

## DISASTER RISK FINANCING AND INSURANCE: HOW FAR HAVE WE KNOWN?

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### **ABSTRACT**

*Natural catastrophes have resulted in massive losses for Indonesia. The government lacks the capacity to pay all damages caused by the disasters. The purpose of this research is to map the literature on catastrophe risk finance and insurance, particularly in terms of financial instruments that can be deployed. The scoping review approach was used in this study to locate and map relevant material. The findings of this study revealed that there are still significant research gaps on the issue of catastrophe risk finance and insurance, beginning with the research aim, financial instruments mentioned, and research methodologies and procedures applied. This study is planned to serve as the foundation for future research on the subject of catastrophe insurance in developing nations.*

**Keywords:** *Disaster Risk Financing and Insurance, Disaster Insurance, Catastrophe Insurance, Scoping Review, Financial Accounting*

### **ABSTRAK**

Kerugian yang ditimbulkan dari bencana alam di Indonesia sangat besar. Sementara itu, pemerintah tidak memiliki kemampuan yang memadai untuk menutup seluruh kerugian akibat bencana yang terjadi. Penelitian ini bertujuan untuk memetakan literatur mengenai *disaster risk financing and insurance*, khususnya mengenai instrumen-instrumen keuangan yang dapat digunakan. Penelitian ini menggunakan metode *scoping review* untuk menemukan literatur yang relevan dan memetakannya. Hasil dari penelitian ini menunjukkan bahwa masih terdapat beberapa celah penelitian mengenai topik *disaster risk financing and insurance*, mulai dari objek penelitian, instrumen keuangan yang dibahas, hingga metode dan teknik penelitian yang digunakan. Penelitian ini diharapkan mampu menjadi dasar bagi penelitian selanjutnya pada bidang asuransi kebencanaan di negara berkembang.

**Kata kunci:** *Asuransi dan Pembiayaan Bencana, Asuransi Bencana, Asuransi Barang Milik Negara, Scoping Review, Akuntansi Keuangan*

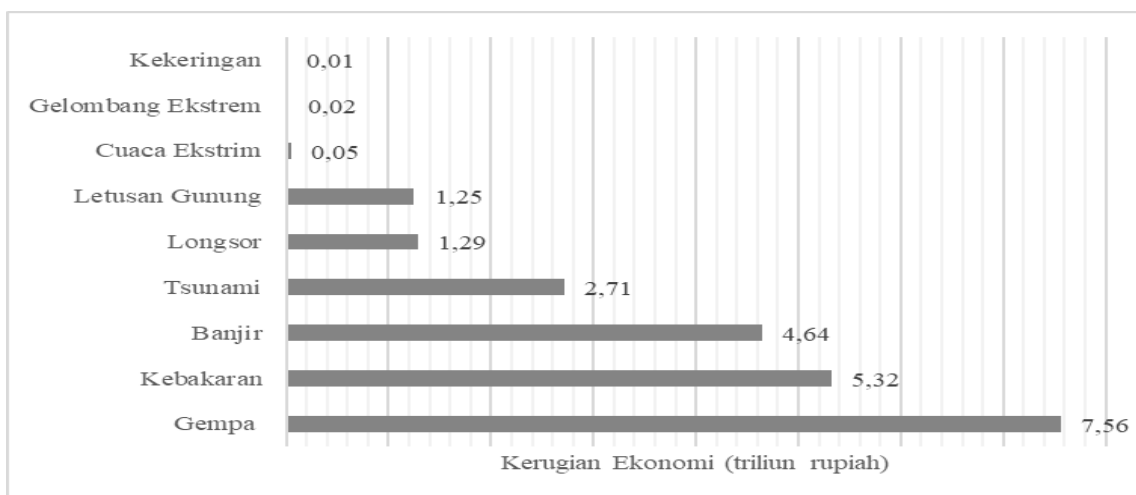
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## 1. INTRODUCTION

