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Assessing Community Disaster Resilience in Balikpapan: Buffer Area of Indonesia's New Capital City

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Abstract of Doctoral Dissertation

The declaration of the regulation to relocate Indonesia's capital city to the Kalimantan (Borneo) island will trigger new vulnerability, especially for flood disaster to surrounding cities including Balikpapan. Markedly, the focus of flood risk reduction in Indonesia remains on structural measures and little attention is being paid to community contribution and flood risk continue to reduce current community resilience. Considering above, this study assesses the level of community disaster resilience to prepare for future flood risk This research will assist in developing approaches to enhance resilience and propose a process to integrate with policy and planning system in Indonesia.

The initial assessment provided in chapter 4 is carried out to determine the present vulnerability level of Balikpapan city. Mixed method has been used for this study with secondary and primary data. According to vulnerability assessment using DPSIR Framework, this research highlights that flood responses in Balikpapan mostly haven't yet been found to be linked to drivers and other components. The responses are usually just temporary or short-term responses such as build dikes, pond, and also providing green spaces eventhough there is zero run off concept in the national level.

The second assessment is provided in the chapter 5. This chapter presents a flood management method by examining the flood risk management strategies of the local municipality and the smart city plan aimed at improving flood resilience. The SETS (Social–Ecological–Technological systems) framework is incorporated with the Flood Resilience Cycle to assess the status of flood management. This is then followed by an examination of smart city plans and programmes in two specific cities, Samarinda and Balikpapan. The chapter primarily focuses on the implementation of SETS-FRC distribution in the two chosen cities. In addition, according to coding from SETS (Social-Ecological-Technical Systems) and FRC (Flood Resilience Cycle, it is inferred that in Balikpapan there are six social domain strategies, eight ecological domain strategies, and nine technological domain strategies.

Chapter 6 shows the output from community disaster resilience assessment, which are 2 levels of community disaster resilience: moderate vulnerable, which are South Balikpapan (2.34), North Balikpapan (2.66), Central Balikpapan (2.31), and Balikpapan Kota (2.41), vulnerable area which are West Balikpapan (1.94) and East Balikpapan (1.98). Furthermore, based on the risk perception analysis, communities in moderate vulnerable areas have higher scores (3.98) compared to vulnerable areas (3.00).

Chapter 7 indicates that there are existing community based strategies as autonomous adaptation. Furthermore, Climate Village is identified as an autonomous adaptation having 7 activities to strengthen resilience. The aim of this chapter is to comprehensively analyse and quantify the specific adaptation and mitigation initiatives implemented in ProKlim using the smart village concept. This study utilises methodological literature review, interviews for situation analysis, and field observations. This study employed five parameters to assess the present state of the Climate Village, namely: resilience, mobility, community, perspectives, and digitalisation. The findings indicate that the introduction of smart villages in *ProKlim* is now in its early phases and requires innovative approaches and integration with smart cities and smart communities.

Last, through triangulation analysis in chapter 8, an approach for enhancing community disaster resilience was developed and incorporated into city-scale planning and implementation stages of resilient cities. The strategies are basically divided into 5 dimensions like community disaster assessment, namely Social, Economic, Governance, Physical, and Environmental. However, since currently Balikpapan does not have a DM Plan nor LAP for DRR yet, the resilience/risk assessment results therefore is an essential document for Government of Balikpapan City in guiding them to develop the resilient city for supporting new capital city in the future.

Keyword: Community disaster resilience, flood risk, SETS, DPSIR, New Capital City, Urban Resilient

LIST OF ASSOCIATED PUBLICATIONS

Journal Papers

1. Ariyaningsih., Sukhwani, V. and Shaw, R., "Vulnerability assessment of Balikpapan (Indonesia) for climate change-induced urban flooding", International Journal of Disaster Resilience in the Built Environment, Vol. 14 No. 3, pp. 387-401. 2023
2. Ariyaningsih, Shaw R. "Integration of SETS (Social–Ecological–Technological Systems) Framework and Flood Resilience Cycle for Smart Flood Risk Management", Smart Cities. , Vol 5 No 4, pp. 1312-1335. 2022
3. Ariyaningsih, Shaw R. Community-Based Approach for Climate Resilience and COVID-19: Case Study of a Climate Village (Kampung Iklim) in Balikpapan, Indonesia. Land. Volume 12 No 3:650. 2023

Conference Presentations

1. Ariyaningsih and Rajib Shaw. Asian Institute of Technology. "Vulnerability Assessment of Balikpapan (Indonesia) for Climate Change-induced urban flooding". 2nd International Symposium on Disaster Resilience and Sustainable Development". Bangkok, Thailand. 24-25 June, 2021.
2. Ariyaningsih and Rajib Shaw. "Flood Management Strategies in Ampal Watershed in Balikpapan, Indonesia". The Northern European Conference on Emergency and Disaster Studies2021. Östersund, Sweden. 21-23 September,2021.
3. Ariyaningsih and Rajib Shaw. "Assessment of Community Disaster Resilience in North Balikpapan Sub-District, Balikpapan, City, Indonesia". IDRIM 2023. IIT Roorkee, India. 28-30 September, 2023.

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Chapter 1

Introduction

1.1 Research Background

Cities may have different characteristics, but they all have similar features such as housing facilities, transportation systems, business areas, service centers, trade zones, entertainment centers and government institutions. However, cities , generally, have to deal with other issues like inadequate housing, low productivity, urban poverty, health problems, inequality or disparity of spaces, congestion, and pollution (Pacione, 2009). Moreover, urbanization in the city has been triggered by many factors such as migration, urban growth, and so on. However, urbanization in the contemporary world have acted as catalysts of urban transformation which caused urban issues. By 2007, 50 percent of the world's population lived in urban areas, which is higher than 30 percent in 1950, suggesting that urban population increase is accelerating (Fekete, 2019; Smith & Lobo, 2019; Wilbanks et al., 2007).

A remarkable transformation has occurred in the world's population distribution, with 56% now living in urban areas as of 2023, a significant surge from 30% in 1950. The urban population is expected to continue to grow, reaching 68% of the total population by 2050. This means an additional 2.5 billion people will live in cities by 2050 (UNESCAPE, 2021; UNISDR, 2015). The fastest-growing urban areas are in Asia and Africa. Asia is home to the largest urban population in the world, with over 2.2 billion people living in cities. Africa is the fastest-urbanizing region in the world, with the urban population projected to double by 2050. The growth of the urban population is putting a strain on cities' infrastructure and resources(Mahdi et al., 2016). This is leading to challenges such as traffic congestion, air pollution, and water scarcity as Ariyaningsih et al., (2022); Izumi et al., (2022); Trias et al., (2019) point out, the global urban population is expected to surge by 3 billion people by 2050. Developing countries will witness the bulk of this growth, doubling their urban populations.

Broadly, global socioeconomic development has been significantly driven by urbanization, which has been particularly important for developing economies (Bae & Chang, 2019). Since the beginning of 21st century, the gap in urbanization rate between developed and developing countries has become narrower. Nevertheless, quick rural-urban migration and frequent climatic disturbances like flooding pose great constraints to sustainable development initiatives in most countries. In the traditional sense of urban planning and development, architectural structures, urban planning strategies, paving materials, as well as watercourse and drainage systems were developed mainly for protection against

storms, earthquakes, floods or landslides(Guan et al., 2018). Consequently, many cities, especially in Asia , are susceptible to climate-related disasters, mostly because of high densities, economic growth, inappropriate urban planning, social , economic and ecological issues (Handayani et al., 2020). Planning is equally important in predicting routine hazards. In particular, scenario modeling can help reduce the effect of such hazards (Buchori et al., 2018). Moving forward, it is imperative that future plannings should be made to include nature in the urban planning with the goal of improving resilience against climate change and natural hazard. Cities can take adaptive plans that will involve integrating with nature to cope with the effects of urbanization and climate change in order to facilitate sustainability and ensure a resilient future(Dhyani et al., 2020).

Urban flooding as a problem in cities has been worsened by the growing effects of climate change and increasing urbanization in the 21stcentury, exceeding the capacity of cities to cope with this issue (Jago-on et al., 2009; Yuan et al., 2019). Floods are one of the worst forms of natural disasters since they can be detrimental to human lives and economy. It could lead to a high-scale destruction of infrastructures, houses and business places resulting into death, injury or eviction (Karrasch et al., 2021; Sahani et al., 2019). Floods cause pollution of water systems; destroy transport corridors; and impair crop plantations. Flooding has a massive economic effect on both direct damages and indirect losses (Tabari, 2020). In addition, the changes in land use, topography and hydrology as a result of urbanization dramatically raise the chances of floods in the city (Ariyaningsih, Sukhwani, & Shaw, 2022; Konrad, 2003; Monteil et al., 2022). These are linked to changes in urban development and land use(Yulianto et al., 2015). In 2020, floods were the most common type of natural hazard in the world making up nearly 62%. Flooding was observed with a high frequency especially in Asia, southern part of America and African regions (Buchori et al., 2018; Hashemi, 2014; Wang et al., 2022). Urbanization as well as deforestation is worsening flood risks and damage through compounding effects. Much research of flood risk has been conducted by researchers in an effort to comprehend the complicated relationship between urbanization and urban flooding. In the light of increasing vulnerability caused by global warming and subsequent climate change, flooding is a serious challenge towards attaining long-term urbanism.

Indonesia, the globe's largest archipelagic nation, is among the world's most flood-prone regions due to a confluence of factors: tidal inundation, sea level rise, river overflow as a result of extreme rain, and the natural process of land subsidence (Syaban & Appiah-Opoku, 2023; Widiachristy & Rachmanto, 2021). In 2021, Indonesia had a staggering 5,402 disaster events, including floods (Indonesian National Board for Disaster Management – BNPB, 2022). Furthermore, Jakarta City, Indonesia's capital, has been severely afflicted by

floods, with some research indicating that it is extremely prone to such disasters (Budiyono et al., 2016; Syalianda & Kusumastuti, 2021). For instance, the 260 million GBP in damage caused by the 2007 flood in Jakarta City. Although the main reason for flooding in Indonesia is riverbank overtopping, a major contributor is the decreased hydraulic capacity of the rivers due to both direct and indirect pressures from development (Abidin et al., 2015; Anugrahadi et al., 2020; Silver, 2012; Surya et al., 2019).

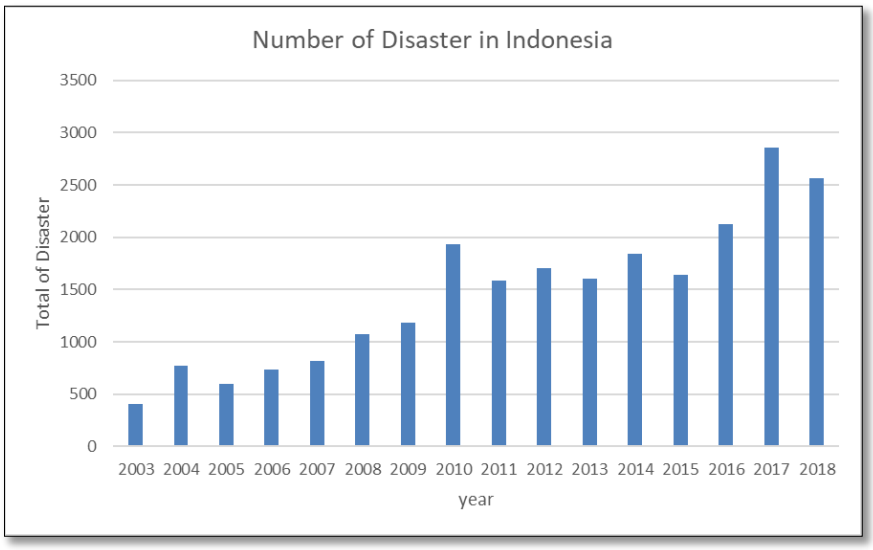

Figure 1.1 Number of Disaster in Indonesia (Source : Authors with BNPB data)

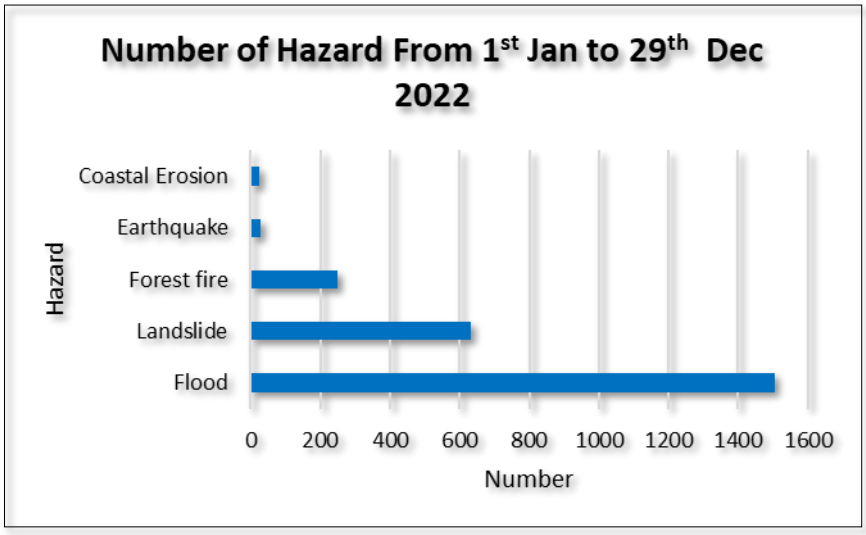

Figure 1.2 Number of Hazard Type in Indonesia (Source : Authors with BNPB data

Community resilience has attracted growing attention from researchers in recent years, driven by the surge in climate-induced disasters(Djalante et al.,

2020; Pamungkas et al., 2014; Shaw, 2001). Community resilience is broadly defined as a community's capacity to anticipate and prepare for impending hazards, adapt to evolving conditions, swiftly withstand disruptions, and promptly recover from their aftermath (Bogdan et al., 2021; Song & Li, 2019). With regard to a community's response towards adversity, resilience became one of the core conceptualizations in the Sendai Framework for disaster risk reduction. This idea is widely accepted under the disaster management(Capozzo et al., 2019; Nofal & van de Lindt, 2022). Previous studies have meticulously outlined the defining features of a disaster-resilient community, including integrated emergency communication systems, current disaster response plans, and also readily accessible resource inventories.

Studies on community resilience draw upon a broad range of literature, including various subjects and perspectives(Bojović et al., 2022; Nofal & van de Lindt, 2022). Recent research has explored community resilience, exploring opportunities for integrating systematic risk assessment into urban planning (Serre et al., 2012). Different types of human communities, such as villages, towns, and cities, may experience varying degrees of loss from the same hazards, suggesting that urbanization is a potential risk factor(Marome et al., 2022; Zeng et al., 2022). However, considering the current community disaster resilience above, this study assesses the level of community disaster resilience to prepare for future flood risk and urbanization. This research will assist in developing approaches to enhance resilience and propose a process to integrate with policy and planning system in Indonesia.

1.2 New Capital City Relocation

The concept for the new capital city of Indonesia was developed and formulated by the National Development Planning Agency (BAPPENAS)(Praditya et al., 2023). In a compelling argument, Akhfian (2023) highlights that it is high time Indonesia's capital was relocated since Jakarta has an extremely lack of space and land for government agencies and its facility. There is a rapidly increasing need for urban space as well as land use, especially in the national capital (Jakarta). Nonetheless, the lack of land has been an obstacle to adequate progress and development. In response to these critical issues, the government of Indonesia has proposed creation of a new national capital on land that was once used for forestry (Syaban & Appiah-Opoku, 2023).

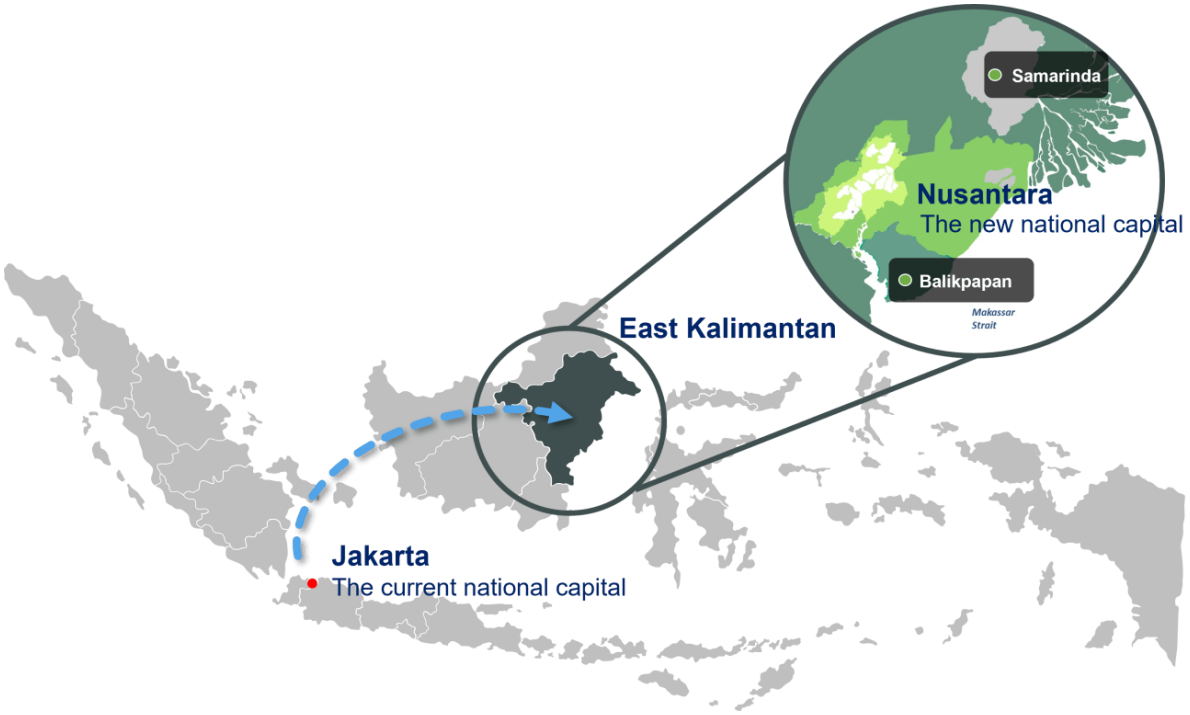

Figure 1.3 Relocation of Indonesia's New Capital City (Source : Asian Development Bank in ESCAP, 2022)

Years of grappling with Jakarta's worsening traffic congestion, air pollution, and sinking ground level prompted the selection to construct Indonesia's new capital city(Garschagen et al., 2018). Jakarta, situated on Java, one of the world's most densely populated islands, faces a heightened risk of earthquakes, flood, and other natural hazards(Abidin et al., 2015). The new capital's location was carefully selected based on its accessibility and closeness to Kalimantan's two major cities, Balikpapan and Samarinda(Praditya et al., 2023). This is summary of reasons why Indonesian government relocated capital city :

1. There are around 57% population of Indonesia lives on Java island
2. There is water supply crisis on Java Island Especially DKI Jakarta (current capital city of Indonesia) and East Java
3. Largest Land Conversion occurred on Java Island
4. Ground Water in Jakarta is decreasing about 7.5-10 cm/year with the quality is 57% contaminated from hazardous waste
5. Sea Level Rise in coastal area of Jakarta has predicted to increase about 25-50 cm
6. About 50% of Jakarta area has HIGH flood vulnerability
7. The Jakarta area is threatened by the activities of volcanic activity (Krakatau, Gede mountain) and the potential earthquake-tsunami Southern Megathrust, West Java and Sunda Strait and onshore earthquakes of the Baribis Fault, Lembang Fault, and Cimandiri Fault.

