A paper presented at the 17th International Conference on Sustainable Development at the Autonomous University, Barcelona, Spain, July, 2023.

Flood disaster mitigation policy in strengthening social and economic resilience in Java island

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OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada.
ISSN 1923-6654 (print) ISSN 1923-6662 (online) www.oidaijsd.com
Also available at https://www.ssrn.com/index.cfm/en/oida-intl-journal-sustainable-dev/

Abstract: Indonesia is one of the most disaster-prone countries in the world and Java Island is particularly vulnerable to flooding due to its dense population, urbanization, and geographical location. Natural disasters cause huge losses both socially and economically. East Java Province ranks second with the most flood events in Indonesia. Floods have an impact on people (deaths, suffering), physical, and economic losses. Floods have caused enormous damage to the island's economy, infrastructure, and human lives, highlighting the urgent need for effective flood disaster mitigation policies that can prevent or reduce the impact of disasters.

The social and economic risks and impacts posed by flooding need to be responded to by effective and resilient policies. Efforts to build resilience in line with the goal of reducing flood risk can be carried out through a combination of prevention, mitigation, and preparedness. Flood mitigation should not only focus on structural aspects but also non-structural aspects.

This research aims to: (i) Assessing flood mitigation policies in Java Island in strengthening the social and economic resilience of the community; (ii) Analyze the design of flood mitigation policies that are able to increase the social and economic resilience of the people in Java Island; and (iii) Proposing recommendations for flood mitigation policies that are able to increase the social and economic resilience of the people in Java Island.

This research uses a quantitative and qualitative approach. Secondary data in this study were obtained from government agencies and government data portals or other credible sources. Primary data were obtained through discussions with relevant sources/agencies. The expected results of this research are: (i) Evaluation of the flood mitigation policies in Java Island; (ii) Analysis and study as well as evaluation of flood mitigation policy designs that are capable of increasing the social and economic resilience of the people in Java Island; and (iii) Formulation of flood mitigation policy recommendations that are able to increase the social resilience and sustainable economy of the people in Java Island.

Overall, this research will contribute to the existing literature and government on flood disaster mitigation policies and their potential to enhance social and economic resilience. It will also provide insights and recommendations for policymakers, practitioners, and academics to improve the flood disaster mitigation policy in Java Island.

Keywords: Flood, Mitigation, Social Resilience, Economic Resilience, Java Island

Introduction

Risk Disaster is a serious environmental issue and is the focus of common attention at the global level (as seen in the 13th goal of the Sustainable Development Goals/SDGs), namely handling climate change and especially in Indonesia (as stated in Law No. 32 of 2009, regarding with climate change adaptation regulations) huge losses; both socially and economically. One of the most obvious impacts that can be seen when a disaster occurs is the loss of people's lives and damage to infrastructure (Daksiya et al., 2017). In addition, efforts to build the resilience of the state, society, and this disaster, are also become the key objectives in the Sendai Framework for Disaster Risk Reduction (SFDRR). Global social goals related to disasters such as SDGs and SFDRR agree to try to reduce fatalities and victims who die from natural disasters around the world (Ahmad et al., 2017).

Risk Disaster is also one of the development challenges in Indonesia, especially in big cities. According to data from the National Disaster Management Agency (BNPB) throughout 2021 in Indonesia, there were 3,506 recorded disaster events and the dominating disaster events were floods (1,174 incidents), landslides (1,035 incidents), and tornadoes (837 incidents). Data shows that disaster events in 2021 had an impact on more than 5.6 million people affected, including 709 people died, and more than 146,248 houses and 3,135 facilities (education, health, offices, roads, and bridges) were damaged. Floods are ranked first in the threat of disaster events globally and in Indonesia with the highest frequency of occurrence. Flood disasters have increased rapidly worldwide in recent years (Buchecker et al., 2013; Surminski & Eldridge, 2015) accompanied by an increase in the impact of losses (Jongman et al., 2015). The social and economic risks and impacts (Haddad and Teixeira, 2015; Lima and Barbosa, 2019; and Brody and Highfield, 2013) posed by flooding need to be responded to by effective and resilient policies (Sharma and Shaw, 2011). Based on OECD data (2010), Mumbai, a city in India, has experienced severe flooding. There are two potential factors that support this, namely climate change and rapid urbanization. The study conducted by Ahmad et al. (2017) tried to identify the link between natural disasters and public health impacts in the SDGs era in Pakistan.

According to the 2022 Indonesian Disaster Information Data (DIBI), Central Java Province ranks first with the most flood events in Indonesia, namely 276 incidents in 2021. Then East Java Province (125 incidents) and West Java Province (120 incidents) are in second and third order. Next are the Provinces of Bangka Belitung (75 incidents), North Sumatra (65 incidents), and Central Sulawesi (60 incidents). From the frequency of incidents, three provinces in Java Island have the highest incidence rate, which is over 100 incidents. Furthermore, flood disasters have an impact on victims who die, suffer, flee, damage to houses, and damage to other facilities. For the record, floods on Java Island in 2021 had an impact on 109 people died, 2.3 million people suffered, 127 thousand people were displaced, 2,471 houses were damaged, and 274 facilities were damaged (DIBI Data, 2021).

As mentioned above, the social and economic risks and impacts posed by flooding need to be responded to by effective and resilient policies. Sharma and Shaw (2011) assess resilience in 5 dimensions, two of which are social resilience and economic resilience. Social resilience is defined as the ability of a group or community to cope with external pressures and disturbances as a result of social change (see also Adger, 2000). Meanwhile, economic resilience refers to the ability to recover from or adapt to the negative impacts of external economic shocks (see Briguglio and Cordina, 2006). Efforts to build resilience in line with the goal of reducing flood risk can be carried out through a combination of prevention, mitigation, and preparedness (Early Warning System), and others (Smith, 1992; Cutter, 2016; Zevenbergen, 2016; Gupta et al., 2003). Although according to de Vet, et al. (2019) most governments around the world prioritize disaster response and recovery over risk mitigation. In Australia and the United States only 3 % and 4% of disaster management spending are used for mitigation (Coppel and Chester 2014; Cigler 2017), while according to the United Nations, financing disaster risk management of US$1 to increase resilience can reduce response and recovery costs by US$7 (United Nations, 2012).