Indonesia is among the countries with a relatively high rate of susceptibility to natural catastrophes (Hadi et al., 2019). Indonesia is likewise at a high pace, with an average national index of 156.3 percent and an index of 136 districts/cities of 169.5 percent, according to the disaster risk index. Indonesia is situated at the junction of three tectonic plates and is part of the ring of fire (Akbar et al., 2018). Indonesia is prone to earthquakes and tsunamis due to its geological location (Amri et al., 2016). Moreover, the climate makes Indonesia prone to natural calamities, such as floods during the monsoon season and famine during the summer months (Agus, 2005). Natural catastrophes in Indonesia were produced not only by geological and climatic circumstances but also by a growth in population, which led to the formation of poorly structured towns and inadequate knowledge of cleanliness (BNPB, 2014). In particular, Law Number 24 of 2007 describes many probable sources of catastrophes in Indonesia. These causes are classified into three types: natural catastrophes, non-natural disasters, and societal mishaps (Mulyawan & Kristian, 2020). Natural catastrophes include earthquakes, volcanic eruptions, hurricanes, landslides, droughts, forest or land fires caused by natural sources, plant pests, epidemics, outbreaks, unusual occurrences, and cosmic events or astronomical objects (Tondobala, 2011). Meanwhile, human-caused forest or land fires, transportation accidents, building or technological failures, industrial consequences, nuclear fission, chemical spills, and space activities are examples of non-natural catastrophes (Novita & Zainuri, 2019). The last one is a societal tragedy brought about by social instability and war (Akhmad & Maryani, 2020). The advent of a calamity in Indonesia is undoubtedly undesirable by all stakeholders since the subsequent impact is far-reaching (Faturahman, 2018). The consequences of disasters might include physical damage, economic damage, and even fatalities (Artiani, 2011). The destruction of numerous institutions and infrastructure, such as houses, roads, bridges, schools, hospitals, and places of worship, can result in physical casualties (Widjanarko & Minnafiah, 2018). Disasters can entail economic losses in addition to physical damage (BKF, 2018). Figure 1 demonstrates the average lot of monetary losses suffered by Indonesia from 2000 to 2016.



**Figure 1. Average Economic Losses in Indonesia Due to Disasters from 2000 to 2016**  
Source: BKF (2018)

The researchers intend to collect and map research on catastrophe risk financing and insurance by utilizing the scoping review method. The scoping review technique has been utilized in several international studies to map out a topic that they intend to investigate. Alberton and Gorey (2018) researched the police profession using a scoping study. Cooper et al. (2020)

examined research-practice partnership research approaches in the field of education using this strategy. Scoping review is also commonly employed in health-related research, such as Murcott's (2016) study on mental health care received by patients aged 16 to 25. This research strategy is still not extensively used in Asian academics. In Indonesia, scoping studies are still primarily implemented for research mostly in health or nursing fields. In their study of working moms' experiences with exclusive breastfeeding, Nurvitriana et al. (2020) employed a literature survey. Meanwhile, Widiasih et al. (2020) were using the SET PRO technique to map research on the design of research protocols. Irafahmi (2019) utilized this method to analyze the relevancy of auditing education in the field of audit. Researchers have discovered little evidence of the scoping review method being used in accounting research, particularly in catastrophe risk finance and insurance studies. Based on this reason, our research fills the gap in disaster insurance works of literature by proposing two research objectives to fulfill: (1) how far we know disaster risk financing and insurance (DRFI), and (2) how far we comprehend the implementation of DRFI strategy in Indonesia.

## **2. METHODOLOGY**

### **The Scoping Review as Methodological Means to Synthesize DRFI Knowledge**

To map prior studies on disaster risk financing and insurance, this paper employed the scoping study method. Scoping research design is a type of literature survey that incorporates mapping salient scientific studies and summarizing each, in order to preserve a thorough understanding of the subject (Levac et al., 2010). Scoping survey, also known as scoping review, is used to map a complicated subject that has never been thoroughly studied heretofore (Colquhoun et al., 2014). Because the scoping is not intended to address a specific research topic, it can be applied to a wide range of studies (Daudt et al., 2013). Arksey and O'Malley (2005) were among the first to use the scoping review methodology (Colquhoun et al., 2014). This technique was being used to pursue four primary goals: (1) discussing the scope and character of the research; (2) calculating a grade for the use of a comprehensive systematic review; (3) summarizing and disseminating research evidence; and (4) identifying research gaps in the current publications (Daudt et al., 2013). The review can be carried out in five primary stages and one supplemental step, according to Arksey and O'Malley (2005)'s concept as displayed in Figure 2.

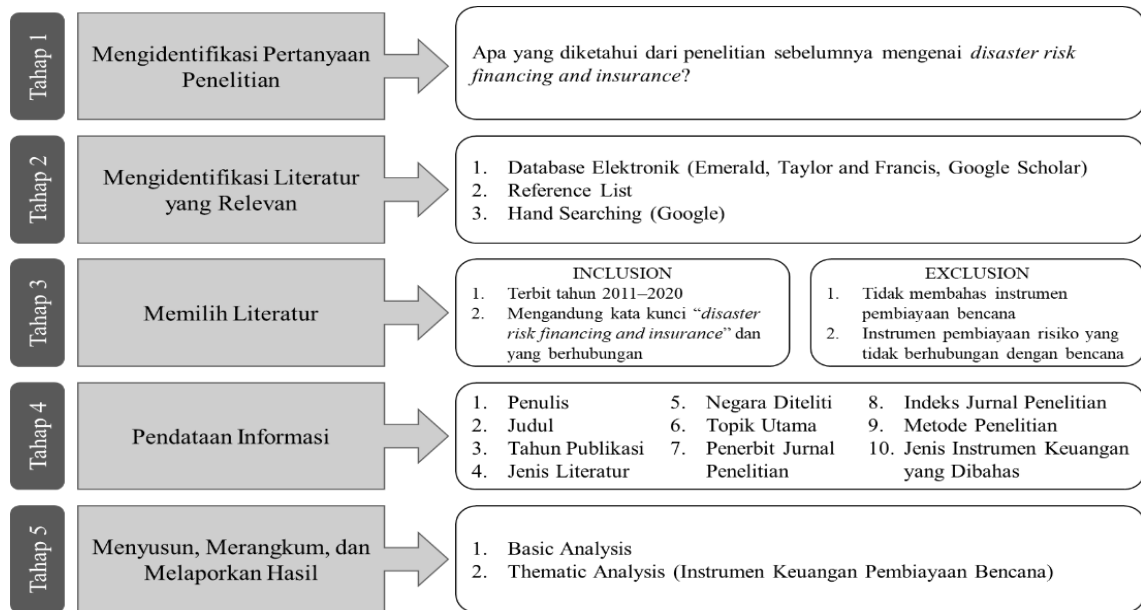
#### **Stage 1: Identifying Research Issues**