East Kalimantan, a region recognized for its tremendous biodiversity, is home to a diverse flora and wildlife. Massive land use changes, such as forest and other natural habitat clearing, are likely to be required for the building of Indonesia's new capital city inside this region. These changes have the potential to have a considerable influence on the area's biodiversity, particularly on species that are already threatened with extinction (Wardhana, 2021; Warsilan, 2019; Wells et al., 2016). Ecosystem processes such as nitrogen cycling and soil formation are essential to biodiversity, but they are at risk when natural habitats are lost. A flurry of massive infrastructure projects, including the construction of new roads, buildings, and other vital utilities, is also expected to follow the establishment of the new capital city. By destroying habitats and upsetting the fragile balance of ecological processes, these infrastructure projects may amplify the negative effects of land use changes on biodiversity (Lahjie et al., 2019; Tarigan et al., 2017).

In its early stages of development, the new capital city will assume the role of the administrative hub for the Indonesian government. A significant portion of civil servants, comprising approximately 182,462 individuals, will be transferred from Jakarta to East Kalimantan, with 79% originating from ministries and the remaining 21% from other government agencies and institutions. The precise ministries and institutions slated for relocation will be identified following national constitutional law. Furthermore, approximately 53,483 national army personnel and police officers will also be transferred to the new capital city. In conjunction with their families and additional associated personnel, a total of 1.5 million individuals will migrate to become residents of the new capital city during the initial phase of the relocation process (BAPPENAS, 2019).

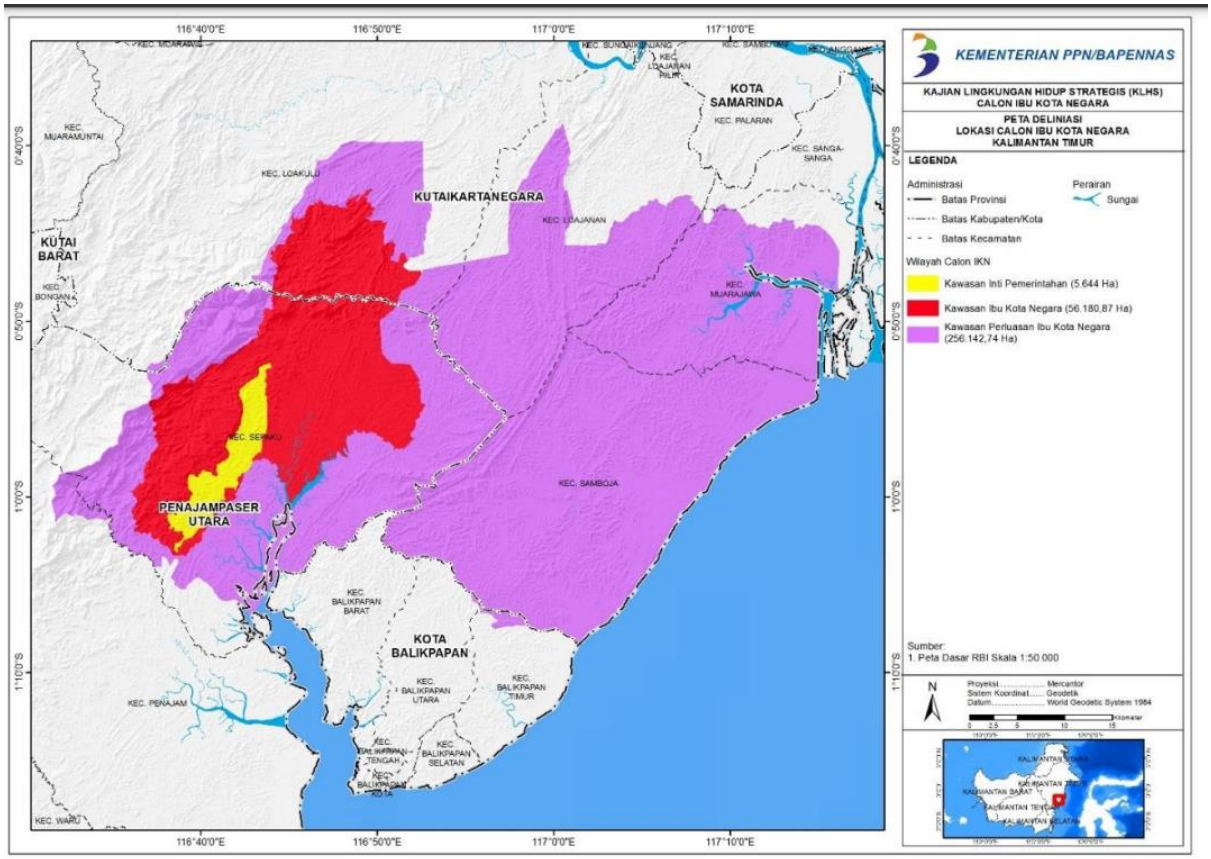

Figure 1.4 Deliniation of New Capital City (Source : Ministry of Public Works, 2020)

1.3 Justification of Choosing Balikpapan City as A Case Study

After the enactment of Law Number 3 of 2022 concerning the State Capital named Nusantara and hereinafter referred to as the New Capital City of Indonesia (IKN) on February 15, 2022, Article 6 Paragraph (2) states the scope of the IKN area which is located in the district of Penajam Paser Utara, East Kalimantan province. The law regulates the establishment of a state capital called Nusantara as the state capital and the establishment of the Nusantara Capital Authority as a ministry-level institution that organizes the Nusantara Capital Special Regional Government.

Basically, the definition of "buffer area" based on Wild and Mutebi's definition (1996) refers to :

"Any area, often peripheral to a protected area, inside or outside, in which activities are implemented or the area managed with the aim of enhancing the positive and reducing the negative impacts of conservation on neighbouring communities and neighbouring communities on conservation"

Sayer (1991) also mentions that buffer area is "a zone, peripheral to a national park or equivalent reserve, where restrictions are placed upon resource use or

special development measures are undertaken to enhance the conservation value of the area". The absence of a global consensus and established definitions for buffer area has resulted in the adoption of various definitions and descriptions for such area. As a result, the term of "buffer area" in this research refers to Law 3/2022 regarding New Capital City of Indonesia. The definition of buffer area is supporting area for new capital city regarding the economic aspect and transportation hub as well as gate to enter New Capital City.

There are two primary categories of buffers. The first category, known as "the functional buffer," originates from the predominant land use and is characterised by its historical zoning functions. The second one, known as "the landscape buffer," has emerged relatively lately(Barełkowska & Chlasta, 2014). Both buffers have the same objective: to mitigate or eliminate the negative impacts of a particular land use on the surrounding area. The landscaped buffer is a form of artificial instrument that utilises vegetation as an alternative. Furthermore, it serves as a barrier to block sound and hide or reduce undesired views. Unfortunately, quantifying its effects is challenging, as its effectiveness relies on psychological and aesthetic factors. Due to those concept, buffer area need to support new capital city from negative impacts and help new capital city to enhance their resilience.

The new capital city, Balikpapan, and Samarinda will create a mutually supporting triangle of economic growth. The new capital city will serve as the primary administrative center and a hub for green innovation, supporting emerging sectors focused on biosimilars, vaccines, plant-based proteins, nutraceuticals, and renewable energy (EBT). Samarinda will serve as the central hub of the Three Cities framework, which aims to convert the mining, oil, and gas industry into a modern, environmentally friendly, and sustainable energy sector. Meanwhile, Balikpapan will play a crucial role in the economic growth of the Three Cities by utilizing its well-established logistics hub and shipping services for import and export industries. It will also enhance its position as a major economic hub for both regional and international trade.

As mentioned in the Law of New Capital City, the buffer zone of the new capital city includes Balikpapan, Samarinda, the border of Penajam Paser Utara, Kutai Barat, and Kutai Kertanegara. These areas are often subject to flooding. In Samarinda and Balikpapan City, flooding is caused by two factors, namely natural factors such as high rainfall, regional topography, and Mahakam River tides, and the second factor is human, which is mainly sourced from the element of population growth (Table 1.1) (Setiawan et al., 2020) in Balikpapan City, especially in the Ampal watershed is influenced by internal and external factors (Ariyaningsih, Sukhwani, & Shaw, 2022). These internal factors include river capacity, drainage capacity, soil infiltration, water flow height, water runoff,

erosion, sedimentation, watershed area, watershed shape, topography, morphometry, vegetation. While the external factors that influence it are rainfall intensity, land use, waste disposal behavior, slum areas, flood control system planning, *bendali* maintenance, drainage maintenance, building distance to the river, location of settlements in the river boundary, and back water.

Table 1.1 Population Density

City/Regency	2017	2018	2019
Paser	24,71	25,23	25,76
Kutai Barat	10,72	10,77	10,80
Kutai Kartanegara	28,94	29,60	30,25
Kutai Timur	11,19	11,65	12,11
Berau	10,15	10,42	10,69
Penajam Paser Utara	53,94	54,51	55,04
Mahakam Ulu	1,35	1,35	1,36
Balikpapan	1241,60	1260,57	1279,02
Samarinda	1177,13	1197,55	1218,05
Bontang	1045,80	1067,83	1089,38

Source : East Kalimantan Statistical Agency (2020)

The research findings in Balikpapan City indicate that the urban drainage system is a contributing factor to the occurrence of flooding. Rahardjo (2014) identified seven factors that contribute to flooding in metropolitan areas. The seven factors contributing to flooding encompass unsustainable development practices, lack of adherence to clean living habits among the general population, inadequate urban drainage planning and maintenance, and inconsistent implementation of the Spatial and Regional Plan by the authorities. Furthermore, there is a lack of initiative to preserve the equilibrium of the aquatic ecosystem, mitigate land subsidence, and manage excessive precipitation (Sari, 2022). This flood issue will lead Balikpapan for vulnerability and distrub its function as buffer area of new capital city.

The research design has selected the community level within the sub-district as the sole case study. This level is appropriate for assessment due to its reduced administrative complexity and increased homogeneity. Furthermore, the sub-district level bears distinct accountability for overseeing public matters, despite its position as the second-lowest tier of administration, following the village level. Although the majority of my study was conducted at the sub-district level, I also incorporated data from the provincial and municipal levels to enhance the analytical outcome.

The flood hazard was chosen for assessment based on stakeholders' preference and the disaster document, which stated that flood hazard is the most

prioritised hazard in Balikpapan due to its significant losses and damages. Floods are a foreseeable form of peril due to their consistent and recurring nature. Therefore, evaluating flood hazards is suitable for forecasting the consequences of flood events on a community and identifying crucial factors that contribute to flooding. Given that floods are a frequent and annual sort of hazard in Indonesia, the case study was especially relevant. In addition, Table 1.1 below showing selection criteria for case study.

Table 1.2 Criteria Selection

No	Criteria	Case Study Characteristics
1.	Flooding should occur at least once every five years in the area.	data from BPBD Balikpapan (2023) states that flooding occurs annually, and the number of flooding points recorded reached 81 points in 2021.
2.	The flood event is expected to have a significant impact on the municipality.	In 2020, flooding in Balikpapan occurred 149 times with 78 families affected. Total losses reached IDR 390 million
3.	Flooding should become a common occurrence in communities.	The community in Balikpapan is aware of floods. Community has several autonomous adaptation to dealing with flood, for example raising the house floor and build small dike in front of their home.
4.	There should be some non-governmental organizations (NGOs) working on community development or disaster risk reduction.	Local non-governmental organizations (NGOs) that work to reduce the likelihood of disasters include Lingkar Daya Konservasi Alam (Lingdaka), Stabil, and Kami Sahabat Peduli Lingkungan (LSM KSPL). When it comes to managing flood risks, some of the NGOs also provide informal training to other local NGOs.
5.	There is a study/ document on the risk mapping areas	The study on balikpapan flood assessment is a study from 2021 to 2023 that analyzes flooding in the Balikpapan city watershed.
6.	A flood is one of the major disaster events, according to a legal document of planning at the municipal level.	The revision of Balikpapan Regional Plan identifies vulnerable areas to floods
7.	There is evidence that climate change played a role in the development of the recent flood event.	Strategic Environmental Assessment of Balikpapan (2018) indicates that climate change has contributed much in flood risk.

1.4 Problem Statements

One of the major drivers of urban sprawl is population growth because of migration and the formation of new capital cities. As a result, the demand for housing and infrastructure in adjacent places such as Balikpapan espected to grow. Land in East Kalimantan will most certainly be in high demand for the

establishment of a new national capital. This could lead to forest degradation and ecological contamination. The loss of natural habitats for plants and animals, as well as the increase of disaster risks such as landslides and floods, are two consequences of forest degradation. Environmental pollution can negatively impact public health and the environment. The construction of the new capital city of Indonesia is projected to release approximately 50 million tons of carbon dioxide equivalents (MtCO2e) directly from deforestation within its immediate footprint.

Furthermore, deforestation within a 200 km radius could release an additional 2,326 MtCO2e due to indirect impacts from the new capital city. These indirect impacts include increased population growth, rising demand for resources, and new infrastructure that facilitates access to forests for loggers and settlers. The resulting carbon emissions would equal 126% of Indonesia's 2014 greenhouse gas emissions. Given that the ecological footprint of cities can extend far beyond their physical boundaries, ranging from 200 to 1,000 times their size, constructing a 2,000 km2 capital city could have an ecological footprint of 0.4 to 2 million km2. This is three times the size of Borneo (740,000 km2), highlighting the potential for extensive indirect impacts to neighbourhood cities like Balikpapan.

Study from Meteorological Agency (2020) estimated that the number of heavy rains in the future will increase by more than 50% in Balikpapan. Based on BNPB data (2022), the projected frequency and intensity of flooding in Balikpapan city is expected to increase under all climate change scenarios. The RCP 2.6 scenario is the most optimistic scenario and still projects an increase of 0.5 times/year and 5 cm. RCP 8.5 scenario is the most pessimistic scenario, and projects an increase of 2.0 times/year and 20 cm. The combination of population growth, urban sprawl, and disaster losses can lead to a decrease in the resilience of cities. Resilience is the ability of a system to withstand and recover from shocks and stresses. When cities become more sprawling and less compact, they become more vulnerable to natural disasters and other disturbances.

There needs to be preparedness and anticipation from all elements involved, including the government, experts, and the community, which play an important role in building public perceptions and awareness of the potential threats faced according to the characteristics of the region. This is because the community is an actor who plays an important role in resilience to support new capital city.

Drawing from the research context, the present study's problem formulation specifically pertains to Balikpapan, considering the potential for relocating the new capital city to exacerbate existing urban issues. The influx of migrants could strain Balikpapan's existing infrastructure and services, raising concerns about the city's ability to accommodate this demographic surge. The question of Balikpapan's resilience in the face of migration pressures remains a

subject of debate. Therefore, it is essential to examine the operationalization of resilience concepts to assess Balikpapan's resilience in coping with the impact of the new capital city relocation. Then, it is necessary to look at the current regulation and develop an approach to enhance the cities resilience to overcome issue from new capital city relocation. Thus, the research questions of this study are:

1. What is the level of community disaster resilience in Balikpapan City?
2. How can community-based resilience strategies be integrated into other public policies, particularly in Indonesian planning systems?

1.5 Research Objectives

The main objective of the research is to assess community disaster resilience in Balikpapan as a buffer area of Indonesia's New Capital City, with detailed objectives are:

1. To review the current regulations and policies related to disaster in Indonesia.
2. To assess the current level of community disaster resilience
3. To develop an approach for enhancing community disaster resilience integrated with the Indonesian planning system to support the new capital city.

1.6 Research Methodology

The study utilized quantitative and qualitative methods to achieve the objectives and answer the key questions. This section describes the flow of my research. The research process is summarised in Figure 1.4 . This research contains 3 main parts, which explored below :

1. Justification and Understanding

Conducting a thorough literature review and gathering secondary data from various sources, including academic journal articles, reports, and publications, formed the foundation of this research. These documents were carefully examined and analyzed to extract relevant empirical data. The initial phase of this research focused on an extensive literature review to gain a comprehensive understanding of the key concepts of community resilience, with a particular emphasis on flood risk in urban environments.

2. Assesment of Selected Study Area

This section comprises four assessments:

i. Vulnerability Assessment: Employing the DPSIR-Vulnerability Framework, a comprehensive vulnerability assessment was conducted to identify the current vulnerability status and key flood drivers.
ii. Regulatory Assessment: Leveraging the SETS-FRC framework, a thorough evaluation of existing flood-related regulations implemented by local governments in the selected areas was undertaken.
iii. Community Disaster Resilience Assessment: The community's disaster resilience was meticulously assessed through an extensive literature review and a questionnaire administered to community leaders.
iv. Community-Based Approach Assessment: To conclude, researchers delved into the effectiveness of community-based approaches in addressing flood risk management.

Figure 1.5 depicts the four assessment areas: vulnerability, regulatory, community disaster resilience, and community-based approach. This multi-faceted approach provided a comprehensive understanding of flood risk management in the selected areas, paving the way for evidence-based policy recommendations and effective flood mitigation strategies.