Furthermore, according to Urbanus (2021) and Wibowo (2019), one of the successes in efforts to implement disaster mitigation is through non-structural mitigation such as policy and institutional strengthening, risk assessment and integrated planning, thematic handling of disaster-prone areas and strengthening preparedness, and handling of disaster emergencies. Meanwhile, according to Nazamuddin (2007), several non-structural mitigation policy instruments include: (i) cash assistance and public works programs; (ii) assistance for the unemployed; (iii) wage and price subsidies; (iv) targeted human development or cash transfer programs linked to school participation requirements or regular visits to health clinics; (v) exemption from certain public service fees: (vi) food and nutrition assistance programs; and (vii) microfinance and social fund programs. The government can provide choices to the public with adequate information about the types and nature of flood resilience programs. The things above emphasize the importance of mitigation in reducing risk and building resilience to disasters. In the event of flooding in Indonesia, especially Java Island, social and economic aspects are the dominant aspects affected. Flood mitigation policies need to be directed at increasing the social and economic resilience of the community. Therefore, this research will formulate flood mitigation policies that are able to increase the social and economic resilience of the people on the Java Island.

Theoretical Background

Theory of Public Finance

Since 2001, Indonesia has implemented a fiscal decentralization system, which has resulted in the delegation of financial authority to regional governments. So that the sources of financing for the implementation of regional development in the future are as follows: (i). Regional Original Revenue (PAD). Regional original income comes from regional original economic sources, namely from the results of regional taxes, regional levies, results of separated

regional wealth management, and other legitimate regional original income (Halim, 2007; Nurcholis, 2007); (ii). Balancing Fund. Balancing funds are regional funding sourced from APBN funds consisting of Revenue Sharing Funds (DBH), General Allocation Funds (DAU), Special Allocation Funds (DAK) (Mahsun et al, 2006: 39); (iii). Regional Loans. Regional Loans are all transactions that result in the Region receiving a sum of money or receiving monetary benefits from other parties so that the Region is burdened with the obligation to repay; and (iv). Other valid receipts.

Since 2018, the central government has prepared a Government Work Plan (RKP) with the theme "Stimulating Investment and Infrastructure for Growth and Equity". The approach used in preparing the 2018 RKP is strengthening the implementation of the money-following program policy. What is meant by "Money Follow Program" is that the budget is allocated for priority programs that are jointly determined. So far, what the ministries/agencies (K/L) have mostly done is the "Money Follow Function" whereby the budget is allocated to each post in each K/L regardless of priority. Strengthening the money follow program is carried out using a holistic-thematic, integrative, and spatial approach with attention to: (i). planning controls; (ii). Strengthening planning and budgeting; (iii). Strengthening regional-based planning; and (iv). Strengthening the integration of funding sources.

Meanwhile, this regional financing policy requires the use of alternative methods, such as: (i). Regional loans. Funding for the development of public service infrastructure comes from the Central Government, Other Regional Governments, Bank Financial Institutions, and Non-Bank Financial Institutions. This loan requires DPRD approval for medium and long-term loans; (ii). Municipal bonds. Long-Term Loans originating from the community to finance public infrastructure projects that generate revenue for the APBD and/or provide benefits for the community; (iii). Cooperation between the Government and Business Entities (PPP). PPP Cooperation is a cooperation between the Government and Business Entities in the provision of infrastructure services for the public interest based on an agreement between the two parties by taking into account the principle of risk sharing; (iii). Non-Budget Investment Financing (PINA). PINA is a financing mechanism for priority investment projects whose funds come from sources other than the government budget which are encouraged and facilitated by the Ministry of National Development Planning/Bappenas. Priority projects selected to be funded with the PINA scheme are: (i) Supporting the achievement of development priority targets; (ii) Having economic and social benefits for the people of Indonesia; (iii) Having commercial viability; and (iv) Meeting the readiness criteria. Sources of financing for PINA can come from investment, managed funds, banking, capital markets, insurance, financial institutions, other financial service institutions and other legal financing. One of the obstacles to financing disaster mitigation is the low priority of local governments to do so due to budget constraints. One alternative to overcome this is by implementing PPP and PINA by the local government. Nonetheless, according to Iqbal (2020) cooperation between the Government and Business Entities (PPP) is an alternative that can be implemented to cover the budget in providing infrastructure, especially in disaster mitigation.

Sustainable Development Theory

The concept of sustainable development has become an important part of the concept of social science, especially economics. Rogers et al. (2008) stated that, the main concept of sustainable development refers to the relationship between economic development and environmental quality, social leveling, vis a vis conflict on how humans must understand, achieve, and maintain it for survival in the future (see among others: Turner, 1988; Jacobs, 1991; and Kibert, 2016). This concept has been in motion since 1972 when a study attempted to explore the relationship between environmental quality at an international conference (see Rogers et al., 2008). Furthermore, Rogers et al. (2008) and Hariss & Roachs (2018) compiled three main components in the concept of sustainable development, namely: (i). economic approach. Maximizing revenue and maintaining or increasing the return on capital (constant or increasing return of scale); (ii). ecological approach. Maintaining the resilience of the biological environment and life support systems; and (iii). Socio-cultural approach. Maintain social stability and cultural systems.

The concept of sustainable development is reflected through global goals known as the Sustainable Development Goals (SDGs). The implementation of good governance in a program needs to involve various stakeholders (multi-stakeholders), especially also on the SDGs which is called collaborative governance (see Florini & Pauli, 2018 and Sachs, 2015). The goals of SDGs which are closely related to disaster mitigation and socio-economic resilience are related to SDGs 13 namely Mitigating Climate Change by strengthening the resilience and adaptive capacity of more vulnerable areas, such as countries in the middle of the continents and island nations. This handling must go hand in hand with efforts to increase awareness and incorporate the steps into national policies and strategies. With political will and widespread use of technological measures, it may still be possible to limit the rise in global average temperatures to two degrees Celsius above pre-industrial levels