The first step is to figure out how the research challenge is going to be phrased. Framing of the problem will serve as a guide for designing research query tactics (Greidanus et al., 2019). The researchers formulate the research query as "what is known from past research about catastrophe risk finance and insurance?" in this study. The focus of this study will be on financial instruments used in disaster risk financing and insurance policies.

#### **Stage 2: Locating Suitable Literary Works**

Researchers seek appropriate study material to solve research concerns in order to have a comprehensive discourse (Kua et al., 2020). Published or unpublished papers can be used as pieces of knowledge (Peters et al., 2015). There are four approaches to searching for literature st, according to Arksey and O'Malley (2005). The first is to make extensive use of electronic databases

and the internet (Eacott & Freeborn, 2020). The second step is to browse through the bibliography (reference list) from prior studies (Eacott & Freeborn, 2020). If the researchers were unable to identify the primary literature on the topic addressed using the previous two methods, the researchers could conduct a hand-search of the key literature (Mikelyte & Milne, 2016). Finally, pre-existing knowledge and networks can be used to garner information about the key publications (Gurung et al., 2020). What's more, researchers might ask affiliated organizations directly for materials that have not been made available (Shaw et al., 2014). The journal and literature search engines included in this study are Emerald, Taylor & Francis, and Google Scholar. In addition, the researchers used the Google search engine for doing manual searches. The author utilizes the phrases disaster risk financing and insurance in online databases and search engines.



**Figure 2. Scoping Review Procedures**  
 Source: Arksey and O’Malley (2005)

**Stage 3: Selecting Relevant Works of Literature**

The previous stage's search results will, of necessity, comprise a large amount of irrelevant material (Gurung et al., 2020). As a corollary, researchers must pick the most relevant literature and discard research that is not related to the research topic (Shaw et al., 2014). Arksey and O'Malley (2005) created a systematic review approach that may be used to assure uniformity across researchers in selecting relevant research. The approach in question is the application of inclusion and exclusion criteria (Nizzero et al., 2017). This study defined the inclusion criteria for picking relevant studies, which were (1) papers published between 2011 and 2020 and (2) works of literature containing the words "disaster risk financing and insurance" as well as other keywords related to main keywords such as "disaster risk management", "disaster risk management risk reduction", "disaster risk insurance" in the title, abstract, or writings overview. Conversely, the exclusion conditions are as follows: (1) literature on disaster risk management and disaster risk reduction which does not cover disaster finance instruments, and (2) literature on risk insurance that is not associated with catastrophes.

**Stage 4: Charting the Data**

We documented the knowledge gleaned from the published studies in this fourth step

(Mikelyte & Milne, 2016). To deliver the best potential value to the reader, researchers must select the key information obtained from the literature (Jouda & Finn, 2020). This data will then be entered into Microsoft Excel (Shaw et al., 2014). In this study, information is gathered in the form of (1) author, (2) title, (3) year of publication, (4) type of literature, (5) country studied, (6) main topic, (7) journal publisher, research, (8) index of research journals, (9) research methods, and (10) types of financial instruments described in the literature.

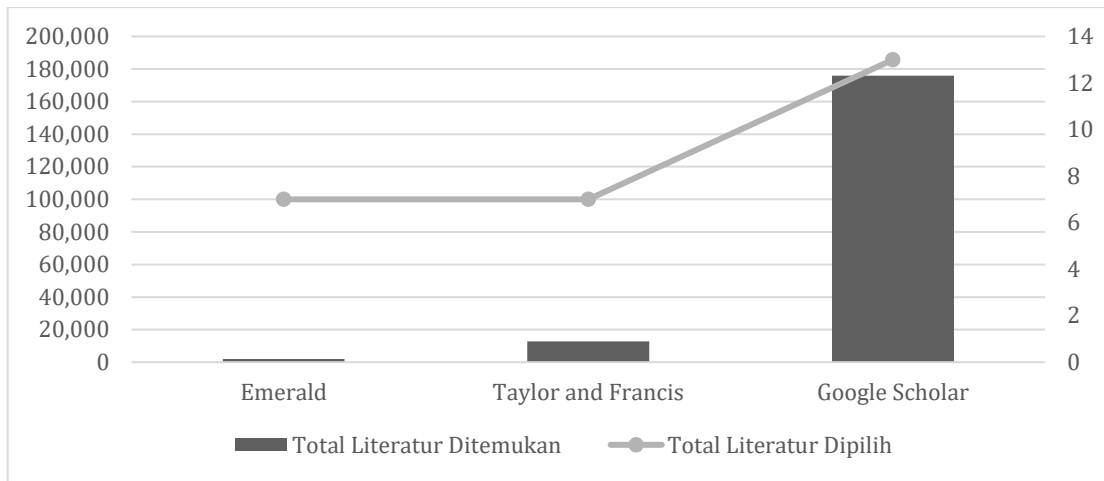
### **Stage 5: Assembling, Synthesizing, and Presenting the Results**

