerate because of reconstruction efforts, which will result in higher investments and, in the long run, 'productivity benefits' on the economy. Aside from the negative and positive effects, a few research have revealed that the growth effects of natural hazards diminish over time.

When natural hazards are divided into sub-groups, more accurate estimates can be obtained. In contrast to the popular belief, floods have a major positive effect on agricultural growth. Floods have the potential to boost agricultural growth by 2.13% points and GDP growth by 2.68% points over the medium term. [96] Although water is essential for agriculture, a surplus of it can be damaging to crops. The positive benefits of floods on agriculture are surprising in this regard. These consequences could be linked to the timing of floods, in which floods may affect only one cropping season out of many cropping seasons, resulting in a plentiful supply of water all year. As a result, agriculture-based nations may generate higher GDP growth via this transmission mechanism. The 'productivity effect' refers to the probability of floods indicating a positive growth effect, which shows that hazards may only impact the production or output levels and not the economy as a whole.

According to Panwar and Subir (2018), earthquakes have a positive correlation with non-agricultural growth and GDP. They appear to cause a 0.4%-point rise in non-agricultural growth.[96] The beneficial effect of a natural hazard (floods and earthquakes) is that the destruction and devastation caused by such hazards may encourage more investment in the rebuilding and/or upgrade of dwellings and public facilities, boosting the country's GDP in the near term.

Not surprisingly, droughts have been shown to have a negative impact on agricultural growth. [96] Water scarcity has a significant negative influence on agricultural productivity, demonstrating the crucial relevance of water in agriculture. Its damage is generally greater in consecutive years (or cropping seasons). The effects are minor in scale and mainly have an impact on agricultural growth. Storms have mostly negative impacts on economic growth parameters. As a result, rising natural hazard expenses are increasingly being passed on to state and national budgets. Consequently, short term and long term consequences of natural hazards are demonstrated in Fig 1.1.



Source: [10, 60, 96]

Figure 1.1: Consequences of natural hazards

According to Munich Re (2019), the inflation-adjusted total catastrophe loss average for 2018 was over \$ 140 billion, making it one of the ten most expensive hazard years in terms of overall damages.[84] Local governments' infrastructure and insurance funding is inadequate and insufficient, making it impossible for national governments and global aid organizations to forecast natural risks and coordinate private insurance with efforts to promote local hazard risk reduction initiatives.

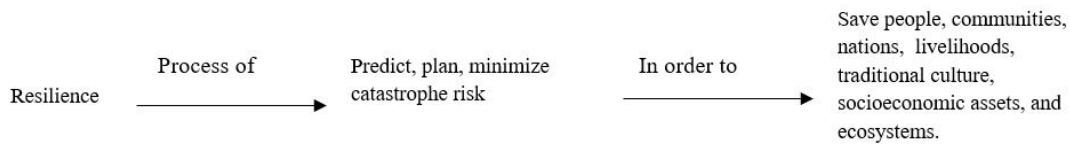
Developed by the UN, The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 offers a broad framework for the current coordinating situation as seen in Fig 1.2. It establishes a global goal of reducing hazard damage to essential infrastructure and disruption of basic services by 2030. The Framework also calls for increasing the capacity to learn and thereby predict the effects of a hazard, which is a critical component of increasing natural hazard resilience.



Source: [123]

Figure 1.2: The Sendai Framework for Disaster Risk Reduction 2015-2030

The introduction of the word resilience plays an important role in this regard, but the term is interpreted in a variety of ways depending on the field of research. This definition is important for describing the functionality of societies, infrastructures, or any other form of system under hazard conditions. Hazard risk management resilience is a term created by different institutions. For instance, *UNDRR* was formerly known as the *United Nations Office for Disaster Risk Reduction (UNISDR)* defines it as the ability of a system, group, or civilization exposed to risks to quickly and efficiently resist, adapt, accommodate, and recover from the consequences of a hazard. According to *UN*, resilience is the process of predicting, planning for, and minimizing catastrophe risk in order to safe people, communities, and nations, as well as their livelihoods, traditional culture, socioeconomic assets, and ecosystems as shown in Fig 1.3. *Intergovernmental Panel on Climate Change (IPCC)* explains resilience as, the potential of a social or ecological system to absorb disruptions while maintaining its essential structure and modes of operation, as well as its potential for self-organization and change adaptation. [112] Finally, *Department for International Development (DFID)* defines the term as, it refers to a country's, community's, or household's ability to adapt to change by preserving or improving living standards in the face of shocks or pressures such as earthquakes, drought, or violent conflict without jeopardizing their long-term prospects.



Source: [123]

Figure 1.3: Definition of Resilience

In this sense, the European Commission is promoting resilience to ensure proper planning and coordination for hazard risk management and long-term growth. More specifically, as described in a recent document from the European Commission, the role of insurance in climate change adaptation should become more and more important in the future, in comparison to what has happened in the past. Significant catastrophe damages can be compensated financially by insurance schemes, allowing those affected to recover more quickly. The quicker and more thorough the recovery, the lower the long-term effects of a catastrophe would be, which will help society become more resilient.

Stakeholders in the insurance industry may create incentives or mandates for risk management, which can help to minimize the potential consequences of a severe events. Another choice is to incorporate resilience requirements in the insurance policy: if an insurance holder may not take certain steps to mitigate the danger to which he or she is subjected, the pay-out would be reduced.

Construction of mitigation infrastructures, which must be funded by stakeholders such as public administrations, is a critical point for growing resilience against severe weather events such as floods. The so-called resilience bonds, which are a recent addition to the finance-insurance market, are specifically designed to meet this type of need. They incentivize communities to invest in resilience in order to lower the human and financial costs of hazards as they occur and they are intended to finance risk mitigation programs through a resilience rebate, which converts avoided losses into revenue. Cities and utilities are looking at emerging financial and insurance instruments like Catastrophe Bonds and Resilience Bonds to find financial capital and transfer the risks of such catastrophic events to financial markets.

1.1 Why do countries need resilience and how it works?

Natural catastrophes impact negatively on economic and financial infrastructure and stability, especially in small and low-income nations and those with a single sector. Vulnerable regions and countries are fighting a never-ending battle to respond to hazards while also attempting to construct resilient economies and financial systems that can resist future threats.

Develop local resilience to minimize economic damage

Direct impacts, such as infrastructure damage and loss of life can be measured. In addition to these expenses, communities face losses in environmental protection, education, health and poverty reduction areas. As catastrophes become more frequent and intense, the international societies should assist communities in strengthening hazard planning and preparedness in order to decrease the damage and better rebuild in order to mitigate future risk.

A. Improve planning and preparation to decrease the impact

Early warning systems (EWS) and modern detection technologies are essential investments in catastrophe preparedness that benefit the entire society. Early warning systems must be linked to community-based education programs, and information and communication technology (ICT) must be used to coordinate emergency response. Also, technology should be used to coordinate communications during and after hazards. During hazard response activities, these investments increase essential communication networks.

B. Rebuild better to avoid future threat

Developing more resilient economies could help to reduce the huge financial and social costs of recovery. However, support of Multilateral Development Banks and the donor communities is needed since there exists technical assistance and severe funding gaps in countries. It's difficult for local governments to handle the economic crises, unemployment, and widespread displacement that follows a hazard. As a result, it is essential for resilience to diversify economies so that they can absorb the shock of a catastrophic hazard. At a national level, this might entail attracting alternative industries such as financial services and technology firms, as well as investing in comprehensive "capabilities for the future" educational programs to better serve the workforce. On a corporate level, this could imply expanding export markets and establishing online sales channels to mitigate market risk. The funds should be used to support recovery efforts, but they should also serve as a motivator for attracting private sector investment and promoting stability throughout affected economies in order to enhance stability and resiliency.

Boost local businesses and marketplaces after a hazard

The private sector and MDBs must work together to establish long-term local economic infrastructure that can resist and recover fast from natural hazards since economic resilience is generally the most important at the local level.

A. Increase local hazard-resilience capacity

Businesses should maintain production with less inputs in the aftermath of a hazard by utilizing stocks or excess capacity. They can discover input alternatives to lower the cost of materials in limited supply, offer overtime to cover for lost production, or rearrange production based on demand and capacity requirements. However this is not the same scenario for every enterprises. Businesses with numerous locations and good financial health can absorb finan-

cial loss and recover faster, while businesses with diversified or unnecessary supply chains can avoid supply chain risk, and companies with multiple sources of revenue and distribution networks (e.g. the internet) will do better. Companies should re-evaluate their unproductive business divisions or invest in new technology. These adjustments result in cost reductions or new revenue sources, which result in a recoupment of economic losses through greater profitability. Mutual assistance among citizens and businesses is maybe one of the most fundamental approach for a quick economic recovery.

B. Facilitate rapid payment method for insurance claims and recovery funding

Early economic stimulation would not be completely achieved without effective payment systems to support recovery. Innovative technology breakthroughs like block chain and biometric authentication allow for faster payment without raising the risk of corruption or lack of transparency. Utilizing block chain to purchase contract documentation might eliminate the need for paperwork, which is frequently lost or destroyed in a hazard. It's technology decreases handling costs and eliminates fraud whereas smart contracts can maintain established contract conditions, such as withholding payment until hazard repairs are completed by preferred repair businesses.

Biometric data might also be used to speed up the delivery of post-hazard supplies or financing. Recipients could use retina scanning or fingerprint technologies to confirm their identity, preventing duplicate distributions. Public institutions might provide funds to confirmed bank accounts in the early aftermath of a hazard, and lenders could use money saved on confirmation procedures to extend further liquidity. Unfortunately, there may be some drawbacks of using biometric data. First of all, they can cause some privacy concerns and require a working internet infrastructure, which may be absent following a hazard. Secondly, vulnerable people such as the disabled and elder people have missed benefits since they are unable to get to distribution sites, and there have been documented incidents of manual workers whose weathered fingerprints would not scan.

C. Consider legislative changes to assist rapid recovery

Public sector officials should examine simplified regulatory procedures and requirements in post-hazard recovery contexts, evaluate financial incentive structures and fund small business grant or loan programs since they play an important role in enabling an early economic stimulation environment.

Governments can engage in emergency rules and procedures in the aftermath of a hazard to enable local actors to participate in quick recovery efforts. Processing timelines for procurement choices and new construction approvals can be accelerated to help firms and individuals get back on their feet faster. Many communities now have costly building permitting rules, which increase the time that companies remain closed, causing individuals to be out of work for longer periods of time and limiting them access to essential supplies.

According to researches, funds provided to microenterprises increased recovery time after

hazards and the retail sector is identified as the most effective case. As a result, countries should consider focusing post-hazard assistance on certain industries, particularly small businesses that serve as critical support for local communities.

Finally, while reasonable price ceilings may be used to protect hazard victims in the immediate aftermath of a hazard, they must be balanced against the hazards of encouraging warehousing and discouraging enterprises from obtaining additional supplies. Because the "profit-seeking motive" is eliminated, if the price ceilings set too low, enterprises may be discouraged from working creatively to deliver resources to difficult-to-reach hazard areas.

Encourage international financial institutions to help local and national governments by coordinating donor aid and funding channels

Specific operational and financial difficulties must be addressed with strategies supported by the international community to improve the acceptance and utilization of these funds because many international organizations have shown an interest in helping with humanitarian response and preparedness.

A. Enhance cost structure, collaboration and flexibility in donor financing

Increased flexibility should be taken into account in financing for humanitarian response in order to minimize costs and improve efficiency. Capacity challenges in local governments could be a serious obstacle when it comes to taking the responsibility of driving the agenda and aid coordination efforts. Donors should consider to support the actions of local governments in this situation by putting credible advisors at their disposal. Advisors can be integrated in important departments of local government, assisting government officials in planning and organizing appropriate actions while also developing long-term capacity.

B. Use alternative, resiliency-focused financing methods While official help should continue to play an important role, several alternative channels could be proposed which will enable donors to improve the possibility for private finance choices discussed in Section IV while allowing governments more access. Alternative methods are described below as;

- Creating financial reserves for emergencies

Other donors and MDBs should utilize defined draw-down procedures to increase the utilization of emergency finance reserves for vulnerable partner nations. In the case of a natural hazard, partner countries should be able to access these funds in order to provide hazard relief which will definitely reduce their reaction time. To manage the operation of this account, periodic review procedures between the donors and the partner countries can be established.

- Developing finance tools based on forecasts

Forecast-based financing is a new way to fund hazards that has gained popularity lately. Local communities or local governments, aid providers and meteorological services come together in this manner of financing to agree on particular funds that are activated when meteorological

station predictions surpass a certain level.

- Rising the use of de-risking strategies

MDBs are crucial in recovery financing and de-risking resilience in order to improve private sector financing. In addition to regular political risk insurance and loan guarantees, numerous products such as catastrophe insurance pools, index-based insurance, weather derivatives, and others can assist developing countries in de-risking natural hazards and increasing resilience spending. These instruments can be used with the combination of technical assistance institutions to build capacity and strengthen the institutions in recipient nations.

- Approving concessional finance for resilience programs

MDBs can set up procedures for governments in vulnerable areas to get low-interest loans and grants for resilience finance. Concessional finance can encourage resource-limited governments to invest in resilience at a minimal cost, potentially lowering their recovery costs.

Increase the involvement of the private sector, both nationally and internationally, to hazard recovery and preparedness

A. Establish a private sector-led coordination structure

Rapid recovery and economic resilience require private sector support, and its stakeholders can supply much-needed funding, innovation, and mobility. On the other hand, the private sector is currently limited in its ability to play a meaningful role prior, during, and after a natural hazard. Due to a shortage of visibility to a bankable supply of resilience projects, private sector financing is frequently hindered. Furthermore, the private sector frequently fails to understand complex government processes, communication mechanisms, and procurement policies when operating across municipalities, regions, or several nations.

As a result, the international society should work together to create an overall strategy for private sector recovery and resilience. This framework should promote private industry leadership in cooperation, combine international, local and regional private sector actors, encourage mechanisms that integrate resilience investment and prepare to existing operations, and provide guidelines for private sector investment opportunities.

Developed by the United Nations, The Sendai Framework for Disaster Risk Reduction 2015-2030 offers a broad framework for the current coordinating situation. In addition to this, UN has a set of coordinating structures in place to allow UN bodies and other humanitarian groups to collaborate effectively with governments in hazard response. The UN's Connecting Business Initiative (CBI) is able to connect into a large network of private sector entities to help their response and recovery activities. Governments have also established committees and networks to coordinate entities at the sub national and national levels.

B. Facilitate integration and coordination at local, regional, and international levels

To improve economic resilience, the relationship between multinational and major national

firms and their local private sector peers must be reinforced, particularly in emerging economies. This should be achieved by strong collaboration between the public and private sectors, and also the donor community.

Local organizations of commerce, industry groups, and networks should work with national and multinational private sector leaders to establish and engage with local business partners. Those on the ground often have a better understanding of what is required and are more eager to help in uncertain times. For instance, local financial firms that have connections with the affected community are more willing to lend to local companies after a severe natural hazard than financial organizations without any connections. Integrating local financial organizations into hazard risk planning and engaging them to the global and national companies for capacity development support could prove to be an effective strategy to provide quick and responsive financial services for affected local businesses in a hazard.

C. Make greater use of innovative private-sector financing

The private sector should play a leading role in fostering resilience and preparation by developing innovative financing tools. Traditional financial instruments, for example, can take a long time to process. Time gains an important value in the aftermath of a natural hazard, and the financial instruments available to local businesses who are attempting to rebuild must be flexible and responsive. The clearest area for the private sector to play a significant role is in the development of innovative and flexible financial tools to promote infrastructure resilience and recovery. "And these tools are mobile money, Peer-to-peer lending, crowdfunding, Block chain-enabled tools, Adaptive financing, Micro-insurers.

1.2 Literature Review

According to the hazard definition and classification review of UNDRR, the technical working committee was directed by the definition of 'hazard' established by the *United Nations General Assembly (UNGA)* in February 2017 as a scientific undertaking; specifically, "a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation". [122]

This term encompasses a broader range of risks than has previously been the case in the subject of disaster risk reduction and includes processes and activities in the definition of hazard.

Current hazard terminologies and glossaries were used to create the first hazard list. A hazard was only considered if it met all three criteria: has the potential to harm a community; has quantifiable geographical and temporal components and has reactive and proactive measures available. The hazard list presently excluded from complex human processes and activities where it was difficult to detect a single or restricted set of hazards, compound hazards, and underlying catastrophe risk drivers.

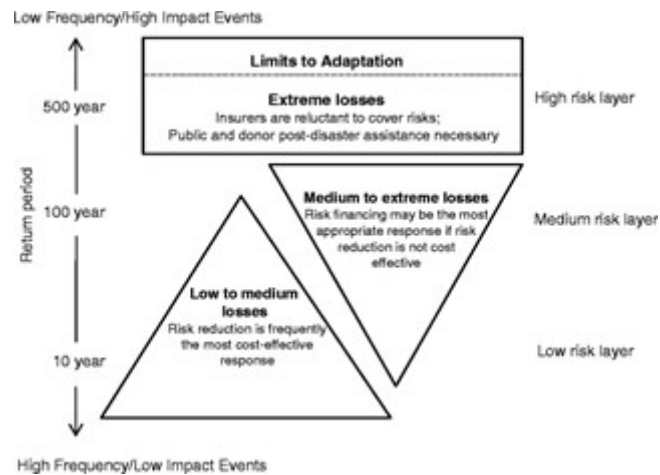
Since the Yokohama Strategy for a Safer World and Hyogo Framework for Action 2005–2015, disaster risk reduction has progressed, as illustrated by the more extensive approach expressed in the Sendai Framework for Disaster Risk Reduction 2015–2030. The framework added a new structure to the definition of the hazard as “natural or man-made hazards, as well as related environmental, technological and biological hazards and risks”.

Each hazard has a risk associated with it, which is defined as the probability of the hazard leading to a hazard and the effects of that hazard if it occurs. An incident or an emergency is the result of a realized hazard risk, which is usually defined as a situation with negative implications that necessitates the intervention of one or more emergency services (fire, police, emergency medical services, public health, or others) to handle.

In the international context, disaster risk management (DRM) is the process by which people, societies, and countries cope with the hazards they face. Major hazard risk management is largely a government activity, but the private and nonprofit sectors are increasingly incorporating hazard risk reduction into their business risk management efforts, realizing that investing in public, national, and global resilience can be a worthwhile investment strategy.

Mitigation, or the process of decreasing these effects, is described as a long-term effort to minimize or eliminate the risks to people and property posed by such hazards and their consequences. It is distinct from the other emergency management techniques in that it focuses on long-term risk reduction rather than hazard preparedness, rapid response to a hazard, or short-term recovery from a hazard occurrence. The aim of mitigation is to build societies that are economically sustainable, socially prosperous, better developed, and environmentally safe.

Risk-financing and risk-reduction techniques can be targeted to various layers of risk in terms of their magnitude, as shown in Figure 1.4. Risk-reduction strategies, particularly for strategic investments, may be primarily suitable for low-loss incidents that occur regularly (low-layer risk). Governments and donor agencies usually absorb very low-probability, high-consequence (high-level) risks in extremely vulnerable nations. Since insurers are sometimes reluctant to fund catastrophic events, public and donor sponsorship or government backed insurance are often the chosen alternatives for the high-risk layer.



Source: [70]

Figure 1.4: Risk Layer Framework

Table 1.1: Risk-financing and risk-reduction techniques

| Technique | Role |
|---|--|
| Solidarity | <ul style="list-style-type: none"> • Governments and donor assistances provide relief. |
| Savings and credit | <ul style="list-style-type: none"> • Sufficient for losses in the medium-layer range that are not easily reducible, but it may be inadequate for long-term catastrophic events. |
| Informal risk sharing | <ul style="list-style-type: none"> • Involving mutual trade, kinship relations, and community self-help when savings, credit, and government assistance are unavailable such as informal risk-hedging programs, being microfinance customers, or relying on shared social relationships. |
| Insurance mechanisms | <ul style="list-style-type: none"> • Allowing households to handle shocks to their livelihoods and properties and reducing damages and losses if premiums are rewarded for risk mitigation investments. |
| Index-based micro-insurance programs | <ul style="list-style-type: none"> • Bypassing conventional insurance's high costs in order to serve low-income markets by providing small coverage and drastically lowering transaction costs. Micro-insurance may be indemnity-based, meaning that products are written against real losses, or index-based, indicating that products are written against physical or economic causes, such as incidents that cause damage rather than the loss itself. |

| | |
|--|---|
| Public sector risk transfer | <ul style="list-style-type: none"> • Insurance and other risk transfer methods should be considered by small and highly exposed countries that cannot depend on a tax base to raise post-event funds in order to cover public property, contingent liabilities to the private sector, and possibly even to provide public support for private risk transfer goods. |
| National insurance programs | <ul style="list-style-type: none"> • Selling region- or nation-wide policies covering high-risk-level droughts, floods, and other hazards. The Turkish Catastrophe Insurance Pool (TCIP), the first national public-private partnership in the developing world, was established to provide affordable coverage for earthquake risk in urban areas. |
| Catastrophe bonds | <ul style="list-style-type: none"> • Investors earn an above-market return if a pre-specified catastrophe does not occur but loses interest if it does. International insurers do not bear the risks; however, capital markets absorb them directly by investors, who earn a contingent interest rate based on the expected risk. |
| Contingent credit | <ul style="list-style-type: none"> • Providing a government with lower-cost resources than either insurance or the accumulation of reserves, it has the major drawback of exacerbating a country's debt burden. |
| Donors that support governments | <ul style="list-style-type: none"> • Donors may consider insurance for rapid deployment of assistance in the critical time window between the occurrence of a natural hazard and the occurrence of avoidable losses and they may assist vulnerable countries in arranging insurance. |

Source: [70]

There are also some international hazard risk management methods. When the capacity of the entire nation's hazard management stakeholder community, including NGOs and companies, is surpassed, the event is referred to as an international hazard, and the capacity and participation of the international community of responders becomes significant.

The point at which a catastrophe becomes international in scale and scope is determined by a variety of factors that are specific to each region including the magnitude of the hazard's consequences; the availability of economic resources; responder expertise, skills, and capacity; and infrastructure's built-in resilience; the government's actual capacity to handle the crisis, as well as the public's perception of that ability (which could be affected by how much the government has lost as a result of the event); and the availability of specialized assets, to name a few. There are some international risk reduction programs and their roles which are listed

in Table 1.2.

Table 1.2: International Risk Reduction Frameworks and Roles

| Policy Documentation | Role |
|---|--|
| United Nations Disaster Management Efforts (was declared in 1945 and today, 193 countries are members of it) | <ul style="list-style-type: none"> • Manage hazard relief and collaborate with donor and recipient governments on recovery and reconstruction. • Address a particular humanitarian need that arises in both human-made and natural crises and hazards through UNDP, UNHCR UNICEF and WFP. |
| The Hyogo Framework for Action (was established in 2005, at the second in Japan and 168 countries adopted it) | <ul style="list-style-type: none"> • Integrate hazard risk reduction into strategies and plans for long-term growth. • Construct hazard resilience, institutions, processes, and capacities to develop and strengthen it. |
| The Sendai Framework for Disaster Risk Reduction (was established in 2015) | <ul style="list-style-type: none"> • Decrease global hazard mortality by 2030. • Reduce direct hazard economic loss as a percentage of global GDP. • Limit essential infrastructure damage and interruption of basic services in the event of a hazard • Expand the number of countries with national and local hazard risk reduction strategies by 2020. • Extend access to multihazard early warning systems, as well as hazard risk information and evaluations. |
| The United Nations Office for Disaster Risk Reduction (was created in 1999) | <ul style="list-style-type: none"> • Coordinate international hazard risk reduction activities, as well as guide, monitor, and report the Sendai Framework for Disaster Risk Reduction's implementation. |

| | |
|--|--|
| | <ul style="list-style-type: none"> • Campaign for the Sendai Framework for Disaster Risk Reduction to be implemented, which includes raising global awareness of the benefits of DRR and equipping citizens and governments to reduce their own danger vulnerability. • Advocate increased hazard-related spending, more hazard-related education, increased climate change adaptation, and better gender equity in hazard-related decision-making processes. • Educate and link people through the DRR website Prevention Web. |
| The United Nations Development Programme(was established in 1965) | <ul style="list-style-type: none"> • Investigate private investment in developing countries, as well as the exploration of those countries' natural resources and the training of the local population in development activities. |
| The United Nations Office for the Coordination of Humanitarian Affairs (was founded in 1998) | <ul style="list-style-type: none"> • Meet the needs of victims of hazards and emergencies with its special role in hazard management and the coordination of assistance provided by the UN framework. |
| The International Financial Institutions | <ul style="list-style-type: none"> • Offer direct loans or programs to national governments in order to provide financial services. It is usual for countries with low capital reserves to seek increased or additional emergency loans in the aftermath of hazards to finance the costly task of reconstruction and recovery. |

Source: [25]

1.3 Aim of the Study

The motivation in this study is to discover the use of resilience as a financial tool to recover and survive from disaster impacts and in this study we wanted to see how different types of financial mechanism instruments are used in different parts of locations of the world to compensate disaster losses because the most crucial question in risk management especially financial disaster risk management is to answer the question who paid the losses?