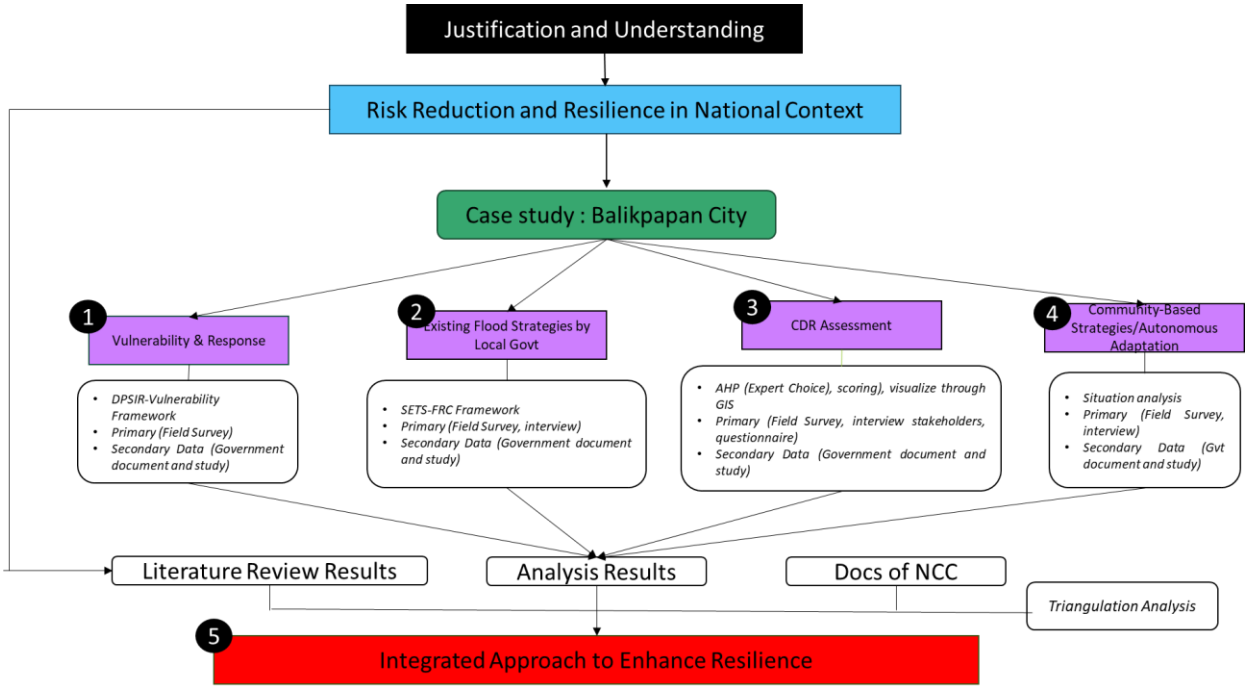

Figure 1.5 Research Work Flow

Table 1.3 Research Questions, Objectives, Tools, and Output of Research

Research Questions	Research Objective	Sub-Objective	Input (Data)	Tools/Method	Output (Objective Result)
What is the current level of community disaster resilience in Balikpapan City?	To review the current regulations and policies related to disaster in Indonesia.	Examining vulnerability and government response	1. Key informants' interview 2. Secondary data	DPSIR-Vulnerability Framework	Current vulnerability and government capacity of flood
		Evaluating flood risk strategies and regulation		SET-FRC Framework	
	To assess the current level of community disaster resilience	Developing framework to assess community disaster resilience	1. Previous frameworks 2. Key stakeholders	PRISMA	Framework for assessment
		Assessing community disaster resilience	Questionnaire for city level and sub-district level	AHP, Weighted SUM, GIS	Resilience Map
		Assessing Risk Perception	Questionnaire for moderate and vulnerable area	descriptive analysis (mean and std deviation)	Correlation of characteristics and risk perception
How can community-based resilience strategies be integrated into other public policies,	To develop an approach for enhancing community disaster resilience which is integrated with the Indonesian planning system	Evaluating Autonomous Adaptation (Climate Village)	Head of villages interview	descriptive analysis	Preparedness of climate village became smart villages
			1. Objective Result No. 1 2. Objective Result No.2	Triangulation analysis	Approach and strategies to enhance Balikpapan resilience to

Research Questions	Research Objective	Sub-Objective	Input (Data)	Tools/Method	Output (Objective Result)
particularly in Indonesian planning systems?	to support the new capital city.		3. Evaluation of climate village 4. New Capital City Regulation and Masterplan 5. Balikpapan Development Plan		support new capital city

1.7 Thesis Structures

The thesis structure consists of 3 part which shown at Figure 1.6 below.

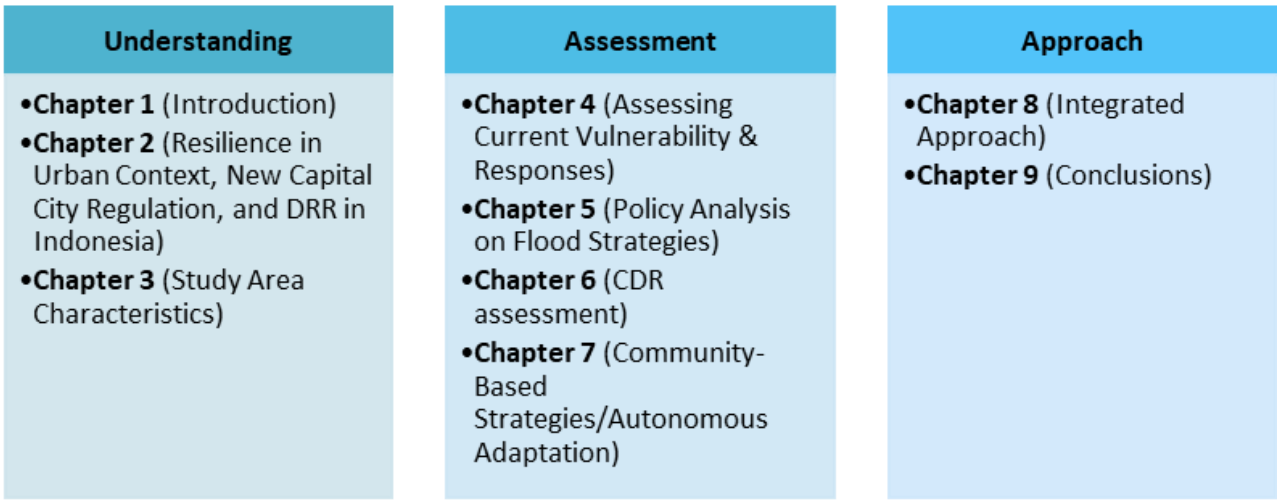

Figure 1.6 Thesis Structures

This "Understanding" part presents the background of this study, the problems that initiate the research questions, the study's objectives, and its significance. In this chapter, the research methodology is presented, as well as the systematics of the writing of this study. This part also review the concept of urban resilience and flood risk in the urban context. This part highlights the impacts of flood risk and relationship with resilience. In addition, this part also elaborate disaster management and resilience approach in Indonesia. It provides an overview of available law and regulation on disaster management from the global level to Indonesia's context. In the end, , a description of the case study area is presented, including the profile of the research location as well as its characteristics and disaster.

Part "Assessment" presents the findings of the study. This includes the current vulnerability status using DPSIR-Vulnerability Framework, identifying the existing strategies to address flood at the local level. Furthermore, this chapter discusses the gaps inferred by the analysis. Community disaster resilience was analysed in this part to be an input of enhancing resilience. After assessments, the approach for enhancing future resilience has developed in "Approach". This part also discusses issues on implemeting the approach for future resilience. It concludes with recommendations for better future community resilience.

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Chapter 2

Literature Review

2.1 Community Disaster Resilience and Vulnerability

In a research published in 2004, Wisner et al. clarified the theoretical foundation of the PAR (Pressure and Release) Model, which describes how stresses and shocks interact. It brought to light the potential for many acute stresses to overwhelm an established metropolitan system, especially when paired with other disruptive occurrences. A number of pressures and disturbances may cause disasters to occur if numerous community systems—physical, social, economic, institutional, and environmental systems—are unable to manage particular natural catastrophes in an effective manner (Joerin, 2012; Sharma et al., 2011; Comfort et al., 1999; Hewitt, 1997).

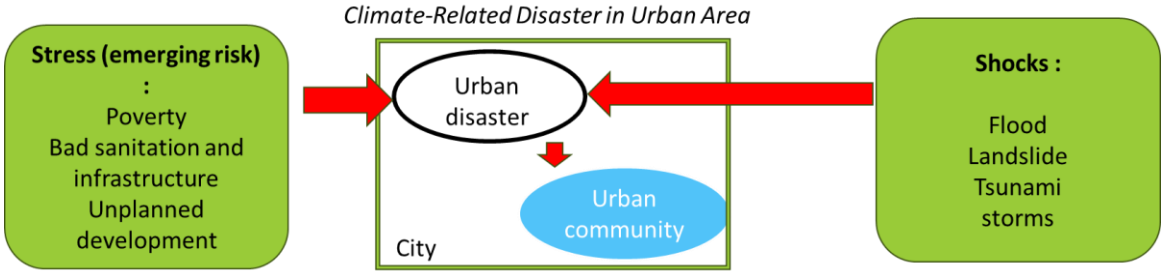

Figure 2.1 Climate-Related Disaster in Urban Area

Source : adapted from Joerin and Shaw, (2012); Sharma et al., (2011); Comfort et al., (1999); Hewitt, (1997)

Resilience, a concept that has been examined by numerous scholars, has been subject to diverse definitions and descriptions. Holling (1973) initially established the concept of resilience in the study of ecology. In 1973, Holling provided a definition of resilience as the capacity of a system to endure a certain level of disturbance without undergoing a shift in its control or structure. The system's resilience can be quantified by assessing its capacity to endure and maintain functionality despite significant disruptions. Over time, the concept of resilience has developed, changed, and incorporated socio-economic and institutional factors. Tabel 2.1 below shows the community disaster resilience concepts from several scholars.

Table 2.1 Community Resilience Definition

Authors	Community Resilience Definition	Personal Observational Output	Personal Redefined definition
Corck (2010)	the interconnected network of systems that directly impact human society at a grassroots community		

Authors	Community Resilience Definition	Personal Observational Output	Personal Redefined definition
	level, including the socioeconomic, ecological, and built environments.	*Gains Knowledge and to act upon*	*the ability of a community to prepare for anticipated hazards, adapt during hazards, and recover for post-hazard.*
Mileti (1999)	(The ability to) withstand an extreme event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community.		
Bruneau (2003)	The ability of social units to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future earthquakes.		
Godschalk (2003)	A sustainable network of physical systems and human communities, capable of managing extreme events; during disaster, both must be able to survive and function under extreme stress		
Joerin & Shaw (2011)	social system's capacity to absorb external shocks		

Resilience can also be defined as the opposite of vulnerability. Sapountzaki (2012) states that Kasperson and Kasperson (2001) saw the relationship between vulnerability and resilience as opposed. They claimed that when a social system becomes vulnerable, it loses its resilience. According to Glantz and Sloboda (1999), Masten, Best, and Garmezy contend that "resilience" is mostly influenced by communal behaviours. To calculate the time required for a community to "bounce back" after a disaster, resilience assessment must compare risk levels from past to present or current to future. A community's ability to bounce back from one scenario to the next can be judged based on its capacity. Biesbroek, Swart, & Van Der Knaap (2009) and Smit & Wandel (2006) describe adaptation as stakeholders' activities, while vulnerability focuses on coping abilities. Adaptation plays a role in determining coping capacity and susceptibility.

However, strengthening resilience also entails examining what is available and accessible to individuals, households, and, eventually, communities, and expanding on those existing capacities. Béné et al. (2012) then describe the relationship between resilience and communication. The idea of resilience has a

"pragmatic" advantage because of its relatively flexible interpretation, which is "the capacity to absorb shocks." It is confirmed by the fact that people, regardless of their backgrounds or expertise, collaborate based on the above definition (Béné et al., 2012). In addition, Folke et al. (2002) highlighted in Sapountzaki (2012) that resilience and adaptive capacities are regarded as the fundamental attributes for achieving sustainability. Their conclusion states that resilience is a primary goal of both sustainability and sustainable development. Integrating vulnerability with additional concepts, such as resilience and adaptation, helps address the link between vulnerability and public policy (the third path). Resilience, in the context of this research, refers to the ability of urban communities to address disaster challenges and implement effective organisational risk reduction behaviours for disaster management. Hence, the concept of resilience has a strong connection to the reduction of risks.

2.2 Disaster Management and Resilience Approach in Indonesia

According to a historical perspective, disaster risk management (DRM) in Indonesia has evolved over time to address pressing national concerns. The National Coordination for Natural Disasters body was established in 1966 as Indonesia's first national organization for disaster risk management. After undergoing revisions in 1979 under Presidential Decree No. 28, it was rechristened the National Coordination Board for Natural Disaster Management. Amendments to the board were necessitated in 1990 by Presidential Decree No. 43 in order to incorporate the topic of man-made disasters into Indonesian DRM. The board was rechristened the National Coordination Board for Disaster Management as a result of these alterations. Since then, the DRM Board in Indonesia has undergone additional changes to its structure. Rebranding as the National Coordinating Board for Disaster Management and Internally Displaced People in 2001 was the second name change the bureau underwent (Badan Koordinasi Nasional Penanggulangan Bencana dan Penanganan Pengungsi). This new board was established in accordance with Presidential Decree No. 3. It was overseen by the Ministry of Social Welfare. The extraordinarily large-scale impact of the Aceh Tsunami of 2004 prompted further changes. The 2005 ratification of Government Rule No. 83 was the basis for these changes. A new name, the National Coordinating Board for Disaster Management, was endowed upon the board (Badan Koordinasi Nasional Penanggulangan Bencana). From 1966 to 2005, the structure of DRM in Indonesia underwent some changes, but the defining feature of previous management styles was the government's reaction to disasters.

Following a disaster, many types of government organizations served a similar function: they coordinated the response of other ministries and agencies. These government agencies were formed on an as-needed basis to deal with disasters. Due to its ad hoc nature, the agency's primary responsibility was to lend a hand to other government entities during specific events. At the regional and

municipal levels, this setup mirrored the national one (both provincial and municipal). As a result, collaboration centered on responding to emergencies rather than planning for future disasters as a whole. After natural disasters like the Aceh Tsunami in 2004, Indonesia's emergency response was inadequate because it was based on reactive actions.

Now with the issuance of Law No: 24/2007 on Disaster Management, which is a comprehensive law in disaster management for natural disasters, non-natural disasters and social disasters, the institution responsible for handling disaster management at the central level is the National Disaster Management Agency and in the regions is the Regional Disaster Management Agency. The legal basis for the establishment of this Agency is none other than is based on paragraph 4 of the Preamble of the 1945 Constitution. Based on Law No. 24 of 2007, Presidential Regulation No. 8 of 2008 on the National Disaster Management Agency was enacted. The National Disaster Management Agency (BNPB) is a non-governmental led by a head and directly responsible to the President..

Although the legal framework governing risk mapping and assessment is relatively minimal, a significant amount of risk and vulnerability mapping has been conducted in Indonesia, carried out by a number of actors. BNPB first initiated a comprehensive vulnerability mapping exercise in 2009, which was updated in 2011 and more recently in 2013, with a shift in focus from 'vulnerability' to 'disaster risk'. A new version of this mapping is currently being developed. It involves ranking each region and each of Indonesia's 497 districts according to a calculated risk index based on the magnitude of potential impacts, measured from exposure to each hazard, as well as from potential combinations of multiple hazards.178 A risk index by hazard is also included, covering nine natural hazards.179 The Disaster Risk Index is intended to be a basic tool for developing institutional policies, funding proposals, planning, and so on

The presence of BNPB has also changed the disaster paradigm in Indonesia from time to time (Mutaqin, Amri, & Aditya, 2020). Before the 1990s disaster management tended to be reactive when a disaster occurs (disaster response based), the paradigm changed towards disaster mitigation entering the 1990s with the establishment of *BakornasPB*. Entering the 2000s the management paradigm became integrative disaster management and since the establishment of BNPB in 2008, the paradigm of disaster management in Indonesia is now based on Disaster Risk Reduction Disaster Risk Reduction (DRR) (Hidayati, 2009) (Rafliana, 2014) which involves the active participation of the community and emphasizes DRR actions in all components of the disaster of the disaster cycle. BNPB has issued spatial products public service innovations for disaster management in Indonesia, including Data and Disaster Information Indonesia (DIBI).

DIBI which contains historical disaster statistics from 1815 until now has been integrated with population data and basic maps. population data and base maps. DIBI was developed since 2010 with UNDP assistance and has received an

award from UNDP as the best disaster database system in Asia. DIBI is currently a reference and example for many countries in the development of disaster database development. In addition to DIBI, other BNPB innovations include BNPB's Geospatial which contains thousands of disaster maps that can be downloaded for free access by the public. BNPB Geospatial Portal provides basic maps, thematic maps, UAVs to national plans related to disasters in Indonesia.

Table 2.1 Summary of Laws related to disaster management in Indonesia

Law/Regulation	Differences to others
Law No. 25 on National Development Planning System (2004)	• Legal framework for the planning system in Indonesia • As a basis for the development of National Action Plan for Disaster Risk Reduction
Law No. 24 on Disaster Management (2007)	Part of national development • Reference for all disaster activities in pre during and post disaster • Mandated local government in taking responsibility in disasters (establishment of local disaster management agencies) • Participation of community in disaster activities (CBDRM) • A legal framework for the preparation of DRM
Law No. 26 on Spatial Planning (2007)	Requirement of disaster mitigation>based spatial planning (zoning regulations, building codes)
Law No. 27 on the Management of Coastal Areas and Small (2007)	• Risk reduction and mitigation (structural/physical and non-structural/non-physical) to respond disasters in coastal areas) • DRR must be integrated in the plans and management and utilization of coastal areas and small islands, involving central, local government, and communities
Government Regulation Number 13 of 2017 concerning National Spatial Planning	Zero run-off is suggested to be one of the benchmarks of successful implementations of the regional drainage system

Risk mapping is implemented in Indonesia not only to benefit the activities of the disaster management sector, but, perhaps more importantly as a basic foundation for the development of spatial and development plans from village to national level. The DM Law emphasizes this indirectly, and thus could benefit from a revision to clarify this mechanism. risk assessment information is fully considered in both of these planning processes. However, the approach is often inconsistent concerning the type of risk information considered, the type of maps

used, whether communities have been consulted, and so on. Indeed, many smaller administrations (e.g. at district, sub-district and village levels) often have to base their decisions on risk maps that do not contain the necessary detail to obtain an effective overview of the risks faced. Last, BNPB has issued its own regulations on community and private sector participation in disaster management frameworks, which help to clarify the responsibilities and rights mentioned very generally in the DM Law and its supplementary regulations.

2.3 Correlation of Disaster Risk Reduction in Indonesia with Environmental Assessment and Climate Change Adaptation

Overall, Indonesia has a strong and comprehensive legal framework for disaster management. The DM Law of 2007 provides the foundation for disaster management and DRR in Indonesia. Indonesia established an independent National Council on Climate Change under a Presidential Regulation in July 2008. With a composition of 17 ministers under the chairmanship of the president, the council became a powerful tool for multisectoral coordination and policy-making at the highest level. However, in early 2015 the two National Councils together with the Indonesian REDD+ Agency were merged into the Directorate General of Climate Change within the MoEF.