Because scoping review research does not include the accuracy of the findings, it cannot be utilized to determine if a study produces robust and generalizable findings (Shaw et al., 2014). Scoping reviews are more suited for identifying research trends and providing an insight into current literature on research subjects (Morvannou et al., 2018). There are two methods for presenting the findings of scoping review research (Levac et al., 2010). The first step is to offer a fundamental analysis of the extent, character, and dispersion of the knowledge acquired from the chosen literature (Gurung et al., 2020). The second step is to organize the chosen literature according to the topic of discussion (Greidanus et al., 2019). If researchers can present study findings consistently, scoping review research can discover various gaps in prior studies on the research issue (Peters et al., 2015). Scoping review study, in particular, to be more meaningful to readership involves contributions from professionals and stakeholders (Levac et al., 2010). As a response, Arksey and O'Malley (2005) incorporate the second round of consultation with relevant parties. Consultation can offer further information about potentially relevant literature that might provide valuable knowledge on the research issue (Sælør et al., 2014).

## **3. RESULT AND DISCUSSION**

### ***[Spotlight 1] How Far do We Have the Knowledge of Total Numbers of DRFI's Keywords?***

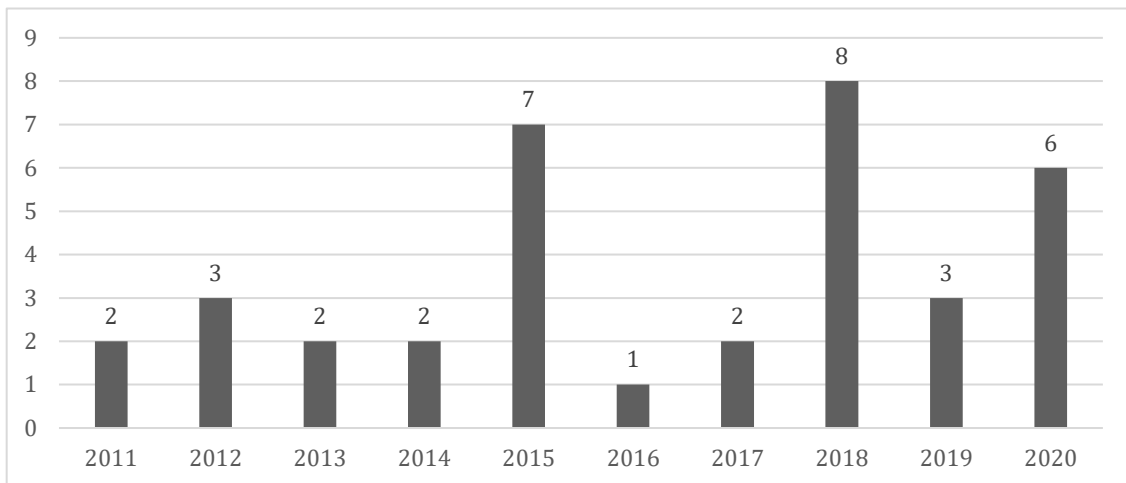
This study searches three internet databases for relevant material using the keywords "disaster risk finance and insurance." The number of search results for these terms in each database is depicted in Figure 3. The Emerald database yielded 2,000 results, Taylor and Francis yielded 12,787 results, and Google Scholar yielded 176,000 results. The researcher searched the whole body of literature for material that was relevant to the goal of the scoping review in this study. Utilizing the inclusion and exclusion criteria, seven pieces of literature from Emerald, seven kinds of literature from Taylor and Francis, and thirteen pieces of literature from Google Scholar were chosen. In addition to looking for literature in electronic databases, researchers used reference list approaches and hand searching with Google. Nine additional types of research were discovered using the two strategies, bringing the total number of papers used in this study to 36.