The resilience is one of the golden word that have been used since past years, post 2015. Before 2015 which is the start of the Sendai Framework which was stated in Chapter 1.

With Sendai Framework, the disaster risk management including the financial component has changed. It switched from disaster risk reduction to generating and creating resilience at local level, national level, international level since we live in a global world and recently covid has been a very good example that everything is global and there is a very strong hint for international collaboration which is also mentioned in the sustainable development goals.

Therefore, in this study, the researcher would like to see how the resilience can be achieved using different financial tools for different types of targets which turn into disasters in vulnerable countries at different locations of the world.

CHAPTER 2

FINANCIAL INSTRUMENTS

In this chapter, the financial instruments that are used in dealing with financial hazard risk management are introduced.

2.1 Available Bonds

2.1.1 Catastrophe (CAT) Bonds

According to Federal Reserve Bank of Chicago, Hurricane Andrew that hit Florida in the United States in 1992 costed \$27 billion and \$15.5 billion was covered by insurance.[99] Since it was the costliest natural hazard in US at that time, insurers wanted to increase insurance capacity and they purchased more reinsurance from reinsurers who are unaffected by the hurricane. Furthermore, publicly sponsored state insurance plans were established to cover a part of the losses directly related to catastrophic hazards. On the other hand, the demand for natural hazard related insurance by people and companies required more capital flow into reinsurance. The insurance sector developed a new financial instrument known as a catastrophe bond to boost available capital and they are also known as Cat Bonds.

Cat bonds are like insurance policies in that they pay out when a hazard reaches a certain level of magnitude. Large insurance and reinsurance companies have historically used Cat bonds, to cover themselves against catastrophic losses. These bonds are intended to mitigate the financial risks associated with quite low-probability, high-consequence natural hazards. They are more like insurance plans than conventional municipal bonds.

If a hurricane occurs, for example, the goal of a Cat bond is to reduce the economic disruption rather than restrict the destruction on the ground. They are unusual in that they are intended to be "triggered" in the event of a catastrophe. This ensures that if a hazard occurs within a certain time frame during the bond's lifetime, the Cat bond policyholder retains the entire bond value to cover damages, while investors lose some or all their principal invested. When a Cat bond is sold, the money collected from investors is put into a secure, low-yielding collateral account for the duration of the bond. If no triggering catastrophe occurs during

this period, investors will receive their money back at the bond's maturity date, just like every other bond. The return on investment is calculated by combining the principal return with monthly coupon payments (from the sponsor's insurance premiums and interest on the collateral account). But from the other hand, if a trigger event occurs during the bond's lifetime, investors will lose all or part of their investment. This money will be used to pay the Cat bond sponsors. Hurricanes, floods, earthquakes, and numerous catastrophe scenarios are just some of the hazards that Cat bonds will protect.

According to the World Bank, the insurance policy owner is the Cat bond's sponsor. Sponsors (or co-sponsors) are the ones who pay the premiums and are the ones who get the money. A Cat bond is usually issued by a special purpose vehicle (SPV) created by an insurance company or a global investment bank (or both) that designs the financial transaction, provides the legislative structure for execution, is responsible for bringing the bond to market, and regulates the money held in the collateral account. [115]

These bonds offer investors attractive rates of return due to the possibility of a triggering case. Hazard risks are uncorrelated with other investment risks, which makes Cat bonds appealing. Individual investors to major pension funds, Cat bond investors come in a range of shapes and sizes. These investors are usually looking for portfolio diversification and are eager to take on more risk (along with the risk of losing their initial investment) in exchange for higher returns.

CAT bonds in Türkiye

In accordance with the Turkish Catastrophe Insurance Pool (TCIP), earthquakes can result in many deaths and property losses, as well as many insurance claims in the affected areas. Unfortunately, Türkiye is prone to natural hazards such as floods, landslides, and avalanches, in addition to earthquakes. Therefore, Turkish insurers emphasized on other disaster management strategies and one of them is called Bosphorus 1 Cat Bond, which includes earthquake risk, is the first of its kind in Türkiye. It was issued in 2013 and has a value of \$ 400 million. [2] This amount would be kept apart from the rest of the funds and invested in short-term US Treasury bonds. Investors can collect income equivalent to the insurance premium charged by the TCIP in three years in addition to the return on these bonds. TCIP will be able to use the \$ 400 million in this account for indemnity payment during this time if an earthquake strikes in Istanbul and "triggers" the Cat bond, and if the fixed parameter is exceeded. The Cat bond will be triggered by a determined index based on seismographic data. The funds will be returned to the investors if there is no earthquake according to the TCIP.

Bosphorus 1 has also brought risks associated with Turkish geography to the global Cat bond industry and has pioneered the use of alternative markets and products in post-catastrophe financing in the Turkish insurance sector.

Türkiye is in one of the most active seismic areas in the world. Past earthquakes in Türkiye have demonstrated how damaging these occurrences can be to economy and society. According to the AFAD earthquakes are the most destructive hazard with 35,47% among other

hazards such as floods, landslides, avalanches in 2020. [17]

The most severe one was happened in Kocaeli in 1999 with 7.4 magnitude and more than 18,000 people were dead. The total cost was above \$20 billion according to the Disaster and Emergency Management Presidency Department of Earthquake. [14] Therefore, the impact of the 1999 earthquakes highlighted the need for effective disaster risk management strategies and the TCIP was established in the aftermath of the Marmara earthquake. Historically, Türkiye’s private insurance sector has been unable to provide sufficient capacity for catastrophe property insurance against earthquake risk, and the Turkish government has been exposed to significant financial risk in case of a natural hazard.

According to Başbuğ and Özdemir (2015), the primary goal of the TCIP is to shift national risk to a global network of risk-sharing pools managed by multinational reinsurance companies. It seeks to (1) split the cost, (2) share the risks, (3) expand insurance culture, (4) encourage earthquake resistant structure development, (5) offer building warranty procedures, and (6) support to lessen the financial pressure on the government’s budget during hazards. [22]

The TCIP covers the financial damages that are caused by earthquakes, explosions, fires, tsunamis, and landslides that re caused by earthquakes. Unfortunately, it does not cover expenditures for rubble clearance, bankruptcy, company downtime, loss of rent revenue, alternative housing and company premises costs, and injuries and fatalities or any other losses that happen after an earthquake that are not included in the policy. [2]

The TCIP’s organizational model is a collaboration of private and public and private organizations which is known as a public-private partnership. It is a non-profit corporation with a special framework. Its ability to pay indemnity is unaffected by the government’s budget. By holding premiums low, it encourages access to Compulsory Earthquake Insurance (CEI) through a comprehensive distribution network that includes partner insurance providers, their agencies, and bank branches, ensuring that anyone, regardless of means, may benefit from such assurance. It also backs up its insurance activities with public awareness programs, emphasizing that CEI is, most of all, a social responsibility for everyone demonstrated in Table 2.1.

Table 2.1: Advantages and Disadvantages of TCIP

| Advantages | Disadvantages |
|---|--|
| Encouraging society’s contribution to the system to increase their awareness about taking precautions against earthquakes | Individuals’ low insurance buying rate |
| Critical payments were made between the years 2010-2013 | Gap between earthquake owners and non-owners |
| | High insurance price |

Source: [22]

The technical and operational transactions of the Pool are handled by an insurance or reinsurance firm that has been designated by the Treasury Under secretariat for five-year periods. To ensure that CEI continues to expand, the Pool oversees policy development as well as high-profile advertising and social initiatives to raise earthquake and insurance awareness.

2.1.2 Resilience Bonds

A novel risk reduction strategy focused on strategic growth of urban and infrastructural structures was proposed in the last Sendai Framework built in 2015 based on the resilience principle to make urban areas more resilient. Also, it calls for increasing the capacity to learn and thereby predict the effects of a hazard, which is a critical component of increasing natural hazard resilience. [124]

A Resilience Bond is the latest insurance vehicle intended to assist cash-strapped governments in increasing both physical and financial hazard security. These bonds combine insurance coverage (such as parametric insurance plans and catastrophe bonds) with capital investments in hazard resilience programs (such as flood walls and building retrofits) to mitigate potential hazard losses. [101]

The European Bank for Reconstruction and Development (EBRD) launched the world's first dedicated climate adaptation bond at the end of summer 2019 since it is now widely acknowledged that the global society must share the risks and hazards posed by climate change and, more broadly, the climate. [33]

2.1.3 Difference between CAT and Resilience Bonds

Resilience Bonds are a form of Catastrophe Bond in which insurance premiums are linked to resilience programs in order to utilize avoided losses with a rebate structure. The "resilience rebate" is a source of funding for programs that reduce risk in observable ways. A Resilience Bond differs from a catastrophe bond in that it employs the same financial modeling as a catastrophe bond. However, it simulates two scenarios: business as normal and an environment in which a protective infrastructure project is implemented. It calculates the difference in estimated losses between when the hazard occurs with and without the project. The difference is accounted for as a resilience refund, which can be used to finance the project.

Figure 2.1 demonstrates how adding a resilient infrastructure project to a traditional Cat bond system will lower investors' risk (of losing their principal invested) and sponsors' premium payments. Sponsors, issuers, and investors have identical basic relationships as in traditional Cat bonds. Resilience Bonds vary in that they directly provide the risk mitigation benefit of a particular resilience project in the estimated loss to investors. It's a two-step procedure. The issuer must first evaluate whether and how much a resilience project reduces potential losses using financial catastrophe models. This is used to calculate the resilience refund based on

the lower cost of making coupon payments to investors. The second move is to collect the cost savings from lower investor coupons and allocate them to bond sponsors in the form of a resilience refund that can be used to fund risk-reduction investments.

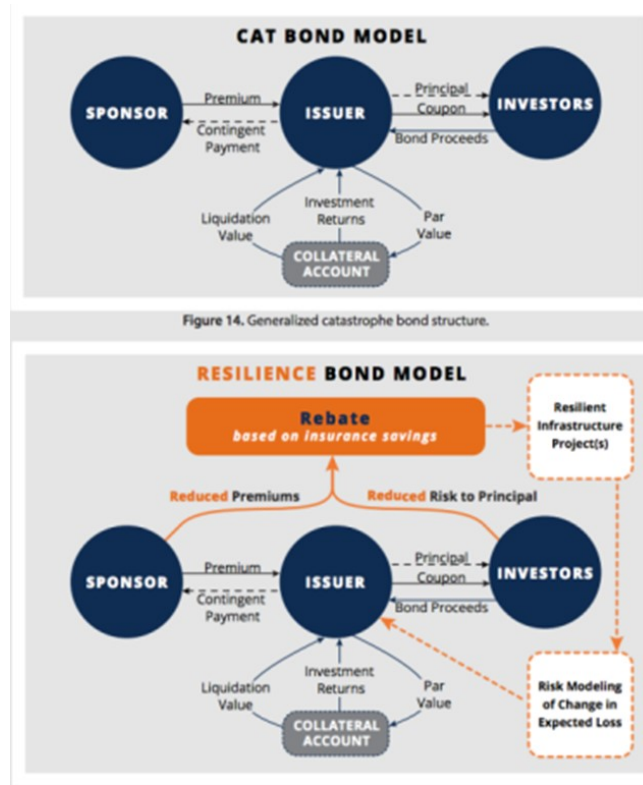


Figure 14. Generalized catastrophe bond structure.

Source: [124]

Figure 2.1: Resilience and CAT bond Structure

2.1.4 Green Bonds

In recent years, material and rapidly evolving climate conditions have heightened the public’s sense of urgency for implementing globally enforceable policies to prevent global warming. The creation of a green economy through the development of a green financial system is one of the most effective ways to achieve this aim. Green financing instruments and activities, such as green bonds, green loans, green equity, green derivatives, and so on, have been described as the most urgent steps required to impact the greening of the financial system. The majority of the literature focuses on green bonds due to their uniqueness and the lack of data related to green loans, green equity, and green derivatives. [49]

Green bonds are a new type of fixed income asset issued by governments, companies, and other organizations to fund environmental and climate-friendly initiatives like renewable energy, recycling, and green infrastructure. It helps to lower the costs of environmentally

friendly programs, and raise awareness of the financial risks associated with climate change.

In 2007, the green bonds market had a market capitalization of less than \$1 billion. The demand continued to rise in 2019, with new issues reaching a new high of \$257.7 billion.[66] The market's expansion was supported by a number of factors. The first one is strong government policy support, especially in Asian and European countries. The Paris Climate Agreement's goal of slowing the rise in global average temperature necessarily involves vast amounts of money to help with the transition to a low-carbon economy. Moreover, private institutions have expanded their green bond fundraising. Issuing green bonds is associated with corporate social responsibility for creditors and, in some cases, saves money on funding. As is seen in Table 2.2 despite the fact that new issuance has increased significantly in recent years, the green bond market remains small and has the potential to expand into a significant segment of the global fixed-income market.

Table 2.2: Annual issuance of green bonds

| Year | Volume(% Billions) |
|-------------|---------------------------|
| 2007 | 0.8 |
| 2008 | 0.4 |
| 2009 | 0.9 |
| 2010 | 3.9 |
| 2011 | 1.2 |
| 2012 | 3.1 |
| 2013 | 11.0 |
| 2014 | 36.6 |
| 2015 | 41.8 |
| 2016 | 81.0 |
| 2017 | 155.5 |
| 2018 | 170.6 |
| 2019 | 257.7 |

Source: [66]

In addition to this, green bonds offer an innovative approach to earn a financial return while also making a good impact to the environment. The key feature of a green bond is that the earnings are only used for ecologically sustainable programs. According to the World Economic Forum, the number of investors who are worried about their portfolio's environmental influence is growing, and many are beginning to include social, environmental and governance problems into their investment models. [11]

A central guideline of the Green Bond Principles (GBP), which underpin the industry is to report on how the proceeds of green bonds are used. According to these voluntary but influential rules, the monitoring should be done annually and a list of the programs to which

proceeds have been allocated, a review of the projects and the projected environmental effects should be included.

Green bonds have four main components that are used to enhance transparency and disclosure and thereby promote the credibility of the green bond market:

- Utilization of Proceeds
- Evaluation and Selection Procedures for Projects
- Proceeds Management
- Reporting

The GBP recommends using qualitative performance metrics of the predicted environmental effect and, where possible, quantitative performance measures in terms of reporting. For example, energy capacity, greenhouse gas emissions reduced/ prevented, electricity generation, number of people with access to renewable power, reduction in water usage, number of cars available, and so on.

For instance, The Amundi Planet Emerging Green One (AP EGO) fund was established in 2018 in collaboration with the International Finance Corporation (IFC) as part of the it 's Green Cornerstone Bond Program (GCBP) in Paris. [21] The fund is financed by the International Finance Corporation's (IFC) Green Bond Technical Assistance Program (GB-TAP), which seeks to establish a market for green bonds in developing nations. The AP EGO fund is a layered fund with a credit enhancement feature. Three characteristics distinguish the fund as a guide in green financing. It is the first fund exclusively focusing on green bonds from emerging market financial institutions, and it is one of the biggest green bond funds, with up to \$2 billion to invest. Its collaboration with GB-TAP is the first of its kind, bringing together demand and supply for green bonds.

According to investment research professionals, green bonds have many benefits for many investors. To begin with, they can provide access to geographical areas or smaller ventures that would otherwise be unavailable, as well as large enough "ticket sizes" for many investment firms. Second, the proper research and analysis needed to assess the 'greenness' of individual green bonds and their issuers will take time, particularly if an investor has exclusionary requirements and certain sustainability thresholds that must be met before investing. Allowing the managers of a green bond fund, which conforms to tighter green standards than most issuers, to handle this challenge will save investors a lot of time and effort.

Green bonds in Türkiye

The Industrial Development Bank of Türkiye (TSKB) which promotes a low-carbon economy, has pioneered yet another innovation in the field of sustainability. It has made history by being the first Turkish bank to sell a "Green/Sustainable Bond" on foreign exchange markets. The gains from Türkiye's first Green/Sustainable Bond issuance will be used to fund

climate-related clean energy and resource efficiency investments, as well as socially beneficial healthcare and education initiatives. With a size of \$300 million, TSKB received 13 times the issue size in demand, and the bond issue received a demand of \$4 billion from 317 institutional investors in foreign markets. [3] The funds raised from the bond issue will be used to finance and/or refinance renewable energy initiatives that address climate change, resource efficiency investments, and social impact projects in areas including health, education, ports and electricity transmission lines.

2.1.5 Blue Bonds

The oceans finance industry is still in its development, but the need for funding to confront risks to our ocean's health is becoming extremely critical and according to the World Bank, the Republic of Seychelles issued the world's first blue bond in 2018. [116] The bond, which collected \$15 million from foreign investors, illustrates how nations may use capital markets to fund the sustainable usage marine resources. The proceeds will be used to assist the extension of marine protected regions, better regulation of key fisheries, and the growth of the Seychelles' blue economy.

Blue bonds are a ground-breaking financial instrument created to fund long-term marine and fisheries operations in order to improve healthy seas. Earnings from investments in feasible blue economy initiatives are generated via blue bonds and by issuing a blue bond, investors can fulfill their social responsibilities while also benefiting the ocean and humanity.

Seychelles economy is highly dependent on marine resources and beside tourism, the fishing sector is a key industry in the country. Fish goods account for approximately 95% of total domestic export value and 17% of the population is employed in the sector which highly affects the yearly GDP. Therefore, it is crucial to protect the well-being of marines in the country and with the help of the World Bank, 15 million\$ is raised for the country.

Moreover, the Asian Development Bank supports blue bonds to fund projects that generate financial returns, and they issued their first blue bond on 10 September 2021. [13] Bank of China and Nordic Investment Bank have also issued blue bonds. Although, blue bonds are not currently used in Türkiye, they could be a beneficial financial instrument in the future since Istanbul faced a huge sea pollution problem in previous year.

The blue bond exemplifies the ability of financial markets to develop sustainable ocean alternatives that perfectly balance marine protection and economic opportunities.

2.2 Available Funds

2.2.1 Calamity Funds

The Calamity Fund is a one-time lump sum fund established under the General Appropriations Act to provide assistance, relief, and recovery services to communities and areas impacted by man-made and natural hazards, as well as repair and restoration of permanent infrastructure, including capital expenses for pre-hazard operations, rehabilitation, and other related activities. [104]

In Philippines, the passage of a new hazard management law has resulted in significant improvements in the country's hazard management goals, focus, structure, and systems. The Philippine Disaster Risk Reduction and Management Act, which was signed into law in May 2010, establishes a legislative structure for institutionalizing the country's hazard risk reduction and management programme, which includes funding from the national government.

The Republic of Türkiye's strategic investment wing and equity solutions provider is the Türkiye Wealth Fund. It is an asset-backed development fund that focuses on the portfolio firms' growth ambitions through value creation programs, important industry investments, and visionary projects to assist the country's economic development.

TWF's portfolio comprises Borsa Istanbul and three of Türkiye's largest state-owned banks in terms of asset size. TWF's portfolio also includes the consolidated state insurance companies Türkiye Sigorta and Türkiye Hayat Emeklilik.

As of the end of 2020, the Türkiye Wealth Fund (TWF), one of the largest financial entities in Eastern Europe, the Middle East, and Africa, has a total market capitalization of \$296 billion. The main goal of this financial capability is asset value maximization, provide equity for strategic domestic investments, assist Turkish enterprises in becoming regional and global leaders, and contribute to the development of capital markets. [8]

2.2.2 Reserve Funds

A reserve fund is a savings account or other highly liquid asset set aside by an individual or business to meet any future costs or financial obligations, especially those arising unexpectedly. Less liquid assets will be used if the fund is set up to cover the costs of planned improvements. Reserve funds may be established by governments, financial institutions, and private households to provide immediate liquidity for hazard relief and recovery.

In 2006, the Mexican government decided to use a combination of reinsurance and a Cat bond to hedge its catastrophe reserve fund, FONDEN, against major earthquakes. For the three-year duration 2007-09, the contract is tied to a parametric seismicity trigger in terms of magnitude and depth. For a net premium/interest of \$26 million, the Cat bond offers protection of \$160

million out of a total cover of \$450 million. [127]

The bond was issued by Swiss Re and it costs 230 basis points in interest if payment is not triggered.

FONDEN funds can be used for public infrastructure maintenance, restoration housing for the poor and some aspects of the natural environment. It is able to transfer risks through insurance and other risk transfer instruments such as Cat bonds to mitigate the volatility of demand on its resources. On the other hand, it is not permitted to take on debt.

To be eligible for FONDEN funds, affected government agencies must show that the scope of the restoration needs exceeds their financial ability and submit a detailed request outlining the extent of the damage and the approximate cost of reconstruction.

Reserve funds in Türkiye

According to the Central Bank of Türkiye (CBRT) reserve funds are classified as; [28]

- Convertible foreign currency assets (euro, US dollar, British pound, etc.),
- Gold complying with the international gold standard,
- Special Drawing Rights,
- International Monetary Fund (IMF) Reserve Position.

The CBRT maintains Türkiye's reserves in accordance with the following goals:

- Making the Turkish economy more resistant to unforeseen domestic and global financial shocks
- Providing access to the foreign cash required to service the Treasury's internal and external foreign currency obligations
- Supporting monetary and exchange rate policy and increasing confidence in these policies
- Increasing the Turkish economy's reputation in foreign markets

2.2.3 Contingency Funds

A contingency fund is a separate account managed by the federal government with funds available for immediate use in the event of a hazard. Governments are expected to make monthly contributions to the fund. Since the government manages the fund, the administration costs should be smaller than the insurer's markup. Just before the time-constrained post-hazard response and recovery process, the government acquiring the line of credit and the lender (in this case, the World Bank) negotiate on the loan terms, both on interest rates and

repayment terms. A cause, such as the declaration of a catastrophe or the occurrence of a threshold level of damages, is often used in contingent credit. Contingent credit is often used in combination with the government's emergency contingency funds, insurance, and other risk-financing solutions, which together make up the country's risk-financing potential. When all other solutions have been eliminated, donor support can be required to handle any remaining shortfalls.

They enable countries to respond to a hazard without diverting funds from current economic and social development programs. Furthermore, these financial instruments serve as a foundation for implementing comprehensive risk management plans and investments that go beyond hazard relief to improve preparedness and resilience while also improving governments' financial readiness to adapt to shocks.

Several organizations, including the World Bank, the Inter-American Development Bank (IDB), and the Japan International Cooperation Agency (JICA), have hazard-related contingent lines of credit. For instance, Catastrophe Deferred Drawdown Options (Cat-DDOs) from the World Bank provide immediate liquidity in the event of a catastrophe and help improve hazard risk management ability. Furthermore, via the International Development Association's Crisis Response Window (IDA CRW), the World Bank also provides Contingency Emergency Response Components (CERC) and post-hazard financing. The CERC is a new tool for hazard management and preparedness at the project level and across industries, allowing for the rapid mobilization of pre-approved funds in the event of a hazard, such as a disease outbreak. It enables the rapid reallocation of investment project funds to immediate post-hazard recovery needs after sufficient former technical and logistical planning for their disbursement and use. For example, a CERC was recently used to help Jamaica in improving its hazard resilience. Likewise, the IDA CRW provides additional assistance to low-income countries in the event of extreme economic crises or significant natural hazards, allowing them to recover their long-term development plans. [128]

Also, in 2012, the IDB introduced its Contingent Credit Line for Natural Disasters to help countries with immediate funding needs following a natural hazard and in 2013, JICA created the Stand-by Emergency Credit for Urgent Recovery (SECURE) to contribute post-hazard financing.

2.2.4 InsuResilience Funds

According to the Insuresilience Investment Fund Climate change is already having an effect on us.[63] Extreme weather events including floods and droughts are becoming more common and severe all over the world. Poorer people in developing countries, especially those working in climate-sensitive industries, are disproportionately affected by climate impacts. Adapting to climate change is crucial to protect lives and livelihoods, and it is basically a matter of survival for humans. That's why the insurance industry has a critical role to play in promoting climate change adaptation.