Table 2.2 Linkage of Disaster Risk Reduction and Climate Change Adaption Institutional Framework in Indonesia

Policy Instruments	Spatial Planning	Climate Change	DRR and Disaster Management (DM)	Poverty Reduction Strategies	Integration Scheme
Regulation /Planning/ Institution	The 2007 RTRWN, Island RTRW, Provincial RTRW, RTRW of Strategic Areas, National Spatial Planning, Coordinating Board (BKTRN), Ministry of Public Works	NAP>CC is in process, but it requires support of legal frameworks, Ministry of Environment, Ministry of Forestry, Ministry of Marine, Ministry of Agriculture, BAPPENAS	Regulations on DM: Government Regulation No. 21, 22, 23/2008, DM Plan and NAP>DRR of BNPB/BPBD, BAPPENAS, BPPT, LIPI	PRSSP under the coordination of the Coordinating Minister for People's Welfare, Public Works, Ministry of Cooperative	RPJP and RPJM, Annual Working Program, BAPPENAS and BNPB will lead the coordination of multi stakeholders
Direct Intervention	Special attention to vulnerable areas, protection regions	LULU fs, Forest Protection / Conservation / Water Management	Mapping of prone areas/ DRR Assessment for disaster prone areas, establishment of EWS in disaster prone areas	Social system / Community Forestry System, PNPM	Coordination among programs, projects, Integration of climate change and DRR in PNPM
Capacity Building	Improvement of community participation in R & D, spatial planning, Improvement of the role of community control in R & D	R & D, Improvement in education, community awareness and participation in climate change	R & D, Improvement in education, community participation in EWS as well as DRR	Community> Based Society Organizations (CBSOs) capacity building	Integration of community empowerment with CBSOs

Indonesia's National Action Plan for Climate Change Adaptation (RAN-API)141 provides overall direction for CCA initiatives in Indonesia. Although it has no formal legal basis, it is accepted as an integral part of Indonesia's national development framework. It is also included as a cross-cutting theme in the government's long-term and medium-term development plans. It is recognized that a systematic and concerted effort with a reliable strategy, as well as a shared commitment and responsibility of various parties, is required to achieve the goals of CCA. commitment and responsibility of various parties, are needed to mainstream climate change into the national and local development agenda. into the national and regional development agenda. In addition, with the Sendai Framework for Disaster Risk Reduction, DRR programs and activities in Indonesia are not only regulated by the National Medium-Term Development Plan (RPJMN) 2015-2019, but the National Policy and Strategy in Disaster Management 2015-2019, will also refer to this framework. Basically, most of the national documents related to DRR are already aligned with the SFDRR because in recent years, Indonesia has started to mainstream DRR into development.

In dealing with disaster risk reduction efforts related to the sustainable development agenda, the Government of Indonesia will build sustainable natural and environmental resources, and disaster management. It is stated that the development target in disaster management and disaster risk reduction is a decrease in the Disaster Risk Index in the growth centres in hazard-prone areas. Government Regulation 21/2008 on Disaster Management provides further relevant details on DRR. While essentially repeating some of the key provisions of the DM Law, Government Regulation 21/2008 requires an action plan for DRR, together with some specific requirements regarding its development.

Although the disaster management legal framework does not relate to sectoral legislation, it does contain practical links to relevant sectors. For example, action plans for DRR are supposed to be coordinated with the agency or institution responsible for development planning, namely the National Development Planning Agency (BAPPENAS) at the national level, as well as the Regional Development Planning Agency (BAPPEDA) at the local level. This raises a big question about the coordination of DRR efforts with other sectors under the law, which is surprisingly little.

There is no clear link between the DM legal framework and legislation and institutions dealing with climate change adaptation, nor is there a clear link with sectoral laws. The importance of valuing the environment, and environmental management and conservation as components of the broader Sustainable Development framework is considered, but no mechanisms or links to relevant sectoral laws or institutions are included. Ultimately, the DM Law and its regulations only hint at where the crossover between BNPB/BPBD and other sectors in the field of DRR lies and fail to provide a solid foundation for

multisectoral collaboration and coordination. According to one respondent, the lack of a tangible mechanism for DRR coordination with other sectors suggests that the DM Law and related regulations remain just "BNPB documents".

Law 32/2009 also creates a framework for the Strategic Environmental Assessment (SEA) process. This review is defined as "a series of systematic, comprehensive and participatory analyses to ensure that the principles of sustainable development have become the basis for and are incorporated into regional development and/or policies, plans and/or programs." Both central and local governments are obliged to conduct an SEA process in the formulation of spatial plans, development plans and all other policies, plans or programs that have the potential to cause environmental impacts or risks. SEA interventions are included in the formulation of alternatives and become recommendations for alternative improvements to the formulation of policies, plans and programs. The drafting of SEA provisions is very broad, and while it is intended to cover as many sectors and activities as possible, the risk is that the MoEF and regional administrations do not have a clear focus for their efforts. Issues to be considered in the SEA process are outlined in an infinite list, with some items relevant to DRR (e.g. the ability of the environment to support and implement development, and estimates of environmental impacts and risks) but do not contain anything specifically related to disasters.

Similar to the DM Law and the way it links to other sectors without providing details on implementation, Law no. 32/2009, for example, requires that "every spatial plan shall be based on SEA" without explaining where the responsibility lies or what the procedure is. However, these matters have been further elaborated in secondary legislation, most notably in the Minister of Home Affairs Regulation No. 67/2012 on SEA. This places the obligation to carry out SEA on the relevant governor, mayor or regent. It also emphasizes that its main objective is to ensure that sustainable development as well as the evaluation of environmental risks and impacts are incorporated into the long-term and medium-term development plans.92 and medium-term development plans.92 It is understandable that this regulation was issued by the Minister of Home Affairs and not by the Minister of Forestry and Environment because Minister of Home Affairs and not the Minister of Forestry and Environment as the latter has authority over the local and district governments, while the Minister of Environment only has authority over the agencies under him.

Environmental Impact Assessment (AMDAL) in Indonesia is mandated in Law no. 32/2009, and it is an important environmental prerequisite prior to the commencement of major projects. The process is defined in the law as "the study of the substantial impact of a business plan and/or activity on the environment, which is necessary to make a decision on the implementation of the business and/or activity". (It should be noted that Law 32/2009 uses the abbreviation 'AMDAL' to refer to Environmental Impact Assessment, as this is the full

Indonesian term for Analisis Mengenai Dampak Lingkungan/AMDAL). In this report the term AMDAL will be used for consistency.

Under the DM Law, disaster risk analysis must be incorporated into the preparation of an EIA. In doing so the analysis of potential impacts on the environment, which considers the likely impacts of natural hazards and whether these risks will increase, should indeed be taken into account but there appears to be no legislation that actually clarifies which 'analysis' of the DM Law should be involved or, perhaps more importantly, how this analysis should be incorporated into the EIA process. It seems reasonable that the disaster risk maps, and hazard indices prepared by BNPB should be explicitly considered by AMDAL applicants, but it is unclear to what extent this process is followed. Respondents noted that many AMDAL applicants will conduct their own risk assessments as part of the process which may or may not utilize the knowledge of BNPB and BPBD. knowledge of BNPB and BPBD.

2.4 Review on Disaster Risk Reduction at Local Level in Indonesia

DRR action plans are required at both national and local levels. National plans should be coordinated by BNPB together with the agency responsible for development planning, as well as to utilize "comprehensive and integrated preparedness in forums involving government, non-government, community and business institutions." Local plans benefit from the same process, but with local stakeholders from the same groups. Several regional, district and local disaster management plans and contingency plans have been and continue to be developed. While there is a strong focus on disaster response, these plans demonstrate a strong opportunity to incorporate appropriate DRR priorities.

Under the Disaster Reduction Law, local governments are authorized for DRR (and to incorporate it into their development programs). This is a development from its basic position under Law No. 13/2014 on Local Government, which retained some areas exclusively for the central government, and left the rest (including Disaster Risk Reduction and Sustainable Development) to local governments. Their authority over disaster management also includes the power to decide on disaster management policies in line with regional development policies, and development plans that include elements of disaster management planning, cooperation with other provinces, districts, and cities in the implementation of such policies, and formulating policies to prevent depletion of natural resources. The intersection with other sectors here is very clear, not only in terms of preventing natural resource depletion, but what is not conveyed is what these functions cover and with whom to coordinate.

Local governments can establish Regional Disaster Management Agencies (BPBDs) that include provincial-level agencies (chaired by the governor's secretary), and district-level agencies (chaired by the regent or mayor). These are stipulated in separate local regulations, many of which have been drafted and

passed by local governments (although their contents are not considered within the scope of this report). The establishment and organization of BPBDs is also regulated in two pieces of legislation: Minister of Home Affairs Regulation No. 46/2008 on Guidelines for the Organization and Working Procedures of BPBDs, and Head of BNPB Regulation No. 3/2008 on the Establishment of Regional Disaster Management Bodies. The duties and functions of BPBDs are the same as those of BNPB, but with a clear focus on the local level. DRR is not mentioned as a specific part of the BPBD's mandate, but can be inferred through other responsibilities, such as setting directions and guidelines covering disaster prevention, preparation and dissemination of disaster-prone area maps, and so on.73 DRR, on the other hand, is mentioned as a specific part of the local government mandate.

The nature of decentralization in Indonesia, particularly Law No. 6/2014 on Villages, allows for local administrations and communities to have potential pathways into DRR decision-making. Under Law 6/2014, there are a number of mechanisms for community representatives to take decisions related to village exposure to risk. While the legal framework authorizes the relevant institutions, based on the analysis above it is questionable whether this results in a clear division of responsibilities. The overlap between the mandates of BNPB and BPBDs is already apparent. Furthermore, the working relationship between BPBDs and their home local and district governments does not appear to have been considered. In particular, the DM Law is relatively silent on the responsibilities of district governments (such as regencies and municipalities) for DRR. While there is a National Platform for DRR (Platform Nasional Pengurangan Resiko Bencana Indonesia/ PLANAS), it is more of a civil society organization and was not established by law, nor is it an official government vehicle for coordinating its approach to DRR. Although the platform is strategically important, an example being its influence in the ongoing DM Law revision process discussed below, the platform is a civil society organization and is not discussed below, the platform should not be considered as a substitute for the multisectoral coordination bodies that are clearly given the coordination body that is clearly mandated and transparent at the national level.

Article 7(5) of Law no. 28/2002 states that administrative and technical requirements for customary buildings (i.e. those built in accordance with customary norms), semi-permanent buildings, emergency buildings, and buildings built in disaster site areas are determined by the local government according to "local social and cultural conditions." Adat housing is very prevalent in Indonesia, consisting mostly of single-story clay brick houses found in many rural areas, which are highly vulnerable to seismic hazards such as earthquakes. This is therefore an opportunity for local governments to design and implement appropriate standards for traditional or customary buildings as well as buildings used either for, or more vulnerable to, disasters.

Local stakeholders can thus have limited control over DRR decision-making and activities through legal mechanisms (with respect to rights granted through village and local government regulations) as well as through community-based committees and forums. More detailed mechanisms to ensure this could be included in the disaster management legal framework - but perhaps not essential, given the level of activity and initiative demonstrated by communities and civil society in Indonesia. If poorly conceived, these mechanisms could also contribute to the growing number of local committees, organizations and forums. As BNPB has said in its latest Hyogo Framework progress report, "the main challenges of decentralized disaster risk management include the lack of resources to be provided to the local level and limited resources in the region." A greater focus needs to be placed on building the technical and financial capacity of local communities, and this can only happen through concerted government action with the support of a range of partners. There are a number of schemes that attempt to address this, but given the size and complexity of Indonesia, this is a difficult task. One such scheme, headed up by BNPB, is the Disaster Resistant Village program, which specifically seeks to promote community participation in DRR at village level. For civil society organizations and the private sector, their involvement depends less on the legal framework than on practicality. The Indonesian Red Cross (PMI) has a special status under the law which means it is involved in government forums as well as various other coordination forums within BNPB (a similar legal arrangement applies to UN agencies). PMI's extensive network of offices and volunteers allows it to work closely with BPBDs in many areas and is actively involved in community based DRR initiatives.

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Minister of Environment Regulation Number 17 of 2012 on Guidelines for Community Involvement in the AMDAL Process Community Involvement in the AMDAL Process
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Head of BNPB Regulation No. 11 of 2014 on Community Participation in Disaster Management Implementation of Disaster Management

Chapter 3

Research Study Area

3.1 Characteristics of Balikpapan City

Balikpapan City is located between 1.0'-1.5' South latitude and between 116.5'-117' East longitude. Based on its geographical position, Balikpapan City has the following boundaries:

i. North - Kutai Kartanegara Regency;
ii. West - North Penajam Paser Regency;
iii. South and East - Makassar Strait.

Based on its geographical location, Balikpapan City is in the eastern part of Kalimantan Island and is directly adjacent to Balikpapan Bay and Makassar Strait. The administrative area of Balikpapan City consists of (six) sub-districts and 34 villages and can be seen at Figure 3.1.

a. South Balikpapan, with 7 villages: Damai Baru, Damai Bahagia, Sepinggan Baru, Sungai Nangka, Sepinggan Raya, Gunung Bahagia, and Sepinggan.
b. East Balikpapan, with 4 urban villages: Manggar, Manggar Baru, Lamaru, and Teritip.
c. North Balikpapan, with villages: Gunung Samarinda, Muara Rapak, Batu Ampar, Karang Joang, Gunung Samarinda Baru, and Graha Indah.
d. Central Balikpapan, with 6 urban villages: Gunung Sari Ilir, Gunung Sari Ulu, Mekar Sari, Karang Rejo, Sumber Rejo, and Karang Jati.
e. West Balikpapan, with 6 villages: Baru Ilir, Margo Mulyo, Marga Sari, Baru Tengah, Baru Ulu, and Kariangau.
f. Balikpapan Kota, with 5 villages: Prapatan, Telaga Sari, Klandasan Ulu, Klandasan Ilir, and Damai.

Balikpapan City is a city in East Kalimantan with the third largest population after Samarinda City and Kutai Kartanegara Regency. The following Figure 3.2 is the population of Balikpapan City based on sub-districts in 2018. Based on document of Flood Study by Balikpapan City Government (2020), Balikpapan City's drainage is served by 86 channels or rivers that directly drain into Balikpapan Bay or Makassar Strait. There are no primary channels designed specifically to drain drainage water and wastewater from urban areas. All existing primary drainage channels are natural and have been adapted to meet drainage requirements. Because they are derived from natural channels, most of the channel traces, both flat and sloping, have a curving trajectory. There are three types of water bodies (receiving water) that are used to receive flow from existing primary channels: the sea, bays, and large rivers that resemble bays in that the water surface elevation along the river at high tide or low tide is relatively no different from the sea level at the river.

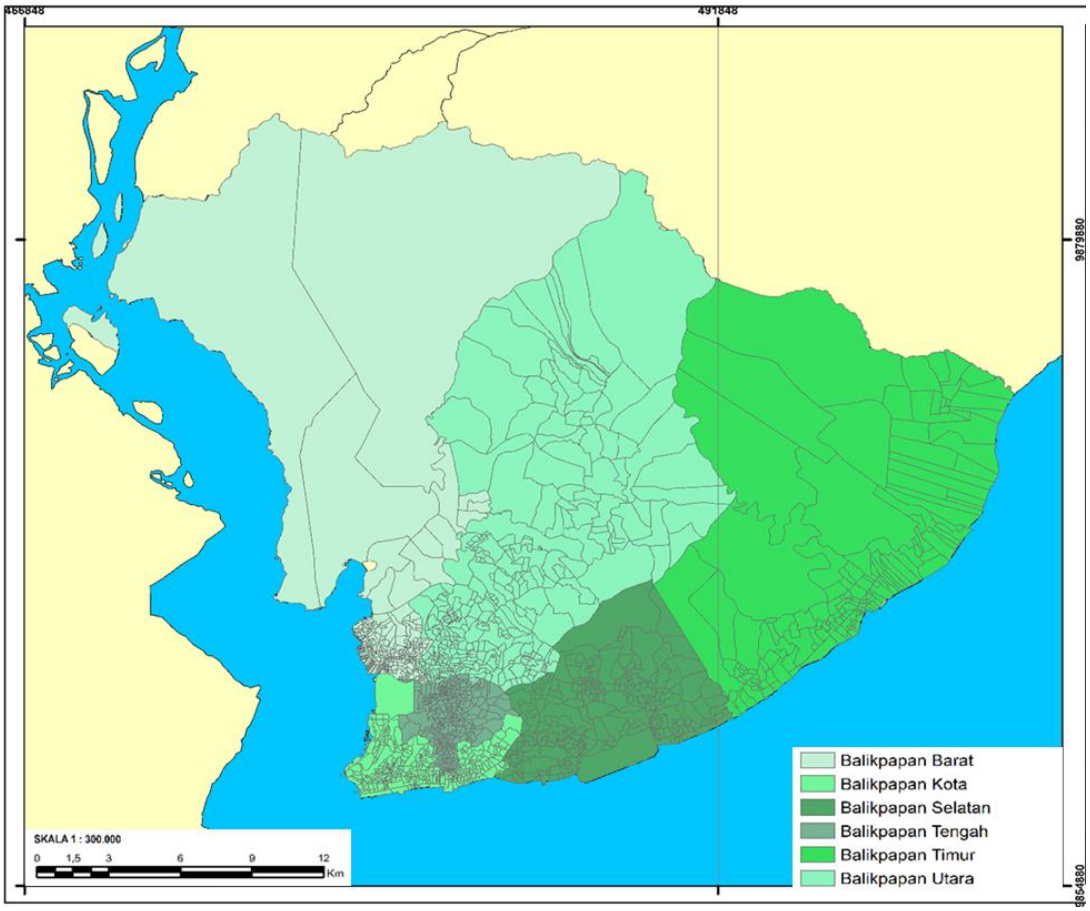


Figure 3.1 The Administrative Map of Balikpapan (Source : modified from Balikpapan City Planning Document, 2019)

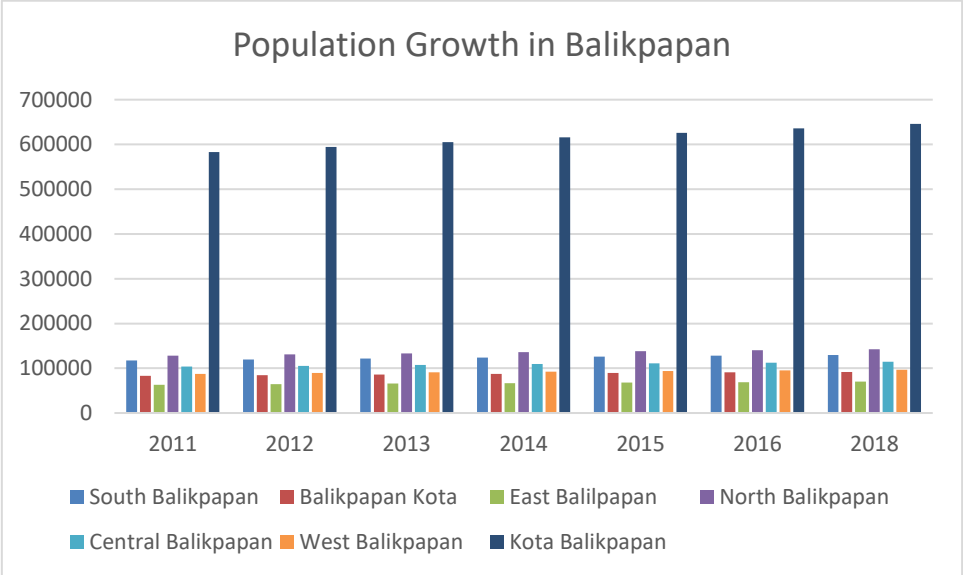


Figure 3.2 Population Growth in Balikpapan City (Source : Balikpapan Statistical Agency, 2019)

Table 3.1 Area of Sub-districts (Kecamatan) in Balikpapan City

No	Sub-District	Area (Km²)	Precentage (%)
1	North Balikpapan	1328,7	26,40
2	East Balikpapan	1306,9	25,97
3	South Balikpapan	375,9	7,47
4	West Balikpapan	1806,4	35,89
5	Central Balikpapan	107,7	2,14
6	Balikpapan Kota	107,4	2,13
Total		5033	100

Source : Balikpapan Statistical Agency (2020)

According to the data in table 3.1, the sub-district with the greatest land area is West Balikpapan Sub-district, covering 1806.4 Km², which accounts for 35.89% of the total area of Balikpapan City. On the other hand, Balikpapan City Sub-district has the smallest land area, measuring 107.4 Km², which represents 2.13% of the total area of Balikpapan City.