**Figure 3. Electronic Databases Used to Apply Keywords**  
**Source: Researchers' Analysis**

***[Spotlight 2] How Far do We Have the Knowledge of the Literacy Publication Year?***

The literature used in this study was published between 2011 and 2020. Figure 4 depicts how the literature on catastrophe risk finance and insurance changes year after year. There was a lot of literature in 2018 that explored catastrophe risk finance and insurance, specifically 8 research articles. Furthermore, by 2015, there were as many as 7 pieces of literature, and by 2020, there were as many as 6 works of literature. In contrast, in previous years, the literature on this issue was limited to one to three publications each year. This illustrates that the issue of catastrophe risk finance and insurance fluctuates year after year.

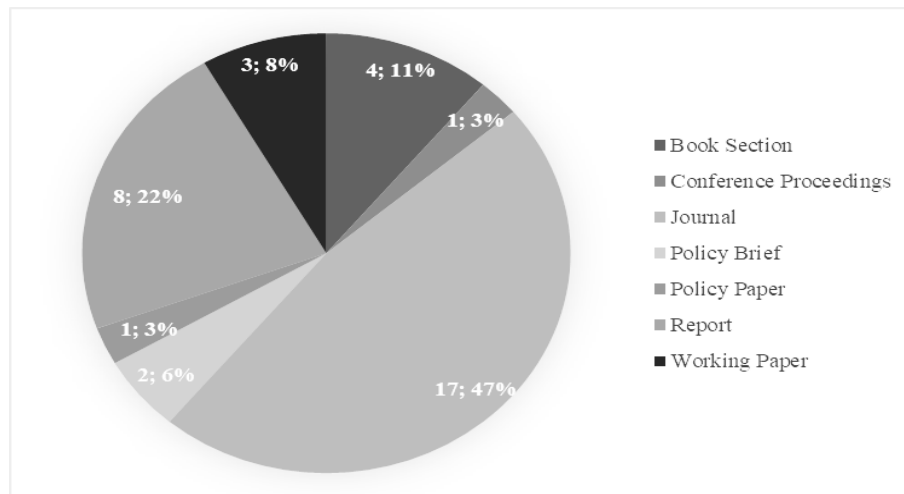


**Figure 4. Literature Publication Year**  
**Source: Researchers' Analysis**

***[Spotlight 3] How Far do We Have the Knowledge of the Type of Literature?***

Several categories of literature were used in this study, including (1) book chapters, (2) conference proceedings, (3) journals, (4) policy briefs, (5) policy papers, (6) reports, and (7) working papers. Figure 5 shows that the majority of the literature on catastrophe risk finance and insurance is in the form of journals and reports. Almost half of the entire literature used in this study is research publications, with 17 journals accounting for 47 percent. Then, with a total of

eight reports, the genre of knowledge in the area of reports was rated second. The book sector is behind with a proportion of 11%. Then came three working papers, two policy briefs, and the categories of literature in the form of conference proceedings and policy papers came in last with one each.



**Figure 5. Type of Literature Documented**  
**Source: Researchers' Analysis**

**[Spotlight 4] How Far do We Have the Knowledge of Journal Publishers?**

In this study, research journals are the most commonly used category of literature. All of the journals utilized in this study have been indexed globally, namely by Scopus. The journal classification by Scopus makes use of quartile values marked by the letter "Q." The Scopus index divides journals into four categories: Q1, Q2, Q3, and Q4. The index number "1" denotes the finest and most trustworthy academic publications. The index controlled by each journal publisher is shown in Table 1. In this study, the Q1 index includes six journals from five publishers. Then, from a total of six publishers, there are seven Q2 indexed journals. Following that, there is one Q3 journal, and the final Q4 index has three journals. It can be noticed that the publishers of indexed journals Q1 and Q2 are the ones who primarily address catastrophe risk finance and insurance.

**Table 1. Journal Publisher Indexes**

Publisher	Total
<b>Q1</b>	<b>6</b>
Climate and Development	1
Climatic Change	2
Housing Studies	1
Natural Hazards	1
Nature Climate Change	1
<b>Q2</b>	<b>7</b>
Agricultural Finance Review	1
Disaster Prevention and Management	1
Environmental Hazards	2
Geneva Papers on Risk and Insurance: Issues and Practice	1
International Journal of Disaster Risk Science	1
Planning Practice & Research	1
<b>Q3</b>	<b>1</b>

International Journal of Disaster Resilience in the Built Environment	1
<b>Q4</b>	<b>3</b>
British Actuarial Journal	1
Journal of Human Ecology	1
Journal of Natural Resources Policy Research	1

**Source: Researchers' Analysis**

***[Spotlight 5] How Far do We Have the Knowledge of Main Topics Addressed in Publications?***

Because the breadth of disaster risk finance and insurance policy is so extensive, it is not unexpected that this issue is debated on other topics as well. In a sense, the literature resorted to in this study does not cover the complete issue of catastrophe risk economics. Only 18 papers had the major topic of research on DRFI, out of all the literature examined in this analysis. Table 2 highlights three more subjects that are frequently discussed in relation to this policy: disaster risk insurance, disaster risk management, and disaster risk reduction. There are ten pieces of literature on disaster risk management, six on disaster risk insurance, and two on disaster risk mitigation, all of which dissect disaster risk finance and insurance policies.