Weather insurance helps to improve climate resilience by protecting against the financial consequences of severe weather events. It accomplishes this by allocating funds for post-hazard reconstruction and investing in hazard adaptation. Because of three major factors, this protection has become more important than ever;

- A rise in the number and severity of extreme weather events
- The significant funding shortfall for climate adaptation measures
- A shortage of insurance in developed nations

Therefore, the German Development Bank launched the InsuResilience Investment Fund in 2015, formerly known as the Climate Insurance Fund. The Fund's ultimate goal is to help developing countries respond to climate change by increasing access to and use of insurance and their main goal is to make micro, small, and medium businesses, as well as low-income communities, less vulnerable to severe weather events.

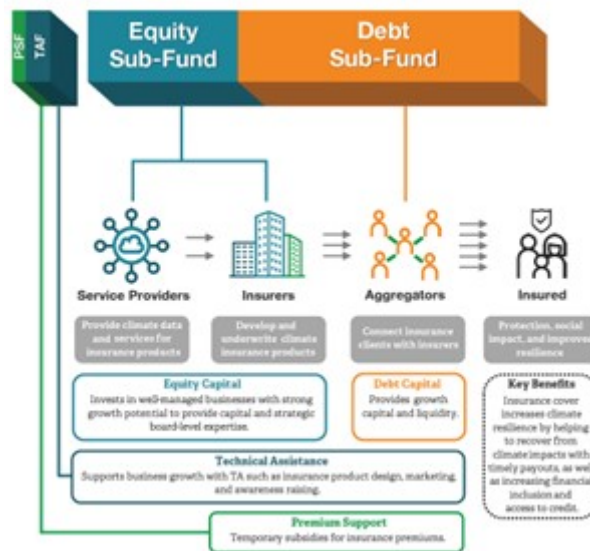
The IIF is made up of four distinct components as seen in Fig 2.2 that work together to maximize its impact potential: two investment sub-funds and two grant facilities.

Debt Sub-Fund: The Debt Sub-Fund of the IIF invests in aggregators that either sell micro-insurance or intend to do so in the future.

Equity Sub-Fund: This sub-fund invests in companies that provide climate insurance products or related services across the entire insurance value chain, from insurers to brokers to data and software providers, including agritech and fintech firms.

Technical Assistance Facility (TAF): The TAF assists in the launch and growth of the investee's climate insurance by providing international experience in feasibility studies, data sourcing, insurance product design and operations support, as well as marketing and distribution advice.

Premium Support Facility (PSF): It offers temporary incentives to IIF investees' clients to help them pay their insurance premiums.



Source: [63]

Figure 2.2: The IIF's Composition

IIF investments have allowed investees to introduce new insurance products and dramatically enhance existing ones, making them better suited to the needs of poor and disadvantaged customers. Brand growth has been driven by emerging technologies and data access for many of the investees. For instance, Skymet, an Indian climate data and software firm, was able to invest in 2,100 new automated weather stations in Maharashtra state thanks to an equity investment in 2017.[63] The company now manages over 6,000 surface-based automatic weather stations across India, providing higher-quality and more timely data that is critical for developing climate insurance products.

The Asia Insurance Company was able to introduce two weather index insurance policies as a result of the IIF's investment, with payouts going directly to farmers' loans when their region experiences drought or flooding. Since no loss-adjustment is needed, these products tend to lower transaction costs for policyholders and insurers. Farmers benefit from their quick payouts to repay their debts, which helps them recover quickly.

2.3 Available Facilities

2.3.1 Global Index Insurance Facility (GIIF)

The Global Index Insurance Facility (GIIF) is a World Bank Group program that provides catastrophic risk transfer options and index-based insurance in developed countries, facilitating access to financing for smallholder farmers, micro entrepreneurs, and microfinance

institutions. [50]

Index insurance is a comparatively recent yet groundbreaking approach to insurance provision that pays out compensation based on a pre-determined index (e.g. rainfall level, volcanic activity, animal mortality rates) for losses in properties and investments, mostly working capital, caused by conditions and catastrophic events, without the need for conventional insurance claims assessors. When crops are adversely affected by climate, index insurance may help small businesses and farmers stabilize profits, strengthening livelihoods, savings, and long-term risk management for the world's small farmers.

To assess the viability of index insurance markets, the GIIF World Bank Team conducts feasibility studies and index insurance pilots.

ACRE Africa's work in index insurance has shown that these products can help farmers better handle risks from climate hazards and are growing the agricultural insurance sector in East Africa. The project has also attracted attention in index insurance among insurance firms and government agencies. As part of its climate adaptation policy, Kenya has included index insurance.

This project has taught practical lessons that have been applied to related initiatives in other African countries. ACRE Africa's creative approach to delivery of index insurance policies by intermediaries that could effectively aggregate smallholder farmers was a core part of the project's positive outcomes as shown in Fig 2.3. This concept has been repeated in a number of countries and is now regarded as essential for the viability of index insurance products. The project also taught members how to properly handle basis risk, which is one of the biggest obstacles for insurance providers and farmers when it comes to index insurance.



Source: [12]

Figure 2.3: Role of ACRE on the ACRE's Value Chain

2.3.2 Global Facility for Disaster Reduction and Recovery (GFDRR)

GFDRR is a global collaboration established in 2006 to help developing countries better understand, control, and decrease their risk from natural hazards and climate change. [50] It helps vulnerable countries strengthen their resilience and mitigate risk by providing technical support, capacity building, and analytical work. Their main goal is to help countries develop their capacity to cope with natural hazard threats and to improve the pace and efficiency of international hazard recovery assistance. Also, GFDRR aims to promote ex-ante hazard risk mitigation through operational and financial support, as well as crisis management and rapid hazard recovery and restoration preparation for future catastrophes. It is headquartered at the World Bank and is funded by 37 countries and 11 international organizations. It collaborates with over 400 sub national, regional, national and international partners. [47]

GFDRR is currently implementing its strategy across eight areas of engagement that endorse the Sendai Framework objectives and the Paris Agreement, as well as contribute to the Sustainable Development Goals' achievement. These are; [5]

- Utilizing innovation and science in hazard risk management
- Encouraging resilient infrastructure
- Improving hydromet services and early warning systems
- Increasing financial protection by hazard risk financing and insurance
- Strengthening social resilience
- Enlarging climate change resilience engagements
- Providing resilient recovery

GFDRR has two active funding portfolios to assist the Turkish government in developing climate and catastrophe resilience in member municipalities. One of them is \$1 million and other one is \$0.2 million. The name of the \$1 million portfolio is Türkiye Urban Resilience and it is started at 2020 and will be finished in 2023. The project is funded by Japan-World Bank.

The first portfolio covers an open access to risk information and aim to increase resilient cities, resilient infrastructure and develop awareness of resilience to climate change. With the help of this project, Türkiye will successfully fulfill the three Priorities of Sendai Framework which are recognizing disaster risk, improving disaster risk governance to handle disaster risk and investing in disaster risk reduction for resilience.

The funding intends to;

- Investigate the current level of climate change resilience and adaptation strategies and policies in Türkiye.

- Increase the awareness of resilience measures and the critical need to develop them within a risk management and continuous learning framework.
- Integrating climate adaptation and resilience into policy debate by using a macro-fiscal framework
- Guiding possible development policy loans in order to contribute to the national development planning

The second portfolio consists of \$200.000 and the name of it is Climate Change Adaptation and Disaster Resilience in Türkiye: establishing a baseline to inform national policies. It is started at 2020 and will be finished at 2022. It is funded by GFDRR itself.

2.4 Weather Derivatives

Weather influences economies all over the world, having a direct impact on sales, prices, or both. The sensitivity of sales, supply, or costs to meteorological elements such as temperature, sunlight, rainfall, snowfall, wind, and so on is known as weather sensitivity. Weather may be classified as catastrophic or non-catastrophic depending on the magnitude of its effects. Floods, hurricanes, and tornadoes are examples of catastrophic weather events that have a low chance of occurring but cause significant financial losses. Minor variations from regular or natural conditions, such as colder than usual winters and rainier than usual summers, are considered non-catastrophic weather. The key distinction is that non-catastrophic weather has an effect on business results but does not endanger people's lives or property.

Weather's catastrophic effect has long been understood, accepted, and controlled. Non-catastrophic weather exposure, on the other hand, has only recently received much-needed publicity as the impacts of climate change have become more evident and businesses have been forced to tighten their cost controls due to the economic crisis. Companies must use effective weather risk management to mitigate the negative impact of bad weather and the resulting earnings volatility. Weather derivatives are a modern method for non-catastrophic weather risk management that has a number of advantages over other options.

Weather derivatives are financial contracts exchanged on the derivatives markets that are intended to provide indemnification in the event of poor weather and thus serve as a protection against non-catastrophic weather risk. The weather index is the underlying asset of weather derivatives, and there is no spot market for weather indices because it is not a physical good. The weather derivatives market allows financial exposure to weather to be traded.

The weather derivatives market dates back to the mid-1990s, when the US energy sector was deregulated, and the unusually warm El Nino winter of 1997/1998 in the United States. [65] With deregulation, monopolies started to give way to competitive market systems, and many oil and utility companies discovered that, though they could hedge price risk with energy futures and options, they had no way to hedge weather risk, which can drastically alter demand

for their goods and services.

The following characteristics describe a weather derivative contract:

- The contract period's start and end dates
- A measurement stations
- A weather factor assessed at the meteorological station over the contract duration, such as temperature, rainfall, snowfall, wind speed, and sunshine hours
- A weather index that averages the weather variable over the duration of the contract
- A pay-off feature, in which a derivative contract is settled shortly after the contract duration has ended
- A premium charged by the buyer to the seller at the start of the contract for certain forms of weather financial derivatives

Weather derivatives may be exchanged on a monitored exchange or on an over-the-counter market for insurance and reinsurance. Currently, the Chicago Mercantile Exchange (CME) is the only exchange that trades weather derivatives. Weather swaps and call and put options are the most popular forms of weather derivatives.[62]

Weather derivatives are used by businesses to smooth earnings, cover excess expenses, recover lost opportunity costs, boost profits, and broaden investment portfolios. They can also be used as an alternative asset class and efficient portfolio diversifiers since weather indices have a low correlation with traditional types of investment such as stocks and bonds.

In addition to weather derivatives, there exist weather index insurance which can be used in two ways. One way is to provide farmers with a form of protection to help them manage drought risk in their farms. Another way is to use a market-based model to fund public and nongovernmental organization drought relief programs.

Weather index insurance works on the principle that contracts are written against particular perils or hazards, such as droughts, that are described and reported at regional levels, typically at a local weather station. If an insured event happens, all those who purchased policies will be fully compensated. The index should be specified against weather events that are strongly correlated (on the downside) with yields of significant crops grown by farmers in the area, or with major animal losses, in order to serve as drought insurance for farmers or relief agencies. [98]

2.5 Drought Index

According to F. Fava and A. Vrieling (2021), droughts, described as periods of water scarcity compared to normal circumstances, are one of the most destructive natural hazards, affecting

millions of people worldwide each year and having catastrophic consequences. [44]

For instance, National Centers for Environmental Information stated that droughts cost \$6–8 billion per year on average in United States and only 22 of them cost more than \$200 billion between 1980 and 2014. [88] In addition to this, according to current European Commission estimations, the costs of droughts in Europe over the previous 30 years were at least \$100 billion in total. [27] Therefore, it can be concluded that, droughts cause problems on national economies and have devastating consequences for small-scale farmers and livestock keepers' wellbeing and food security. Standard drought solutions in African countries, such as humanitarian aid in the form of cash or food transfers, are effective tools for assisting drought-affected people. These responses, on the other hand, have often proven to be too slow, inefficient, and to promote dependence rather than resilience.

Index-based approaches have gained tremendous popularity in the last two decades among the various climate risk financing instruments, especially for targeting drought shock influences on African small-holder farming systems. Drought risk financing based on an index utilizes trigger mechanisms that depend on a straightforward and objectively assessed drought indicator. To be useful in monitoring and thus shifting risk, the underlying index must be strongly correlated with drought-related economic losses. When the index values fall below a pre-determined threshold, which is usually derived from historical index realizations, payouts are made.

Drought risk financing based on indexes restricts knowledge asymmetry problems like adverse selection and moral hazards, lowers transaction and verification costs, and allows for more accurate and timely payout delivery.

The category of drought (meteorological, agricultural, hydrological, or socioeconomical), the environment regime, and the affected areas, as well as the available data have an influence on the index chosen. [46]

Droughts have long been linked to widespread humanitarian hazards such as food shortages, violent wars, and urban displacement. These issues have been especially severe in Africa's dry lands, where the resource base is extremely low and the socio-political situation is extremely unpredictable. In order to solve that problem, The World Food Programme developed an index-driven insurance scheme to provide extra money in the case of severe drought, the sum being based on contractually defined drastic shortfalls in precipitation calculated in terms of the Ethiopia Drought Index, to supplement and partly replace their conventional food-aid solution to famine. Rainfall data is collected from 26 weather stations throughout Ethiopia, serving different agricultural regions. [59] Via AXA Re, a Paris-based reinsurer, the World Food Programme was able to secure an insurance deal based on the Ethiopia Drought Index in 2006.

Drought in Türkiye

According to Dabanli (2018), drought hazard and vulnerability for Turkish provinces are

explored using hydro-meteorological and actual socioeconomic data. Drought vulnerability and risk assessment are critical components of the drought phenomena; yet, in Türkiye (and elsewhere), a lack of properly integrated drought risk assessment may result in greater socioeconomic consequences. [61]

Although earlier studies give fundamental information, the socioeconomic drought impact (risk) for Türkiye has not been explored. Damage to property, population density, agricultural land, and availability to household water are all examples of socioeconomic variables. A drought with a high socioeconomic value is likely to cause more damage than the other dangers. [19]

Türkiye has seen considerable urbanization growth in the last 30 years, spurred by its open economic policies and industry (World Bank Report 2015). As the world's population grows, so does the demand for water. Finally, numerous political factors influence changes in land usage, particularly in irrigated land areas. Droughts are becoming increasingly common in Türkiye as a result of these developments. As a result, a thorough understanding of the effects of drought on socioeconomic sectors in terms of hazard, susceptibility, and risk assessments is required.

Because of the complexity of droughts, standardized indices such as the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index are commonly used in drought studies (PDSI). Because of its simple nature, the SPI is a widely used indicator. [31]

Based on the literature, a simple methodology is used to estimate drought risk and determine the sensitivity levels of Turkish regions. Rainfall data is used to calculate SPI, which leads to the computation of drought danger by giving weights and ratings to the SPI probability distribution. Drought susceptibility is then determined by combining four socioeconomic parameters, including population density, total agricultural land area, irrigated land area, and municipal water. [57]

TARSIM is the name of Türkiye's flooding, hailstorm, hurricanes and drought defense system. One of the most effective and sustainable methods currently being used in the nation. The introduction of an insurance mechanism has been suggested as a way to cover the risks posing a threat to Türkiye's agriculture sector. TARSIM offers many insurance types, some of which include crop, greenhouse, and village-based drought index insurances. For instance, crop insurance covers quantity losses from hail, storm whirlwind, fire, earthquake, landslide, and flood, as well as quantity losses from hail to fresh produce and cut flowers. Hail, earthquakes, volcano eruptions, car impacts, storms, technological equipment, and crops grown in greenhouses are all covered by greenhouse insurance. According to the findings of the risk assessment and evaluation, greenhouse insurance provides coverage for building materials, technical equipment, and crops grown there as well as risks from hail, earthquakes, volcano eruptions, vehicle impacts, storms, whirlwinds, fires, landslides, floods, and snow/hail weight. [109]

CHAPTER 3

RESILIENCE IDEAS IN DIFFERENT CONTINENTS

3.1 Resilience in South Asia

Asia-Pacific region has experienced exponential economic development over recent decades in accordance with X. Lu. [69] Also, he concluded that more infrastructure investment, predicted at \$1.5 trillion per year over the next decade, will be required to maintain development momentum and remove existing poverty in Asia. This remarkable change may have reduced inequality and poverty, but it has come at a considerable environmental expense, jeopardizing the region's prospects for a prosperous future and long-term social growth. Extreme weather events and geophysical shocks are common in the area, and it is one of the most vulnerable regions in the world to potential climate change. Although natural hazards affect all countries, Asia and the Pacific are especially vulnerable since the region is frequently subjected to major geophysical shocks and weather events making it one of the most vulnerable. Seven of the ten countries with the highest projected hazard risk worldwide are Asian Development Bank developing member countries. which are Bangladesh, Cambodia, the Philippines, Solomon Islands, Timor-Leste, Tonga, and Vanuatu. [68]

As a result, not only must infrastructure investments be more resilient, but also regional investments in hazard risk mitigation and climate change adaptation must be increased. In light of this, there is a strong case for prioritizing, planning, implementing, and scaling up investments in resilient infrastructure.

The ADB was established in the early 1960s as a financial institution to promote economic growth and cooperation in one of the world's poorest regions. [1] Although continuing its efforts to eliminate extreme poverty in Asia and the Pacific, the ADB envisions a stable, equitable, resilient, and sustainable Asia and the Pacific. ADB's hazard risk mitigation investments have shifted in recent years, moving away from structural projects toward the nature-based solutions, community-based resilience infrastructure, and projects that incorporate structural and nonstructural interventions.

A change in emphasis is needed to achieve the new Strategy of ADB in 2030 priority of hazard and climate mitigation while also achieving stable, equitable, and sustainable growth. As a result, the ADB has established a comprehensive resilience strategy. From four main per-

spectives, the goal is to develop climate change and hazard resilience: physical infrastructure resilience, financial resilience, eco-based resilience, and social and institutional resilience as demonstrated in Fig 3.1.



Source: [1]

Figure 3.1: A Holistic Approach to Resilience

However, putting this vision into action would necessitate novel organizational approaches as well as new investment styles and resources. The benefits of such a strategy are obvious. It is considering expanding and promoting initiatives that have strong co-benefits in terms of nature-based solutions, environmental conservation, food security, hazard risk management and biodiversity enhancement.

Asia and the Pacific will need to tap into new funding sources, especially private investment in order to meet expected infrastructure investment needs in the future. ADB helps its members and partners achieve social and economic growth by offering loans, technical support and equity investments. It has steadily increased its financing for resilient infrastructure growth, especially in sectors that are more prone to climate and hazard effects, driven by its strategies and in response to the needs of its developing member countries.

The Asian Development Bank is collaborating with developing member countries to improve their financial resilience to hazard risk. It is improving the related financing mechanisms to help ensure effective and appropriate flows of post-hazard funding.

This assistance entails;

- Assessing hazard risk and associated relief, early recovery, and reconstruction funding needs and gaps
- Putting together detailed hazard risk financing plans
- Implementing and developing hazard risk financing instruments

- Improving budget execution plans in the aftermath of a tragedy
- Integrating post-hazard finance tools into a larger resilience system

It manages a number of the most critical climate funds based on resilience, including the Pilot Program for Climate Resilience under the Climate Investment Funds, in collaboration with other multilateral development banks. It has also collaborated with the Green Climate Fund (GCF) to help resilient infrastructure investment projects in some of region's most vulnerable countries by leveraging concessional financing.

In what is known as the convergence of green and gray infrastructure, the ADB has been investing more in nature-based methods to supplement hard-engineered systems for hazard risk mitigation and climate resilience building. Natural ecosystems offer ecosystem services, such as controlling functions, as well as high co-benefits, such as positive environmental effects and livelihood opportunities, which are used in nature-based solutions. For instance, natural solutions (sponge cities) are being pilot-tested in Pingxiang, People's Republic of China, as part of an ADB initiative to deal with rising flood risk and inadequacies in drainage infrastructure and wastewater treatment. In more detail, according to the World Future Council sponge cities denote a city that does not permit any water to flow through the ground and, much like a sponge, collects rain water, which is then automatically filtered by the soil and permitted to reach the urban groundwater. [134]

To deliver urban–rural flood risk management and ecological river management, the project combines the use of wetlands, trees, bio-retention, green roofs and surface water absorption systems with more conventional gray solutions. Along this example, ADB has established a hazard insurance pool for city governments in the Philippines to provide fast post-hazard funding for early recovery following earthquakes and typhoons. Via risk diversification, economies of scale, and profit retention, the pool arrangement lowers premiums. The national government will provide the initial pool capital, and it is expected to receive a sovereign loan from the ADB for this reason.

Since the introduction of ADB's green bond program in 2015, the bank has raised about \$7.6 billion to help fund climate change mitigation and adaptation initiatives. [1] Green bond projects that are eligible are reported on a regular basis by ADB energy, climate change, and environmental specialists.

3.1.1 Case Study 1 (CARE)

The Climate Adaptation and Resilience for South Asia (CARE) Project's goal is to create an ideal environment for climate-resilient policies and investments in South Asia's key sectors and nations. The Regional Integrated Multi-Disaster Early Warning System for Africa and Asia (RIMES) and the Asian Disaster Preparedness Center (ADPC) are leading the project, which is funded by the World Bank. [129]

The ADPC is an international organization whose mission is to increase people's and institutions' resilience to hazards and climate change by assisting nations in improving their systems and institutions' ability. The Climate Resilience section at ADPC is ideally matched with CARE since it focuses on developing climate risk information, tools, methodologies, and systems for use in risk management and climate change adaptation strategies across many sectors. Climate resilience is increasingly being mainstreamed into public spending and planning. Some of its actions are;

- Conduct evidence-based policy analysis in order to incorporate climate risk management into sectoral policies and action plans.
- Create investment strategies for scaling up current climate-resilient structural solutions.
- Improve policy and strategic frameworks for integrated water resource management and climate-smart agriculture.
- Incorporate gender-responsive resilience into sector initiatives.
- Assist in the implementation of selected adaptation priorities under the Nationally Determined Contributions by providing policy and expertise support.
- Promote training in key sectors on climate-resilient adaptive policymaking, design, and solutions.

CARE intends to enhance regional collaboration among priority nations in the South Asia area, as well as help them in regional data and information exchange and the development of regional infrastructure standards. By building momentum and facilitating collaboration, collective regional actions to address climate threats will generate economies of scale, lower transaction costs, promote shared learning, and have an overall multiplier impact.

3.1.2 Case Study 2 (Indonesia)

Flooding has become more frequent and intense in Indonesia's cities over the last two decades. Severe floods in and around Jakarta, Indonesia's capital, affected more than 36,000 people in early 2020. [7] Rapid urbanization, poor infrastructure, and the consequences of climate change are just a few reasons of an increase in flooding in Indonesian cities.

The government has been working on a nationwide program for urban flood resilience, emphasizing on the importance of addressing these issues. GFDRR has provided crucial technical and financial support to the development of diagnostics for three cities Bima, Manado, and Pontianak as part of the Japan-World Bank Program for Mainstreaming Disaster Risk Management (DRM) in Developing Countries. These communities have been chosen as pilot cities for the national program since they are especially vulnerable to flooding.

In these three cities, over 300 officials have trained extensively, as well as consulting and technical support, in numerous critical areas of integrated urban flood risk management. A technical team has conducted flood hazard modeling for the three pilot cities in collaboration with local government officials, taking into account population growth and climate change effects.

Officials have recognized difficulties and opportunities in flood resilience in close cooperation with community stakeholders, especially civil society, the commercial sector, academia, and with support from GFDRR providing a preliminary matrix of possible actions that address flood risk while simultaneously promoting environmental sustainability and social harmony in their particular localities.

In line with the Indonesian government's objective to a balanced approach to flood resilience that promotes climate co-benefits, GFDRR's involvement has placed a particular emphasis on strengthening officials' knowledge base concerning green infrastructure and nature-based solutions.

For Türkiye:

In 2030, the ADB's new strategy will demand fresh organizational techniques, as well as new investment styles and resources. New funding sources, particularly private investment, are needed to meet future infrastructure investment needs. Unfortunately, the World Bank estimates that Türkiye's economic growth will be 1.4 percent in 2022. [132] Rising energy and food prices will disproportionately affect the poor, jeopardizing a post-pandemic employment-driven poverty recovery. Türkiye's energy and agricultural commerce, as well as tourist arrivals and abroad building projects, are all expected to be disrupted. Import price increases will have a direct impact on households and industry, as well as a negative impact on the current account balance and inflation.

The monetary boost exacerbated the deterioration of macroeconomic conditions. The lira sank to new lows, while inflation soared to new highs, with the former peaking at 18.00 per dollar on December 20, 2021, and the latter at 61.1 percent year-on-year in March 2022. [132]

By providing loans, technical assistance, and equity investments, the ADB assists its members and partners in achieving social and economic growth. Driven by its policies and in response to the demands of its developing member nations, it has steadily boosted its financing for resilient infrastructure expansion, particularly in sectors that are more vulnerable to climate and hazard effects. If Türkiye joins the ADB, it will be able to get financing and so implement resilience initiatives.