3.1.1 Temperature

The air temperature in Balikpapan City is influenced by factors such as its elevation relative to sea level and its proximity to the coast. The maximum temperature recorded in February 2017 was 34.8 degrees Celsius, while the lowest temperature was 22.4 degrees Celsius. Balikpapan City, being located in a tropical climate region, experiences a relatively high level of humidity, with an average range of 82 - 91%.

3.1.2 Topography

Balikpapan City is situated at an elevation ranging from 0 to over 100 metres above sea level. The highest elevation in Balikpapan City is between 20 and 100 metres above sea level, covering an area of 20,090.57 hectares or 51.66% of the total area. The area between 10 and 20 metres above sea level spans 17,260 hectares (34.17% of the total area), while the area below 10 metres above sea level covers 6,980 hectares or 13% of the total area. The topography map can be found in Figure 3.3. Balikpapan City is characterized by its sloping topography with hills and valleys. The slope condition in Balikpapan City ranges from 15-40%, and it covers a total area of 21,305.57 Ha or 42.33% of the city's total area. Within the Ampal watershed, the upper region is predominantly found along the watershed boundary, with the exception of a portion of Damai Bahagia village that has a comparatively lower height. Furthermore, the elevated region is primarily situated within Graha Indah village, precisely at the watershed boundary. The

central portion of the watershed, encompassing Kelurahan Gunung Samarinda Baru and Kelurahan Damai Baru, consists of lands with relatively low altitude, ranging from 2.5 to 10 meters. The degree of elevation (slope) in Balikpapan directly impacts the likelihood of erosion or landslide occurrences. The slope classification employed includes the following categories: flat (<8%), mild (8-15%), slightly steep (15-25%), steep (25-40%), and very steep (>40%). Below is a table displaying slope statistics for Balikpapan City.

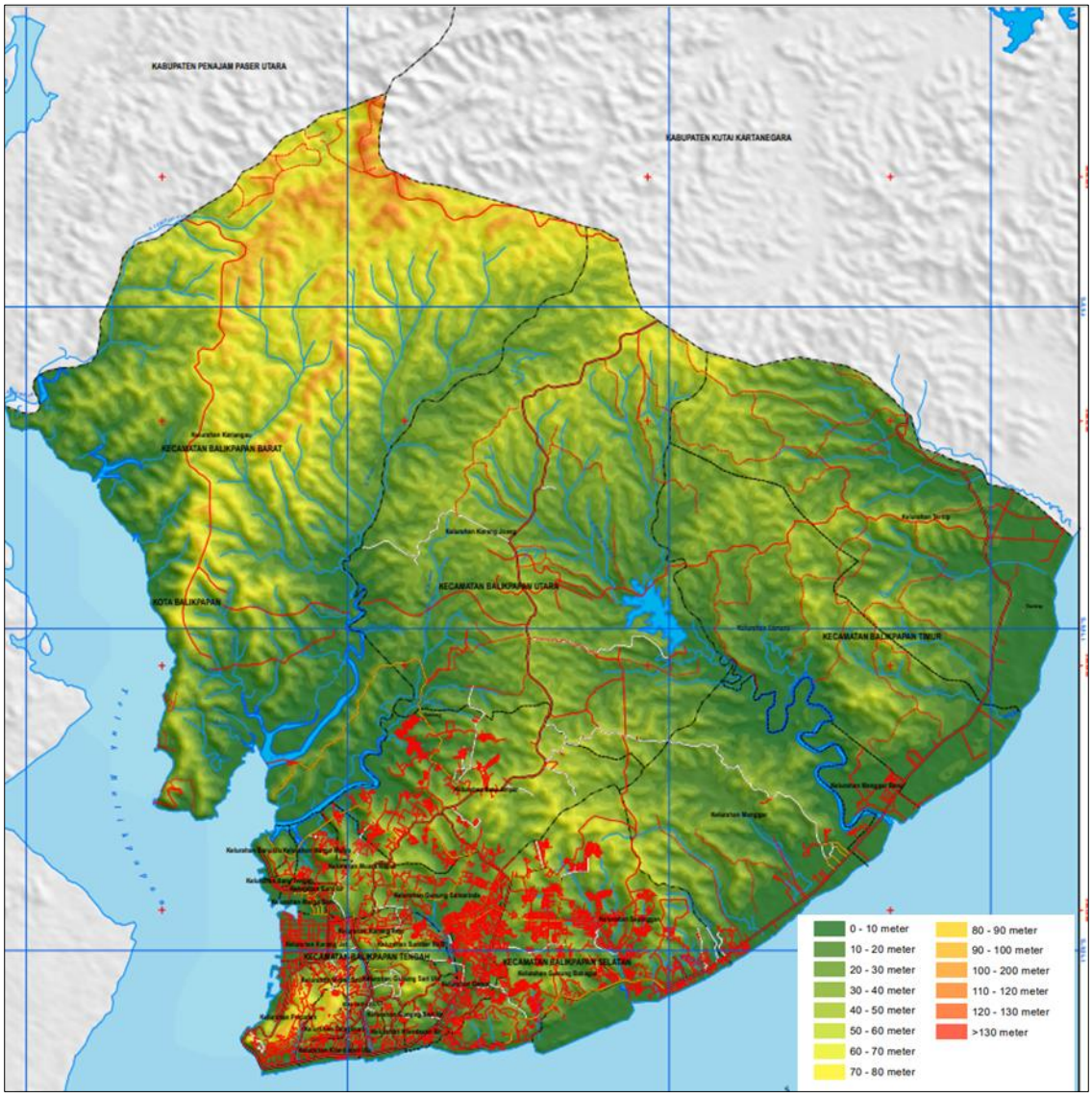


Figure 3.3 Topography Map of Balikpapan (Source : adapted from Balikpapan City Agency, 2019)

Table 3.2 Elevation of Balikpapan City

No	Elevation (slope)	Area (Ha)
1	0 - 8 %	31587,02
2	8 - 15 %	1203,98
3	15 - 25 %	3186,28

4	25 - 40 %	12541,21
5	> 40 %	1294,24

Source : Balikpapan Statistical Agency, 2020

3.1.3 Soil Type

Balikpapan City is primarily characterized by its morphology, with 85% of its land being hilly. The hilly areas are predominantly composed of podsolic red yellow soil, which is characterized by a thin topsoil, a loose soil structure, and low soil moisture content. The soil in question is a variant of yellow red podzolic soil, characterized by its low topsoil and vulnerable to erosion due to its fragile soil structure. The remaining 15% consists of flat terrain situated along the eastern and southern beaches of Balikpapan City. The soil of Balikpapan City is classified into five categories, including alluvial, marine, fluvio-marine, volcanic, and tectonic/structural. Below, I will provide detailed explanations regarding each type of soil found in Balikpapan City. Balikpapan is a city.

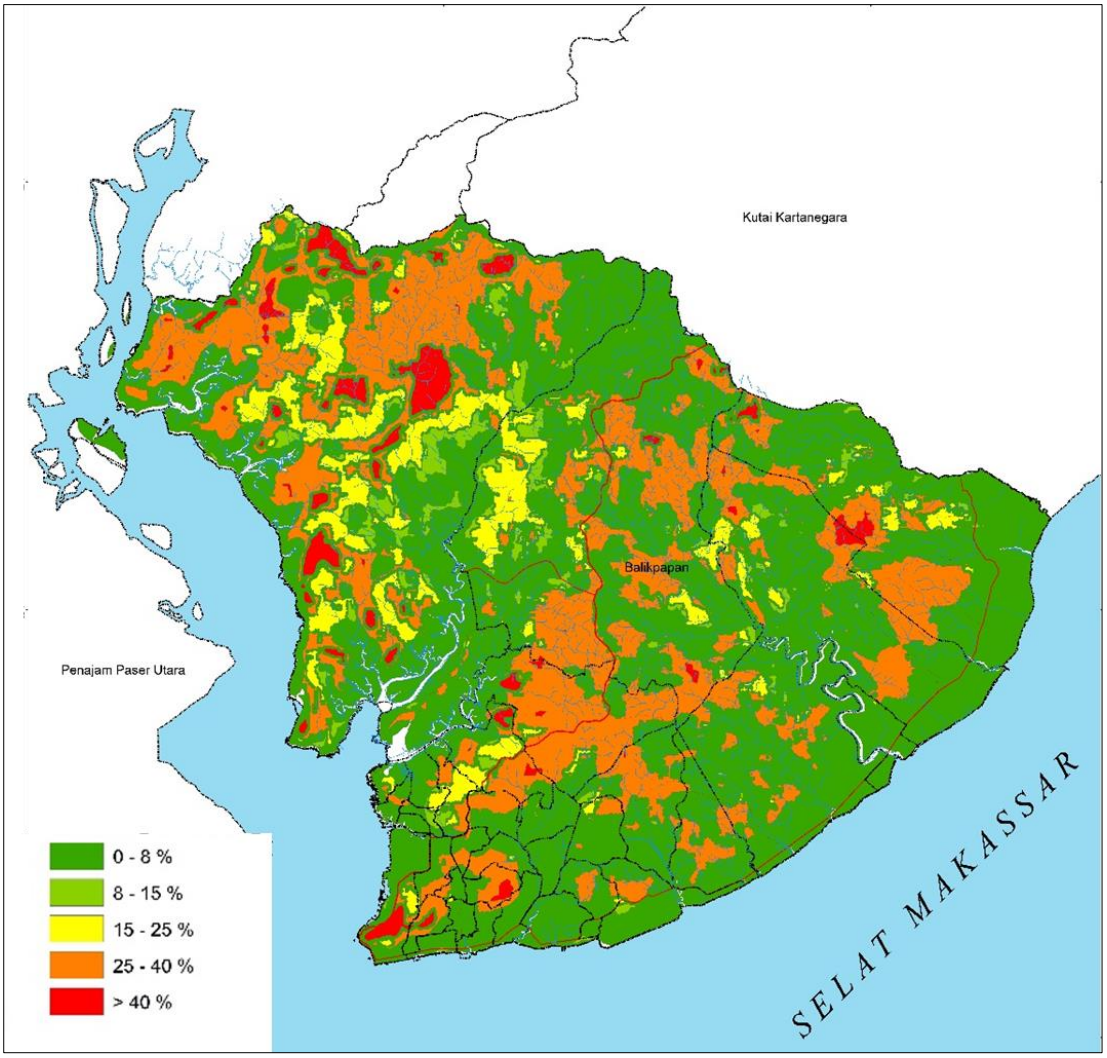


Figure 3.4 Elevation Map of Balikpapan City (Source : adapted from Balikpapan Planning Agency, 2020)

3.1.4 Geological Condition

According to the geological structure, Balikpapan City may be classified into different geomorphic units, specifically the unit of medium undulating hills, the unit of weak undulating hills, and the unit of alluvial plain. The moderate undulating hills geomorphic unit covers over 55% of the land and has an average incline ranging from 15% to 40%, with an elevation variation of approximately 10 to 30 metres. The weak undulating hills geomorphic unit, which comprises about 30% of the region, is characterised by a moderate undulating pattern. It typically has a slope ranging from 5% to 15% and a height difference of around 3 to 15 metres.

3.1.5 Land Use

Land use is a significant factor that impacts the pace of development in a given location. The land use in Balikpapan City as of 2019 is mostly characterized by undeveloped land, covering an area of 39,540.30 hectares, while the built-up area occupies 10,378.90 hectares. Table 4.5 displays the respective area of each land use categorization in Balikpapan City.

Table 3.3 Land Use in Balikpapan City

No	Land Use	Area (Hectare)
1	Forest	22471,45
2	Industry	1152,73
3	Tourism	41,48
4	Trade and Services	607,18
5	Housing and Settlement	8203,17
6	Paddy Field and Forest Production	1595,15
7	Transportation Infrastructure	374,35
8	Park	10731,31
9	Abundand Land	4742,39

Source : Balikpapan Statistical Agency, 2020

According to the provided table, the land use classification with the greatest extent in Balikpapan City is Forest, covering an area of 22471.45 hectares. Conversely, the land use classification with the smallest extent in Balikpapan City is Tourism, occupying an area of 4.48 hectares.

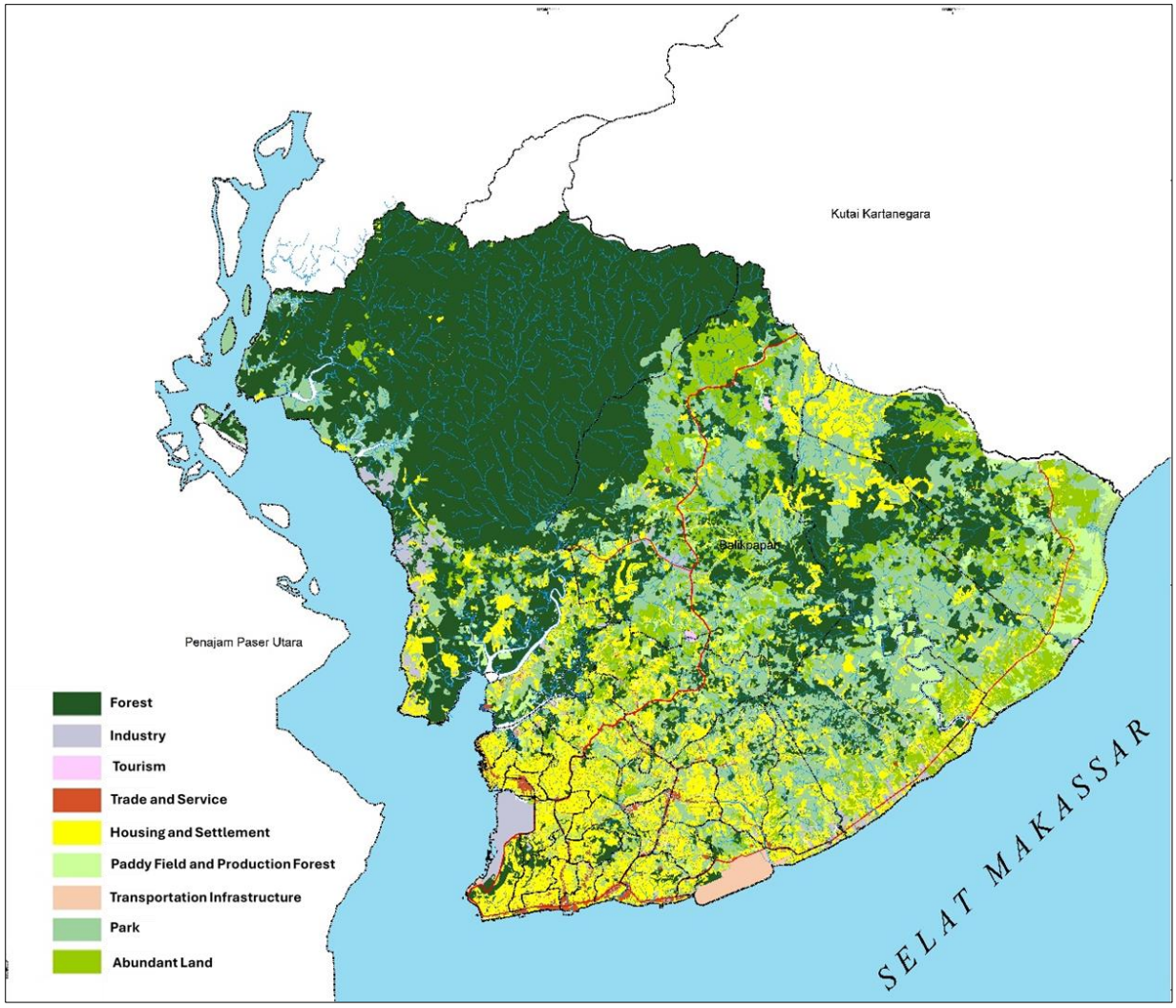
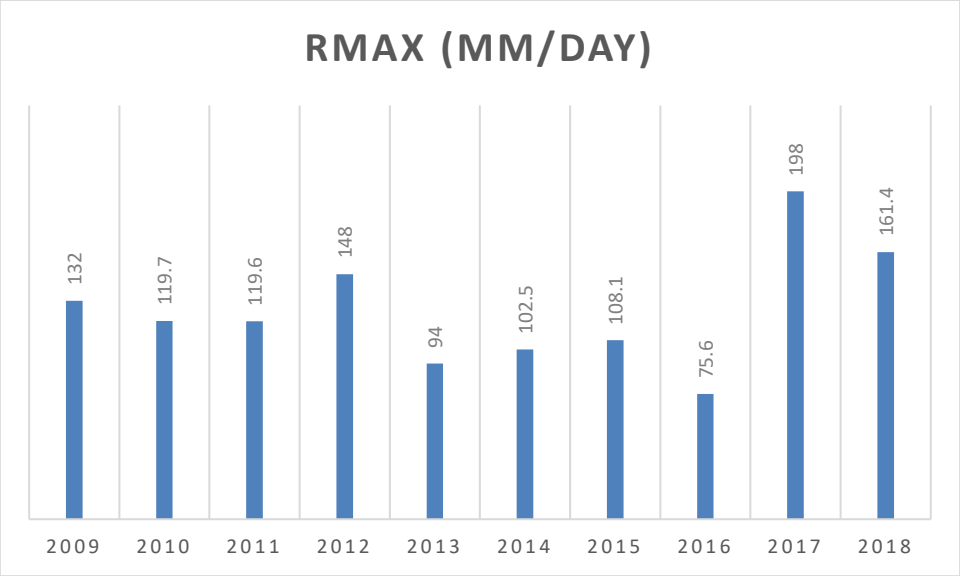


Figure 3.5 Land Use Map of Balikpapan City (Source : adapted from Balikpapan Planning Agency, 2020)

3.2 Review of Flood Risk in Balikpapan City

Disasters that occur in Balikpapan City are disasters with a type of meteorology disaster, which is a type of disaster that is influenced by climate Balikpapan City has a tropical climate, with seasons like those in East Kalimantan in general, namely the dry season and the rainy season. The dry season usually occurs from May to October, while the rainy season occurs from November to April. This situation continues every year interspersed with transitional seasons) in certain months. However, in recent years, the season in Balikpapan has been erratic. This can be seen in the rainfall data in Balikpapan City as shown in the following table.