Mitigation Concept

Mitigation as a Part of Disaster Risk Management

Disaster risk management is an important aspect of development to handle and overcome disaster risks, prepare before a disaster occurs and rebuild communities after a disaster occurs (Feng, 2009; Tan et al., 2011; and Kohler, 2004). Disaster risk management takes into account and links technical, economic, social, political, ecological and cultural aspects into an integrated system and this will work effectively by carrying out disaster management planning and good cooperation at all levels. Disaster reduction efforts are launched through the World Conference on Disaster Reduction. The conference produced the Sendai Framework (2015-2035) which is a non-binding voluntary agreement, within 15 years, which recognizes that countries have an important role in handling disaster risk. This role can be divided between local government, private divisions, and others. According to the Asian Disaster Reduction Center, disaster risk reduction in the concept of Disaster Risk Management (DRM), consists of 4 phases, namely: (i) prevention/mitigation; (ii) preparedness; (iii) response (response); and (iv) rehabilitation/reconstruction. Disaster management policies in Indonesia also use the 4 phases of the disaster management cycle. Disaster management when linked to the disaster cycle consists of activities before a disaster occurs, during a disaster, and after a disaster occurs. Activities before a disaster occurs (pre-disaster) in the form of prevention and mitigation (impact reduction) as well as preparedness activities. When a disaster occurs, an emergency response is held and after a disaster occurs, rehabilitation and reconstruction efforts are carried out.

Flood Mitigation

According to the study by Dewi and Suharjo (2014), structural mitigation forms for flood disasters include: (i) Construction of infiltration wells that can help minimize flooding in flood-prone areas; (ii) Improvement of drainage such as culverts to accommodate water; and (iii) River dredging due to siltation that occurs. Meanwhile, the non-structural mitigation that can be carried out includes: (i) Socialization of the Musrenbangkel group held by the sub-district for the community to participate in minimizing flood disasters through voluntary work cleaning up garbage; (ii) Socialization in helping to carry out the river dredging process; and (iii) Socialization in building arrangements so as not to disturb the surrounding waterways.

According to Yuniartanti (2018) structural mitigation recommendations for reducing flood risk include: (i) Preparation and evaluation of a drainage planning system (Drainage Master Plan); (ii) Construction of retention reservoirs; (iii) Development of an early warning system; and (iv) construction of jetty and river naturalization. While the non-structural mitigation carried out includes: (i) Urban forest development; (ii) Upstream watershed conservation; and (iii) Plans for dry land farming with the concept of agroforestry. According to Robbani et al. (2020), forms of structural mitigation in riverside areas, namely: (i) Evaluation of the drainage system; (ii) Creation of Green Open Space (RTH) on river banks; (iii) Building a catchment area in the form of a biopore or retention pond to restore a number of land functions along the riverbank area; and (iv) Normalizing the river in the form of widening and deepening the river. Meanwhile, the forms of non-structural mitigation in riverside areas are: (i) Literacy and disaster counseling in schools and communities; (ii) Communication and mutual cooperation between the community and the government; and (iii) Determination of evacuation routes and gathering points. Judging from its nature, mitigation can be classified into 2, namely passive mitigation and active mitigation (Asprilliana, 2018). Passive mitigation measures include drafting regulations and policies, making disaster-prone maps, developing guidelines or standard procedures, research or studies, and forming organizations. While active mitigation can be in the form of making warning signs/signs, supervising development implementation, basic disaster training, resettlement of residents, and building an evacuation system.

Then according to Urbanus et al. (2021) several structural and non-structural mitigation practices are described as follows: (i). Structural mitigation (among other things: Building embankments and water defenses along rivers that are prone to flooding and near settlements; Regulating flow rates and water loads by looking at the speed in the upstream area; and Cleansing river ecosystems in maintaining contents in rivers in reducing sedimentation in rivers); and (ii). Non-structural mitigation (among other things: Forming self-help groups in the community; Forming an extension group and conducting training; Creating a working group; Evaluating the mapping of flood-prone areas; Rehabilitating infrastructure both facilities and infrastructure in dealing with disasters; Analysis of flood data; Making disaster-prone maps; Availability of clothing, food, boards; Create standard operations for flood control; Conduct Evacuation Simulations; and Hold Focus Group Discussions.

The Resilience of Social and Economics

Resilience is a measure of a system's capacity to cope with shocks and various changes, while at the same time maintaining the same basic structure and function (see, among others: Wilde, 2011; Maddi and Khoshaba, 2005; Wagnild and Young, 2007; Twigg, 2007; Glantz and Jhonson, 1999). The faster a system returns to normal, the system has a higher resilience. In the context of disasters, resilience is defined as the ability of a system, community or society that is exposed to threats to resist, absorb, accommodate and recover from the impact of a hazard quickly and efficiently (UNISDR, 2009).Twigg (2007) views resilience to disasters as consisting of three important aspects, namely: (i) The capacity to absorb pressure or forces that destroy through resistance or adaptation, (ii) The capacity to manage, or maintain certain basic functions and structures (bounce back) during hazard events; and (iii) The capacity to recover or 'bounce' back' after an event (learning and adaptation). The Climate and Disaster Resilience Initiative (CDRI) is an instrument for assessing the status of disaster resilience, including climate-related disasters. In CDRI, resilience assessment uses 5 dimensions of criteria, namely physical, social, economic, institutional and natural dimensions (Sharma & Shaw, 2011).

Social resilience is the ability of a group or community to cope with external pressures and disturbances as a result of social, political, and environmental changes (Adger, 2000). Social resilience explains how individuals who are bound in community groups and communities create positive self-defense in the face of various pressures and shocks, in this case the threat of disaster. Meanwhile, the family of economic resilience is understood as a dynamic state of persistence and strength in facing various challenges, threats, and obstacles as well as disturbances from both external and internal, directly or indirectly endangering the survival of the economy (Wulandari, 2017). Economic resilience refers to the ability to recover from or adapt to the negative impacts of external economic shocks (Briguglio and Cordina, 2006).

Research Methodology

This study uses a qualitative approach with the grounded theory type which includes coding techniques. Bandur (2019) describes several things, namely: (i). Understand the meaning conveyed by respondents to the phenomenon being studied; (ii). Provide open-ended questions to understand the complexity of the main ideas or phenomena under study; (iii). Data can be in the form of words/text, pictures, and so on; (iv). The use of analysis of text, images, and so on to obtain broad and general patterns; and (v). Identify the opinion/position of each participant. The data collection in this study was carried out through Focus Group Discussion (FGD) which involved stakeholders in accordance with the formulation of the problem which was built according to the characteristics of the first qualitative research. Furthermore, in the FGD conducted, stakeholders will be directed to provide perspectives on the formulation of the problems formed in this research so that the objectives of this research can be achieved. The results of the FGD activities will be written down in the form of transcripts from each informant involved. Furthermore, based on the transcripts that have been prepared, a coding process will be carried out systematically. In this case, coding is intended to be able to draw on the existing themes contained in the informant's perspective in the form of coding nodes. In addition, a systemic literature review will also be carried out to support the findings in the coding analysis.