Türkiye, which is equally vulnerable to climate change and disasters, could benefit from the CARE Project. Türkiye, for example, has approved \$135 million to safeguard 90,000 poor and vulnerable people from natural and climate-related disasters, according to the World Bank. This project tries to improve their economic prospects. [130]

The Türkiye Resilient Landscape Integration Project (TULIP) aims to improve rural communities' livelihoods and infrastructure services in the Bolaman River Basin in the eastern Black Sea Region and the Çekerek River Basin in central Anatolia. Climate change consequences on both basins are severe, including seasonal floods and droughts, soil erosion, and landslides.

High poverty rates, low agricultural output, and poor infrastructure characterize the regions. The World Bank's funding will support an integrated approach that will create shovel-ready jobs and diversify livelihood options while also strengthening climate and disaster resilience and laying the groundwork for long-term land management.

Increased access to resilient infrastructure for flood protection, drinking water storage, agricultural irrigation supplies, and improved road conditions to promote mobility and market access will benefit local residents. Green infrastructure and livelihood diversification operations will also benefit individuals who rely on pastures and forest resources.

Aside from the two river basins, the project will help build a national landscape resilience strategy, as well as climate adaptation efforts and long-term recovery for vulnerable rural communities. It will also provide a repeatable model for integrated national resource management that can be used in other vulnerable rural areas, as well as establish national and subnational ability to implement this integrated landscape management model.

Likewise, The Turkish government has been trying to expedite urban transformation in order to improve the urban built environment's resistance to earthquakes and other natural disasters such as floods, landslides, and climate change, particularly housing. The majority of housing stock in Turkish cities built before 2000, when contemporary seismic construction rules were implemented, is extremely sensitive to seismic and climate hazards and requires immediate reinforcement. Around 6.7 million residential buildings in Türkiye are anticipated to require structural retrofitting or reconstruction, at a cost of \$ 465 billion. [117] Only roughly 4% of these structures have been modified so far. Given the magnitude of the urban transformation target, existing public finance options for resilient retrofitting or reconstruction of vulnerable housing are insufficient to satisfy the vast financing requirements. Additional funding mechanisms are needed to make resilient housing retrofitting and rebuilding available to homeowners, particularly those in the middle and lower income groups, so that they can participate in the urban transformation process. The World Bank has been assisting Türkiye's Ministry of Environment, Urbanization, and Climate Change (MoEUCC) in addressing this critical issue of urban resilience.

With funding from the Japan-World Bank Program for Mainstreaming Disaster Risk Management in Developing Countries, the World Bank hosted a Virtual Knowledge Exchange for MoEUCC officials with the Japan Housing Finance Agency (JHF) on December 21, 2021. The goal of this virtual event was to discuss the Japanese experience with providing financial support to homeowners for home upgrades and retrofits to lessen the effects of earthquake and flood threats.

The MoEUCC representatives learned how JHF has contributed to increased housing re-

silience and energy efficiency in Japan by purchasing long-term fixed-rate mortgages applicable to high-quality housing from financial institutions, who then provide such mortgages to individuals for their residential properties, through the Virtual Knowledge Exchange. Representatives from the JHF highlighted their knowledge in providing mortgages for post-disaster rehabilitation of afflicted houses, as well as mortgages for seismic and landslide-related housing retrofitting and other disaster preparedness projects. JHF personnel also gave details on qualifying requirements, roles and duties of several agencies involved, JHF's technical inspections, and lessons gained from their funding operations.

JHF went into detail about how their operations helped to promote high-quality housing. JHF has launched Japanese Government subsidy-applied mortgages, which are interest rate deducted mortgages, to enhance high quality housing, not only in terms of resilience to natural hazards, but also in terms of durability, energy efficiency, and inclusive design. The usefulness of JHF's services in reducing damage and loss of housing has been demonstrated in previous disasters.

MoEUC officials learned about numerous design elements of different financing methods to promote seismic- and flood-resilient housing in Japan through the virtual knowledge exchange, which are relevant for solving the difficulties faced in Türkiye. It gave the Turkish government an ideal opportunity to learn about cheap financing choices and incentives for retrofitting and reconstructing houses to meet resilient standards while also enhancing energy efficiency and improving housing quality. Japan's experience and lessons can help Türkiye build finance arrangements to enable resilient home rehabilitation and achieve its urban development ambitions.

3.2 Resilience in Latin America

Earthquakes, volcanoes, hurricanes, high temperatures, droughts, floods, landslides, and other natural hazards endanger Latin America and the Caribbean Region (LCR). According to the World Bank's Natural Disaster Hotspots study, LCR is home to seven of the world's top 15 countries with three or more hazards [133]. Governments in Latin America and the Caribbean have long recognized the need to address hazard risk, and over the last few decades, they have worked to develop tools to effectively mainstream hazard risk management into development activities.

World Bank, previously known as the International Bank for Reconstruction and Development, has aided around 100 developing economies in fitting to the changes in world economy with means of loans and specialized advisory.¹ The group is vital in severe situations like involuntary immigration, epidemics, pandemics, climate change, etc. It has the capabilities to aid both by providing solutions and by integration of long-term developments. [125]

For instance, World Bank approved a \$75 million grant for Haiti's social protection. [131] This will help Haiti's efforts to build an adaptive safety net system to adjust to shocks, such as

COVID-19, and to reduce the country's susceptibility to food insecurity and potential hazards. Its aim is to allow the cash transfer program to be promoted in the event of an emergency, such as a natural hazard or a health crisis.

Furthermore, in cooperation with the World Bank, the Mexican government recently renewed its long-standing cat bond program to cover \$360 million in tropical storm and earthquake threats.[4]

Risk Management Solutions, Inc. (RMS) has the primary say in the image and degree of risk regarding all participants of financial instruments. They have been centre stage at alleviating hazard risk for more than three decades by helping organizations take better action and assure desired end results. Utilizing modeling science and state of the art technology, RMS allows improved risk assessment and certainty for all parties. Their models are the gold standard for the industry.[24]

For example, RMS has been working closely with Build Change in order to increase the Building Resilience for Vulnerable Communities like Colombia. More than 10 million people have migrated to Colombia's major cities, such as Bogotá and Medellín, in the last 20 years. Due to a shortage of affordable housing, many of these low-income families have relocated to the suburbs, where they build haphazardly with low-quality materials. This suggests that people are constructing homes without following any legal or standardized design procedures.

While city officials are aware of the problem, they frequently lack the resources to adequately address the growing vulnerability of their current housing stock, putting low-income families at risk of death, injury, and financial loss as a result of house damage or collapse in the event of a potential earthquake.

RMS has been collaborating with Build Change since late 2013, exchanging research and experience and providing early funding of their preventive program activities in Latin America – before a major earthquake strikes. This work focuses on promoting the opportunities of home retrofitting for low-income families living in Bogotá's informal communities, and includes collaborating with stakeholders to influence long-term policy changes, building local skill bases, and promoting insurance and financing solutions for low-income families. RMS earthquake risk modeling was used in this case in Colombia to not only help measure potential risks, but also to determine how risk levels could change if mitigating factors were implemented. The direct results of Build Change's retrofitting were analyzed by RMS in terms of costs, cost savings, damage prevention, and injury and death reduction.

RMS was able to determine the potential impact and cost effectiveness of a measured retrofit program, which has contributed to a broader acceptance of retrofitting in Colombia – as well as a greater institutional urgency to address the issue. It is founded that retrofitting homes in four neighborhoods over a ten-year period could prevent over 120,000 deaths and \$2.8 billion losses in 200-year case. [24]

3.2.1 The Caribbean Catastrophe Risk Insurance Facility

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) was established in 2007 as the World's only multi-country risk pool and it is a Caribbean-based segregated portfolio company that is owned, managed, and licensed. It was created with the assistance of the WB and a grant from the Japanese government. It was funded by donations from the Canadian government, the European Union, the governments of the United Kingdom and France, the World Bank, the Caribbean Development Bank, and the governments of Ireland and Bermuda to a Multi-Donor Trust Fund (MDTF), as well as membership fees paid by participating states. It currently has 23 members consisting of 19 Caribbean governments, 3 Central American governments and 1 electric utility. [26]

The facility sees enhancing climate change adaptation capacity and hazard risk management among its members as an important part of its role, and perceives comprehensive disaster risk management (CDRM) as an essential component of regional development. CCRIF shares its members' desire for long-term economic growth, environmental sustainability, fiscal responsibility, and poverty eradication. As a result, CCRIF assists its members in the implementation and development of hazard risk management and climate change adaptation plans aimed at decreasing vulnerabilities and increasing resilience.

CCRIF assists in the alleviation of short-term cash flow issues to the small developing economies that suffer from major natural hazards. Its parametric insurance mechanism enables it to give quick payouts to members in order to not just help them finance their early hazard response but also keep core government activities running smoothly.

When a parametric insurance policy is activated, it immediately provides short-term liquidity to Caribbean and Central American governments, limiting the financial effect of catastrophic hurricanes, earthquakes, and excessive rainfall events. It is the world's only regional fund to use parametric insurance, providing member governments with a one-of-a-kind opportunity to obtain earthquake, hurricane, and excess rainfall hazard coverage at the lowest feasible cost.

3.2.2 Case Study 3 (El Salvador)

El Salvador, although being Central America's smallest country, has a long history of devastating earthquakes, tropical storms, volcanic eruptions and droughts. The national government is collaborating with GFDRR to guarantee that the country's economic development progress is robust to the country's and region's increasing climate and catastrophe risks.

The Salvadoran government's top priority are to improve infrastructure and public services. As a result, GFDRR has been assisting with analytical and capacity-building efforts aimed at assisting the government and local governments in identifying, prioritizing, and implementing resilient economic development.

The Ministry of Local Development has established a comprehensive framework for authorities to assess the suitability of investments in local economic development whereas taking into account a wide variety of resilience considerations, such as hazard exposure and vulnerability, social and environmental impact and the long-term viability of operations and maintenance in collaboration with a technical team supported by GFDRR. GFDRR has also aimed its support toward the construction of a community involvement framework for resilient economic growth in municipal marketplaces, at the demand of the Salvadoran government. [129]

The concluded community engagement structure provides a template for intervention on resilient economic development, covering areas such as social capital, structural vulnerability, social environment, and information and communications, based on these insights and a structured review of hazards affecting the country's municipal marketplaces.

GFDRR's assistance for El Salvador's analytical work to resilient economic growth has been supported by a variety of capacity-building efforts aimed at maximizing the results' adoption.

For Türkiye:

The World Bank awarded a \$265 million loan to Türkiye in July 2021 to improve the seismic safety of public buildings while simultaneously boosting energy efficiency to minimize energy bills and damaging carbon emissions. [118]

More than 140 schools, dorms, hospitals, and government buildings will be better insulated, strengthened, or rebuilt as part of the Seismic Resilience and Energy Efficiency in Public Buildings Project. More generally, more than 6 million individuals who rely on the public services offered by the targeted buildings will benefit.

Türkiye is one of the most earthquake-prone countries in the world, with 76 earthquakes since 1900 resulting in nearly 90,000 deaths, affecting over 7 million people, and causing direct losses of over \$425 billion dollars. [118]

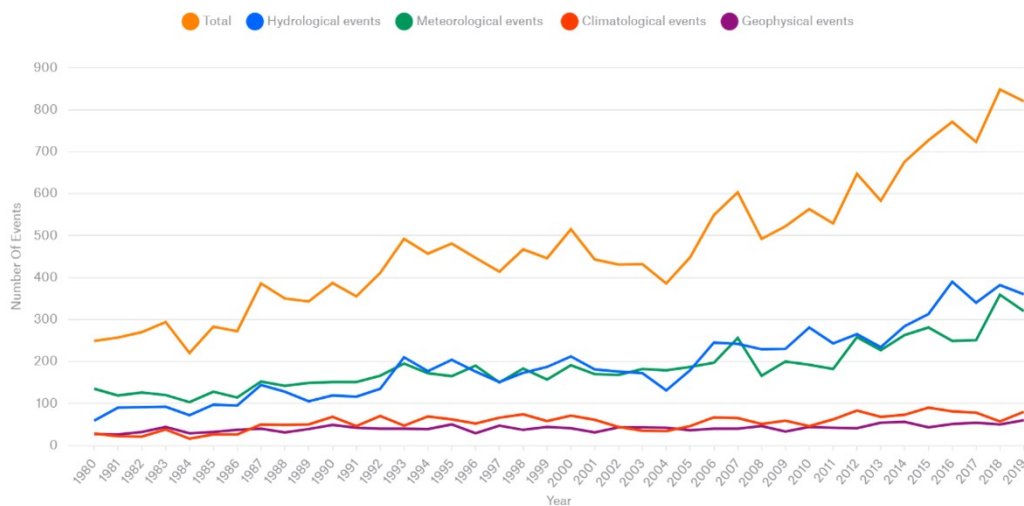
The project's main components include:

- Seismic strengthening and energy efficiency improvements in central government buildings: This will include structural strengthening to reduce earthquake risk and increased climate change adaptation interventions, such as strengthening roofs to withstand wind and snow loads and rainwater harvesting during times of water scarcity. Measures to improve energy efficiency will let buildings' occupants have more functioning and comfort during extreme heat and cold events, which are predicted to become more common as a result of climate change. Promotion of alternative energy sources, such as solar panels, will help businesses stay open in the event of a crisis.
- Advanced technical support and capacity building: This entails the creation of a long-term, greatly scaled-up investment program aimed at improving public building energy efficiency, structural strength, and multi-hazard resilience.

3.3 Resilience in Europe

Several major hazards have struck Europe, causing significant economic damage and deaths, as well as fatalities and social disruption. The 2010 eruptions of Iceland’s Eyjafjallajökull volcano, droughts and forest fires in Portugal and Spain in 2012, earthquakes in Italy in 2009 and 2012, heavy rainfall that triggered historic floods in Central Europe in 2013; floods in the United Kingdom in the summer of 2007, and the winters of 2014/15 and 2015/16; and a hail storm that struck France, Belgium, and Western Germany in 2014, are just a few examples. [81]

As a result of the predicted growth of urban and economic activities in hazard-prone regions, natural hazard threats and losses in ope are expected to continue to rise as seen in Fig 3.2. Furthermore, climate change could increase the frequency and severity of severe climate and weather events including droughts, heavy precipitation and heat waves.



Source: [81]

Figure 3.2: Loss events worldwide 1980 – 2019

Consequently, it is essential to take comprehensive action on hazard risk in order to enhance European societies’ resilience to natural hazards. As the existing situation in Europe demonstrates, insurance can be offered publicly, through a partnership, privately, subsidized, or mandated, based on the concept of solidarity or as a risk-based market mechanism.

The European Investment Bank helps developing countries find innovative solutions to promote sustainable growth, human rights, reduce poverty and inequality, and improve lives. [81] Since its establishment in 1958, in over 140 countries around the world, the EIB collaborates closely with other EU institutions to encourage European integration, promote EU growth, and support EU policies. In 2007, the EIB issued the world’s first Green Bond, labeled a

Climate Awareness Bond (CAB). As at end 2020, EIB remains a world leader issuer of Green Bonds with over €33.7bn raised across 17 currencies, of which the € equivalent of 6.8bn in 2020. [36]

There exists excessive examples of EIB to improve the investment in green bonds. One great example would be the discussion about reducing the global carbon footprint which the interactive live event 'Investing in Climate Action: The Make-or-Break Decade' brought together climate leaders and experts from around the world. The EIB's job includes raising climate resilience and pioneering work on green bond growth, as well as leadership in the phase-out of fossil-fuel financing. The EIB recently approved a Climate Bank Roadmap, which outlines plans to support €1 trillion in climate action and environmental sustainability investments by 2030 and to increase annual climate action and environmental sustainability funding to at least 50% of EIB activities by 2025. [40] Furthermore, the EIB has agreed to avoid funding existing fossil fuel energy projects and instead concentrate on renewable energy, energy conservation, alternative fuels, and the infrastructure that supports the growth of these technologies.

Another remarkable example is about implementation of an agreement for €875 million in new long-term European Investment Bank funding for Greece. [41] Hundreds of local sustainable urban investment schemes and energy efficiency projects in towns and cities across the country will begin. Water and wastewater, waste management, road safety and environment adaptation, smart city projects, flood control, earthquake protection in schools, and strengthening public health initiatives against COVID-19 will all be supported by a €500 million 25-year loan from the EIB. [37]

Furthermore, the 28 EU Member States demanded the Economic Resilience Initiative(ERI) in 2016 as part of the EU's coordinated response to the challenges faced by mass displacement and migration as a result of Syria's civil war as is shown in Fig 3.3. ERI's goal is to encourage high-return public and private investment in order to address the various problems in Europe's Southern Neighbourhood and the Western Balkans. The project is being carried out in close collaboration with EU member states, the European Commission, and other stakeholders. The first countries to apply to ERI were Croatia, Bulgaria, Italy, Lithuania, Poland, Luxembourg, Slovakia, Slovenia, and the United Kingdom. [38]

It works on long-term options that are critical for successful growth in shock-prone countries. If combining funds from the donor sector with EIB funding, ERI provides a package of loans and creative financial goods. Donor donations assist in unlocking investments that can help generate new opportunities in the regions, especially for disadvantaged social groups such as young people and women. The ERI Fund allows donors, especially EU Member States, to take advantage of the EIB's full range of instruments networks, and resources to optimize the development effect of mutual finance in affected regions and contribute to the UN Sustainable Development Goals. The ERI Fund was founded as part of the Partnerships Platform for Funds, which is run by the EIB.

The Economic Resilience Initiative benefits both the public and private sectors in terms of

investing in utilities such as clean water, oil, and power, particularly in areas where infrastructure needs have been exacerbated by migration; but also, for example, enhancing schooling, healthcare, municipal transportation, and urban services. Also, expanding private sector, resulting in more job openings, such as by increased funding for small companies and micro-enterprises.

EIB primarily employs four categories of instruments to aid economic development:

- Private equity funds promoted by a growing number of private equity fund managers whose investing practices emphasize social and environmental considerations, as well as long-term viability.
- Lending in local currency, especially to micro and small businesses (MSMEs) and entrepreneurs, to boost access to capital.
- Risk-sharing mechanisms, such as first-loss insurance, guarantees, junior equity tranches or subordinated debt, which would allow the EIB to share risk with local banks in order to assist underserved MSMEs.
- Direct funding in the form of debt or equity contributions in projects with significant developmental effects, but which often carry a greater risk of failure and difficulty in recouping the investment.

More than 60 projects worth a total of €5.65 billion have been funded under the ERI. The plan is estimated to bring in an additional €15 billion in funding. About half of the money was spent on private sector growth. About 11,000 small and mid-cap firms would profit from lending by affiliate banks alone, sustaining over 218,000 positions. Currently, the public sector is investing €1.35 billion. [73]



Source: [37]

Figure 3.3: European Investment Bank's Economic Resilience Initiative

3.3.1 Case Study 4 (Romania)

Faced with the threat of worsening natural catastrophes as a result of climate change, Romania may draw on its lengthy experience dealing with natural hazards. Over the last five decades, there have been upwards of 85 catastrophic occurrences, resulting in more than \$6 billion in losses and destruction. [7] Earthquakes and floods are very damaging to the country.

The government of Romania, in collaboration with GFDRR, has been scaling up its efforts to involve and empower civil society organizations (CSOs) in national efforts to improve resilience to hazards and climate change in a country with a strong nongovernmental sector. The organization has played a crucial role in allowing information sharing, creating collaborations, and crowd sourcing scalable disaster risk management(DRM) solutions in Romania, with an emphasis on relying on the skills and experience of civil society. [73]

The Bucharest Community Foundation, another civil society organization, used the platform to strengthen its contact with many of its business sector supporters.

A technical team, sponsored by GFDRR, held a workshop under the platform's sponsorship to highlight the necessity of investing in DRM in Romania to representatives from the group's funders. Also, a technical team has collaborated with the Ministry of Public Finance to create a tool for analyzing catastrophe fiscal implications.

For Türkiye:

The European Investment Bank (EIB) is giving Türkiye with an additional €200 million in funding to improve earthquake resilience. By considerably renovating or replacing existing dwellings, the EIB funds aim to increase Türkiye's residential buildings' seismic resilience. The associated energy efficiency improvements will also be eligible works. Similar work on public buildings was already funded by the EIB with a total of €500 million in the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP), which was launched in 2006 as a proactive approach to managing earthquake risks through prevention and mitigation in the aftermath of the devastating Marmara earthquake in 1999. [111]

The Council of Europe Development Bank (CEB) and Türkiye's Ministry of Treasury and Finance signed a third €100 million loan agreement to fund the İstanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP).

ISMEP, which began in 2005 under the sponsorship of the administration of İstanbul province, is one of the world's largest single city seismic risk mitigation programs. It aims to put in place a comprehensive set of mitigation measures as well as a disaster management system to progressively transform Istanbul into an earthquake-resistant city. [110]

Over the next 20 years, İstanbul is expected to see a seismic event with a magnitude in the 7.5 range on the Richter scale, according to experts. An earthquake of that magnitude would cause even more personal, economic, and environmental damage than the disastrous Marmara

earthquake of 1999.

The CEB has so far provided ISMEP with two loans totaling € 250 million. The first loan was granted in May 2010 and completed in September 2014, while the second loan was approved in March 2014 and completed in March 2019. The CEB's third ISMEP loan will assist Türkiye consolidate the gains obtained with the previous two loans and expedite earthquake preparedness and risk mitigation by focusing on public school and health facility renovation. [110]

3.4 Resilience in Africa

Africa is a vastly diverse continent with tremendous potential in a wide range of industries and sectors. African countries are changing in a variety of ways, including demographic shifts, industrialization, urban growth, innovation, and migration flows. The lives of millions of people are changing for the better. The area has a wealth of natural resources and will benefit from the youth dividend.

Unfortunately, it is confronted with significant challenges such as volatile commodity markets, the threat of trade wars, natural hazards, severe weather, poverty, climate change, political unrest, and income inequality. For instance, extreme weather events, such as tropical storms, floods, rising sea levels, sand erosion, and prolonged droughts, pose a greater threat to agricultural yields, food and water security, habitats, livelihoods, health, infrastructure, and migration on the continent.

Based on the UNFAO, climate change could trigger a 50% drop in crop yields in some of Africa's poorest regions by 2020. [43] Climate change is likely to raise poverty, unemployment and inequality by affecting essential resources such as food, water, and land, as well as increasing competition for natural resources, resulting in further migration, refugees, and livestock scarcity. As more people struggle to secure access to capital, failing to acknowledge climate change could exacerbate political, social, racial, and religious tensions.

These issues necessitate a significant amount of targeted investment. Mobilization of development partners, private industry investors, and project promoters is needed. The continent requires investments in public infrastructure projects that improve quality of life and minimize inequality while also increasing resilience to climate change and unexpected shocks.

Resilience is critical for Africa's sustainable growth and achievement of the Sustainable Development Goals by 2030. Long-term resilience allows low- and middle-income countries across Africa overcome socioeconomic challenges that hinder growth. [39]

In order to make Africa a more resilient continent, the European Investment Bank works on several issues such as;

- Enhancing critical infrastructure that improves people's lives, promotes inclusive and

sustainable development, and creates employment. This includes; better transportation, urban growth, sanitation, and health care in order to avoid potential hazards. These infrastructure investments will increase revenue mobilization and minimize reliance on commodities. Furthermore, people are particularly reliant on ecosystem services for their livelihoods and food. So, pollution of the air and water, waste management, deforestation, land loss, and biodiversity are all issues that need to be addressed.

- Increasing the amount of funds available to the private sector via financial intermediaries. This helps underserved and disadvantaged communities access financial services, boosts economic development, and makes countries more inclusive. Also, this will help to diversify economies, making countries and regions less vulnerable to external shocks. This approach includes, a greater ability to take on risk and engage with a larger number of counterparts in order to have more long-term financing, risk sharing to increase small and underserved enterprises' access to capital and providing equity to entrepreneurs to help them start and expand their enterprises, as well as loans in local currencies to microfinance companies.

- Capacity building and technical support in the private and public sectors to create a deep stream of projects and facilitate successful and timely project delivery.

Since African countries' financing needs vary, the European Investment Bank provides a variety of instruments, many of which are combined. Grants are often important, particularly in conflict-affected countries, vulnerable regions, or situations where investments are at risk. They come from the European Union, EU nations, and other sources which are channeled through the Bank to the projects and they are available from the Bank, and these can be paired with EIB loans for technical assistance or investment. Concessional financing customized to the needs of borrowers is also available from the Bank. The European Investment Bank use a variety of insurance products and first-loss policies to minimize risk and help private companies that are having difficulty obtaining funding in difficult circumstances.

To expand sustainably, create opportunities, and improve people's lives, African countries must become more vulnerable to external shocks. The Bank funds programs that help Africa achieve economic development and stability. Instead of funding African countries' general budgets, it makes contributions that encourage private sector participation and support home-grown enterprise solutions and creative problem solving.