**Table 2. Topics Discussed in Journal Articles**

Main Topic	Quantity	Author
Disaster Risk Financing and Insurance	18	Soetanto et al. (2020), Ozaki (2016), Lucas (2015), Saldana-Zorrilla (2015), Sirivunnabood and Alwarritzi (2020), Schäfer et al. (2020), Teh (2015), Jongman, Hochrainer-Stigler et al. (2014), Prabhakar et al. (2013), World Bank (2012), Hildreth et al. (2011), Juswanto and Nugroho (2017), Baur, et al. (2018), G20 (2012), Hillier (2018), Montier et al. (2019), Panda and Surminski (2020), Martinez-Diaz et al. (2019)
Disaster Risk Insurance	6	Hagenlocher, dkk. (2020), Odeku (2012), Booth (2018), Vincent et al. (2018), Wamsler and Lawson (2011), Hohl et al. (2020)
Disaster Risk Management	10	Coutaz (2018a), Coutaz (2018b), Coutaz (2018c), Coutaz (2018d), Linnerooth-Bayer and Hochrainer-Stigler (2015), Courbage and Mahul (2013), Xu (2019), Mechler and Hochrainer-Stigler (2014), Birkmann and Mechler (2015), Mochizuki et al. (2015)
Disaster Risk Reduction	2	Ruiz-Rivera and Lucatello (2017), Surminski, et al. (2015)

**Source: Researchers' Analysis**

***[Spotlight 6] How Far do We Have the Knowledge of Objects of Study in Literatures***

Table 3 demonstrates that, of all the studies considered in this research, developing nations have earned the greatest attention, with a total of nine studies. This is due to the fact that



catastrophe risk finance and insurance programs in emerging economies have yet to be established (Linnerooth-Bayer et al., 2009). Developing countries are more vulnerable to calamity risk, yet often lack the necessary authority to cope with disasters (Gurenko, 2007). Furthermore, the implementation of DRFI strategy around the world, both in developed and developing nations, is a subject of research that is frequently encountered. Studies utilizing study items from around the world are critical for seeing successful experiences and best practices from other nations (World Bank, 2014). Meanwhile, the topic of research from industrialized nations is quite modest because they have had catastrophe risk finance and insurance policies in place for decades (Aakre et al., 2010). The subject of research that explicitly addresses the execution of this strategy in a country has not been widely implemented.

**Table 3. Countries Widely Used as Research Objects**

<b>Study Object</b>	<b>Quantity</b>
America	1
Africa	1
South Africa	1
Asia Pacific	2
Australia	1
Bangladesh	1
China	2
Europe	2
Indonesia	2
Japan	1
Cambodia	1
South Korea	1
Mexico	2
Taiwan	1
South America and England	1
Malaysia, Philipines, Vietnam	1
America, Caribbean, and Europe	1
ASEAN	1
Other Developing Nations	9
The World	4

**Source: Researchers' Analysis**

***[Spotlight 7] How Far do We Have the Knowledge of Types of DRFI Financial Instruments?***

Table 4 presents that 19 different types of financial instruments are referenced in the various study literature reviewed in this investigation. Disaster hedges, options, swaps, and derivatives, each with just two works of literature, are examples of instruments that are rarely addressed. Because the market for these financial instruments has not evolved, these products have not been extensively employed as a method for catastrophe risk finance and insurance (Braun, 2011). Furthermore, only seven papers have explored the instrument of state property insurance (BMN). Many countries are more concerned with how to raise funds for BMN rebuilding and rehabilitation from donors than with acquiring BMN insurance (Fengler et al., 2008).

**Table 4. DRFI Financial Instruments Mentioned in Research Papers**

<b>DRFI Financial Instrument</b>	<b>Quantity</b>
Government Budget Allocation	27
Reserve Funds	26
Contingent Credit	17
Government Loan	24
Multi-Donor Trust Fund	28
Pooling Fund	14
Micro-credit	9
Micro-insurance	19
Property Disaster Insurance	19
Government Asset Insurance	7
Agriculture Insurance	21
Catastrophe Insurance	33
Insurance Pools	25
Reinsurance	25
Catastrophe Bond	21
Catastrophe Hedges	2
Catastrophe Options	2
Catastrophe Swaps	2
Catastrophe Derivative	2

**Source: Researchers' Analysis**

Meanwhile, disaster insurance is the most commonly mentioned financial item. This is due to the huge market demand for catastrophe insurance (Jaffee & Russell, 1997). Likewise, depending on the sort of disaster experienced in a nation, catastrophe insurance exists in a range of forms (Ericson & Doyle, 2004; Anderson, 1976). Table 5 lists the 28 forms of disaster insurance cited in the study's literature. Flood insurance is the most often utilized kind of catastrophe insurance, followed by earthquake insurance.