Furthermore, the literature review will be carried out using some software assistance, starting from searching the article database (2013-2022) to conduct bibliometric (keyword) analysis. A Systematic Literature Review (SLR) is a systematic review to identify, evaluate, and interpret all the results of certain research, certain topics, or phenomena of concern (Kitchenham, 2004 in Siswanto, 2010). SLR is used to systematically synthesize existing research evidence in terms of searching for research articles, reviewing criticism, and synthesizing research results to answer a question.

As previously explained, this study used the FGD technique in data collection. Data was collected through 7 selected informants. The 7 informants involved will be categorized into the classification of informants based on the institution. Following are the profiles and categorization of informants, as follows:

Table 1. Categorization of Informants

No.	Informants	Position	Agency	Categories
1	Maliki, ST. MSIE., Ph.D	Plt. Deputy for Population & Employment	Bappenas	Regulators
2	Nelwan Harahap, SP	Assistant Deputy for Emergency and Post-Disaster Management	Kemenko PMK	
3	Ir. Hj. Hevearita Gunaryanti Rahayu, M.Sos	Major	Semarang	
4	Gatot Subroto	head office	BPBD East Java	Operator
5	Dr. Raditya Jati	Deputy for Systems & Strategy	BNPB	
6	Assoc. Prof. Adjie Pamungkas, Ph.D	Head of Research Center for Disaster Mitigation and Climate Change	MKPI	Academics
7	Anjar Radite	Vice President	Operations Human Initiative	Association

Source: Author (2023)

Result and Discussion

Road Map and the Strategy of National Flood Management

Policies related to the disaster in the Government Work Plan (RKP) and Government Medium Term Plan (RPJM) are described as follows: (i). Improving the Quality of Indonesian Humans; (ii). Productive, Independent and Competitive Economic Structure; (iii). Equitable and just development; (iv). Achieving a sustainable living environment; (v). Cultural Progress that reflects the personality of the Nation; (vi). Upholding a legal system that is free of corruption, dignified and reliable; (vii). Protection for the entire Nation and Providing a sense of security to all citizens; (viii). Clean, executive, and trusted government management; and (ix). Local government system within the framework of the Health State. Related to the RKP and RPJM above, there are 7 development agendas implemented by the government, namely: (i). Strengthening economic resilience for quality and equitable growth; (ii). Develop areas to reduce disparities and ensure equity; (iii). Improving qualified and competitive human resources; (iv). Mental revolution and development of empowerment; (v). Strengthening infrastructure to support economic development and basic services; (vi). Building the environment, mitigating disaster resilience and climate change; and (vii). Strengthening Polhukhankam (Politic, Law, Defense, Secure) Stability and Public Service Transformation.

In its journey, the concept of social protection implemented by the government continues to experience adjustments. The concept of social protection that was previously rigid and static has changed to a social protection concept that is open and quickly adapts to the conditions that occur. This concept is called the Adaptive Social Protection Concept (PSA). The strategic goal of the PSA Concept is how existing programs and activities can be refined and more integrated in providing adequate and equitable assistance to individuals, households, communities in need before, during and after a disaster occurs, and how the distribution system can be improved. This PSA concept is implemented by referring to: (i). Adaptive Capacity (ie adapting life and livelihoods to risk); (ii). Anticipatory Capacity (ie managing potential risks before a disaster occurs); (iii). Absorptive Capacity (ie coping with negative impacts after a disaster); (iv). Pentahelix collaboration between central government, local government, communities, NGOs, academics, and business entities; and (v). Improving social and economic resilience of households and communities.

Furthermore, at the level of disaster risk in East Java, there are several types of disasters with the following risks: (i). Earthquake Disaster (High Risk); (ii). Flash Flood Disaster (High Risk); (iii). Drought Disaster (High Risk); (iv). Liquefaction Disaster (Moderate Risk); (v). Extreme Weather Disaster (High Risk); (vi). Tsunami Disaster (High Risk); (vii). Landslide Disaster (High Risk); (viii). High Wave Disaster (High Risk); (ix). Technology Failure Catastrophe (Low Risk); (x). Flood Disaster (High Risk); (xi). Forest & Land Fire Disaster (High Risk); and (xii). Epidemic Disasters and Disease Outbreaks (Low Risk).

Result Analysis and Discussion

Results of Focus Group Discussion (FGD) and NVivo Analysi

In this study, from 7 informants, there will be 7 transcripts that will be processed coding. In aggregate, there are at least 15 *nodes* with the highest hierarchy as follows:

Table 2. Aggregate Hierarchy Nodes Reference

No.	Nodes	Ref.	Files coded	Max. Value	Share
1	Stakeholder Synergy	7	7	7	100%
2	HR Skill Improvement	5	4	7	71%
3	Public Awareness	4	4	7	57%
4	Minimum Budget	4	4	7	57%
5	Java Island Flood Disaster Data	4	4	7	57%
6	Outreach > Public Awareness	4	4	7	57%
7	Adaptive Capacity Building	3	3	7	42%
8	Stakeholders Synergy > Absorptive Capacity	3	3	7	42%
9	Climate Change > Flood	3	3	7	42%
10	Sedimentation > Flood	2	2	7	28%
11	Flood Disaster > Consumption > Poverty	2	2	7	28%
12	Stakeholders Synergy > HR Skills	2	2	7	28%
13	Disaster Protocol Setup	2	2	7	28%
14	Stakeholders Synergy > Infrastructure Strengthening	2	2	7	28%
15	Financing Innovation > Resilience	2	2	7	28%

Source: Processed data (2023)

These results indicate that the 15 nodes above have the largest contribution in the entire hierarchy, both in terms of the number of references and data sources. This indicates that, as a whole (4 categories of informants), both implicitly and explicitly agree on the need for stakeholder synergy (Penta Helix) to achieve the effectiveness of flood mitigation policies. In addition, the “Stakeholder Synergy” nodes have the highest resource value (7) with a total contribution of 100%. This indicates that, all informants and all existing data sources (7 transcripts) reflect on the need for stakeholder synergy to achieve effectiveness of flood disaster management and prevention policies. The other nodes namely " HR Skill Improvement" has a reference of 4 with a contribution value of 71%. This indicates that, there are around 71% of informants who alluded to the need to develop skills or knowledge of existing HR. Furthermore, nodes "Public Awareness", " Minimum Budget ", " Flood Disaster Data for Java Island"; " Socialization > Public Awareness", each of which has the same number of references, namely 4 or was mentioned by 57% of the informants involved. As for other nodes, they have a similar interpretation.