A resilient Africa provides the world with numerous benefits, including trade, leverage, political partnerships, finance, and the promotion of shared solutions on global issues such as climate change. Africa's labor pool and ability to quickly embrace new technology, especially in telecommunications and electricity, can provide considerable opportunities for businesses globally.

3.4.1 African Risk Capacity (ARC)

ARC was founded in 2014 with the goal of providing drought help to African countries. The World Food Programme, which is part of the African Union, was responsible for this establishment. It is a mutual insurance business, similar to the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Firm (CCRIF), however nations that supplied loans to fund the company (Germany and the United Kingdom) are also members. It is led by 34 African Union Member States as is seen in Fig 3.4. [18]



Source: [18]

Figure 3.4: ARC Member States

ARC is comprised of two parts: the Specialized Agency and a financial affiliate, ARC Insurance Company Limited (the Company). The Agency is a cooperative structure that oversees and supervises the development of ARC capabilities and services, as well as providing capacity building to individual nations and approving and managing contingency plans. The Company is a financial associate that performs commercial insurance operations such as risk pooling and risk transfer in line with national regulations for parametric weather insurance in Bermuda (where it is located until an equally favorable regulatory and legal regime exists in another AU Member State).

African governments are planning, preparing, and responding to natural hazards in new ways thanks to the African Risk Capacity. ARC's goal is to develop the continent's catastrophe risk management systems via innovation and collaboration through capacity building and risk pooling. It helps nations to control their risk as a group in a financially effective manner in order to respond to likely but unclear hazards by leveraging local expertise and the inherent diversity of weather risk throughout Africa. While these strategies are not new, they may be used in novel ways by African governments to reduce the cost of catastrophe response – before

they become humanitarian catastrophes – and deliver better services to people impacted.

Africa Risk View

Africa Risk View is a major product of the ARC Agency, serving as the technical engine of the ARC risk pool. Its drought product integrates data on vulnerable people with current operational rainfall-based early warning systems on agricultural drought in Africa to create a uniform way for evaluating food insecurity response costs throughout the continent. [18]

In addition to supporting ARC, it offers decision-makers with projected and likely maximum costs of drought-related interventions before and during the agricultural season in every nation in Sub-Saharan Africa. Defining and quantifying risk in this objective manner can help countries and their partners guide appropriate drought response decisions and target food safety investments, in addition to offering a financial early warning tool.

Africa Risk View is developed to explain many forms of meteorological data, such as rainfall projections and agricultural information like soil and cropping cycles. These data are then transformed into useful indicators for agricultural productivity and pasture, which are subsequently applied to vulnerable communities that rely on rain for crops and farmland for their survival. Africa Risk View then utilizes this data to predict how many people are likely to be directly influenced (or have been affected) by drought or low rainfall during a particular season. It analyzes the response expenditures to the observed drought event based on cost per impacted person estimates.

Estimates of the number of people impacted and the cost of responding might be computed for the entire African continent, a region, a single country, or a portion of a country. All components of the underlying Africa Risk View can be customized by users. Nations can also use the program to designate how much of the modeled drought risk they want to transfer to the ARC risk pool for each year by selecting ARC risk transfer parameters.

Africa Risk View's data has greater use beyond only assisting ARC. It might aid early food safety assessments in particular geographic areas as well as contingency planning and emergency preparations in the event of future shocks in a nation. It can also assist in better understanding the drivers and causes of food insecurity in a certain area, allowing the optimal investments or risk management solutions to be made. The tool might potentially be used to enhance micro insurance programs by directing planning and investment decisions targeted at increasing agricultural production or market growth. The tool now focuses on drought but work to cover hazards from river floods and tropical cyclones is continuing.

3.4.2 Case Study 5 (Ghana)

Ghana is one of the West African nations most prone to floods, which have disastrous consequences, particularly for the urban poor. Flood risk management (FRM) regimes and sustainable adaptation measures are urgently needed in Ghana since flood occurrences are predicted

to become more frequent and severe as a result of climate change. To address this, the Ghanaian government has implemented a number of flood mitigation programs. For instance, the National Water Policy establishes flood mitigation measures such as early flood warnings, assuring that mitigation techniques are implemented in conjunction with impacted populations, and enforcing buffer zone restrictions. Buffer zone restrictions, as specified by Ghana's National Water Policy, attempt to keep people from living within a specific distance of river banks. Another key strategy is the Blue Agenda, which focuses on public education and construction code enforcement to prevent floods and associated concerns. [20]

Challenges for FRM

Unfortunately there are some challenges of FRM. To begin with, there is no explicit legislation dealing with flood DRR, meaning that developing rules or a legal instrument might be a vital activity and there is no dumping regulation legislation in place. This was emphasized as critical in ensuring good canal upkeep. As a result, the government's legislative body should make establishing a dumping regulation law a top priority. Also, there is a dissatisfaction with the traditional approach to water control infrastructure design and there exist a social capacity challenge which is an inadequate flood risk and warning information transfer existence.

Opportunities for FRM

Though there exist some drawbacks regarding FRM, it is nigh impossible to deny the benefits and opportunities. Firstly, it improves the capabilities of affected population with upgrades and repairs in infrastructure that translate to a more resilient economy. Severe consequences to flood related destruction of crops would weigh less upon the farmers, with monitoring technology and increased personnel capacity. Second, preexisting warning systems are outdated and are mostly reactive and these should be converted to be active and be checked upon constantly. Third, simulated exercises in risky areas shall be maintained and improved. Feedback and post-assessment should be made so that reactive action can be taken to further improve DRR. Fourth, education for institutions that utilize FRM and DRR should be provided hand-in-hand with software. For instance, Ghana's strong mobile network and coverage is essential before, after and during flooding to provide and receive warnings and update. Finally, the interdependent policy network of governments, agencies and members of society should be examined to grasp the evolution and consequences of FRM and DRM. To act as a guidance beacon of governance, topics of empowerment, infrastructure improvement, representation and social equality should be the key points to be questioned and pondered upon.

For Türkiye: In terms of losses, floods are the second most damaging natural hazard in Türkiye after earthquakes. The graphic depicts 107 floods, 66 large forest fires, 16 incidents of heavy snowfall or blizzards, and 39 landslides based on data from 2021. The EU's Flood Risk Assessment and Management Directive attempts to mitigate the negative effects of flooding. However, in order to completely meet all of the directive's objectives, Turkish law and procedures have to be improved. [42]

The goal of this project is to improve the Ministry of Forest and Water Affairs' and State

Hydraulic Works' (DS) administrative and technical capacity to adopt and execute the EU directive on flood management and risk assessment.

The directive's first step is to align current legislative and administrative structures with it. Upskilling personnel in the directive's requirements, such as completing preliminary flood risk assessments, generating flood hazard maps, identifying flood threats, and preparing flood risk management plans, was part of this project. Study tours to member states are providing firsthand knowledge in implementing the directive.

Following that, the directive's criteria will be tested in the Batı Karadeniz river basin, which was severely flooded in 1998. The findings of this pilot study will serve as the foundation for a countrywide implementation plan for the directive. This plan will also take into account the impact of enforcing the rule as well as the expected flood management expenditures.

Various stakeholders (local governments, industry, farmers, the tourism sector, NGOs) and the general public will be involved in the project through an education campaign that includes public consultations and workshops.

The strengths and weakness of resilience implementation across continents are showed in Table 3.1.

Table 3.1: Strengths and Weaknesses of Resilience Implementation Across Continents

| | South Asia | Latin America | Europe | Africa |
|-----------------|--|----------------------|---|---|
| Strength | <ul style="list-style-type: none"> • Faster growth in economy (domestic consumption and investment) | None | <ul style="list-style-type: none"> • Availability of a wide variety of resources • Leading cultural and creative cities | <ul style="list-style-type: none"> • Increase in industrializing • Fast-growing population and markets • Improvement in foreign markets and financial services |

| | | | | |
|-----------------|---|---|--|---|
| Weakness | <ul style="list-style-type: none"> • Social exclusion • Volatile capital risk • Increased poverty • High agriculture prices | <ul style="list-style-type: none"> • Strong headwinds • A decrease in exports and commodity prices • Low regional productivity • Tighter access to finance • A scarcity of growth-promoting investments • Incapability of allocation of resources | <ul style="list-style-type: none"> • High population density • Inadequate infrastructures • Lack of public green areas • Frequent climate-related hazards • Migration flows • An increase in poverty and social inequalities | <ul style="list-style-type: none"> • International economic fluctuations • Health crises • Extreme weather • Unanticipated population movements inside and across countries • Food crises • Governance challenges |
|-----------------|---|---|--|---|

Source: [53, 55]

When above continents are compared with Türkiye, it is expected that Türkiye's economic growth fall from 11% to 2% in 2022 according to various resources and as it is stated in Chapter 3.1, inflation rate and consumer prices are sharply increasing so there exists a common point between South Asia's weaknesses and Türkiye. In addition to this, Türkiye's industrial production expanded by 9.6 percent in March of 2022, falling from a 13.3 percent rise in the previous quarter according to trading economics. [9] Likewise, in Latin America, there exists also a low regional productivity.

Similarly, both Africa and Türkiye has fast-growing populations but it is crucial to inform people about what and how the resilience could be implemented in Türkiye so that more resilience investments and projects could be applied in the future. Unfortunately, Türkiye has economic downturns in those times, and this creates a question mark whether resilience projects are applicable or not.

CHAPTER 4

RESILIENCE IN TÜRKIYE

Türkiye is situated in an area where hazards, especially earthquakes, are common. Apart from hazards such as landslides, floods, and avalanches, Türkiye's geographical position puts it in the middle of humanitarian hazards that are better characterized as man-made hazards.

It has made headway in decoupling growth from a variety of environmental challenges, but the country's natural resources and environment continue to suffer as a result of fast population increase, urbanization, and industrialization. [95]

Unfortunately, Türkiye faced an unforgettable hazard which is the Marmara earthquake in 17 August 1999. It became a pivotal point in hazard prevention and planning. This catastrophic event highlighted the need for disaster management reform, leading the nation to create a single government agency to organize and exercise legal authority in disaster and emergency situations. The Turkish Parliament established the Disaster and Emergency Management Authority in accordance with this strategy.(AFAD in Turkish abbreviation) [14]

AFAD is a federal agency tasked with minimizing hazards and hazard-related costs, as well as planning and coordinating post-hazard response and encouraging collaboration among government agencies as is seen in Fig 4.1. In addition to 11 search and rescue teams, the institution has 81 regional branches throughout Türkiye. It collaborates with a variety of government agencies and non-governmental organizations depending on the scope and seriousness of specific cases, despite its status as the sole leader on hazards and emergencies.

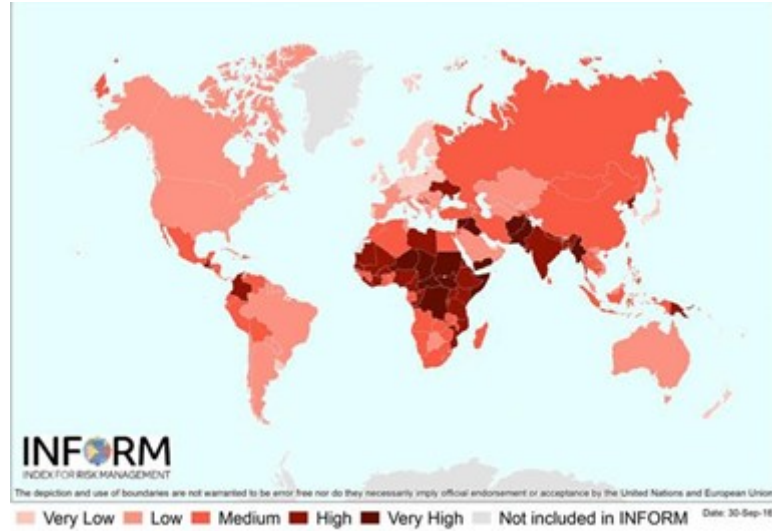
AFAD has successfully coordinated Türkiye's response to a series of devastating earthquakes and floods, among other hazards and has assisted survivors in getting their lives back on track. It has completed well-known humanitarian missions in over 50 countries across five continents, including Somalia, Ecuador Palestine, Yemen, the Philippines, Chad, Nepal, Mozambique and many others. [15]



Source: [15]

Figure 4.1: Strategic areas and goals of AFAD

Türkiye, according to a study focused on the Global Risk Management Ranking, is in the low risk category of countries facing humanitarian crises and hazards, with an index score of 5.06 as shown in Fig 4.2. Considering that the ratings for countries in this category vary from 3.30 to 5.49, Türkiye is near the top of the list. Also, it is the 113th most dangerous country in the ranking, which includes 180 nations. It is ranked 108th in terms of exposure, with a score of 12.30, and 112th in terms of vulnerability, with a score of 41.11. [15]



Source: [6]

Figure 4.2: Global Risk Index

Since Türkiye is in a risky location, AFAD concluded its mission statement as, "to create a hazard-resilient society." This strategy aims to mitigate potential damages by minimizing risk in advance of an incident and developing the capacity to respond quickly and effectively if an incident occurs.

Furthermore, The European Bank for Reconstruction and Development (EBRD) which was founded in 1991 put a lot of effort towards boosting the resilience and accelerating the transition to a greener economy in Turkey as shown in Table 4.1. It prioritized the following strategic targets for 2019-2024 for Türkiye: [34]

Table 4.1: EBRD Strategic Targets for Türkiye(2019-2024)

| Strategic Priorities | Expectations in 2024 | Actions |
|---|---|---|
| <p>Enhancing the financial sector’s resilience and developing domestic resources and financial markets.</p> | <ul style="list-style-type: none"> • Improving the financial sector’s resilience by maintaining capitalization, a sustainable financing system, and sound risk management practices in the banking sector. • Widening and diversifying debt and domestic equity capital markets. • Increasing digitalization and reliability in the provision of financial services. | <ul style="list-style-type: none"> • Assisting financial institutions in strengthening their capacity to lend to the real economy and households as a reaction to the recent downturn in bank lending. • Encouraging the use of alternative financing sources and modern, less common, or more advanced fixed and floating rate instruments(ex: Islamic instruments, project bonds debt funds and securitization, among others.) • Supporting the advancement of financial innovation, such as novel outcome-based finance mechanisms like impact bonds and FinTech (financial technology) (e.g. crowd funding, e-payment platform). |

| | | |
|---|--|--|
| <p>Promoting good governance and encouraging Türkiye’s knowledge economy and significant advancement practices.</p> | <ul style="list-style-type: none"> • Extending higher value-added activities by greater supply chain alignment and increased service practices of local businesses. • Enhancing innovation ecosystem. • Involving private sector to infrastructures with a more level playing field. | <ul style="list-style-type: none"> • Providing corporates (including SMEs) with direct and/or indirect funding and consulting services, with an emphasis on backward/forward linkages, export competitiveness, technology improvements, and skills transfers, as well as facilitate best-practice corporate governance and market standards. • Assisting corporations in implementing new practices and innovations by providing direct funding or consulting services for “Industry 4.0” investments, as well as assisting market leaders and “Blue Ribbon” high-potential SMEs, including through the RSF. • Encouraging the commercialization and corporatization of municipal services to increase their quality and operational and financial performance. |
| <p>Engaging the private sector to promote economic inclusion and gender equality.</p> | <ul style="list-style-type: none"> • Improving access to entrepreneurship and skills for inclusion target groups, such as youth and refugees. • Developing economic opportunities and gender equality. • Increasing more access to services and economic opportunities in less developed areas. | <ul style="list-style-type: none"> • Looking at different conduits and distribution networks to reach out to inclusion focus groups, such as youth and refugees. • Continuing to promote women’s inclusion in the work force through programs such as equal opportunity, supply chains, and women on boards. • Encouraging the expansion of infrastructure (including social infrastructure) and access to private and public services in remote areas, especially in refugee-hosting areas, in order to create economic opportunities. |

| | | |
|--|---|--|
| <p>Accelerating Türkiye’s transition to a green economy and improving regional electricity connectivity.</p> | <ul style="list-style-type: none"> • Expanding renewable energy potential and a more diverse energy mix. • Improving energy and resource quality, climate resilience, and environmental performance. • Developing energy resilience and concrete steps toward a dynamic energy market, with a greater share of the private sector. | <ul style="list-style-type: none"> • Providing renewable energy programs with direct and indirect funding (wind, hydro, solar, geothermal, biomass and distributed generation). • Supplying direct and indirect energy efficiency funding, with an emphasis on manufacturing, agriculture, transportation, and buildings – including promotion of green buildings, smart/green technology, and emissions-reduction programs under the Green Cities Framework. • Assisting with network upgrades for renewable energy integration, smart metering/smart grid infrastructure enhancements, regional interconnection and energy efficiency application implementation. |
|--|---|--|

Source: [33]

According to these strategic targets, expectations and actions there exist some implementation risks and protection of them through risk control strategies. First of all, Türkiye is facing an economic volatility such as the devaluation of the lira and interest rate and inflation rate increases. This leads to an increased susceptibility of banks and local companies as well as reduced investor interest. Unfortunately, since investors lost their confidence, they would limit their business opportunities about investing in resilient projects in future. Also, uncertain political developments and an insecure environment might restrict funding available from important donors (like the European Union) and increase the risk of an investment. These would be the highest risks of the implementation of the strategies in Turkey but EBRD could manage those risks through; finding clients with resilience priorities, avoiding too concentrated sub-sectors or related businesses by diversifying customer’s portfolio, attempting to co-financing with other International Financial Institutions and adjusting the duration of clients’ investments to produce reflows and increase the capacity available for future investments.

In addition to EBRD, the World Bank also supported Türkiye since it has been battling the effects of COVID-19 and the bank has provided \$1.5 billion in finance for five crucial development initiatives as is seen in Table 4.2. Their goal is to protect people and businesses while enhancing climate resilience.

Table 4.2: Financing supportive projects of World bank for Türkiye

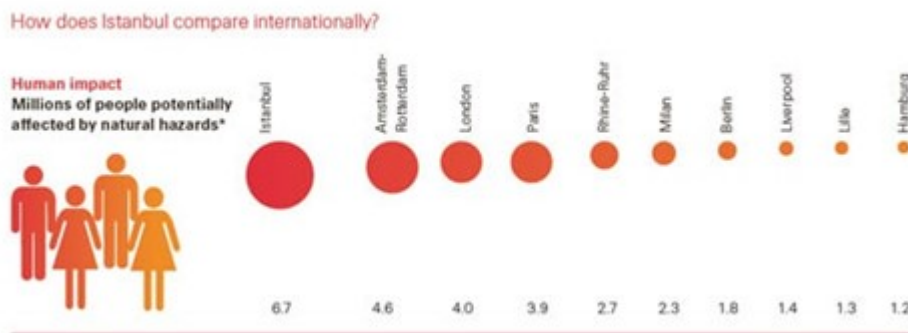
| <i>Financial assistance elements</i> | <i>Projects</i> |
|--|---|
| Encouraging Türkiye's Response to the COVID-19 | <ul style="list-style-type: none"> • <i>The \$500 million Türkiye Emergency Firm Support Project</i> intended to ensure that small and medium firms (SMEs) impacted by or responding to the economic consequences of COVID-19 had access to credit. • <i>The \$300 million Rapid Support for Micro and Small Companies During the COVID-19 Crisis Project</i>, led by KOSGEB, aims to keep viable micro and small enterprises open and sustain employment levels in the face of the pandemic. |
| Keeping the Long-Term Development Agenda in Mind | <ul style="list-style-type: none"> • The \$300 million Organized Industrial Zones Project supports investments in "green" infrastructure, such as improved water and energy efficiency facilities, developed wastewater treatment plants, and energy-efficient structures in industrial zones, as well as in "basic" infrastructure. • <i>The \$135 million Türkiye Resilient Landscape Integration Project</i> focuses at enhancing rural populations' lives and infrastructural services in the eastern Black Sea Region and in the central Anatolia. • <i>The \$265 million loan to Türkiye's Seismic Resilience and Energy Efficiency in Public Buildings Project</i> improves the seismic safety of public buildings while also lowering energy expenses and reducing damaging carbon emissions |
| Syrian Refugee Crisis-Related Development Challenges | <ul style="list-style-type: none"> • Municipal Services Improvement Project in Refugee Affected Areas • Formal Employment Creation for Refugees and Turkish Citizens • Employment Support and Activation of Work-Able People under Protection and Turkish Citizens Project • Agricultural Employment Support for Refugees and Turkish Citizens through Enhanced Market Linkages • Social Entrepreneurship, Empowerment and Cohesion in Refugee and Host Communities |

Source: [126]

As stated previously, Turkey is prone to natural hazards due to its geographical location and according to the Desinvanter Database, 196 earthquakes struck Turkey between 1900 and 2020, killing about 100,000 people. [67, 72]

Istanbul is well known as the Türkiye’s economic powerhouse. Over than 40% of the country’s GDP is generated in the city. However, millions of people who live and work in this thriving metropolis are constantly at risk of devastating earthquakes. The Northern Anatolian Fault caused a weakness in the soil ’s crust that generated severe earthquakes in 1999 in the cities of Kocaeli and Izmit. Both the private sector and government have taken significant steps to improve urban resilience and insurance coverage since then. As previously stated in Chapter 2 in section 2.1.1, the TCIP for homeowners was established.

According to Swiss RE experts a huge earthquake near Istanbul would cause a total economic loss of \$90-120 billion, with around three-quarters of it remaining uninsured. It is estimated that 6.7 million people will be exposed which is 2 million more than in Amsterdam-Rotterdam and 2.7 million more than London as shown below as shown in Fig 4.3[106]



Source: [106]

Figure 4.3: Risk comparison of Istanbul and other countries

Since the upcoming earthquake is unknown, government has already been taking actions in order to increase the resilience in the city. Significantly, the government-sponsored Turkish Catastrophe Insurance Pool (TCIP), which is operated by Eureka Sigorta, provides earthquake insurance for homes. Also, Bosphorus Ltd. Series 2015-1 Class A is a cat bond which helps to build relationships with the capital markets. The bond features a parametric trigger that generates an immediate payout to TCIP if the specified earthquake criteria are met, and it provides three-year coverage as a derivative.

In the case of an earthquake, Türkiye’s capacity to shift disaster risk to foreign capital markets will assist the country to minimize pressure on government finances and the broader economy. Thanks to the TCIP, approximately 52,80% of Türkiye’s homes have earthquake insurance now. It became one of the world’s major catastrophic insurance pools and turned into the most sophisticated one by offering second cat bond. [30]

Reminding people of the earthquake threat and its negative consequences is a challenging goal to attain; yet, offering information and raising awareness is possible. According to the

findings of a survey conducted by Özdemir and Yılmaz (2011), the biggest reason for not purchasing required earthquake insurance is a lack of knowledge about the advantages and application processes. [137] This highlights the importance of delivering more information to people about the advantages and use of this insurance system, maybe through the use of additional media and social resources. [100]

According to Kunreuther and Pauly (2004) better knowledge provided to the people about the likelihood of an earthquake occurrence, the extent of potential damage to their houses, and the structure and the mechanism of insurance policies may raise awareness and result in better insurance purchasing behaviour. [58]

Despite legal constraints, the Turkish government has already decided to support natural hazard victims regardless of their involvement in mitigation measures. As a result, demonstrating consistency between rules and their application is critical in developing cooperative policies between legislators and the society.

In Türkiye, there are lots of earthquake insurances but 2021 summer showed that Türkiye should be prepared for other hazards and the government should take important steps in order to reduce the impacts of natural hazards. Devastating wildfires were happened in the Mediterranean region of Türkiye.

Wildfires in 2021:

All forests in Türkiye are under the control and supervision of the government. The General Directorate of Forestry (OGM), which is affiliated with the Ministry of Agriculture and Forestry, is in charge of forest management.

In August, the southern coast of Türkiye was set ablaze by forest fires. The combination of heat waves, severe drought, high winds, low humidity and dry weather created the wildfires and flames engulfed burning buildings. The fire caused land to become barren for agriculture, vegetable growing, or cattle raising, thus destroying valuable livelihoods.[119]

Turkish authorities fighting the country's worst wildfires of all time have been criticized of failing to prepare for the hazard after official data revealed that they spent a fraction of the budget on the wildfire prevention this year. Türkiye's official forestry agency said it spent less than 2% of the 200 million lira (\$24 million) it put aside for infrastructure, projects, and equipment to battle forest fires in the first half of the year. On the other hand, Portugal set aside €224 million (\$265 million) this year to prevent and control forest fires and Spain's central government set aside €65 million. [105]

For sure, these violent wildfires had some financial effects to the economy. The Muğla and Antalya Metropolitan Municipalities increased spending in response to recent wildfires in Türkiye, although according to Fitch Ratings the impact on budgetary and debt metrics remains unknown. The financial cost will be minimized by central government assistance, and the ratings assessments of municipalities will factor in expenditure shocks. The affected

area is around three times that of the 2008-2020 average, and the expense of responding will surpass hazard response funds for 2021. AFAD and other central federal departments have transferred \$530,75 million to hazard survivors, but municipalities and other public-sector have provided firefighting guidance as well as emergency support such as shelter and food in their metropolitan areas. [45]

Consequently, there are some lessons that should be learned from these devastating wildfires. To begin with, increasing awareness and education are the most effective approaches to prevent or eliminate improper behavior. Also, enforcement of law will be successful. In other words, bans, the restrictions and penalties imposed by the state legislature can lead to significant changes in human behavior. These wildfires signaled that, nations must be better prepared to predict such events, create contingency plans, and have the required health, safety, and emergency (HSE) equipment as well as aircraft resources.