Figure 3.6 Annual Maximum Daily Rainfall (mm/day)



Source : BMKG Balikpapan, 2019

Based on the table above, it can be seen that the rainfall that occurs in Balikpapan City each year is different. The lowest rainfall occurred in 2013 which amounted to 94 mm while the highest rainfall in Balikpapan City occurred in 2017 which amounted to 198 mm. The rainfall tends to be constant in 2010-2011 and 2014-2015. According to BMKG (2019) it is known that normal rainfall is divided into 3 categories, namely low (0 - 100mm), medium (100 - 300mm) and high (300 - 500mm). Based on this, it is known that the rainfall in Balikpapan City is a medium rainfall. The rainfall in Balikpapan City by month can be seen in the following data.

In general, the monthly rainfall in Balikpapan City is classified as low to medium. It has been known before that the highest rainfall is in 2017. From the table above, it is known that in 2017 the rainfall occurring each month has increased and decreased. A significant increase occurs from February to March where from February the rainfall amounted to 22.8 mm and in March the rainfall amounted to 128.1 mm. Based on this, it can be concluded that the highest rainfall in 2017 occurred in March and the lowest rainfall in 2017 occurred in February. Based on the Operation Plan for Flood Disaster Emergency Management in Balikpapan City (2019), it is known that in order to anticipate flooding that will occur due to rainfall, the Balikpapan City government conducts monitoring at several flood points and analyzes rainfall and water discharge increase. However, according to data from DIKPLHD (2016), in a span of 30 years, in general, the intensity of rainfall has not changed. Balikpapan City can experience rain with a duration of 1.5 hours but the intensity is equal to 12 days of rain. This means that

even though rain is rare or only occurs for a short time, it does not mean that it cannot cause inundation or flooding. Rain with these conditions can still cause inundation or flooding if it has a high rainfall intensity.

Figure 3.3 Flood Condition in Graha Mulawarman Settlement, Balikpapan in August 2022

According to the Final Report on the Making of the Ampal River Area Risk Map (2015), it is known that there are 218 buildings located on the Ampal river border. Referring to the Minister of Public Works Regulation No. 63 of 1993 concerning River Boundary Lines, River Benefit Areas, River Control Areas and Former Rivers, it is known that the boundary lines of embanked rivers in urban areas are set at a minimum of 3 (three) meters on the outside along the foot of the embankment. According to the Final Report on the Preparation of the Risk Map for the Ampal River Area (2015), the border area of the Ampal River should be 6.28 ha. However, based on existing conditions and data on the distribution of buildings, around 211 buildings intersect with the river boundary, so it can be concluded that in general Ampal River does not have a river boundary.

Figure 3.4 Flood Condition at MT. Haryono Corridor, Balikpapan in August 2022

Floods in Balikpapan City are influenced by high rainfall and ineffective drainage management BPBD Balikpapan City (2019) It can be seen from the period of 2010 to 2018 that the frequency of flood events in Balikpapan City fluctuates with the highest number of events in 2010 with 19 events. The biggest loss occurred in 2012 with 7,044 houses flooded, 40 houses severely damaged, 29 houses lightly damaged, and a total loss of Rp. 1,150,000,000. The following is data on flood events from 2010 - 2018. Based on the flood vulnerability map (Figure 3.2), the flood locations are spread in several areas of Balikpapan City, such as Marga Sari Village, Baru Ilir Village, Baru Tengah Village, Gunung Sari Village, Mekar Sari Village, Sumber Rejo Village, Gunung Samarinda Village, Gunung Samarinda Baru Village, Batu Ampar Village, Sepinggan Baru Village, Graha Indah Village, and Karang Joang Village. However, most areas of Balikpapan City are flood-prone areas with moderate category.

Flood-prone areas in each watershed in Balikpapan are scattered in the center of the region and upstream areas. The percentage of flood-prone areas ranges from 0.3%-3%. Sepinggan watershed is the area that has the greatest level of vulnerability, which is equal to 3.14% or 27.42 Ha. Ampal watershed, which although often encountered inundation, is the watershed with the lowest vulnerability with area with only 0.34% or 9.17 Ha.

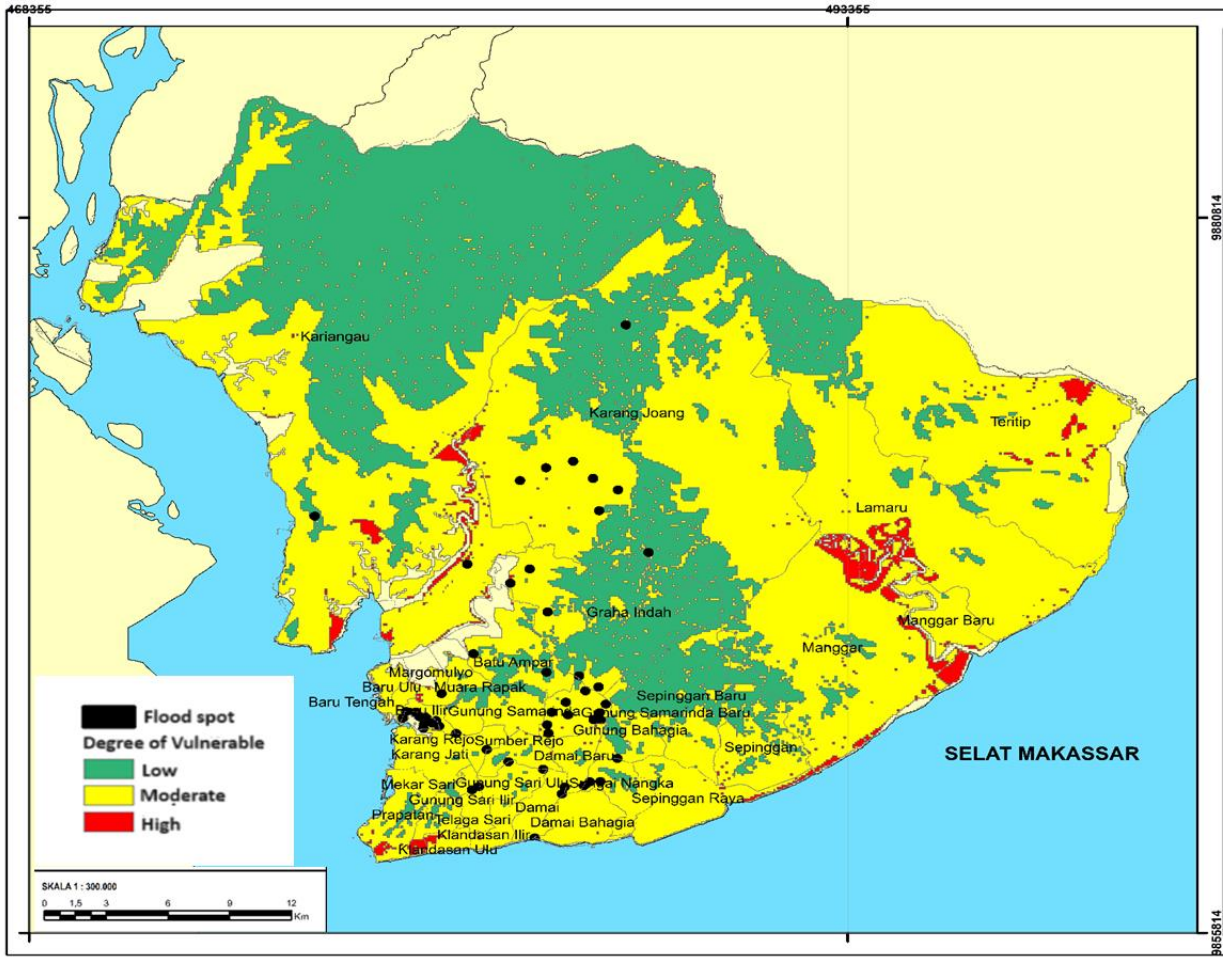


Figure 3.3 Flood Vulnerability Map (Source : modified from Erik, 2019)

Fluvial flooding has been recognised as the predominant type of flooding in Balikpapan, especially in locations with low elevation. The flooding is caused by a lack of sufficient river capacity to transport water without it spilling over. Sedimentation is usually the primary factor that reduces the ability of rivers to transport water. Insufficient upkeep of rivers and alterations in land use and land cover (LULCC) can both contribute to the accumulation of silt. Land use change initiates soil erosion, resulting in the deposition of erosional sediments in rivers. Pluvial flooding is another common type of flooding in Balikpapan. The primary causes of this sort of flooding are inadequate drainage systems, intense rainfall, and reduced capacity of rivers and channels. In addition, predominantly metropolitan regions are situated in low-lying locations, and concave areas experience greater impact from the accumulation of runoff originating from the surrounding higher elevations.

The inadequate upkeep of urban drainage systems leads to a substantial decline in their capacity, primarily caused by the accumulation of sediment and solid debris resulting from human activities in the channels. The accumulation of waste in the drainage channel obstructs the flow of water and hinders proper drainage.

3.3 Balikpapan City as Buffer Area of New Capital City

The implementation of the new National Capital City plan in East Kalimantan Province designates Balikpapan City as a buffer zone for the National Capital City region. Balikpapan City serves as a buffer in four key areas: trade and industry, settlements, tourist, and transportation infrastructure. As a result, Balikpapan City is implementing measures to establish itself as a buffer zone. The present plans are as follows:

1. Proposal for the construction of a road along the coast. Balikpapan, a forthcoming development in the southern coastal region of Balikpapan City, will serve as the primary hub for commerce and services in the city. It will span an area of 383.53 hectares. The objective of this coastal road proposal is to bolster Balikpapan City's role as a commercial and service hub, as well as a tourist destination.
2. The Kariangau Industrial Estate (KIK) in Balikpapan is scheduled to be constructed in the western region of the city, covering a proposed area of 3314.1 hectares. KIK will provide assistance to Balikpapan City in establishing it as a protective area for the industrial sector.
3. The Toll Road Plan aims to establish a connection between Balikpapan City and the NCC area, as well as Samarinda City. This plan will enhance accessibility between Balikpapan City and the IKN area, allowing for a travel time of around 30 minutes. The implementation of this toll road project will enhance Balikpapan City's role as a transportation infrastructure hub.

The intentions pertain to the efforts of Balikpapan City to establish its role as a buffer zone for the National Capital, aligning with the intended roles of the upcoming fields. The presence of this plan will serve as a determining factor in the assessment of land use transformation in Balikpapan City resulting from the relocation of the national capital.

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Chapter 4

Current Status of Vulnerability of Balikpapan (Indonesia) for Climate Change Induced Urban Flooding

4.1 Introduction

Over the years, a progressive increase has been observed in the earth's surface temperature around the world, and this trend is expected to continue in the future (Jones et al., 2010). Dale *et al.*, (2017) underlined that the continually increasing temperature is mainly indicating a change in the climate. This indication can also be seen in the form of average increase in the earth's surface temperature. NOAA's 2020 Annual Climate Report the combined land and ocean temperature has increased at an average rate of 0.13 degrees Fahrenheit (0.08 degrees Celsius) per decade since 1880. These rapid changes in the earth's surface temperature reveal a significant acceleration of climate change, which raises potential concerns for global communities. Many developing countries, particularly those having tropical climates, are extremely sensitive to climate change's effects (Bigi et al., 2021). Herein, the vulnerabilities become even greater when considered simultaneously with the ongoing trends of population growth and deforestation (Pollner et al., 2010). In regard to that, climate change is also expected to have a greater impact on urban areas. For instance, the urban heat island (UHI) impacts change the microclimate of cities, heightening the climate unpredictability induced by global warming and increasing the severity of rainfall events in these areas (Pour et al., 2020). Correspondingly, the rainfall intensity and frequency have also been found to be higher in big cities, and these effects have been connected to urbanization in many cases worldwide (Zhao et al., 2016).

Comprised of more than 17,000 islands, Indonesia is vulnerable to a wide range of natural disasters, the most frequent of which are floods. Flood disasters have had a significant impact in terms of deaths, illness, and damage/losses, particularly in the Balikpapan, East Borneo, which has a tropical climate characterizing watersheds and coastal areas. However, since Balikpapan is a bay city with calm waves, coastal flooding is uncommon. Balikpapan Bay has a surface area of roughly 15,000 hectares 'ha' and a total watershed area of 211,456 ha (Napitupulu et al., 2021). UNISDR (2015) states that the changing climate in the developing countries and its influence of other factors also has an impact on increasing the intensity of natural disasters, such as urban floods. Climate change is thus expected to drastically alter the timing and magnitude (depth) of rainfall events, causing flooding in many urban areas around the world, including Indonesia. Remarkably, these trends are already being noticed in Balikpapan. Typically, cities flood when there is a lot of rain, and likewise, flooding in urban

areas of Balikpapan is also one of the most serious threats to human safety and economic prosperity. Balikpapan has experienced annual urban floods and major floods since the 2000s and it has been the priority disaster issue from 2009 to 2015. As per the Regional Disaster Management Agency data in 2021, every year at least 115 families are being affected by the urban floods. Throughout 2015, flood disasters hit Balikpapan with as many as 88 flood events at 38 flood points. In 2016, the incidence of flooding increased to 89 flood events (Balikpapan Disaster Agency, 2017).

Even though the aspect of vulnerability has been studied since the 1980s and is one of the most important ideas in disaster risk management, more research is still needed, particularly to guide the assessment process (Pamungkas, 2012). There is a need for a better understanding of connections between vulnerability components such as exposure, sensitivity, and adaptive capacity. Understanding those three components for flood can be useful for understanding its risk. Yet, in the study area of Balikpapan, there has not been any localized research discussing the urban flood risk and their links to climate change. Previous research in Balikpapan City has only discussed about the functions of watershed area and its impact to flooding (Kadar Yanti et al., 2018) and a few others have only conducted vulnerability mapping to flooding (Harfadli & Ulimaz, 2021). Even the newest research published in 2021, only focus on drainage channels and volume of rainwater runoff (Ilir et al., 2021). However, the relationships between the multi-faceted components in the vulnerability itself are yet to be explored. Also, in Balikpapan, no studies have so far used an integrated strategy to link the causes and effects of urban floods to give relevant solutions. In due consideration to the limitations of the current research in Balikpapan City, Indonesia – particularly in linking flood vulnerability to climate change, the primary objective of this research is to examine the vulnerability components and their intra- and inter-relationships with climate change, as well as the dynamics that support the problem, with a particular focus on the relationship between DPSIR and vulnerability elements.

Overall, this paper divided into six sub-sections, including the Introduction (Section 5.1). Sub-section 5.2 mainly provides a literature review to establish the theoretical understanding of urban flood, climate change, and DPSIR-vulnerability framework. Sub-section 5.3 explains the adopted research methods and Sub-section 5.4 provides an analysis of the DPSIR components in the case study area. Sub-section 5.5 explores more about the core problems happening in Balikpapan, like concerning floods in reference to the analysis results. Finally, sub-section 5.6 summarizes the key findings and limitations of this chapter.

4.2. Climate Change Induced Urban Floods

Several researchers, like Coates and Norton (2021), Heinzlef *et al.*, (2020), Kim *et al.*, (2019), Moss *et al.*, (2021), Pour *et al.*, (2020), Song and Li, (2019), have pointed out that climate warming will hasten the global hydrological rotations. Due to the consequentially higher precipitation and decreased evapotranspiration, river discharge will expand globally, increasing the frequency of floods in many parts of the world. In the future, climate change is thus expected to increase the risk of rainfall and design floods (Kim et al., 2019). In addition, the hydro-meteorological hazards and human involvement can also contribute to urban floods. Increased flood hazards in cities have been attributed to insufficient drainage systems, poor land-use planning, inequities, and a lack of ecosystem services. Besides, the world is quickly urbanizing. Currently, more than half of the world population lives in cities, and by 2030, almost 5 billion people are expected to live in cities (Jegatheesan et al., 2019). While the rise of megacities involves a focus on reducing urban disaster risks, it can still expose urban populations to high levels of vulnerability, if not effectively addressed. As of 2018, the global megacities alone hosted around 1.4 billion people, which illustrates the vulnerability of a huge number of urban residents to disasters, particularly the urban poor and socially disadvantaged communities, who are especially vulnerable to the risks of urban flooding (Pour et al., 2020).

Urban floods, on the other hand, represent a special type of flood event that occurs when a city's drainage system fails. Because there is less land available for water attenuation and infiltration, most of the rain falling in cities is meant to be drained using existing storm-water drainage systems, however, it may have been originally designed to handle less amounts of runoff water. Intense precipitation events can therefore cause urban floods when the amount of precipitation and the volume of rainfall runoff within the city, exceeds the area's drainage capacity. In such situations, the rainwater collects in places other than the drainage system, causing stagnation in low-lying areas (Jegatheesan et al., 2019). Urban flooding often blocks roads, floods low-lying homes, and affects people's daily lives. Due to the high human density in these locations, which mostly contain high-value buildings and a high concentration of economic activity, structural and property damage, as well as economic losses, can be significant. As a result, the consequences of urban floods are always worse (Wan Mohtar et al., 2020).

On a local level, rapid urbanization also causes a shift in land use/land cover and a change in the microclimate (Freitag et al., 2018). In context of China's major cities, several studies have earlier indicated greater and more severe rainfall throughout the rainy seasons, as well as an increased frequency of intense rainfall (Guo et al., 2018). In the summer, the megacity of Beijing has been witnessing an upsurge in severe rainstorm occurrences later in the evening (Hu et al., 2017).

Flood peaks and associated return delays are also therefore likely to become common in urban areas. Moreover, the flooding can be induced by both, urbanization-induced changes in land use and increased rainfall intensity due to climate change. The scale and extent of urban development sustainability will therefore determine the proportional impacts.

4.2.1 Vulnerability Assessment and DPSIR Framework

Development of theoretical frameworks to evaluate the disaster impact have so far been the focus of many studies. In context of the same, an important theoretical tool for disaster management has arisen in recent years, in the form of disaster vulnerability assessment (Abid et al., 2016; Füssel & Klein, 2006). In large scale, particularly in Europe and North America, several vulnerability assessments have been conducted (Liu et al., 2020; Nagy et al., 2018). Due to the diverse socio-economic and natural backgrounds of each city, it has however been difficult to translate the large-scale study findings into specific local policies and initiatives (He et al., 2019; Jago-on et al., 2009). While most of the previous studies have depended on the evaluation of indicator systems of vulnerability, it still cannot fully represent the impacts of climate change on individuals and communities. In metropolitan areas, human activity and environmental change are inferred to interact in complicated ways, making it hard to simply evaluate views in the IPCC's concept of climate change vulnerability. As a result, it has been realized that including process analysis models within the vulnerability framework would be advantageous (Icely, 2015).

Till data, many researchers have utilized different indicators to assess the level of vulnerability in different study contexts. However, the adopted criteria in choosing these aspects are not always well stated. Factors chosen are often unrelated to the characteristics or dimensions of vulnerability. Correspondingly, Adger (2006) and Bruno Soares *et al.*, (2012) urge for a more detailed explanation of the factor selection process. Many studies have looked at different aspects of vulnerability, however the selected criteria have a weak connection with the fundamental characteristics of vulnerability characterization (Armas & Gavris, 2013; Pamungkas et al., 2014).