Next, the following will show the Hierarchy of the Nodes1 System (Effectiveness of flood mitigation policies on social and economic resilience). Apart from that, in the context of the effectiveness of this mitigation policy, it is also necessary to strengthen the synergy of stakeholders (Penta Helix). The contribution value can be seen in the table below:

Table 3. Nodes System Hierarchy Reference 1

No.	Nodes	Ref.	Files coded	Max. Value	Share
1	Stakeholder Synergy	7	7	7	100%
2	HR Skill Improvement	5	4	7	71%
3	Public Awareness	4	4	7	57%
4	Minimum Budget	4	4	7	57%
5	Stakeholders Synergy > Absorptive Capacity	3	3	7	42%
6	Stakeholders Synergy > HR Skills	2	3	7	42%
7	Disaster Protocol Setup	2	2	7	28%

Source: Processed data

From Table 3, it can be seen that the "Stakeholders Synergy" node has a contribution of 100% of all existing sources. This means that, proven stakeholder synergy is needed in flood disaster mitigation policies. Meanwhile, the impact of "Increasing HR Skills", "Minimum Budget", and "Public Awareness" was mentioned by 71 da% and 57% of the informants involved, respectively.

Next, the following will show the Hierarchy of Nodes 2 System (Implementation of Flood Mitigation Policy). The contribution value can be seen in the table below:

Table 4. Nodes System Hierarchy Reference 2

No.	Nodes	Ref.	Files coded	Max. Value	Share
1	Outreach > Public Awareness	4	4	7	57%
2	Adaptive Capacity Building	3	3	7	42%
3	Stakeholders Synergy > Infrastructure Strengthening	2	2	7	28%
4	Financing Innovation > Resilience	2	2	7	28%

Source: Processed data (2023)

From the table above, it can be seen that the "Socialization > Public Awareness" nodes contribute 57% of all available resources. This means that, half of the informants involved mentioned that the need for socialization is related to increasing the level of public awareness. Furthermore, the impact of "Adaptive Capacity Building" was mentioned by 42% of the informants involved.

Furthermore, in the following, it will be shown regarding the Hierarchy of the System of Nodes Others (things discussed by the informants outside the context of the stated research objectives). The contribution value can be seen in the table below:

Table 5. System Hierarchy Reference Nodes Others

No.	Nodes	Ref.	Files coded	Max. Value	Share
1	Java Island Flood Disaster Data	4	4	7	57%
2	Climate Change > Flood	3	3	7	42%
3	Flood Disaster > Consumption > Poverty	2	2	7	28%

Source: Processed data (2023)

From the table above, it can be seen that the "Java Island Flood Disaster Data" node has a contribution of 57% of all available sources. This means that half of the informants involved mentioned data on the development of flood disasters on the island of Java. Furthermore, the climate change factor that causes flooding was mentioned by 42% of the informants involved.

Next, the results of the comparative chart analysis will be displayed. This section is the second stage in coding analysis (*Second Cycle Coding*). The Second Cycle Coding is based on nodes or coding that have been made before (*First Cycle Coding*) and the results describe the similarities mentioned by each informant (category). In the similarity of nodes between Regulators and Operators, there are 11 similar nodes (Flood Data for Java Island, Minimal Budget, Financing Innovation > Resilience, Flood Disaster > Consumption > Poverty, Adaptive Capacity Building, HR Skill Improvement, Stakeholders Synergy, Public Awareness, Sedimentation > Flood, Stakeholders Synergy > Infrastructure Improvement, and Outreach > Public Awareness) mentioned by both parties, either explicitly or implicitly. In comparison between Regulators and Academics, there is 1 similarity of *nodes* (*Stakeholders* Synergy) mentioned by both parties. In comparison between Regulators and Associations, there are 3 common nodes (*Stakeholder Synergy, Public Awareness Promotion, and Disaster Protocol Preparation*). Comparison between Operators and Associations. there are 2 similar nodes (Stakeholders Synergy, and Outreach > Public Awareness) mentioned by both parties. In comparison between Academics and Associations, there is 1 similarity of nodes (Stakeholders Synergy) mentioned by both parties. In comparison between Regulators and Academics, there is 1 similar node (Stakeholders Synergy, and Socialization > Public Awareness) mentioned by both parties.

Furthermore, still in the *Second Cycle Coding stage*, several *causal coding will also be grouped* that have been built in the previous stage. There are 16 causal coding, namely: Governance + Leadership > Institutional Capacity; Sectoral Ego > Stakeholders Synergy; Infrastructure > Flood Potential; Stakeholders Synergy > HR Skills; Synergy > Absorbtive Capacity; Technology > Disaster Impact Reduction; Capacity Building > Sustainability; Public Community > Public Awareness; Public Campaign > Risk Awareness; Financing Innovation > Resilience; Stakeholders Synergy > Infrastructure Strengthening; Outreach > Public Awareness; Flood > Social Impact; Flood > Economic Impact; Disaster Mitigation > SDGs; Climate Change > Flood.