In addition, Turkish citizens at risk should receive regular training on disaster management, emergency planning, containment and fire prevention. Due to a lack of resources in the fire-ravaged areas, firemen from all across the country were called to assist. So, fire-stricken areas require more resources and equipment. Initiatives for natural reforestation and replanting must be prioritized. Furthermore, Türkiye needs a new National Forest Program that is strategically aligned with Sustainable Forest Management and incorporates global best practices. More regular emergency exercises, as well as their evaluation, should be incorporated into larger sustainability principles. One of the lessons learned from Türkiye's recent forest fires is that the National Forest Program needs to be modified to encompass agriculture, tourism, energy, and industry since all of them are interconnected. To better undertake risk and impact analyses, fire ecologists in Türkiye and around the world must have combined sessions with marine biologists, hydrologists, meteorological departments, climatologists, and geo-engineers. This will provide humanity with a better grasp of the best mapping and mitigation approaches for global warming and its related extreme weather events.

Floods in 2021:

The frequency and severity of extreme climate changes have increased in general as a result of climate change, while individual events cannot always be attributed to it. Flooding is a typical occurrence in Turkish coastal cities around the Black Sea, where many buildings are built on riverbeds, rendering them prone to flooding. Experts claim that by limiting natural channels, flooding will occur more frequently. Due to this mismanagement of rivers, heavy rainfall causes floods, flash floods, and landslides in northern Türkiye.

In August, cities around Black Sea faced with floods, which were caused by severe rain. Several houses and bridges are destroyed. Streets filled with wrecked automobiles, and power is cut off. Based on the AFAD, 70 people died (60 in Kastamonu, 9 in Sinop, and 1 in Bartın) and over 360 individuals have been affected, with 7 people getting hospital care. More than 2,300 people have been evacuated from the cities of Bartın, Kastamonu, and Sinop. A lot of buildings and roadways have been damaged. [35]

The General Directorate of Forestry (OGM), which is part of the Ministry of Agriculture and Forestry (MoAF), has begun planning a project for the Bolaman and Çekerek Basins called "Turkey Resilient Landscape Integration Project (TULIP)" to address the challenges that the basins face while also enhancing the livelihood security and resilience of local communities against climate-induced landslides, flooding, and drought. [74] It was started in 2021 and planned to be finished in 2028.

The Türkiye Resilient Landscape Integration Project was investigated by OGM in collaboration with the main national and local implementing institutions. Finally, the OGM chose to collaborate with the World Bank and the MoTF.

The project's main goal is to enhance rural populations' access to resilient infrastructure, better chances for livelihood, and comprehensive landscape management in selected regions of Türkiye.

A wider and more individual-centered preventative strategy is required for disaster risk management effectiveness. The Sendai Framework incorporates the concept of comprehending and implementing new technologies and instruments in disaster risk reduction. Therefore, Türkiye has signed up to the Sendai Framework, which aims to reduce catastrophe risk globally between 2015 and 2030. Implementing the Sendai Framework necessitates international collaboration, global technology opportunities, knowledge sharing, innovation, and direct access to disaster risk reduction technologies and information.

Türkiye published the "Spatial Strategy Plan" in 2021, with one of the project's goals being to identify spatial strategies for settlement management in light of natural risks. This plan helped in the regulation of informal settlements, and also most significantly, the country's growth was planned in advance, taking into account natural dangers.

Moreover, AFAD concluded the pilot research that concluded in the first provincial-level disaster risk mitigation strategy for Turkey's Kahramanmaraş province in mid-2020. The plan was part of Turkey's "National Platform of Disaster Risk Reduction" (TARAP), and it takes into account the objectives in the Sendai Framework in order to accomplish them. It includes of three objectives, 21 targets, and 225 activities.

For future, several approaches could be done in order to increase resilience and decrease the drawbacks of natural hazards. Existing physical hazards must be recognized and addressed first. Policies and strategies must also be developed to safeguard and strengthen vulnerable components, particularly people at all levels. This is critical for preventing and/or reducing current risk aspects.

Another critical consideration is availability. About 90% of international hazard assistance has gone into recovery efforts such as emergency reconstruction and response with just 10% going toward preparedness and prevention. Even though studies suggest that a \$1 million investment in resilient infrastructure may provide a 4 to 15% return, financial investment in it remains a concern. [120] This is because the hazard has not yet occurred, and it is hard to

persuade people to invest money on something that does not yet exist. However, private and public sector awareness is critical. It is obvious that we must focus more on preparedness and prevention rather than just emergency response and rebuilding when a hazard happens.

In Japan, for example, a risk management class is included in the education system. This also broadens risk management across the foundation in terms of knowledge, consciousness, preparedness, and fundamental prevention.

Governments must take steps to inform and incorporate people at every level, as well as to change people's perceptions of natural hazards. Success will never happen until people become involved in this struggle.

In Türkiye, people should be informed about natural hazards, involving preparedness, responses during risk exposure, and post-disaster recovery. They should have more information about seismic hazard.

Other natural hazards indicated above may also cause significant financial damage in the country, and consciousness of them must be raised. The collaborative impact in communities must be re-established. When people become aware of who is vulnerable and when a hazard occurs, they may act as first responders before the formal response arrives.

Another concern that must be addressed during DRM is to minimize the emergence of new hazard risks. Türkiye must adopt social, economic, and educational measures to increase preparation and consciousness. By implication, everyone should be aware of the natural hazard risks.

CHAPTER 5

METHODOLOGIES

In this thesis, two analyses are described. First one includes the dataset which is taken from the annual report about insurance and private pension activities in Türkiye between 2000 and 2019. Year, number of earthquakes, average premium per policy, average loss, number of claims, number of policies, paid premium and paid loss data's are used and regression is run using R. Average premium per policy is calculated by dividing paid premium to number of policy and average loss is calculated as dividing the paid loss to the number of claims. The dependent predictor is average loss and explanatory variables are average premium per policy, number of earthquakes and year. Unfortunately, there wouldn't be a good fit for regression result.

```
y = mydata$`Average loss`
x1 = mydata$Year
x2 = mydata$`Number of earthquakes`
x3 = mydata$`Average premium per policy`
fit1 = lm(y~ x1*x2*x3,data = data_frame)# most accurate linear model based on the correlation matrix and p
value
summary(fit1)
##
## Call:
## lm(formula = y ~ x1 * x2 * x3, data = data_frame)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -1848,495 -1150,903 -1633,658  580,839 -738,899
##
## Coefficients:
##             Estimate      Std. Error  t value    Pr(>|t|)
## (Intercept) -211205.11428    1010100.817   -0.209    0.8370
## x1           106.48373       505.9116     0.210    0,8359
## x2           -40.43192       82.35202    -0.490    0,6301
## x3            25.26419        89.1918     0.283    0,7806
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3859.9549 on 16 degrees of freedom
## Multiple R-squared:  0.309992, Adjusted R-squared:  -0.0733
## F-statistic: 0.5669 on 16 DF, p-value: 0.6446
```

Figure 5.1: Multiple Regression Model

Therefore, another alternative analysis is made, i.e, meta analysis which helps to understand

the current model. The term "meta" means "after" or "beyond" in Greek, therefore "meta-analysis" implies "analysis of analyses." It is the statistical examination of data from different primary research on the same topic with the goal of generating a quantitative estimate of the phenomena being examined. Meta-analysis is built on mathematical and statistical criteria, making it more objective than other approaches like narrative reviews and less affected from the author's own beliefs. The steps of meta analysis is described in table 5.1.

Table 5.1: Steps in Meta Analysis

| | |
|--|--|
| Create a research question <i>Research question is identified as "Could Türkiye use Resilience bonds as an investment tool?"</i> | <ul style="list-style-type: none"> • Make a list of core and secondary objectives • Identify the range of the question |
| Search relevant information | <ul style="list-style-type: none"> • Create a search strategy: Systematic or rapid search |
| <i>Systematic search is done by determining the relevant primary data</i> | <ul style="list-style-type: none"> • Determine eligibility and screen studies |
| Collect and integrate study-level data <i>Relevant studies are derived and analyzed. Model parameters are predicted for the regression.</i> | <ul style="list-style-type: none"> • Derive data from relevant studies • Collect study-level features and experimental variables that are relevant • Assess the study's quality • Predict model parameters for complex relationships |
| Assessment and preparation of data <i>Accurate data is assessed and used for forming a new regression model</i> | <ul style="list-style-type: none"> • Calculate relevant outcome measure • Assess the degree of discrepancy between studies • Make the necessary data transformations • Choose meta-analytic model |
| Create a summary measure using study-level data | <ul style="list-style-type: none"> • Gather data and calculate a confidence interval and a summary measure |
| Explorative analyses | <ul style="list-style-type: none"> • Investigate possible sources of heterogeneity • Assess meta-regression and subgroup |
| Synthesis knowledge <i>Future predictions are suggested</i> | <ul style="list-style-type: none"> • Explain findings • Provide suggestions for future projects. |

Source: [48]

A comprehensive result of resilience in Türkiye and other continents are well presented and multiple studies are analyzed and synthesized. In this thesis, the sources of meta-analysis are from prevention web and GFDRR. The United Nations Office for Disaster Risk Reduction manages Prevention Web, a global collaborative knowledge sharing portal on hazard risk reduction. The site provides a variety of knowledge products and services to aid DRR professionals in their work. First and foremost, Prevention Web is a collaborative platform providing information for and from the global DRR community. The knowledge base, which is updated

daily, has content from over 8,000 organizations working at the regional, national, and local levels to reduce hazard risk and improve hazard resilience. [121]

GFDRR has been introduced in Chapter 2 in section 2.1 titled as "Financial Instruments in use of financial hazard risk management" but as a reminder it is a global partnership that assists poor nations in better understanding and minimize their vulnerability to climate change and natural hazards. GFDRR is a World Bank-managed grant-funding instrument that supports hazard risk management projects around the world. It provides assistance on knowledge, finance, and technical to 400 international, local, regional and national partners.

The parameters for the meta-dataset are derived from an extensive search using Prevention web and GFDRR. The terminologies of "financial hazard risk management" and "economics of hazard risk reduction" are used to create this search. The definitions of news, documents and publications, resources and events about financial hazard risk management from the source of prevention web are listed in Table 5.2.

Table 5.2: Sources of prevention web

| Source | Definition |
|----------------------------|---|
| News | Hazard risk and resilience in the news, and news from the disaster risk reduction (DRR) community and beyond. |
| Documents and publications | Hazard risk and resilience publications, reports, research papers and case studies. |
| Resources | A selection of reference material on various hazard risk reduction topics and emerging trends. |
| Events | Various courses, conferences, seminars about financial hazard risk management. |

Source: [121]

The countries considered in the study have an impact on the results. The recorded direct damages and the number of people died and impacted are smaller in developed economies and larger in developing economies. Especially, Asia, Africa and Europe would be the regions where hazards strike most frequently.

Three regions are used in the prevention web which are Africa, Asia and Europe. 49 countries are included in Asia continent and some of them are Afghanistan, Bangladesh, China, India, Indonesia. For example, Europe consists of 46 countries such as Austria, Belgium, Finland, Germany, Türkiye, United Kingdom. Finally, Africa has the highest number of countries with 55 and some of them are Zimbabwe, Uganda, Tunisia.

However, GFDRR combines Pacific region to South and East Asia. Also, Central Asia is combined with Europe and finally, Middle East and North Africa are examined together. For

instance, Cambodia, China, Vietnam are analyzed in East and South Asia And Pacific region and Albania, Armenia, Türkiye are in Europe and Central Asia region.

The definitions of publications, events, features, videos about financial hazard risk management from the source of GFDRR are listed in Table 5.3.

Table 5.3: Sources of GFDRR

| Source | Definition |
|--------------|---|
| Publications | Reports, documents about resilience and hazard risk management |
| Events | Webinars, sessions and meetings on the sustainable infrastructure sector and hazard risk management |
| Features | Campaigns, projects in order to increase the awareness of hazard resilience and strengthen community-based hazard risk management practices in various countries. |
| Videos | Presentations that were made on hazard risks in some regions and training workshops about building hazard resilience to natural hazards. |

Source: [47]

The Figures of number of news, documents and publications, resources, features and events are displayed. The time period is yearly, and it is from 2010 to 2021 which is interpreted in two different time frames. The reason of this interpretation is that 2015 is a milestone. Sendai Framework was published in 2015 and researchers in disaster risk management conclude analyses as post Sendai and after Sendai and therefore the first time frame is between 2010-2015 and the second one is between 2016-2021. One of them is between 2010-2015 and the other one is between 2016-2021. For sure, these natural hazards affected countries in terms of financially. Economic losses from hazards are increasing in all regions, creating a serious danger to the economies of low-income countries and even exceeding wealth creation in most of the world's wealthier nations. It is observed that, there is a direct link between hazard-related financial losses and a lack of risk management investment, especially at the local level. A supportive example for this argument is appeared when economic costs from natural catastrophes are compared to the countries' Gross Domestic Product (GDP). The relationship between hazards and their effects to the economy are examined in two tables. One of them include the time frame of 2010 and 2015 and the other once describes the hazards that happened between 2016 and 2020. The tables are presented in the appendix.

Between 2010 and 2015

2010 was dominated by a series of large earthquakes on a scale that did not see in recent decades and majority of the were occurred on the America and Asia continents. [75] There is

an increase in all sources of Europe. The heat wave that hit Russia and neighboring nations caused widespread devastation. Air and heat pollution killed at least 56,000 people, making it Russia's deadliest natural hazard in history. [75] Also, a winter storm called Xynthia devastated Spain and France and resulted in losses of \$ 6.1 billion. In addition to these hazards, in April, the Icelandic volcano Eyjafjallajökull was exploded. Although there was little direct harm, interruptions in the supply of critical products to industrial companies meant that many sectors were affected over time. When Africa is analyzed, there is a decrease in publications figure but there is an increase in the number of news and events in the continent. There were roughly 2600 victims in Africa and the greatest number of death was occurred in Central and Western Africa due to several floods. Also, poisoning from illegal gold mining caused 400 victims to die. [107] Finally, there is an increase in all sources of Asia. Floods that were occurred by heavy monsoon rains in Pakistan devastated the country. The entire loss was \$ 9.5 billion, a huge sum for Pakistan's developing economy.[75] Moreover, an earthquake with 7.7 magnitude caused a tsunami with waves exceeding a height of three meters in Mentawai Islands in Indonesia. According to the local authorities, more than 112 people were dead. Unfortunately, flooding in Thailand has affected over 3 million people and weeks of rain have destroyed homes and villages due to the overflowed rivers and dams. Likewise, flooding in Vietnam affected 150,000 homes and 700,000 people. [64]

2011 was the costliest year ever with respect to natural hazard losses since a series of deadly earthquakes and a huge number of weather-related hazards were occurred. The regional allocation of losses was unusual, and Asia accounted for around 70% of all economic losses.[76] Figures show some differences in the Asia continent. There is an increase in news and publications figures but there is a decrease in resources and events figures. The Tohoku earthquake in Tohoku, Japan, was the most devastating event of the year. It struck with a magnitude of 9.0 and it was Japan's most powerful earthquake ever recorded. Unfortunately, the quake caused a devastating tsunami as well. With economic damages of \$ 210.0 billion, it was the most costliest natural catastrophe ever recorded. [51] Moreover, China was harmed by a drought, a storm and another flood which further contributes to a total of 159.3 million victims in China in 2011, accounting for 65.1% of all hazard victims worldwide. [51]

As a supplier and a manufacturer of products, Japan plays a significant role in global supply chains. Unfortunately, the enormous supply networks in Japan were immediately disrupted as a result of the large infrastructure damage due to the Tōhoku earthquake. Interest rates and the value of the yen are also affected. Also, this extensive damage affected many agricultural and fishing areas in Japan. Of course, the impact of the Japanese hazard extends far beyond Japan. It served as a reminder that even the most developed and well-prepared countries are vulnerable to catastrophic events.

In addition to the Tohoku earthquake, Thailand had to face with various floods. According to experts, these floods were the worst in 50 years and approximately 800 individuals died as a result of this event.[76] The floods were the most expensive natural hazard for Thailand, with economic damages in billions of dollars. For instance, 25% of the world's source of components for computers were affected.

There is an increase in all sources of Africa. Famines and droughts in Ethiopia, Kenya, and Somalia took numerous lives. When compared to the country's population, 42.9% of Somalia's population was affected by natural hazards in 2011, the majority of which were caused by drought. [51]

In 2012, Europe figures show some differences. There is an increase in resources and events figures but there is a decrease in news and publications figures. Two earthquakes in Italy's Emilia Romagna area proved to be Europe's most costliest hazard. The magnitudes of earthquakes were 5.9 and 5.8 respectively and many of the buildings were devastated. [77]

Although there is a decrease in the number of news, there is an increase in the publications and events in Africa. It is the most populous continent, owing to severe droughts and subsequent famines in various sections of the continent and that lead to numerous deaths in Kenya, Sudan, Mali, Burkina Faso and Niger. By contrast, heavy rains caused widespread flooding in Cameroon, Niger, Chad, Nigeria, and Senegal, killing hundreds and displacing millions. Flooding was at an all-time high in many of these nations. For instance, Niger saw its worst floods since 1929, displacing nearly half a million people and killing at least 68 individuals, affecting 70,000 families. [113]

There exist a decrease in the news and a slight decrease in the event figure in Asia. However, there is an increase in resources and publications figures. In the area, there were substantially less severe natural hazards. The most damaged country was China with a variety of hazards which were 13 floods and landslides, 8 cyclones, 7 earthquakes, and one period of radical temperature. Overall, 17.4 million got affected. [78] Also, typhoon Bopha hit the Philippines killed over 1,000 people and left many others missing.

In 2013, the overall image of natural hazards was characterized by extremely high losses from weather-related catastrophes in Europe and Super Typhoon Haiyan in Philippines. Floods and hailstorms caused tens of billions of dollars losses in central Europe and 6000 people died because of the super typhoon. [52] Even tough, there is an increase in the news figure, all sources show a decrease in Europe because losses were rather minor when it is compared with previous years. This implies that early warning systems and loss mitigation strategies can help to mitigate the effects of natural hazards. Flooding in eastern and southern Germany and surrounding states was the costliest natural hazard of the year. The following flooding on numerous rivers established new records. Due to enhanced protection measures, the historic old city center of Dresden was mostly unharmed.[78]

Although there is an increase in the number of features, there is a decrease in all other sources in Africa. More than 140,000 people were killed in six floods. In contrast, Africa's significant weather and climate patterns from the previous decades continued as 2013 was one of the continent's hottest years since 1950, with temperatures above average in most locations. [136] For instance, a drought in Zimbabwe claimed the lives of 2.2 million people. [53] Also, the availability of water in this area is 10 to 20% which was lower than usual. [32] The crop yields were negatively affected. Also, severe drought conditions were driven by signifi-

cant precipitation shortfalls in Namibia and Angola. According to the government, the 2013 harvest was 42% less than the 2012 harvest. [136]

The features Figure shows an increase but there exists a decrease in other sources in Asia. They faced with a super typhoon Haiyan, which swept over the southern Philippines with maximum wind speeds of over 300 km/h. As a result of the storm, over 6,000 people were died, and millions were displaced. Important agricultural regions were largely damaged since it plays an important role in the economy. Furthermore, 31 additional storms were occurred and in 2013, the typhoon season was above average in Asia. These hazards in the Philippines demonstrate the critical need for more action in developing and rising countries to effectively protect people. This involves secure structures and protection facilities, as well as insurance programs backed by the government that provide financial support to people who got affected by hazards. [78]

Natural hazard losses in 2014 were considerably lower due to the lack of extremely catastrophic hazards and a benign hurricane season in the North Atlantic. The overall economic losses and number of fatalities were lower than the previous year because early warning systems worked better in many regions and officials constantly brought citizens to safety places during the potential weather hazards. [54] There is an increase in all sources of Europe. A catastrophic hailstorm hit Europe this summer.

Figures show some differences in Africa. There is an increase in news and publications figures but there is a decrease in events and features figures. The reason of this could be the Ebola virus that began in West Africa and it expanded quickly by late summer. In addition to the huge and tragic loss of life, the Ebola epidemic has also caused severe damage to West African economies in several important sectors, leading to stagnant trade, damage to agriculture, and investor panic. Most of the cost comes from the higher cost of doing business in a country/region or across borders. These are mostly due to changes in people's behavior because of their fear of getting the disease, which has left many companies without employees, slowed transportation, and resulted in travel restrictions for citizens of the affected nations.

Before the Ebola epidemic deepened, West-African countries made significant economic progress. In 2013, Sierra Leone and Liberia graded second and sixth respectively among the 10 countries with the highest GDP growth rates in the world. [108] However, due to the Ebola epidemic, the expected profitability of investment projects were decreased and also investor confidence dropped quickly. This contraction in the economy caused many financial factors changes in African countries. the first change is occurred in mobility limitations, trade, and transportation. The second change is happened in the agriculture sector. According to the Food and Agriculture Organization (FAO), agriculture accounts for 57% of Sierra Leone's GDP, 39% of Liberia's GDP, 20% of Guinea's GDP and 22% of Nigeria's GDP. [108] The disruption of the planting season that broke out earlier this year was reduced the harvest.

The features and resources figures show a decrease but there exists an increase in other sources of Asia. Cyclone Hudhud in India was the costliest catastrophe of the year. Approximately

7,700 people are dead and total economic damage was \$7billion. Authorities evacuated approximately half a million people and relocated them to safe areas after receiving warnings from the Indian weather services. [79] Same scenario occurred with Typhoon Hagupit, which hit the Philippines. It had wind speeds rising above 175 km/h at times but luckily, before typhoon, 165.000 people were evacuated. [71]

In 2015, natural hazard losses were lower than 2014. The Nepal earthquake was the deadliest hazard, as well as the costliest in terms of overall damages, with 9,000 people killed and \$ 4.8 billion in losses. [80]

Europe figures show some differences in the continent. There is an increase in resources and publications figures but there is a decrease in news and events figures. Europe faced hot and dry summers because of the heat waves and drought. By contrast, some major floods were occurred because of a storm which hit Great Britain. It brought excessive rainfall and resulted in significant flooding. Then it moved to Scandinavia and the total number of losses were reached to \$ 1.5 billion in Northern Europe. [80]

Figures show some differences in Africa. There is an increase in events and features figures but there is a decrease in news and publications figures. In 2015, Africa was hit by 62 natural hazards, a number that was higher than the 2005-2014 yearly average. Somalia was the most vulnerable country in the region. 15 droughts were occurred and 7 of them affected more than 7 million people in total and a drought in Ethiopia harmed 10.2 million people. By contrast, two floods in Somalia and Malawi impacted 900,000 and 639,000 people respectively. The costliest hazard was a drought in South Africa with \$ 1 billion. [55]

Although there is an increase in features figure, there is a decrease in all other sources in Asia. By contrast, the earthquake with a magnitude of 7.8 hit Nepal and the neighboring states of India, Bangladesh and China were also affected. Approximately 9,000 people were dead and 500,000 became homeless due to the destruction of buildings. [80] Unfortunately, like Nepal, most of the emerging and developing countries have a very low proportion of insured losses for natural hazards. The insurance industry is examining new ways to close this insurance gap and assist individuals to better cope with property damages following a hazard.

Between 2016 and 2021

In 2016, it is reported that approximately 1,900 loss events were occurred. Asia was the most vulnerable region with over 60% of the mortality rate. [82] There exists a decrease in the of all sources in Asia because there were two costliest hazards and Asia is generally the most vulnerable region with more extreme events. This year, meteorological hazards were less frequent than previous years. The most extreme case was happened in China. A wildfire harmed 10 million people and that was followed by droughts in South-East Asia, with more than 4.5 million victims. It began in 2015 and lasted until 2017 that affected 330 million people every year. Luckily, the effect of earthquakes were lower than previous years. [56]

There exists a decrease in the of all sources in Europe because there were only severe storms

for a few weeks, which led to a stationary weather pattern that persisted over the continent for an extended period. There were some extensive floods in France and in Germany and in June, a destructive hailstorm passed over Germany and the Netherlands, but these events were not unlikely and extreme.