**Table 5. Varieties of Catastrophe Insurance Quoted in Empirical Literatures**

<b>Catastrophe Insurance</b>	<b>Quantity</b>
Avalance	1
Bushfire	2
Climate	2
Cyclone	7
Drought	8
Earthquake	15
Epidemic	1
Fire	6
Flood	20
Hailstorm	1
Hurricane	2
Inundation	1
Landslide	2
Lightning Strike	1
Meteorite Strike	1
Rainfall	6
Rough Sea	1
Snowfall	1

Catastrophe Insurance	Quantity
Storm	6
Terrorism	3
Tidal Wave	1
Tornado	1
Tsunami	2
Typhoon	4
Volcanic Eruption	2
Wildfire	1
Wind	5
Windstorm	1
Not Mentioned	2

Source: Researchers' Analysis

**[Spotlight 8] How Far do We Have the Knowledge of Research Methods Employed in Literature?**

Almost the majority of the journals included in this study employed qualitative research methodologies. Table 6 shows that 14 research publications embrace qualitative approaches, whereas just three research journals apply quantitative methods. This indicates that more scholars believe that the conversation on catastrophe risk finance and insurance is better served by a qualitative approach since it may give a broader viewpoint (Katongole, 2020). However, studies on disaster risk financing and insurance may be presented quantitatively as well. The presence of three journals that take a quantitative approach confirms so.

**Table 6. Research methods Applied in Research Articles**

Research Method	Quantity
<b>Qualitative</b>	<b>14</b>
Brief Description	1
Case Study	1
Comparative Analysis	2
Content Analysis	1
Cost-Benefit Analysis	2
Empirical Analysis and Modeling	1
Literature Review	5
Thematic Analysis	1
<b>Quantitative</b>	<b>3</b>
Comparative Analysis	1
Data Modeling	1
Probabilistic Assessment & Fiscal Resource Analysis	1

Source: Researchers' Analysis

Both qualitative and quantitative methodologies employ a wide range of techniques. Table 6 demonstrates that academics adopt eight qualitative research approaches and three quantitative research techniques in research publications. The most commonly employed methodology in the qualitative method is the literature review, which consists of five journals. Furthermore, comparative analysis and cost-benefit analysis are the second most popular techniques utilized in qualitative journals. Meanwhile, three strategies are applied in the quantitative method: comparative analysis, data modeling, probabilistic evaluation, and fiscal resource analysis. Based on the finding, there are numerous research gaps in the field of disaster

risk financing and insurance. Using many current analytical approaches, quantitative research may still be investigated in more depth. Nevertheless, even when using qualitative methods, a plethora of additional research strategies, aside from a literature review, may be selected to prepare studies on DRFI.

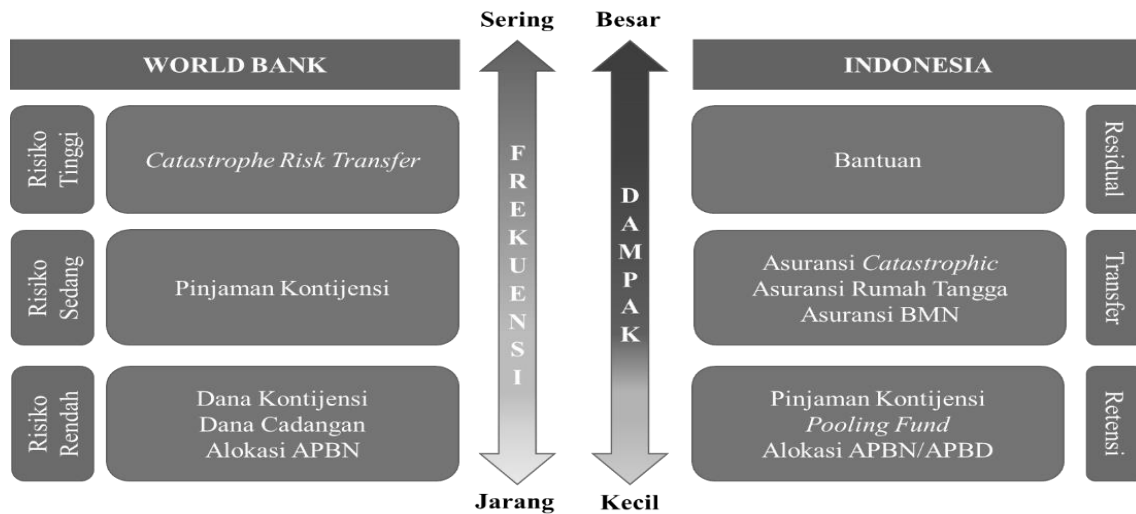
### **Discussion: How Far do We Apprehend the Implementation of DRFI Strategy Deployment in Indonesian Context?**