Recent research has utilized the DPSIR Framework to examine the components of vulnerability and how their features are employed in a comprehensive manner based on city-level data. This allows them to determine if the DPSIR Framework is applicable to a certain case study location. Remarkably, the Organization for Economic Cooperation and Development (OECD) initially proposed the DPSIR concept in 1993 as PSIR (Bonev & Alexandrov, 1993). It explores a chain of causal relationships between diverse human actions and the environment (Feás Vázquez & Feás Vázquez, 2003). The DPSIR framework that

explain disaster impacts and represent influencing variables, in addition to vulnerability, include the following: as described by the OECD's pressure state response (PSR) model (Caeiro et al., 2004), the driving force-state-response (DSR) model proposed by the United Nations, and risk hazard models (Kok et al., 2004). In lines with the OECD's models, the European Environment Agency likewise adopted the drivers-pressures-state-impact-response (DPSIR) model. The model may be used to analyze the interactions between people and environmental systems in the context of a regional economy, society, population, and environment (Liu et al., 2020).

So far, the DPSIR model has been used in studies related to biodiversity conservation, sustainable development, pollution of the environment, and preservation of water resources (Icely, 2015). This analytical framework helps connect the conceptual studies beyond social and natural phenomena, in addition to assisting for comprehending the dynamic structure of a complex system (Dijk et al., 2017). The framework has certain benefits, but it also has some drawbacks related to DPSIR. The DPSIR framework is a useful tool for organizing complicated environmental data for policy making. Using the DPSIR framework, it is easy to see how people and natural circumstances are intertwined in a meaningful way (Quevedo et al., 2021). It also facilitates the ideas between academics, policymakers, and other stakeholders. When used in its regular application context, DPSIR results in a restricted and little understanding of subjects by limiting opinions and the creation of scientific information. However, the DPSIR framework might be used to obtain a handle on the many components that need to be evaluated (Bruno et al., 2020). It may also be utilized to offer the most accurate insight into causality since it separates more stages and highlights the most significant ones.

4.3. Methods

This chapter mainly focusses on Balikpapan city in Indonesia as a case study. With a population is 688,318 people, the city is situated in the Borneo Island in East Borneo (Kalimantan) province (Balikpapan Statistical Agency, 2020). Balikpapan City consists of six districts namely, *South Balikpapan District, Balikpapan Kota District, West Balikpapan District, East Balikpapan District, Central Balikpapan District, and North Balikpapan District.* Figure 4.1 below illustrates the map of Balikpapan city.

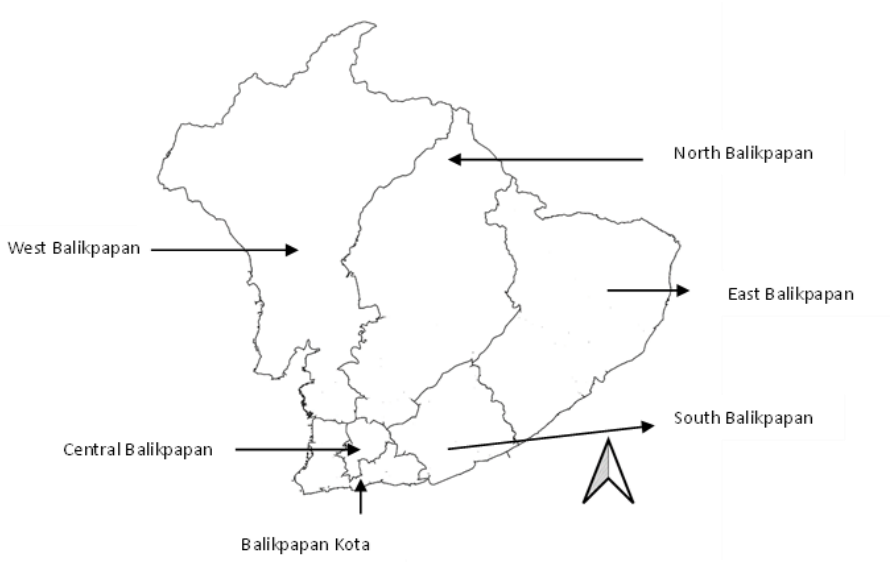

Figure 4.1 Location of Balikpapan City (modified from Balikpapan City Government, 2021)

Herein, to conduct descriptive research through the results of the primary survey and data processing from the secondary survey, this study adopts a qualitative approach method. The primary survey is mainly conducted in the form of field observations conducted from 3rd May 2021 until 7th May 2021. Further, the secondary data were gathered through reviewing a wide range of peer-reviewed papers and publications from several relevant organizations/institutions, such as Balikpapan City Government, Balikpapan Environmental Agency, Public Works Departments, Central Bureau of Statistics. Also, the internet sources from local government's website are used to enrich the results of the study analysis.

Through a combination of qualitative and quantitative data, this research examines the association between people's resource usage behaviors and their vulnerability to flooding. In associated with the theory of vulnerability, models (vulnerability and DPSIR) can explain the impact of disasters and reflect the factors that influence them. In that context, the DPSIR framework can cover economic factors, community, population, and environment, providing a broader viewpoint on the relations between humans and environmental systems in the process of impact analysis. For better comprehension of the study results, the five components of DPSIR framework are explained as follows: A change in environmental conditions is referred to as "state," while "drivers" (also referred to as "trigger factors") explain the factors that lead to a change in environmental conditions, while "pressures," "response" and "impact" refer to the ways in which environmental change affects a community's well-being.

4. 4. Results on DPSIR-Vulnerability Framework

As a first step, the DPSIR Framework was created based on the collected data, and the built connections between vulnerability elements (exposure, sensitivity, and responses) and the DPSIR model. Herein, it is important to highlight that this research has combined the concept of vulnerability in the DPSIR Framework, so that the linkages between various components can be seen. Figure 4.2 below presents the integrated framework between DPSIR and vulnerability aspects.

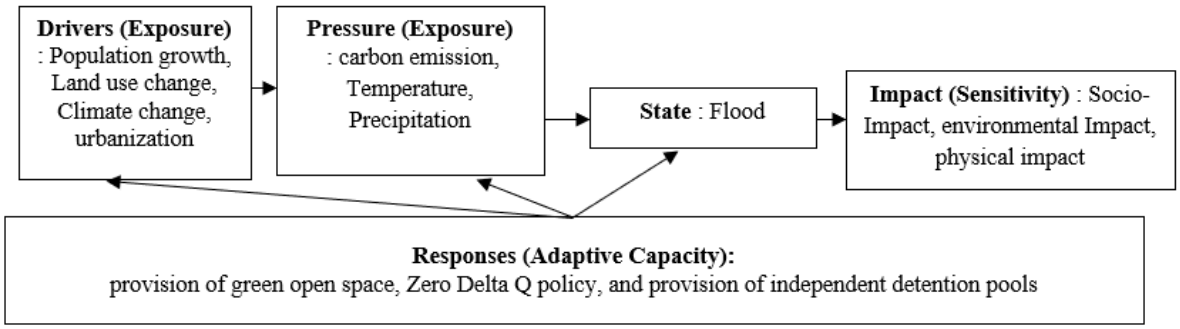

Figure 4.2 Integration between DPSIR and Vulnerability (Image source: Authors)

As evident, the authors have linked the various vulnerability aspects in the context of Balikpapan with DPSIR. In Figure 2, the element of exposure is shown to be closely related to the driver and pressure, and then sensitivity with the impact, and adaptive capacity with responses. In assessing the vulnerability, the research discusses these relationships comprehensively to formulate the recommendations for future responses.

4.4.1 Drivers

The anthropogenic sources of system change are defined as drivers, which include climate change driven by anthropogenic greenhouse gas emissions. Due to increasing emissions, climate change is now widely recognized as an independent cause of environmental change, and everyone should commit to addressing it (Bigi et al., 2021). The continued changes in land use, waste disposal, erosion and sedimentation, slum areas along rivers, ineffective flood control systems, high rainfall, river physiography, inadequate river capacity, the influence of tides, land subsidence, water structure, and damage control building flood, all form a part of factors that cause flooding. The key factors considered as driving forces in this research are population growth, land-use change, urbanization, and climate change.

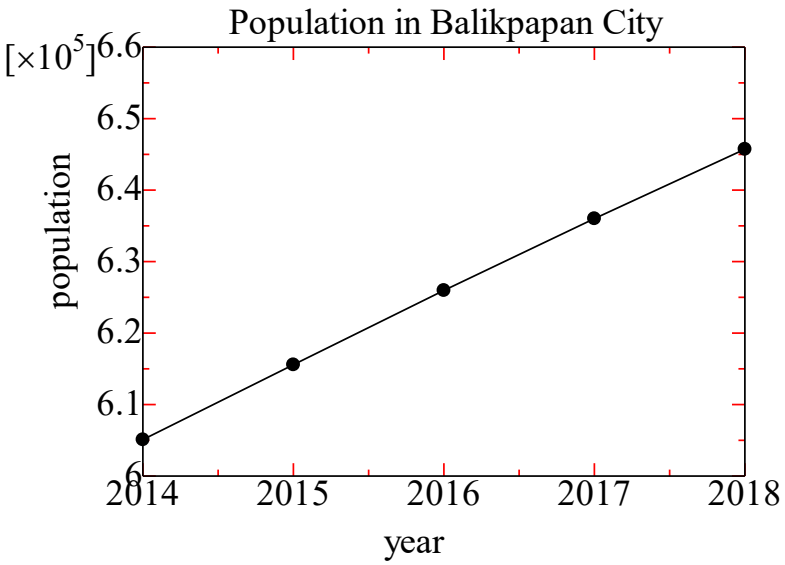

Figure 5.3 Population in Balikpapan City (Balikpapan Statistical Agency, 2021)

Even though Balikpapan is not the capital of the province, it is recognized to be a busy city as trade and services are its main activities. Figure 3 below illustrates the graph of population increase and land conversion in time series, which shows that the population in Balikpapan has been increasing. With the increase in population, the need for land is bound to increase too, as the people living in Balikpapan need a place to live and perform their livelihood activities. This land requirement necessitates the land conversion (Balikpapan City Planning Department, 2021). Moreover, Balikpapan is included in the ranks of cities that have a high urbanization rate of 94.43 percent. As the gateway to East Kalimantan and a transit city, Balikpapan has a relatively higher population growth, as compared to other districts/cities in East Kalimantan (Borneo) Province. Figure 5.4 reveals that Balikpapan City has a high level of urbanization, followed by Samarinda, Tarakan, and Bontang.

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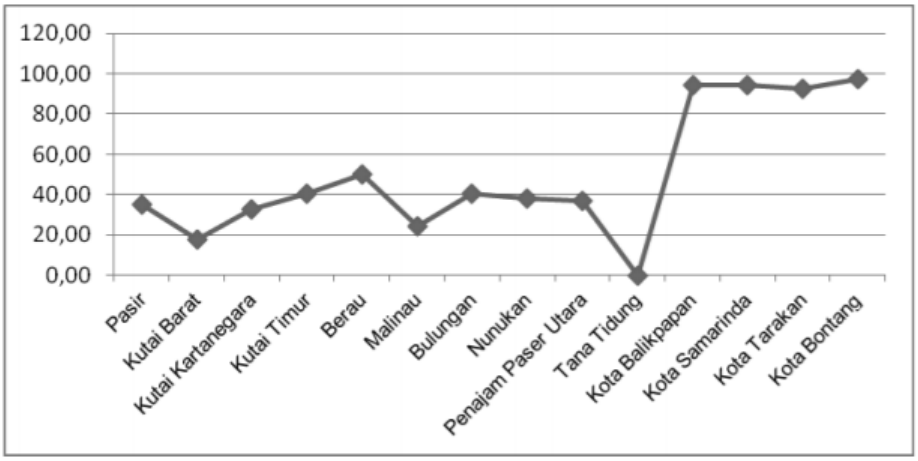

Figure 5.4 Urbanization rate in East Kalimantan Province (Balikpapan City Government, 2019)

4.4.2 Pressures

Pressure is mainly referred to as the method of change imposed on the system by the drivers. For instance, when climate change is defined as a driver, particular changes in temperature, precipitation, and extreme weather can be expected (He et al., 2019). Likewise, human activities such as transportation and food production to meet human needs are also the driving forces that affect the environment. This is a result of identifiable production or consumption processes such as emissions, temperature, and rainfall.

Like other regions in Indonesia, Balikpapan City has a tropical climate with rainy days throughout the year. The highest air temperature in 2020 was recorded in January at 34.3 degrees Celsius, and the lowest in August at 22.2 degrees Celsius. As for the average, the highest air temperature in 2020 was recorded in May with 27.8 degrees Celsius and the lowest in June, August and September with 27.2 degrees Celsius. The highest precipitation in 2020 was recorded in June with 545.6 mm and the lowest in January with 158.1 mm (Balikpapan Statistical Agency, 2021).

Furthermore, the largest share (around 60%) of average pollution to cities in Indonesia comes from the transportation sector (Balikpapan Environmental Agency, 2020). The number of motorized vehicle ownership based on data on the number of vehicles in the City of Balikpapan is increasing every year, with the peak number of motorized vehicles reaching 595,249 units (Balikpapan City Police Traffic Unit, 2018). In addition, based on air pollution data, the city of Balikpapan is observed to be producing carbon emissions with less information. The implicit impacts of pollution or air pollution are also stated as one of the strategic issues in the city of Balikpapan. As per the trend of measurement results from 2009 to 2015, the CO2 levels are continuing to increase, especially at the Balikpapan Plaza intersection located on Jalan Jendral Sudirman, Kelandasan Ilir Village.

4.4.3 State

Floods in Balikpapan City, as defined as the state, are influenced by high rainfall and the ineffective management of Balikpapan City drainage, as observed from 2010 to 2018 frequency of flood events. Therein, high fluctuations were observed with the highest number of events, namely in 2010 with 19 events. The biggest loss occurred in 2012 with 7,044 houses being flooded, 40 heavily damaged, 29 lightly damaged, and a total loss of Rp. 1.150,000,000. Figure 5 shows the data on occurrence of floods in 2010 – 2018. Medium flood-prone areas with the highest area are in Kariangau, West Balikpapan District with an area of 2117.67 ha and

Karang Joang Village, North Balikpapan District with an area of 1,332.78 ha (Regional Disaster Agency, 2019).

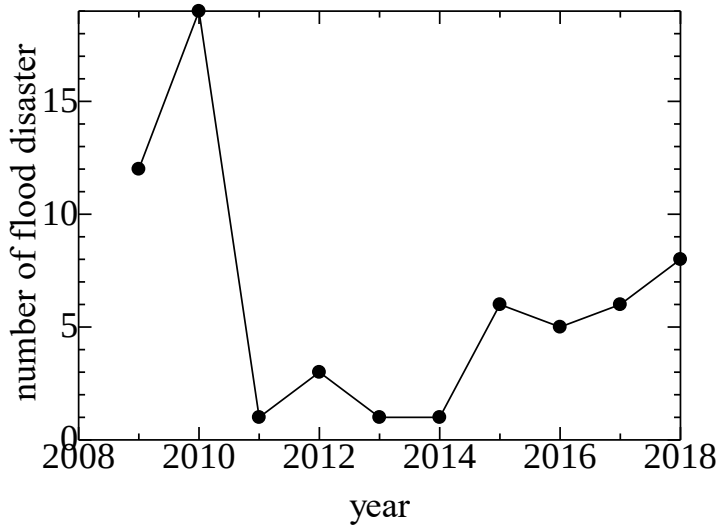

Figure 4.5 Urban Flood Disaster in Balikpapan (Regional Disaster Agency, 2019)

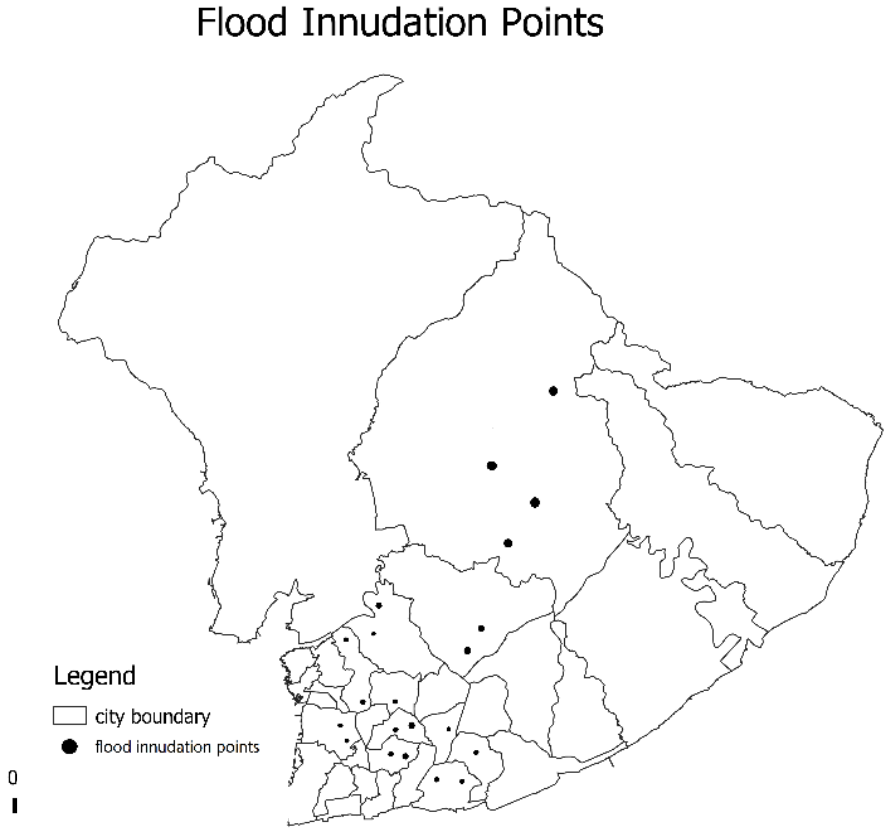

Figure 4.6 Flood Vulnerability and Spot in Balikpapan (based on author's primary surveys)

4.4.4 Impact

The key examples of the flood impacts or losses include loss of life or injury, loss of property, damage to settlements, damage to trade areas, damage to industrial areas, damage to agricultural areas, damage to drainage and irrigation systems, damage to roads and railroads, damage to roads, bridges, and airports, and damage to telecommunications systems, among others. Markedly, the notion of 'impact' is mainly used to describe changes. Like in this condition, air pollution which causes changes in the radiation balance, an increase in air temperature cannot be said to be impacted. A situation can be said to be an impact only if the availability of species in the air, water, and land changes, and can affect humans and their health in using resources. In general, the impacts are of three types namely, socio-impact (including fatalities impacts), environmental impact, and physical impact (including housing damages and damaged cost).

The floods often cause road access to be closed and locked, because of which people cannot go to work, school, or shopping in the center to do their own activities. Through the primary surveys in one of the local households, it has been realized that the local community believes the floods have limited public access. Then, there is also the issue of post-flood environmental circumstances. Floods leave mud and debris in the residence and the community center for the environment. Furthermore, flood water clogs channels or drainage such as sewers, has an unpleasant stench, destroys numerous vegetation, and pollutes wells.