Although there is a decrease in news in Africa, there is an increase in the publications and events. That's because the losses were weather-related events and there were only four small earthquakes causing little damage. Southern Africa faced an extremely dry year, with millions of people affected by drought but surprisingly, floods caused damage in Ethiopia and Sudan got also affected from it.

2017 was reported as the second-costliest year in terms of natural hazards and total losses. Weather-related hazard damages exceeded all prior records and it was accounted over 93% of all incidents globally. [83] The deadliest occurrences in 2017 were disastrous floods caused by heavy monsoon rains in India, Nepal, and Bangladesh and there was an earthquake in Iran which killed about 600 people.

There is an increase in the figures of all sources in Europe because there were two incidents in Europe that cost billions of dollars in total economic losses. The unexpected return of winter to Europe resulted in significant losses in the agricultural industry. Overall losses were also driven by dry weather and drought in significant parts of southeast and southern Europe. Furthermore, winter storms that were occurred in Germany, in the Czech Republic and in Poland caused widespread economic damage.

Although there is an increase in the news figure of Africa, there is decreases in other figures. An avalanche in Sierra Leone killed around 500 people, which made the second-highest number of fatalities in the world.[83] Two tropical cyclones hit Madagascar and southern Africa. Also, drought losses were reported in Ethiopia, Kenya, and Somalia due to hot weather.

There is an increase in the figures of all sources in Asia. In China, the equivalent of a year's average rainfall fell in the capital Zhengzhou within only three days. This caused significant damage and forced 200,000 people to leave their homes. [23] In addition to this, a typhoon hit 10 provinces in Vietnam which caused 29 deaths, 600 house destruction, and damage to almost 40,000 homes. [103] Housing, agriculture, drainage and flood management, and transportation are the fastest covered sectors. Agriculture was the most affected sector with a total damage of VND 5.4 trillion, flood protection and irrigation infrastructure at VND 0.4 trillion, followed by housing at VND 3.7 trillion and transportation at VND 0.2 trillion. [114] Unfortunately, an earthquake of a magnitude of 7.2–7.5 struck Iraq and according to national officials, nearly 10,000 individuals were injured. [102]

2018 was the fourth most expensive year since 1980 with respect to insured losses. This was because of a series of severe and expensive catastrophes that occurred in the second period of the year. Floods, tropical cyclones in the United States and Japan, earthquakes and wildfires caused billion-dollar damages in the second half of the year. The continents most harmed were Asia with 43%, North America (20%) Europe (14%) and Africa (13%). [84]

Despite an increase in the publications figure, there exist decreases in news and events in Europe. However, some extreme events were happened in the continent. First, severe drought that devastated significant parts of Europe and it caused widespread agricultural and forestry losses. Furthermore, two winter storms affected mostly Italy, Croatia, and Slovenia. Finally, the wildfires in Greece took 100 lives and a cold winter in February and March killed 77 people were the deadliest occurrences of the year. [84]

There is an increase in news and publications in Africa because about 1,200 people were killed and 2 million people were affected in Kenya and Nigeria due to the severe floods. [84] Also, Somalia usually experiences drought but this year, the country was suffering from flooding which impacted 700,000 people. Moreover, droughts in Kenya and Madagascar affected 3 million and 1.2 people respectively. [29]

Although there is an increase in the publications figure, there exist decreases in news and events in Asia. On the other hand, Asia was the most devastated continent with respect to number of occurrences. Even though just 14 occurrences were recorded in Japan, 5 of them resulted in losses over 1 billion dollars. [84] In July, heavy rains caused flooding in a number of large cities, which was followed by severe floods and landslides in some places and 2 tropical storms made landfall in September, causing destruction in the region. A significant number of losses were also caused by two earthquakes that happened in Japan. Moreover, Tsunamis struck Indonesia and left some damaging impacts. Increased insurance penetration in these countries may help them in dealing with the financial implications of natural hazards more quickly.

In 2019, Japan, India, China, the United States, and the Caribbean were the most damaged countries by the 820 relevant natural catastrophes that were recorded. Tornadoes, tropical cyclones and storms with flooding were among the incidents. Asia was again the worst-damaged region with 43%. Natural catastrophes took the lives of around 9,000 individuals in the year but the number of fatalities in 2019 is the lowest since 1980. [85]

Although there is an increase in the events, there is decrease in news and publications figure in Europe since a few numbers of hazards are occurred in the continent. A winter storm damaged many countries, and this brought severe floods and devastation to the Mediterranean region which was extremely remarkable.

The figures of Africa show some differences. There in an increase in events and features but there exists a decrease in news and publications. Two powerful cyclones hit the East African coast and Mozambique, Malawi and Zimbabwe were the ones that got the most damage. More than 1,000 people died because of these two incidents. Severe storms, rains and tremendous wind speeds caused significant flooding that destroyed entire communities and wiped off the agricultural output. [85]

Among all the figures, only the features one shows an increase in Asia whereas others imply decreases in sources. Asia was accountable for 43% of occurrences, 48% of deaths, and 50% of overall damages and natural hazards, especially tropical cyclones and floods affected

disproportionately the continent during the year. Monsoon flooding was also significant in India and China. An earthquake in China was one of the catastrophes that resulted in more than \$1 billion in losses. [85]

In 2020, the COVID-19 pandemic took place and it affected all over the world. In December 2019, the virus was discovered in Wuhan, China. Wuhan and other towns in Hubei were locked down in order to stop the outbreak, but it spread to other regions of China and around the world. Approximately one month later, the World Health Organization (WHO) declared a pandemic and it is one of the worst pandemics in history, with over 237 million cases and 4.85 million deaths. [135] Travel restrictions, business closures, lockdowns, occupational hazard controls, testing techniques, and systems for identifying infected people have all been implemented by authorities around the world. The pandemic harmed social and economic systems in all countries, resulting in the worst global recession since the 1930s' Global Depression. It has resulted in widespread supply constraints, which have been worsened by panic buying, agricultural disturbance and food shortages. Many educational institutions and schools have been closed and lots of activities have been canceled or rescheduled. Misinformation has spread through social media and the mainstream media which increased political tensions. Pandemic revealed the most important concerns to the world, and they are geographic and racial discrimination, health equity, and gaps in individual rights. In addition to COVID-19, lots of natural hazards were occurred in 2020 which caused \$210 billion loss and took 8,200 lives around the world. [86]

There is a decrease in all sources of Europe because natural hazards were quite moderate. Heavy rains in France and Italy caused localized significant losses, which are characteristic of the autumn season. Of course, lots of homes, roads and bridges were destroyed as a result of this floods. However, Croatia was struck by 6.4 magnitude earthquake and it was one of the strongest quake in 140 years. Luckily, the fatality rate was low since the area near the epicenter has low population density. [86]

There exists an increase in news but publications and features figures imply decreases in Africa. Flooding had affected roughly 2.1 million people in West and Central Africa and many regions suffered from excessive rainfall. 1.1 million people in 11 countries got harmed in the continent. [89] Additional shocks from major weather events lead vulnerable families to a crisis. Unfortunately, many of the impacted areas were already dealing with food insecurity, hunger and climate change and floods increased the incidence of water-borne infections, had a negative influence on hygiene and sanitation and decreased the ability to implement effective COVID-19 prevention measures.

There is a decrease in news and events figures since natural hazard losses were fewer than the prior year in Asia. Even though, China's summer floods were the world's costliest single occurrence and the storm in India made landfall. Tropical cyclone was the first massive typhoon of the 2020 in the northwest Pacific and it originally passed over Japan's southwest coast and left severe rain, flooding and several landslides in the region. Furthermore, on January 24th an earthquake with 6.8 magnitude struck the area of Elazığ in eastern Türkiye. 41 people lost

their lives and 1607 people got injured in Elazığ, Diyarbakır and Malatya. [16] The Turkish Red Crescent and the AFAD distributed emergency supplies since approximately 10,000 individuals were homeless and they lived in containers, tents, and public refuge sites such as schools, sports centers, and hostels.

From these findings, it can be concluded that, hazards affect the countries economy in a negative way and more adaptive and innovative solutions should be implied in order to decrease the effects of natural hazards to the economies in the world.

For further analysis, paid premiums in life and non-life of three continents and Türkiye are analyzed specifically. The data is taken from OECD. The foundation was established in 1961 and the member countries discuss general policies and rules for international cooperation. There exist official agreements on topics such as bribes exports, investments and imports. In addition to this, they help to establish international standards for the tax system and agreements, as well as provide suggestions on environmental policies and business rules.

Furthermore, the OECD data is fully comprehensive which makes it accurate and reliable. Although there is a risk of double counting in some datasets, OECD eliminates this risk to a minimum level. Time frame for this analysis is between 2010 and 2018 and the included countries are shown in Table 5.4.

Table 5.4: OECD continents and included countries

| Continents | Countries |
|------------|---|
| Asia | • Israel, Japan, Korea, Hong kong, India, Indonesia, Malaysia, Russia, Singapore, Sri Lanka, Chinese Taipei, Thailand |
| Europe | • Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Bulgaria |
| Africa | • South Africa, Tunisia, Egypt, Morocco |

Source: [90, 91, 92, 93, 94, 95]

The median, average and standard values of premium in life and non-life of the continents are described in Table 5.5, 5.6 and 5.7.

Table 5.5: Median of premium in life and non-life for Continents and Türkiye

| | <i>Life</i> | <i>Non-life</i> |
|----------------|-------------|-----------------|
| <i>Asia</i> | 543,484 | 157,52 |
| <i>Europe</i> | 927,683 | 652,842 |
| <i>Africa</i> | 37,575 | 9,291 |
| <i>Türkiye</i> | 1,743 | 9,532 |

Source: [90, 91, 92, 93, 94, 95]

Table 5.6: Average of premium in life and non-life for Continents and Türkiye

| | <i>Life</i> | <i>Non-life</i> |
|----------------|-------------|-----------------|
| <i>Asia</i> | 520,316 | 166,862 |
| <i>Europe</i> | 962,012 | 656,402 |
| <i>Africa</i> | 87,926 | 53,690 |
| <i>Türkiye</i> | 1,621 | 8,794 |

Source: [90, 91, 92, 93, 94, 95]

Table 5.7: Standard deviation of premium in life and non-life for Continents and Türkiye

| | <i>Life</i> | <i>Non-life</i> |
|----------------|-------------|-----------------|
| <i>Asia</i> | 124,319 | 52,866 |
| <i>Europe</i> | 123,9289 | 81,005 |
| <i>Africa</i> | 218,226 | 187,17 |
| <i>Türkiye</i> | 490,68 | 2,178 |

Source: [90, 91, 92, 93, 94, 95]

Changes in life and non-life insurance premiums in different continents and Türkiye in each year is presented in table 5.8. Therefore, in general, a rise in premiums can be justified by an increase in the number of insurance contracts sold and/or the contract price. Economic growth may increase demand for insurance goods, while a competitive insurance market can lower the cost of insurance contracts for individuals and businesses. Several variables may influence life insurance policy sales, which in turn has an impact on premium level. Taxes on insurance products, their costs, the returns they give policyholders, the availability of competing financial products, and customer perceptions of these goods may all influence customer demand for insurance products.

Insurance companies involved in life insurance activities provide a variety of policies with various performance dynamics. Life insurance has typically provided protection against risks that directly impact the policyholder as well as investment or savings contracts such as unit-linked products, annuity contracts etc.

Table 5.8: Life and non-life insurance premiums in different continents and Türkiye

| Life insurance activities | Asia | | Europe | | Africa | | Türkiye | |
|---------------------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|
| | Premium | Non-premium | Premium | Non-premium | Premium | Non-premium | Premium | Non-premium |
| 2010 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 2011 | ↓ | ↓ | ↘ | ↑ | ↓ | ↓ | ↓ | ↗ |
| 2012 | ↘ | ↗ | ↑ | ↑ | ↗ | ↗ | ↑ | ↑ |
| 2013 | ↗ | ↗ | ↘ | ↗ | ↘ | ↘ | ↓ | ↓ |
| 2014 | ↗ | ↗ | ↓ | ↓ | ↘ | ↘ | ↓ | ↓ |
| 2015 | ↘ | ↗ | ↑ | ↑ | ↘ | ↘ | ↓ | ↓ |
| 2016 | ↑ | ↑ | ↘ | ↑ | ↑ | ↑ | ↑ | ↘ |
| 2017 | ↗ | ↘ | ↑ | ↑ | — | — | ↓ | ↓ |
| 2018 | ↓ | ↓ | ↓ | ↓ | ↑ | ↑ | ↑ | ↑ |

Source: [90, 91, 92, 93, 94, 95]

↑ : Increase ↗ : Slight increase ↘ : Slight decrease — : No change
 ↓ : Decrease

Period of 2010 and 2015

In 2010, when non-life sector is compared with the life insurance sector, insurance premium growth in the direct life insurance industry was usually stronger across nations because in many countries, lower incomes, low economic growth, and unemployment hindered premium growth in the non-life sector. Although, natural hazards in some continents caused higher growth in non-life insurance premiums. In 2010 there exist an increase in premium in life and non-life Figures in Asia and there exist an increase in premium in life and non-life Figures in Europe. When Africa taken into account, there exist an increase in premium in life and non-life Figures in Africa and there exist an increase in premium in life and non-life Figures in Türkiye.

The year 2011 was highlighted by an unusually high number of natural catastrophes, as well as the ongoing economic and financial crisis. Natural catastrophes were the dominant subject in various nations, hurting the non-life insurance business. The natural events of 2011 resulted in significant increases in claims payments, which had a detrimental impact on non-life market profits. In several nations, the positive real premium increase of 2010 was unexpectedly reversed, with life premiums falling sharply in some. The macroeconomic climate was the most crucial influence in this. Many economic activity measurements, particularly in advanced nations, indicate that growth has been slow. This atmosphere has a significant impact on the demand for life insurance products. Competition from the banking industry and the low return environment in some countries reduced demand for life insurance products which impacted life insurers' performance. For instance, there exist a decline in premium in life

and non-life Figures in Asia and there is a slight decrease in premium in life for Europe but increase in non-life premium figure in 2011. For example, in France, premium rises in the non-life industry are mostly attributable to price increases, which are in part designed to balance a loss that had deteriorated dramatically in prior years, as was the case in 2010. Although Africa has a slight decrease in both premiums in life and non-life graphs, there is an increase in the combination of pension funds and inflationary increases in premiums. Another factor contributing to the increase was the economy's general development. The investment business is largely responsible for the expansion. Non-life premiums in South Africa also continued to rise in 2011, owing mostly to increases in the property insurance sector, which accounts for at least a third of the non-life market. Inflationary increases, economic expansion, and a minor improvement in credit lending transactions are all factors contributing to non-life sector growth, which is like the life sector. There exists a slight decrease in premium in life and a slight increase in non-life Figures in Türkiye.

In 2012, premiums continued to rise in developing nations especially in Asia and in certain developed countries. Also, a few developed economies indicated premium growth. There exists a slight decrease in premium in life and a slight increase in non-life Figures of Asia. Singapore and Hong Kong saw considerable increase in non-life premiums within the continent. The growth in non-life insurance premiums was primarily driven by an increase in health and accident business and general liability. There exists an increase in premium in life and in non-life Figures in Europe. For instance, premiums for life insurance in Belgium have risen to their highest level since 2007, overcoming the negative real increase witnessed in 2011. While this trend appears to be connected to increased growth in investment-linked products, most of this increase is likely due to individuals' anticipation of a tax raise on life insurance savings and investment classes. For instance, premium rise in Belgium could be explained by the insurers' attempts to enhance profitability, which included boosting premium levels, tightening underwriting requirements for certain loss-making insurance products, and strengthening cost management. There exists a slight increase in premium in life and in non-life Figures in Africa and there exists an increase in premium in life and in non-life Figures in Türkiye.

While the economic climate in many OECD nations remains fragile, notably in the eurozone, the situation in insurance markets has begun to improve in 2013, with notable premium rise in several countries. Premiums in the life insurance business increased at a respectable rate in several nations that had seen slow or negative development since the financial crisis. There exists a slight increase in premium in life and in non-life Figures in Asia. Gross life premiums in Hong Kong increased significantly in 2013, continuing the robust growth pattern of prior years, owing to increases in gross premiums from individual life policies and annuities. Indonesia was the only the country that had a decline in gross life premiums in the year. There exists a slight decrease in premium in life and a slight increase in premium in non-life Figures in Europe. The effects of the economic depression on the insurance markets of countries like Greece, Ireland, and Spain are still being felt. For example, in Greece, the insurance sector's development potential is hampered by high unemployment, low incomes and earnings, rising

taxes, and the country's ongoing crisis. Also, after a period of robust growth in 2012, real gross life premiums in Belgium fell by more than 20%, owing mostly to the low interest rate environment and the rise in the tax on new life insurance contracts from 1.1% to 2%. [90] Africa has a slight decline in both premiums in life and non-life figures in Africa and there is a decline in premium in life and in non-life Figures in Türkiye.

In 2014, both the life and non-life insurance industries, the rate of gross premium growth was positive in most nations, with just a few countries having declines. In general, premiums in non-life sector had a smaller rate of growth than premium in life sector. There exists a slight increase in premium in life and in premium in non-life Figures in Asia. For instance, life premiums in Japan increased by more than 7% since there was a recovery in products with investment and savings components, including high growth in individual annuity insurance. [91] There is a decline in premium in life and in non-life Figures in Europe. For instance, due to decreased sales of traditional life insurance policies, gross life insurance premiums in the Czech Republic and in Poland fell in 2014. Also, due to a significant lack of customer trust and the competition from bank savings products, gross life premiums in the Netherlands fell. Africa has a slight decline in both premiums in life and non-life figures and there is a decline in premium in life and in non-life figures in Türkiye. This fall might be linked to the introduction of a government contribution to private pensions, which resulted in an increase in private pension-related contributions.

In 2015, gross premiums in the life and non-life grew in most countries. This increase might be a signal or a result of improving economic conditions, which encourage people to get insurance. Non-life insurance premiums increased at a higher rate than life insurance premiums. In the OECD region, real gross premiums climbed by 2.4 percent in the non-life sector and 0.7 percent in the life sector. [92] In the non-life industry, the most significant rises in real gross premiums were seen in Ireland, Puerto Rico, Argentina, and Peru. There is a slight decline in life premium and an increase in non-life premium figures in Asia and there is an increasing pattern in premium in life and in non-life figures in Europe. The relative attractiveness of other savings products may also influence the growth of life insurance policies. In a situation where bank accounts are expected to generate just a little amount of interest, life insurance products may be a more appealing way to save. This may be contributing to greater demand for savings products in some countries like Estonia, particularly if depositors may pick their own investment strategy, including methods that are expected to earn higher rates than bank deposits. There is a slight decrease in premium in life and in non-life figures in Africa and there is an increasing pattern in premium in life and in non-life figures in Türkiye.

Period of 2016 and 2018

The execution of the Solvency II reporting standards across European nations was one of the key changes in 2016. The insurance market is maturing in many nations, allowing for further development which caused increases in both the life and non-life sectors. In most countries, insurers made an overall underwriting profit in the non-life market in 2016. The most growth was observed in Americas. The highest increase in life sector was observed in Costa Rica,

Russia and Türkiye by more than 30% in real terms. In addition to these countries, Poland and Lithuania had the strongest increase in non-life activities with 15.9% and 11.3% rise respectively. [93] There is an increase in premium in life and in non-life figures in Asia. For example, the quantity of to life and annuity products grew in Hong Kong. There is a slight decrease in premium in life and an increase in non-life Figures in Europe. In three European nations, the aggregate amount of life gross premiums decreased the most: 27.6% in Finland, 24.0% in Portugal and 14.1% in Poland. This decrease was mainly due to a decline in premiums for unit-linked contracts in these countries. Also, because of market interest rates dropping below 0%, Swiss authorities claimed that insurance companies reduced their operations relating to the sale of life insurance products with guaranteed interest. There is a sharp increase in both premium in life and non-life figures in Africa and there is a rise in life premium and a slight decline in non-life premium figures in Türkiye.

In most countries, gross premiums in the life and non-life industries increased in 2017. Specific insurance classifications, such as motor vehicle insurance, were a primary driver of increases in gross premiums in several nations. There exists an increasing pattern in both figures in Europe. Low interest rates in some nations are encouraging people to buy life insurance as an option to bank savings. For instance, life premiums increased in Russia since people expect larger profits from life products than from savings accounts. Furthermore, Latvia, Lithuania, and Poland had the fastest growth rates in non-life premiums since they had the fastest GDP growth rates, with near to or exceeding 4%. [94] When the economic performance is strong, demand for non-life insurance products frequently rises. There is a minor increase in life premium and decrease in non-life premium figures in Asia and there is a decreasing pattern in both figures in Türkiye.

In most nations, gross premiums increased in 2018, particularly in the non-life insurance market. Russia and Portugal had the largest increase of life premiums. In the non-life premium sector, Latvia and Sweden showed the strongest increase. This increase came from the rise in motor vehicle insurances. There is a downward trend in both figures in Asia and both premium in life and non-life Figures are decreasing in Europe. For instance, Netherlands, Poland Australia and Latvia faced declines in life premiums. The taxation of life insurance savings contracts affect demand for various life insurance products. For instance, there was a tax reform in Latvia which affected the criteria under which policyholders may benefit from tax deductions for payments to several life insurance savings products. Also, trust and consumer awareness in life insurance products is important for industry but unluckily, Netherlands had problems in consumer trust and that was reflected in the decline of life premiums. There exists a sharp increase in both figures in Africa and there is an increasing pattern in both figures in Türkiye.

As part of the meta-analysis, number of disaster related news, publications, resources and events are described detailedly above and all graphs could be found in appendix.

CHAPTER 6

CONCLUSION

In this thesis, the resilience projects/programs that are used in many continents are evaluated. Within this study, three main continents Europe, Africa and Asia with a perspective of Türkiye have been analyzed. Comparisons, limitations, advantages, disadvantages and current situations of them are described in detail and for further review, some advice is also given.

The motivation of this thesis is to decide whether the resilience programs can be applied in Türkiye or not since Türkiye is among the countries that is negatively affected by climate change, and it is already experiencing an increase in the frequency of sudden rains, floods, and drought. Therefore, financial disaster risk management plays a crucial role in the country and is essential to follow some mitigation programs.

This study's roadmap is first to explain what resilience means and how it can be applied to financial disaster risk management. Then financial instruments that are used in financial hazard risk management are illustrated and resilience ideas in different continents are described.

The findings of this thesis support the Sustainable Development Goals such as enhancing resilient infrastructure, supporting inclusive and sustainable industrialization, stimulating innovation and resisting to climate change.

Unfortunately, Türkiye is in an area prone to natural disasters, particularly earthquakes. According to Swiss real estate specialists, a massive earthquake in Istanbul would result in a total economic loss of \$90-120 billion and millions of people would be harmed. That's why, The Disaster and Emergency Management Authority's main goal is to create a hazard-resilient society. This strategy aims to reduce potential losses by reducing risk before an incident happens and strengthening the capability to respond quickly and efficiently if an incident occurs.

In 2021 summer, catastrophic wildfires occurred in Türkiye's Mediterranean area and enormous number of hectares were burned and many living died. In order to eliminate wildfires, state legislative bans, limits, and fines can cause major changes in human behavior. Also, Turkish residents should be trained in disaster management, emergency planning, containment, and fire prevention on a regular basis. Furthermore, Turkish government should create contingency plans, and have the required health, safety, and emergency (HSE) equipment as well as aircraft resources. One of the insights from Türkiye's latest forest fires is that the

National Forest Program should be expanded to include agriculture, tourism, energy, and industry, as they are all interrelated. The wildfires proved that Türkiye should be ready for such dangers, and the government should take significant steps to mitigate the effects of natural disasters.

According to the findings, several approaches could be done in order to increase resilience and decrease the drawbacks of natural hazards in Türkiye. Initially, existing physical hazards must be recognized and addressed. Policies and strategies shall also be developed to safeguard and strengthen vulnerable components, particularly people at all levels. This is critical for preventing and/or reducing current risk aspects. Another critical consideration is availability. Although it is hard to persuade people to invest in resilience projects, private and public sectors could help in the process. Governments must take steps to inform and incorporate people from different backgrounds and capabilities, as well as to change people's perceptions of natural hazards. People should broaden their vision about risk management in terms of knowledge, consciousness, preparedness, and fundamental prevention.