Analysis of Systematic Literature Review

This section will show the results and analysis of data processing carried out using the *Systematic Literature Review* (SLR) approach. In the first stage, it will be shown the results of filtering each data source (article) for further analysis. As previously explained, articles were filtered through a number of inclusion and exclusion criteria with the help of the *Preferred Reporting Items for Systematic Reviews and META Analysis (PRISMA) diagram.* As for before showing the screening results, the following is a table that shows, in outline, how many articles will be used (*eligible articles*), as follows:

Table 6. Data Source Inclusion & Exclusion tabulation

2010-2023	**Keyword Used (Publish or Perish)**		
	Economic Disaster Management	**Disaster Management Impact**	**Disaster Management Social**
Recorded	25	70	200
Gross Totals	295		
Excluded	15	46	151
Included	10	24	49
Total Article Included	83		

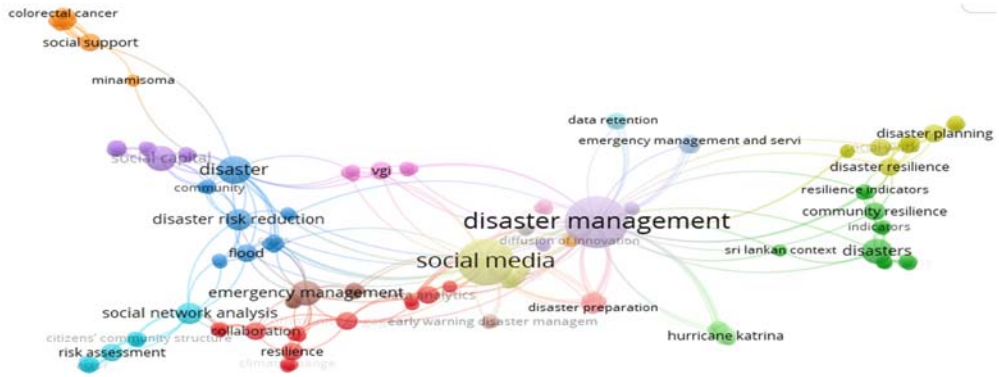
Source: Processed data (2023)

Referring to the table, it can be explained that the keywords *used as input in the search for articles and data sources are used in the Publish or Perish (PoP)* software with the publication time criteria between 2010-2023 (14 years). The use of keywords *used* are: (i). *Economic Disaster Management;* (ii). *Disaster Management Impact*; and (iii). *Disaster Management Social.* The reason underlying the use of these keywords refers to the main theme of this study. Based on the search for the keywords *used*, 295 data were generated (n = 295), while each keyword generated data as much as: (i). *Disaster Management Economic* – 25 data; (ii). *Disaster Management Impact* – 70 data; and (iii). *Disaster Management Social* – 200 data. Furthermore, from the 295 available data, the first exclusion criterion was used, namely the data to be used as input must be published in the form of articles and not in other forms (*Chapters in Books, Reviews, Books, Notes*, etc).

As for the first criterion, 200 data were found in a form other than articles, so in this case the remaining data was (n = 95). The next criteria used are articles that have keywords. This was done to be able to carry out Keyword network analysis at a later stage. In this case, 12 articles were filtered that did not have keywords in the data in the form of articles, so that the remaining (n = 83) articles were processed for further data processing. Based on these stages (use of 2 criteria) it can be concluded that there are 83 eligible articles (*eligible articles*) for further analysis.

Furthermore, in the second stage, partial network mapping will be carried out on each keyword used. First, the mapping results will be shown on keywords that refer to the main research theme, namely *Social Disaster Management* (n = 49), as follows:

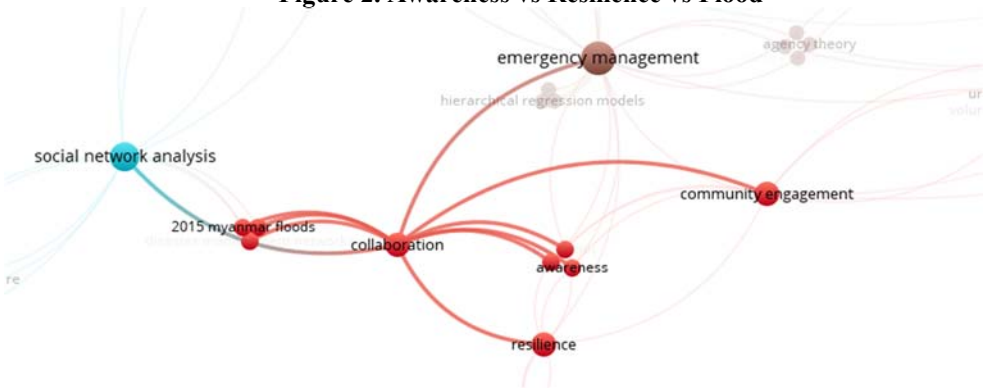
Figure 1. *Disaster Management Social* Keyword Network



Source: Processed data (2023)

Based on the picture above, there are at least 10 main clusters mapped out of 49 articles in the Disaster Management Social keyword network. Cluster 1 (red) consists of 16 nodes namely: 2015 Myanmar Floods, Awareness, Canada, Climate Change, Collaboration, Community Engagement, Data Analytics, Disaster Management, Humanitarian Operations, Leadership, Military Role in Disaster, Neoliberalism, Pandemic, Resilience, Urban Informatics, and Volunteer Crowdsourcing. Cluster 2 (Green) consists of 16 nodes namely: Community Resilience, Disasters, Indicators, Learning, New Zealand, Resilience Indicators, Resilience Measurement, Risk Analysis, Social Learning, Social Processes, Social Resilience, Srilanka Context, Surrogate, Sustainable Development Tourism, and Urban Planning. Furthermore, Cluster 3 (Blue) consists of 14 nodes: Community, Crisis, Disaster, Disaster Management, Disaster Risk Reduction, Earth Observation, Flood, Flood Defense Measurement, Flood Mitigation, Germany, Landslide, Social Network, Twitter, and Volunteered Geographic Information. Furthermore, it will be shown regarding the relationship between aspects of awareness, resilience, and flood disasters through the image below as follows:

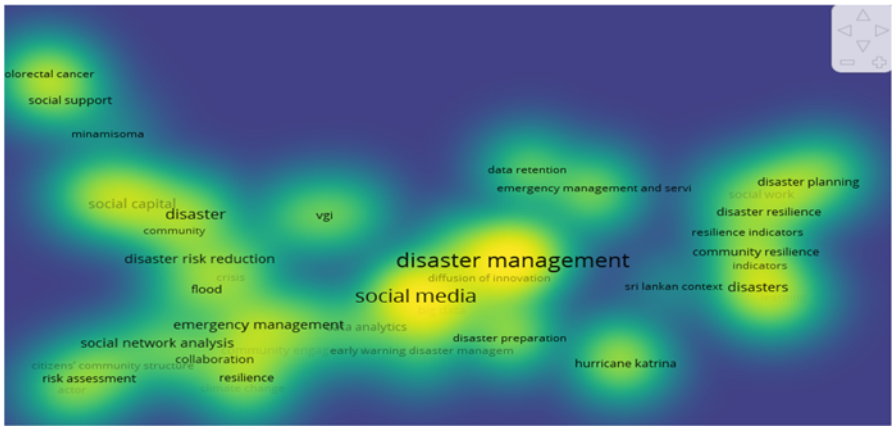
Figure 2. Awareness vs Resilience vs Flood



Source: Processed data (2023)

Based on the picture above, there is a relationship between nodes' Awareness, Collaboration, and also Resilience. The study conducted by Kwok *et al*. (2016) stated that social resilience is influenced by risk knowledge and social support related to disaster management. This seems to be in line with the coding results where there are nodes Socialization > Public Awareness, Adaptive Capacity Building, Stakeholders Synergy > Infrastructure Strengthening, and Financing Innovation > Resilience. So that the results of the two analyzes carried out, the factors of awareness, collaboration, and social resilience in disaster mitigation (flood) are key elements. Furthermore, it will also be shown regarding the mapping from studies on disaster management through density analysis below:

Figure 3. Disaster Management Social Keyword Density Analysis



Source: Processed data (2023)

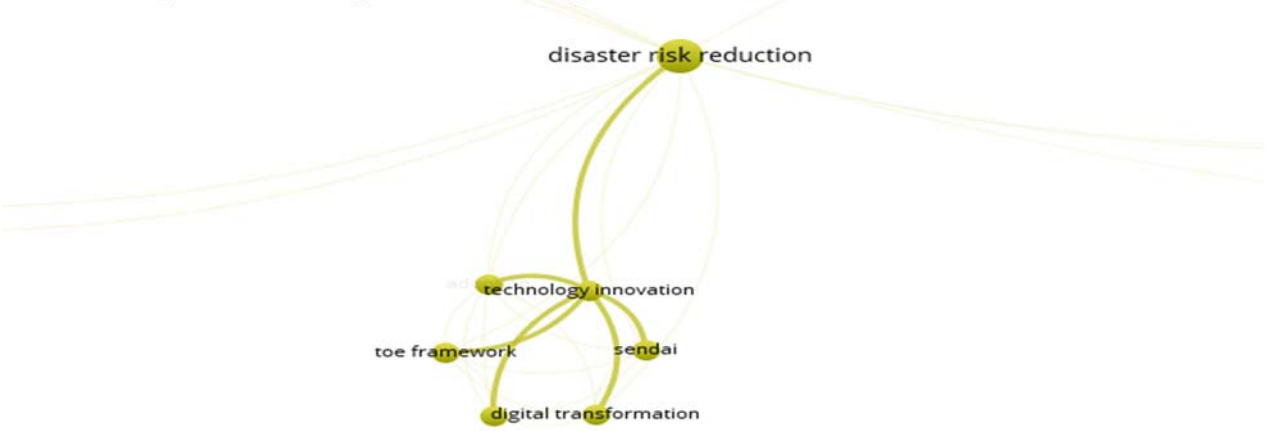
Based on the picture above, it can be seen that many studies using the keyword Disaster Management have been carried out, while relatively many related to floods have been included in the 49 *eligible articles.* This indicates that, of the 49 *eligible SCOPUS articles*, relatively many studies on flooding have been carried out compared to other topics. Next, the mapping results will be shown on keywords that refer to the main research theme, namely *Disaster Management Impact* (n = 25), as follows:

Figure 4. Disaster Management Impact Keyword Network

Source: Processed data (2023)

Based on the image above, it can be seen that there are 5 main clusters mapped from 25 articles, in the Disaster Management Impact keyword network. Cluster 1 (red) consists of 9 items/nodes namely: China, Covid-19, disaster management framework, disaster management strategy, disaster system, emergency relief, hotel industry, reconstruction, and tornado catastrophe. Cluster 2 (Green) also consists of 8 items/nodes namely: Disaster Preparation, Disaster Response, Grassroot Initiatives, Network Effects, Organization, Participation, Social Media, and Volunteering. Furthermore, Cluster 3 (Blue) consists of 8 items/nodes: Cultural landscape, floods, Kerala floods, erosions, sedimentations, soil erosion, tsunamis, and Typhoons. Furthermore, it will be shown about the linkages between technological innovations with disaster risk reduction through the image below as follows:

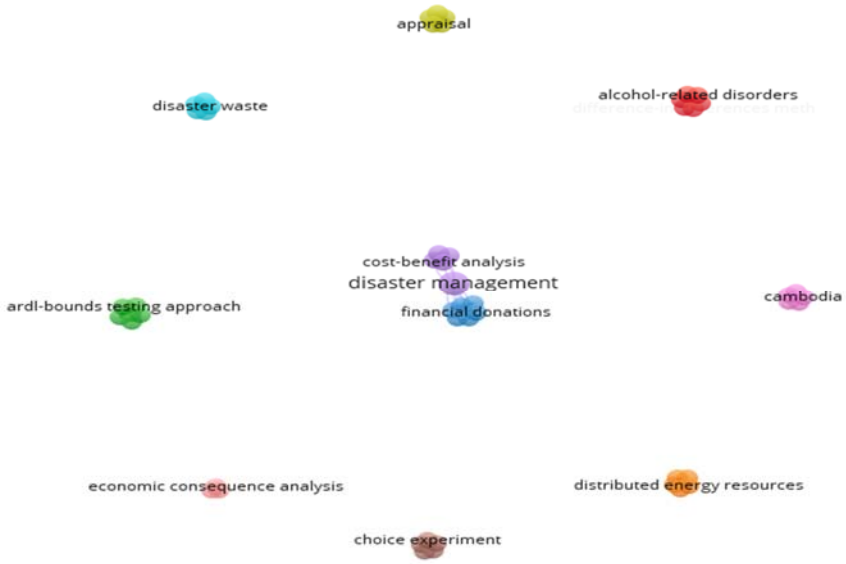
Figure 5. Technology Innovation vs Digital Transformation vs Disaster Risk Reduction