The impact of catastrophes necessitates government intervention to lessen the extent of damage and the long-term consequences that might result (Dari-Mattiacci & Faure, 2015). This demonstrates that the government must plan ahead of time for a calamity since the consequences will be enormous (McEntire & Myers, 2004). Furthermore, catastrophe management takes many years and has an impact on the quality of human life (Zhang, 2016). However, the Indonesian government does not currently have the capacity to compensate for disaster-related losses (Pahleviannur, 2019). As a result, a disaster management funding system is required to limit these risks (Loh, 2005). This catastrophe finance technique is known as disaster risk financing and insurance in the international community (Sirivunnabood & Alwarrtzi, 2020). Other countries, particularly wealthy countries, have put in place catastrophe risk funding and insurance arrangements (Klein & Wang, 2009). Some of these nations are disaster-prone or have recognized the severity of the losses that would be incurred as a result of disasters (Ghesquiere & Mahul, 2010). In 2018, Indonesia, as a developing country, developed a catastrophe risk finance and insurance plan (BKF, 2018). As a result, Indonesia needs a great deal of information and learning from nations that have implemented this approach (Sawada & Zen, 2014). Other parties' reports and studies can be used to gain knowledge.

DRFI is still the best disaster management financing scheme for an emerging economy like Indonesia. The scheme is a proactive strategy for disaster risk reduction that tries to decrease disaster risk through early risk identification and the development of financial mechanisms to mitigate the impact of disaster risk (Katongole, 2020). After identifying and analyzing risks and risk mitigation, DRFI is the final stage in the catastrophe risk management process (Mechler, 2004). The first stage requires identifying and analyzing the amount of the risk (Ghesquiere & Mahul, 2010). The categories of disaster risk are classified based on the characteristics of natural catastrophes, the extent of the effect, and the likelihood of occurrence (Ozaki, 2016). Miller and Keipi (2005) categorize calamity risk into two categories: low risk and high risk. Following the determination of the degree of catastrophic risk, the government must decide what activities must be taken to minimize the risk (Mechler, 2004). The next step is to determine which financial instruments are appropriate for use in relief efforts (Clarke et al., 2017).

In 2011, the World Bank issued advice on which financial instruments are most suited for use in Indonesia. The World Bank's suggested plan divides financial instruments for disaster risk financing and insurance into three major groupings (as portrayed in Figure 6), namely instruments for low, medium, and high-risk layers (World Bank, 2011). A low-risk layer can incorporate a financial instrument in the form of an APBN (Andersen, 2002). The medium risk is then covered by contingent loan funding (ADB, 2019). Conversely, attempts must be made to transfer risk to other parties, such as through calamity coverage and catastrophic bonds, for the high-risk layer (Clarke & Mahul, 2011). In 2018, Indonesia finally implemented a catastrophe risk finance and insurance plan (World Bank, 2020). The catastrophe risk finance and insurance strategy proposed by Indonesia is more extensive than the World Bank's approach. Indonesia categorizes financial instruments into three kinds based on risk management, which takes the form of retaining, transfer, and residual risk (BKF, 2018).

**Figure 6. World Bank and Indonesia DRFI Strategy**



Source: World Bank (2011) and BKF (2018)

When the government undertakes risk retention, it will employ APBN/APBD allocations, pooling funds, and contingent loans (GIZ, 2019). The government will then transfer disaster risk through insurance, such as catastrophic insurance, home insurance, and state property insurance (Poundrik, 2011). However, the government will seek assistance from other nations or international organizations to mitigate hazards that cannot be avoided via risk management (Linnerooth-Bayer & Mechler, 2007). The use of financial instruments for disaster risk financing and insurance is not confined to those advocated by the World Bank and Indonesia. Several other innovative disaster-financing vehicles can be explored by the international community (Linnerooth-Bayer & Hochrainer-Stigler, 2015). Reinsurance, catastrophe options, disaster swaps, and calamity bonds are some examples of these novel alternative investments (Klein & Wang, 2009). Catastrophic insurance comes in a variety of forms, including flood insurance (Jongman, Koks, et al., 2014), earthquake insurance (Tao et al., 2010), and agricultural insurance (Akinola, 2014).

#### 4. CONCLUSION

The mapping of distinct literature on these policies can help to expand understanding of catastrophe risk finance and insurance. This literature can be utilized to educate more about financial instruments that have been used to perform DRFI solutions. Additionally, this research can identify where there is a research gap in the insurance strategy. The gap can be used to provide recommendations and advice to future academics conducting research on the field of DRFI. Future scholars should conduct an investigation on disaster risk finance and insurance relying on the tactics followed by each country. Then, if you want to talk about financial instruments shown in disaster risk finance and insurance, you should discuss catastrophe hedges, swaps, options, and derivatives. Therefore, further research may scrutinize the applicability of BMN insurance in catastrophe risk finance and insurance schemes. Catastrophe insurance, which is still connected to financial instruments, is also a highly intriguing instrument to explore. Because of the various forms of disaster insurance, the examination of this instrument is not as in-depth. This topic's methodology is currently restricted to a qualitative approach with a literature review strategy. In

a nutshell, there are still significant gaps in qualitative research when compared to other methodologies. Of course, by using quantitative research methodologies, more gaps may be addressed.

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