Another concern that must be addressed during disaster risk management is to minimize the emergence of new hazard risks. Türkiye must adopt social, economic, and educational measures to increase preparation and consciousness. By implication, everyone should be aware of the natural hazard risks. Despite legal constraints, the Turkish government has already decided to support natural hazard victims regardless of their involvement in mitigation measures. As a result, demonstrating consistency between rules and their application is critical in developing cooperative policies between legislators and the society.

Availability of the resilience projects are also depending on the economy of a country. Unfortunately, Türkiye is facing an economic downturn nowadays and people would be reluctant to invest money in these projects. If the Turkish economy gains an improvement upon developing and increasing phase, more resilience projects could be put into motion.

To sum up, resilience projects could be achievable in Türkiye and more of them could be done if people's awareness about financial disaster risk management is improved and if Turkish economy takes a turn for the better.

It is obvious that we must focus more on preparedness and prevention rather than just emergency response and rebuilding when a hazard happens. Proactiveness should come before reactivity. Hopefully, future efficient resilience programs and projects will be developed to decrease the financial effects of natural hazards in Türkiye.

Although there wouldn't be a relevant and a reliable regression in the thesis but, for future studies, a survey about resilience could be made in order to collect a data and a relevant regression would be run. Consequently, the insurance companies, policy makers, researchers and people who are interested about resilience and disaster risk reduction could make an interpretation about the valuation of a resilience bond. Future interest payments, interest rate and time to maturity values should be determined.

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APPENDIX A

NATURAL HAZARDS AND FINANCIAL LOSSES IN CONTINENTS

Natural hazards and financial losses in continents are described in two time frames.

Table A.1: Natural hazards and financial losses in continents between 2010 and 2015

| | Europe | Africa | Asia |
|------|---|---|---|
| 2010 | <p>The heat wave that hit Russia and neighboring nations caused forest fires. Air and heat pollution killed at least 56,000 people.</p> <p>A winter storm devastated Spain and France and resulted in losses of US\$ 6.1 billion.</p> <p>The Icelandic volcano Eyjafjallajökull was exploded and air traffic across northern Europe was virtually stopped for days.</p> | <p>Several floods took place in Central and Western Africa, Uganda and other parts of Africa.</p> | <p>Monsoon rains caused floods in Pakistan and up to a fourth of the country was flooded for weeks. The entire loss was US\$ 9.5 billion.</p> <p>8,000 people were displaced due to Indonesia's most active volcano, Mount Merapand.</p> <p>An earthquake with 7.7 magnitude caused a tsunami in Mentawai Islands in Indonesia. More than 500 were missing and 112 people were dead.</p> <p>Flooding in Thailand has affected over 3 million people.</p> <p>Flood in Vietnam affected 150,000 homes and 700,000 people.</p> <p>A typhoon Megi hit Philippines harmed 12,000 families.</p> <p>Cyclone Giri struck Myanmar's Rakhine state which destroyed nearly 75% of homes.</p> |
| 2011 | | <p>Famines and droughts in Ethiopia, Kenya, and Somalia took numerous lives.</p> | <p>The Tohoku earthquake Japan struck with a magnitude of 9.0 and it caused a devastating tsunami as well. The economic damage was US\$ 210 billion.</p> <p>The flood, drought and a storm caused a total of 159.3 million victims in China.</p> <p>Thailand faced with various floods which were the worst in 50 years and approximately 800 individuals died.</p> |

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| 2012 | <p>Two earthquakes with magnitudes of 5.9 and 5.8 respectively in Italy destroyed many buildings, historic sites and companies.</p> | <p>Severe droughts and subsequent famines lead to numerous deaths in Kenya, Sudan, Mali, Burkina Faso and Niger.</p> <p>Heavy rains caused widespread flooding in Cameroon, Niger, Chad, Nigeria, and Senegal, killing hundreds and displacing millions.</p> | <p>China faced with a variety of hazards which were 13 floods and landslides, 8 cyclones, 7 earthquakes, and one period of radical temperature. Overall, 17.4 million got affected.</p> <p>Also, typhoon Bopha hit the Philippines killed over 1,000 people and left many others missing.</p> |
| 2013 | <p>Flooding in eastern and southern Germany and surrounding states was the costliest natural hazard of the year.</p> <p>Very minor losses were recorded even though both Winter Storm Xaver and Windstorm Christian stormed across the UK, northern Germany, the Benelux states and Denmark.</p> <p>Couple of hailstorms affected the parts of southwestern and northern Germany.</p> | <p>More than 140,000 people were killed in six floods in South Sudan, Mozambique, Sudan, Niger, and Senegal.</p> <p>A drought in Zimbabwe claimed the lives of 2.2 million people. The crop yields were negatively affected. Also, the 2013 harvest was 42% less than the 2012 harvest in Namibia and Angola</p> | <p>Asia faced with a super typhoon Haiyan, which swept over the southern Philippines. Many towns were destroyed and over 6,000 people were died and millions were displaced. Important agricultural regions were largely damaged.</p> <p>31 additional storms were occurred and the typhoon season was above average in Asia.</p> |

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| 2014 | <p>A catastrophic hailstorm hit Europe and it moved across France, the western part of Germany and Belgium.</p> | <p>Ebola virus began in West Africa and out of more than 17,100 cases, more than 6,000 people have died from the virus. The epidemic has also caused severe damage to trade, to agriculture, and economy. Many companies left without employees, transportation was slowed, travel restrictions were increased.</p> | <p>The cyclone Hudhud in India killed 7,700 people and caused total economic damage of US\$ 7bn.</p> <p>A typhoon hit the Philippine island of Samar. Luckily, people were evacuated before typhoon.</p> <p>The tropical cyclone season in the eastern Pacific was highlighted by an unusual high number of storms.</p> <p>The Japanese coast was hit by large number of typhoons but damages were minimal due to the country's strong infrastructure and building standards.</p> |
| 2015 | <p>Europe faced heat waves and drought.</p> <p>Some major floods were occurred. The total number of losses were reached to US\$ 1.5 billion in Northern Europe.</p> | <p>Africa was hit by 62 natural hazards.</p> <p>15 droughts were occurred and 7 of them affected more than 7 million people in total and a drought in Ethiopia harmed 10.2 million people.</p> <p>Two floods in Somalia and Malawi impacted 900,000 and 639,000 people respectively.</p> <p>The costliest hazard was a drought in South Africa with US\$ 1 billion.</p> | <p>The earthquake with a magnitude of 7.8 hit Nepal and the neighboring states of India, Bangladesh and China were also affected.</p> <p>9,000 people were dead and 500,000 became homeless due to the destruction of buildings.</p> |

Source: Drawn by the author by using OECD data

Table A.2: Natural hazards and financial losses in continents between 2016-2020

| | Europe | Africa | Asia |
|------|--|---|---|
| 2016 | <p>There were only severe storms for a few weeks. Some extensive floods in France and in Germany happened and a destructive hailstorm passed over Germany and the Netherlands but these events were not unlikely and extreme.</p> | <p>There were only 4 small earthquakes causing little damage. Southern Africa faced an extremely dry year, with millions of people affected by drought but surprisingly, floods caused damage in Ethiopia and Sudan got also affected from it.</p> | <p>A wildfire in China harmed 10 million people and that was followed by droughts in South-East Asia, with more than 4.5 million victims. It began in 2015 and lasted until 2017 that affected 330 million people every year. Luckily, the effect of earthquakes were lower than previous years.</p> |
| 2017 | <p>The unexpected return of winter to Europe resulted in significant losses in the agricultural industry, especially in the fruit-growing industry. It caused billions of dollars. Winter storms occurred in Germany, the Czech Republic and Poland which caused widespread economic damage.</p> | <p>An avalanche in Sierra Leone killed around 500 people, which made the second-highest number of fatalities in the world. Two tropical cyclones hit Madagascar and southern Africa. A drought widespread wildfires and severe floods occurred in Ethiopia, Kenya, and Somalia.</p> | <p>In China, the equivalent of a year's average rainfall fell in the capital Zhengzhou within only 3 days. 12 people died as a result of the rising waters and more than 500 people were evacuated from the Henan tunnels. This caused significant damage and forced 200,000 people to leave their homes. A typhoon hit 10 provinces in the city of Vietnam which caused 29 deaths, 600 house destruction, and damage to almost 40,000 homes. Agriculture was the most affected sector with a total damage of VND 5.4 trillion. An earthquake of a magnitude of 7.2–7.5 struck northeast Iraq and nearly 10,000 individuals were injured.</p> |

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| 2018 | <p>Severe drought caused widespread agricultural and forestry losses.</p> <p>2 winter storms and a major storm occurred along the Adriatic coast, affecting mostly Italy, Croatia, and Slovenia.</p> <p>The wildfires in Greece took 100 lives and a cold winter killed 77 people.</p> | <p>1,200 people were killed and 2 million people were affected in Kenya and Nigeria due to the severe floods. Somalia was suffered from flooding which impacted 700,000 people.</p> <p>Droughts in Kenya and Madagascar affected 3 million and 1.2 people respectively.</p> | <p>Natural disasters took the lives of 7,750 individuals in the area, with Japan and Indonesia being particularly damaged. 14 occurrences were recorded in Japan, 5 of them resulted in losses over 1 billion dollars.</p> <p>Severe floods, landslides and 2 tropical storms caused destruction on the region.</p> <p>An earthquake in Palu, followed by a tsunami, killed over 2,000 people and cost trillions in property damage.</p> |
| 2019 | <p>Few number of hazards are occurred in the continent. A winter storm damaged Germany, Poland, the Czech Republic, Ukraine, France, Belgium, Luxembourg, and the Netherlands. This brought severe floods and devastation to the Mediterranean region.</p> <p>Albania had one of the year's rare earthquakes which caused billion-dollar losses.</p> | <p>2 powerful cyclones hit the East African coast and Mozambique, Malawi and Zimbabwe were the ones that got the most damage. More than 1,000 people died as a result of these 2 incidents.</p> <p>Severe storms, rains and tremendous wind speeds caused significant flooding that destroyed entire communities and wiped off the agricultural output.</p> | <p>Typhoons in Japan and in China caused extreme damages.</p> <p>Monsoon flooding was also significant in India and China.</p> <p>An earthquake in China was one of the catastrophes that resulted in more than \$1 billion in losses.</p> |

| | | | |
|------|--|--|---|
| 2020 | <p>Heavy rains over the Mediterranean shores of southern France and Italy caused localized significant losses.</p> <p>Croatia was struck by 6.4 magnitude earthquake and it was one of the strongest quake in 140 years. Luckily, the fatality rate was low since the area has low population density.</p> | <p>Flooding had affected roughly 2.1 million people in West and Central Africa and many regions suffered from excessive rainfall.</p> <p>1.1 million people in 11 countries got affected. Homes, crops, goods, fields and land degradation were endangered.</p> <p>Additional shocks from major weather events lead vulnerable families to a crisis.</p> | <p>China's summer floods were the world's costliest single occurrence and the storm in India made landfall on the border between India and Bangladesh which was the costliest tropical cyclone of the year in the northern Indian Ocean.</p> <p>A tropical cyclone in northwest Pacific originally passed over Japan's southwest coast and left severe rain, flooding and several landslides in the region.</p> <p>An earthquake with 6.8 magnitude struck Elazığ in eastern Türkiye. 41 people lost their lives and 1607 people got injured in Elazığ, Diyarbakır and Malatya.</p> |
|------|--|--|---|

Source: Drawn by the author by using OECD data

APPENDIX B

GRAPHS OF PREVENTION WEB AND GFDRR

Graphs of news, events, publications and resources of prevention web and GFDRR are described.

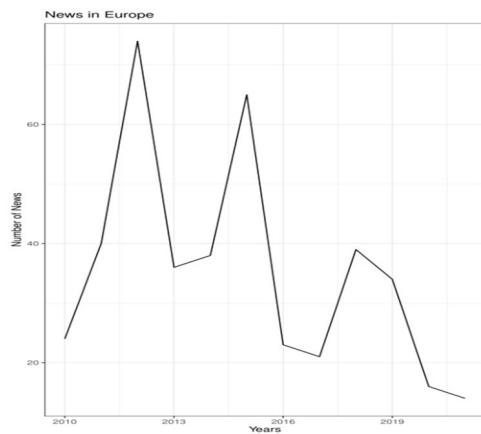


Figure B.1: News in Europe from Prevention web

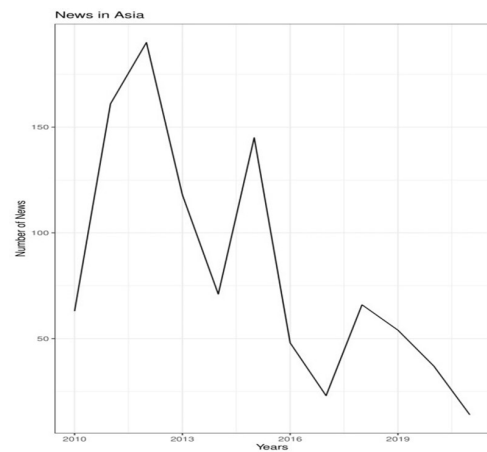


Figure B.2: News in Asia from Prevention web

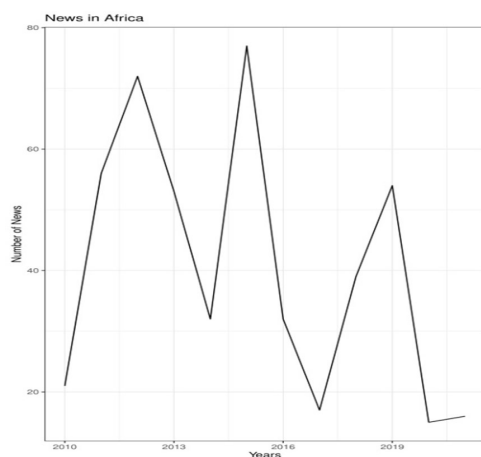


Figure B.3: News in Africa from Prevention web

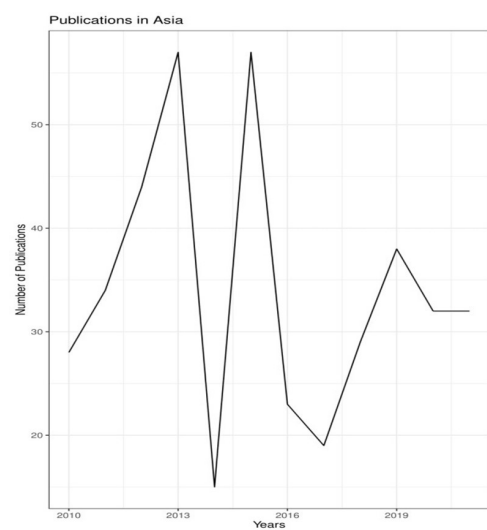


Figure B.4: Publications in Asia from Prevention web

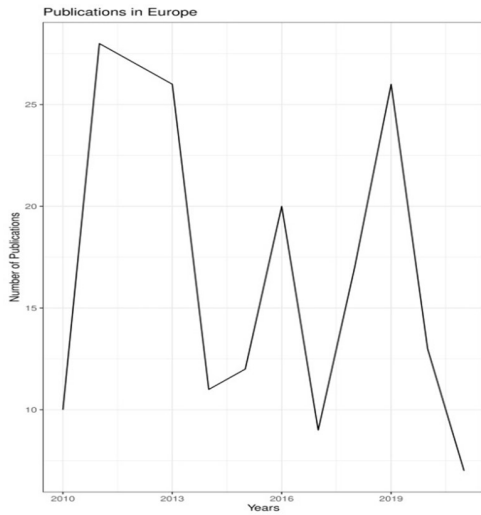


Figure B.5: Publications in Europe from Prevention web

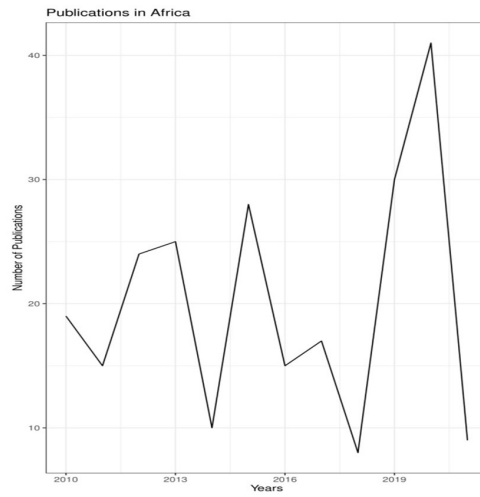


Figure B.6: Publications in Africa from Prevention web

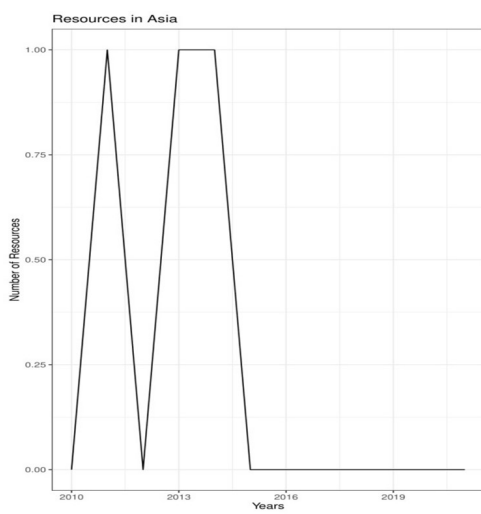


Figure B.7: Resources in Asia from Prevention web

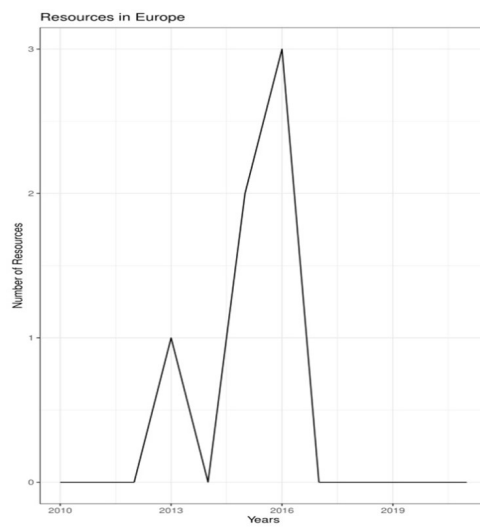


Figure B.8: Resources in Europe from Prevention web

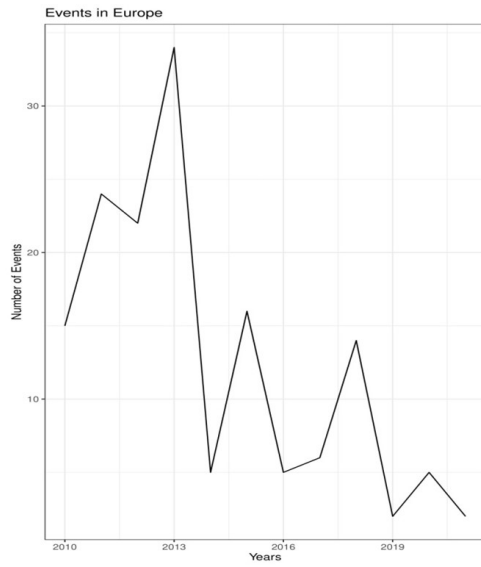


Figure B.9: Events in Europe from Prevention web

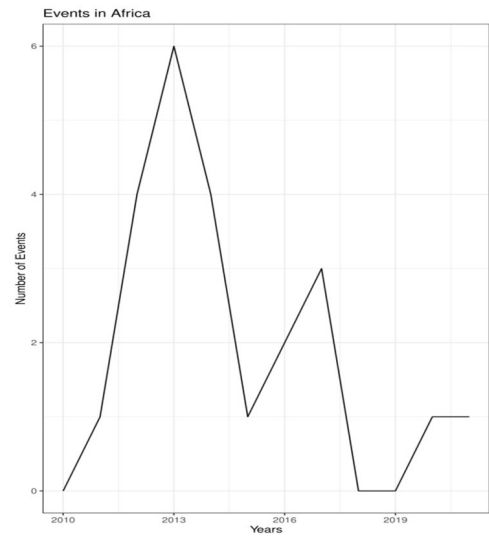


Figure B.10: Events in Africa from Prevention web

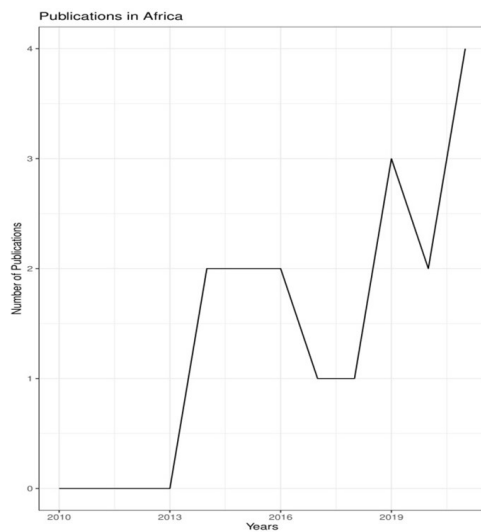


Figure B.11: Publications in Africa from GFDRR

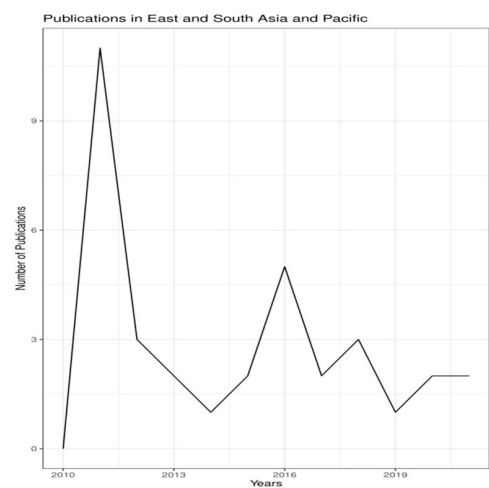


Figure B.12: Publications in East and South Asia and Pacific from GFDRR

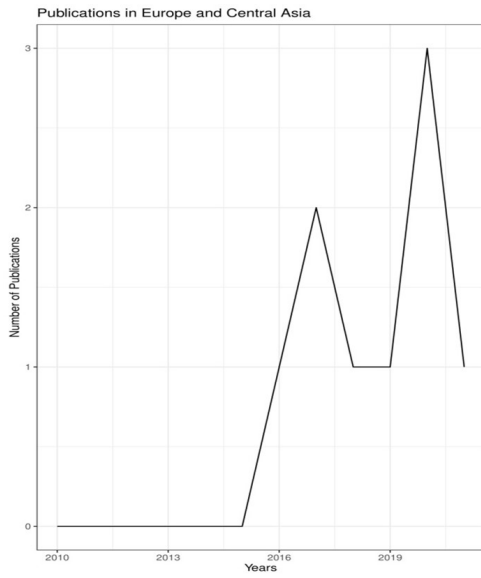


Figure B.13: Publications in Europe and central Asia from GFDRR

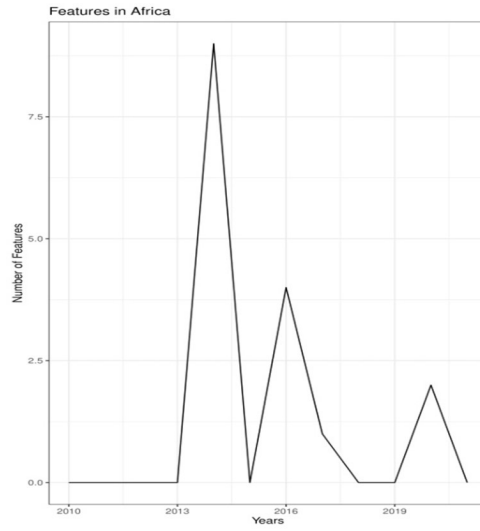


Figure B.14: Features in Africa from GF-DRR

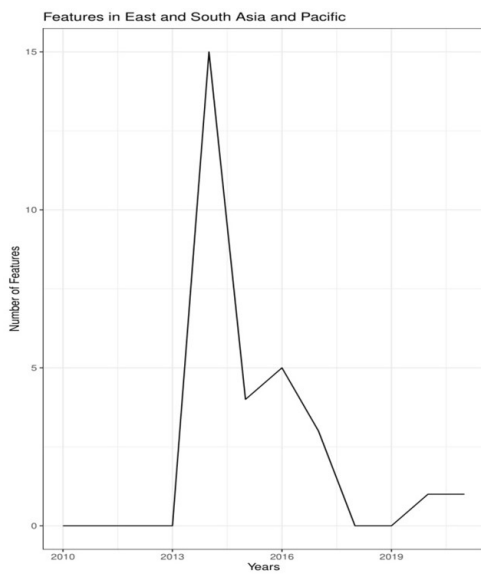


Figure B.15: Features in East and South Asia and Pacific from GFDRR