Source: Processed data (2023)

Based on the picture above, it can be seen that disaster risk reduction can be anticipated by developments in the technological aspect. This can be seen from a study conducted by AlHinai (2020) which shows that the aspect of technology development followed by the development of data and information excellence will have an impact on reducing disaster risk. This can be an additional finding to the results of previous analyzes related to flood management policies related to the development of technological innovations. Next, the mapping results will be shown on keywords that refer to the main research theme, namely Disaster Management (n = 10), as follows:

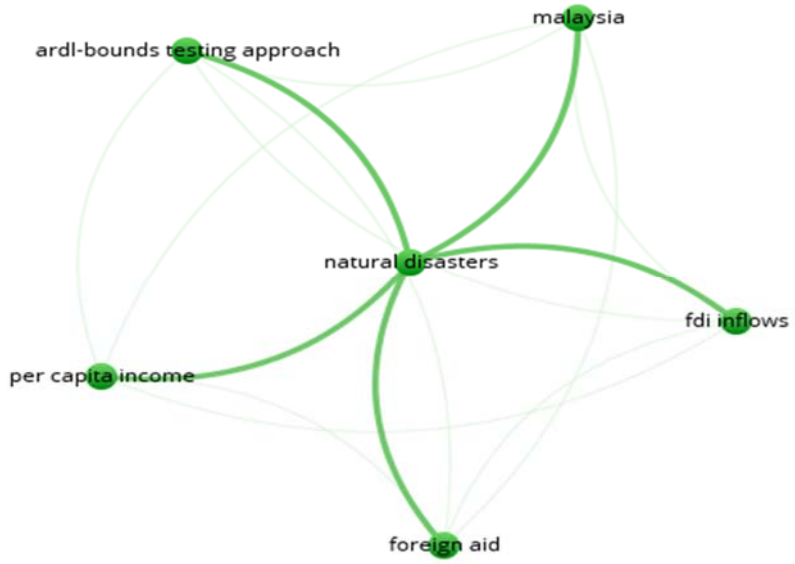
Figure 6. Disaster Management Keyword Network



Source: Processed data (2023)

Based on the table above, it can be seen that there are 10 clusters mapped in the Disaster Management keyword network. Cluster 1 (red) consists of 6 items/nodes namely: Alcohol-Related Disorders, Covid-19, Difference in Difference, Fukushima Nuclear, Accident, Psychological Distress, and Sleep. Cluster 2 (Green) also consists of 6 items/nodes namely: ARDL-Bounds Testing Approach, FDI Inflows, Foreign Aid, Malaysia, Natural Disasters, Per capita Income. Furthermore, Cluster 3 (Blue) also consists of 6 items/ nodes: Financial Donations, Gratitude, Hurricane Katrina, Prosocial Behaviors, Social Marketing, and Volunteers. Furthermore, it will be related to the economic aspect through the image below as follows:

Figure 7. Natural Disaster vs FDI Inflows vs Per Capita Income



Source: Processed data (2023)

Based on the picture above, it can be seen that, in addition to social aspects, the impact of natural disasters is also related to economic aspects such as per capita income and capital inflows (foreign investment). This can be seen from the study of Qureshi *et al* . (2019) who identified the effects of floods on economic growth. The results of the study

show results in which the flood disaster caused a decline in economic growth in Malaysia. This supports the previous coding results, especially at the Flood > Economic Impact nodes.

To Conclusion and Policy Recommendations

Conclusion

Based on the results and analysis previously described, several conclusions can be drawn related to this research, as follows:

1. The effectiveness of flood mitigation policies in Java Island in terms of social and economic aspects is still considered not optimal. This is due to the government's priority on existing mitigation policies is still minimal. Indonesia has 514 Regencies/Cities, where the Local Government which has budgeted a disaster mitigation budget of over 100 billion is only 1 District. This has an impact on the resulting *outcome is also not maximized.*
2. Evaluation of the implementation of flood mitigation policies has not had an optimal impact on aspects of social and economic resilience. Socialization, *Public Awareness,* Adaptive Capacity Building, Stakeholder Synergy, Infrastructure Strengthening, and Financing Innovation are still needed. In addition, synergy or collaboration from stakeholders (Penta Helix elements) is needed to achieve maximum results.
3. The obstacles that are still found in terms of stakeholder synergy are the institutional ego shown through the electoral ego nodes and the not yet optimal synergy of stakeholders. The importance of synergy of stakeholders is considered very crucial because it was alluded to by all informants. In addition, increased collaboration is not only needed in strengthening disaster infrastructure, but also related to outreach to increase public awareness.
4. The Social and Economic Impacts were confirmed in one of the previous studies which stated that social resilience is influenced by factors of risk knowledge and social support related to disaster management. In addition to social aspects, the impact of natural disasters is also related to economic aspects such as income per capita. This was confirmed by the results of one of the previous studies in which the results of the study indicated that floods would have a reduced impact on economic growth. Reducing disaster risk can be anticipated by developments in the technological aspect. This was confirmed from one of the previous studies which showed that aspects of technology development followed by the development of data and information excellence would have an impact on disaster risk reduction. This can be an additional finding to the results of previous analyzes related to flood management policies related to the development of technological innovations.

Policy Recommendations

Strengthening effective and efficient law regulations because it is importantly related to collaboration is important for all existing policy instrument regulations. (2) The Ministry of Finance (BKF) and Regional Governments need to pay attention to strengthening investment financing in relation to increasing APBN and APBD allocations for disaster mitigation which will have an impact on achieving sustainability goals. (3) Strengthening Governance and how to make it more professionally accountable with *leadership* capable of handling problems as well as strengthening *planning governance* and institutional improvement (4) Minimizing sectoral ego from Ministries/Institutions which causes miss coordination. So that the goal of sustainable development is achieved. (5) Stakeholder synergy is needed in increasing *the skills* and awareness of existing human resources. (6) Increasing adaptive capacity related to the potential for flooding so as to create environmental sustainability (7) The role of technology capable of supporting the prevention of impacts due to disasters (8) Implementation of public campaigns related to disaster mitigation to create public *awareness*.

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