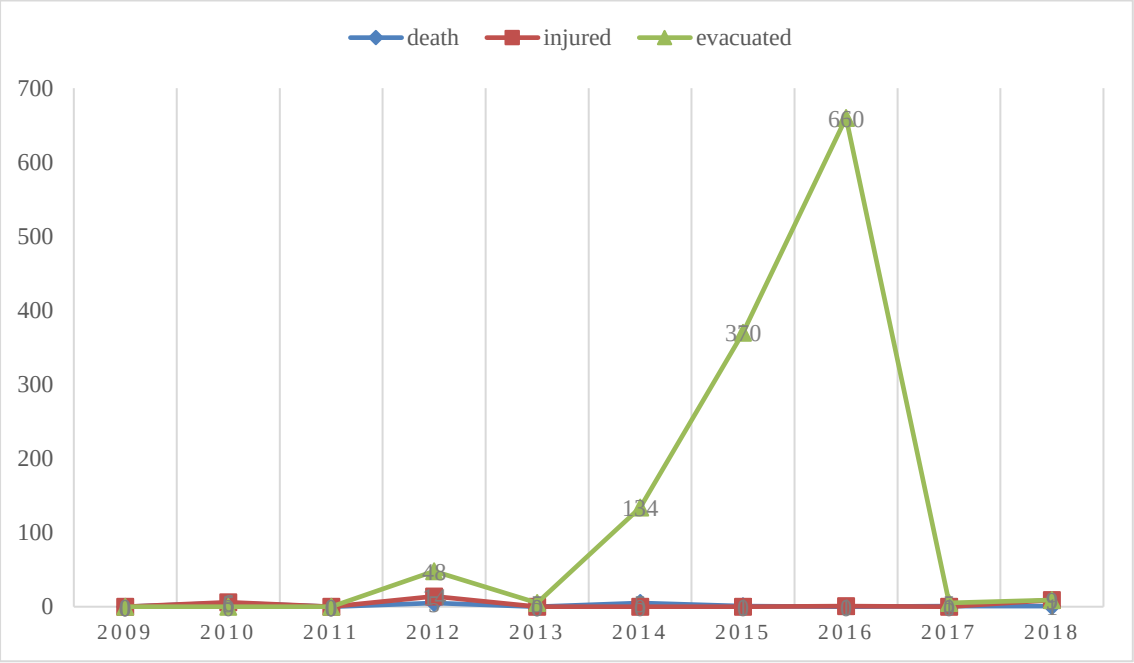

Figure 4.7 Total of Fatalities Due to Flood in Balikpapan (Balikpapan Disaster Agency, 2019)

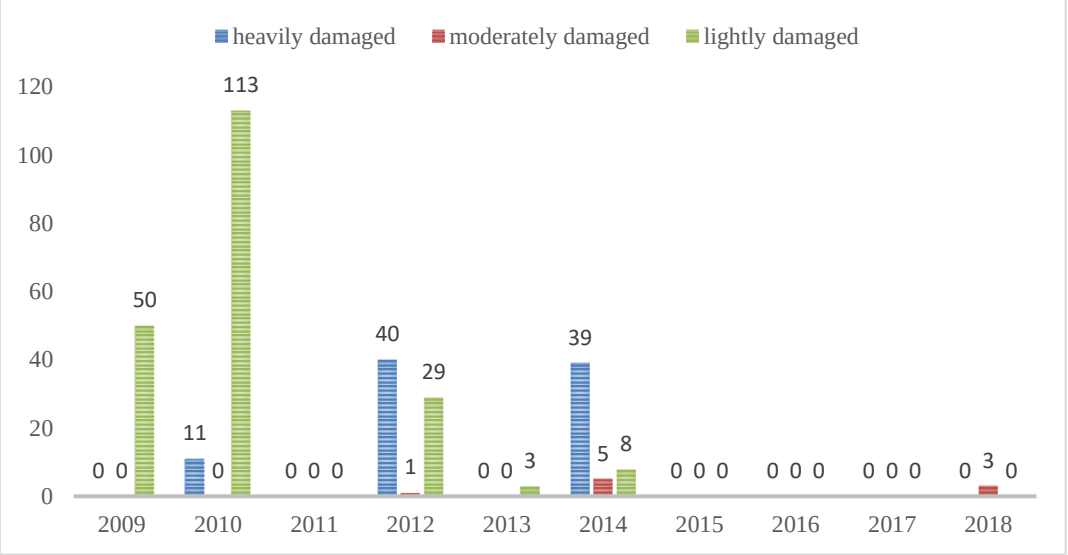

Figure 4.8 Total of Damaged Housing Due to Flood in Balikpapan (Balikpapan Disaster Agency, 2019)

In the Figure 4.7, 4.8, and 4.9, it is known that every year Balikpapan experiences a very big impact from the flood disaster. It can be seen in the graph that from 2009 to 2008 data, the number of damaged houses decreased, but it can be seen in Figure 9 that the damage cost is very unpredictable. This proves that the flood in the city of Balikpapan does not only damage houses, but also damages others like public facilities and other infrastructure, thus causing damage costs because the flood does not decrease.

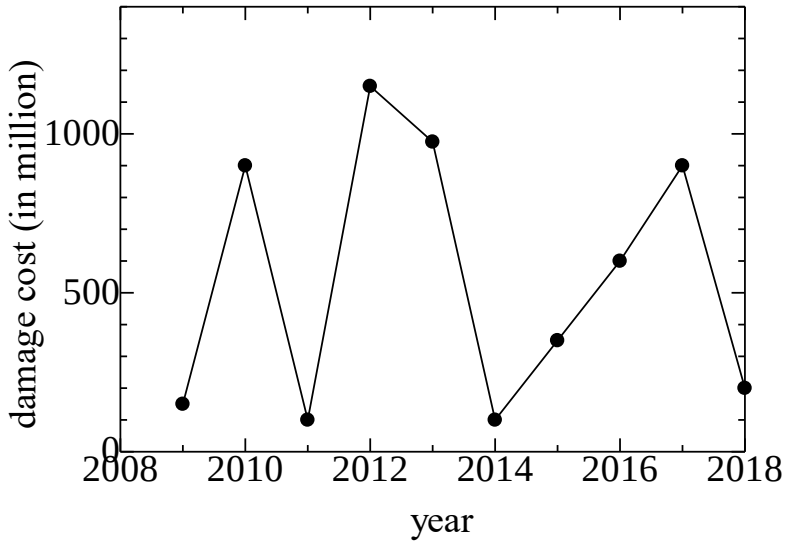

Figure 4.9 Damage Cost due to Flood in Balikpapan (Balikpapan Disaster Agency, 2019)

4.4.5 Responses

Response, in the study context, refers to the responses from the community, both individually and in groups. A response from the public or policymakers is the result of an unwanted impact, which can affect any part of the chain between driving forces and impacts. Some of the responses from society can be attributed as negative responses as they aim to create a new model that is more general in consumption and production patterns. Whereas the positive responses will be those that aim to increase the efficiency of products and processes, through the development and implementation of technology that is healthy for society.

In the study context, the response to the state (urban floods) is that the city administration of Balikpapan provides and maintains green open space regions. Green open space activities are distributed proportionally around the city in the 2012-2013 City Regulation. The presence of Green Open Space has had a significant impact on the city of Balikpapan's ability to avoid flood disasters. To minimize flooding, the city's green open space strategy is to offer green open space for at least 30% of the total area, green open space development in border areas; and green open space development in disaster-prone locations (Balikpapan Flood Assessment Report, 2019).

The principle of zero Delta Q is that every building must not cause an increase in water discharge to the drainage system or river flow system. Ideally, each building absorbs its rainwater. According to the city government, flooding is caused by water not seeping into the ground because of too much runoff into ditches, rivers, and drainage systems that are unable to accommodate rainwater. Therefore, it is very important to develop water infiltration technology for each building (Balikpapan Flood Assessment Report, 2019). A Detention pool or pond is a drainage channel that serves to accommodate and absorb rainwater in an area in Balikpapan. As per the Indonesia Minister of Public Works No. 12 (2014), the environment friendly drainage infrastructure functions as a temporary reservoir of rainwater in an area. Detention pool can be used as a debit control system that will be delegated to an area by temporarily accommodating, thereby reducing runoff discharge from system drainage leading to urban drainage.

4.5. Discussions

Through the research findings derived through primary and secondary research methods, the flood events in Balikpapan are found to be increasing year by year. In this research, it has been discovered that population growth, land-use change, climate change, and urbanization are the most important causes of increasing urban floods in Balikpapan City. Flood control efforts and their impacts can accordingly be carried out through three main approaches, namely moving residents who are or will be affected by flooding, mitigating the flood

impacts, and conditioning the population to live together with the flood. However, what is often done is to control the flood and make the community used to living with the flood, like in other cities in Indonesia (e.g. Semarang City and Banjarmasin). Many such efforts have already been carried out in various areas in Balikpapan, but the results have not been as expected, because of which the floods continue to occur with victims and losses. Considering the increasingly widespread floods in Balikpapan, and the increasing losses, it is necessary to immediately make efforts to prevent and overcome their impacts, which can be carried out structurally and non-structurally.

In the case of Balikpapan City, the response hasn't yet been found to be linked to drivers and other components. The Balikpapan's responses are only directed to "State" component. Furthermore, the responses that local government of Balikpapan have executed (the construction of detention ponds) are usually just temporary or short-term responses. For example, the method was ineffective in the Balikpapan City when it came to reducing the long-term vulnerability of the urban floods. When a city responds to an urban problem like urban flood disaster, it should not be seen as a solution for temporary or short-term solution. Rather, the response developed should deal with the root cause or of the problem itself. Responses can be directed to *drivers, pressure, states, and impacts*, so it can focus on the current situation of the problem. DPSIR's flood vulnerability, including and linking to climate change study, can result in long term responses and recommended flood adaptation and mitigation strategies. Considerations of responses to drivers, pressures, or impacts can lead to certain reasonable outcomes, such as lower urbanization rates, deforestation, and land consolidation. These responses might also be used as a starting point for making decisions and it can help policy makers or stakeholders to understand the risk characteristic of their city's disaster especially in climate change induced urban flood.

4.5.1 Effectiveness of zero delta-Q or zero run-off policy

According to Government Regulation No. 26/2008, the zero delta Q principle policy refers to the requirement for developers or individuals involved in development activities to prevent any increase in water discharge that would enter the drainage channel system or river flow system. When discussing the aforementioned Government Regulation, it is crucial to take into account the implementation of the zero delta Q principle policy when zoning groundwater recharge areas. ZDQP (zero delta Q policy) is an initiative to prevent increased discharge from house development (Indriatmoko, 2010). The ZDQP principal policy is outlined in Government Regulation 26/2008 on the National Spatial Plan, which states that no building should result in an increase in runoff discharge to the city drainage or river system. To ensure zero discharge (ΔQ), water discharge from construction and home development must be balanced. Technologies and

methods that can be employed to accomplish this zero delta Q policy encompass rainfall infiltration areas, biopore infiltration pits, modified landscaping, rainwater harvesting, rain gardens, biopore infiltration channels, injection wells, and infiltration wells, etc.

Research conducted by Margaret et al., (2022) in Balikpapan aims to quantify the influence of housing development in Balikpapan (specifically Daun Village) on the increased flood discharge in the area. Additionally, the study seeks to identify strategies that can reduce the severity of flooding. Daun Village Balikpapan transformed a 60,445 m2 green area into a developed area, resulting in an elevated runoff coefficient and a faster drainage concentration time. The analysis reveals a 3.77 m3/d increase in discharge generation in the Balikpapan Baru sub-watershed, and a 1.12 m3/d increase due to development. Consequently, an alternative analysis is conducted to assess the implementation of ZDQP, which involves a combination of LRB application, optimisation of existing storage ponds, and construction of new storage ponds. The implementation of storage pond optimisation and biopore infiltration holes in the Balikpapan Baru sub-watershed results in a discharge decrease of 4.21 m3/det. Similarly, in the Syarifuddin Yoes sub-watershed, the discharge reduction is 0.38 m3/det. The current decrease in discharge does not yet satisfy the ZDQP standards. Therefore, a new storage pond will be constructed at the Balikpapan Baru exit, measuring 3800 m2 in area and 3.0 m in depth. Additionally, another storage pond will be built at the Syarifuddin Yoes outlet, with dimensions of 1850 m2 in area and 4.0 m in depth.

Another research conducted by Rachmansyah et al., (2021). Following a thorough investigation of the housing development in Taman Sari Puri Bali, located in Bojongsari Subdistrict, Depok City, several conclusions can be drawn. Based on the calculation analysis results, it can be concluded that implementing the Zero Runoff Concept, specifically through the use of Collectors, Rainwater Infiltration Wells, and Rain Gardens, effectively mitigates surface runoff. Rain Gardens can mitigate surface runoff resulting from rainwater by 96.6% of the total discharge in the calculation of land in Taman Sari Housing Puri Bali. 3.4% of the total amount is allocated to the neighbourhood drainage channel. The implementation of Zero Runoff, utilising Rainwater Harvesting and Conservation Ponds, can effectively address the scarcity of clean water during periods of drought. With adequate treatment, the collected rainwater can be used directly by homeowners for residential purposes and even clean water needs for daily consumption. In order to address the challenges posed by climate change, such as floods, droughts, water scarcity, and environmental degradation, one effective approach is to maximise the utilisation of rainfall through the implementation of the Zero Runoff concept. This involves the collection and infiltration of precipitation into the ground.

4.5.2 Role of Green Space For Flood Risk Reduction in Balikpapan

To determine the role of green open space in reducing flooding, tMargaret et al., (2022) examines the frequency of rainfall recurrence by utilising data on the highest amount of rainfall recorded in a single day obtained from BMKG Balikpapan City. Subsequently, the rainfall study is followed by a land use analysis in order to determine the conveyance coefficient (C) value, which is based on the land cover conditions of the Ampal watershed located in Balikpapan. Land use analysis is performed under two circumstances: in 2019 and in 2032, based on the land use planning outlined in the RTRW 2011-2031. The investigation of the Ampal watershed conveyance coefficient value is followed by an examination of the flood discharge volume under both present and planned conditions caused by excessive rainfall in the Ampal River watershed.

Table 4.1 Land Cover Existing and Projection

Land Use	2019		2032		Change	
	Area	Precentage	Area	Precentage	Area	Precentage
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Built Up Area	786,50	28,09	2505,90	89,49	1.719,40	61,40
Non Built Up Area (Green Area)	991,05	35,39	58,88	2,10	932,17	33,29
Non Built Up Area (Non Green Area)	984,01	35,14	141,60	5,06	842,41	30,08
Water bodies	38,63	1,38	93,80	3,35	55,17	1,97
Total	2.800,19	100,00	2.800,19	100,00		

The land use plan, which is based on the Regional Spatial Plan (RTRW), aims to increase the area of developed land by 89.49%. The condition experienced a 61.40% increase in comparison to land use in 2019. This undeniably impacts the value of the entire watershed conveyance coefficient. A hydrological analysis was conducted based on the findings of the 2019 and 2032 land use analysis. This analysis encompassed the examination of the land conveyance coefficient, anticipated rainfall intensity, and flood discharge in the Ampal watershed.

Upon analysing the conveyance coefficient's value from 2019 to 2032, it exhibited a substantial increase, surpassing a 100% growth. This condition is affected by the conversion of non-built areas, including both vegetated and barren ground, into developed regions. The advancement of a region will lead to a reduced rate of water infiltration. As an illustration, the coefficient for green open land is 0.15, indicating that 15% of rainfall transforms into runoff. This is in contrast to

the coefficient for built-up land use, which is 0.75, indicating that 75% of rainfall will become runoff (Astuti, et al., 2017). According to Halim (2014), an increase in the conveyance coefficient (C) of a watershed will lead to a corresponding increase in the flood discharge.

Table 4.2 Flow Coefficient of Ampal Watershed Existing and Plan Conditions

Land Use	2019		2032	
	Area (ha)	Flow Coefficient	Area (ha)	Flow Coefficient
Built Up Area	786,5	0,75	2.505,90	0,75
Non Built Up Area (Green Area)	991,05	0,15	58,88	0,15
Non Built Up Area (Non Green Area)	984,01	0,20	141,60	0,20
Water bodies	38,63	0,15	93,80	0,15
Total	2.800,19		2.800,19	
Ctotal		0,34		0,69

The calculation of the impact of land use change on the increase in flood flow in the Ampal watershed yielded the following conclusions:

- In 2032, there was a significant shift in land use, particularly in developed regions, which accounted for 61.40% of the total. Additionally, there was a decline of 33.29% in non-built green areas.
- In 2032, there was a change in land use that caused the land conveyance coefficient of the Ampal watershed to increase by 105%. The conveyance coefficient in the present situation of 0.34 improved dramatically to 0.69 or comparable to 69% of rainwater that transformed into runoff.
- The Ampal watershed experiences an increase in flood flow by 105% due to land use changes. This increase is exactly proportional to the amount of the rise in the conveyance coefficient. In 2032, the Ampal watershed experienced a maximum flood discharge of 636.05 m3/det, which occurs once every 20 years.

4.5.3 Best Practice in Other Areas

A best practice in this regard can be found in the case study of Thailand (Thanvisitthpon et al., 2018), wherein all stakeholders are involved in reducing flood risk through multi-stakeholder implementation measures and policies; and not solely as the government's responsibility. Although self-adaptation is possible, it also needs a timely warning system and timely support. Adapting and

mitigating flood will be sustainable if we are not set on the structural measures. The community needs to be involved because they know their own problems. Furthermore, Ghozali *et al.*, (2016) also provide a reminder of the need of flood-resilient living for the public. Every area's ability to adapt is a set context, but as people change, so does that ability. The research of the city's flood protection policies and measures should thus include and analyze people's adaptability and lifestyle in addition to hazard from natural disasters. Using DPSIR, the recommended approach can lower the magnitude of floods by dealing with driving forces and reducing the system's vulnerability to flooding by adapting to flood and involve the stakeholders like Thailand has done. Exposure, sensitivity, and the ability to adapt are frequently used to define vulnerability. Exposure refers to the type and extent to which a system is subjected to environmental or sociopolitical stress. The sensitivity of a system refers to how much it is affected or transformed by perturbations. Adaptive capacity refers to a system's ability to evolve in response to environmental hazards or policy changes, as well as expand the range of variability with which it can cope.

4.6 Conclusions

This research investigates the flood vulnerability in Balikpapan city through utilizing DPSIR framework as an assessment tool. This paper collects various flood information in the study area and characterizes the same to deliberate on the drivers, pressure, impact, responses in the study context. Herein, this research documents the flood disaster in the study area with the cause being climate change (as a driver). Due to the defined research methods, the study results may even though be partly biased, but it has been uncovered that the DPSIR framework provides an effective mechanism for enabling dialogue between academics and policymakers. This paradigm aids in the organization of data and allows decision-makers to identify the underlying problems and trigger the real impact, as well as identify leverage points where suitable answers can be delivered. The DPSIR framework can be used to analyze the state of flooding caused by climate change. DPSIR also serves as a reasonable framework for compiling various information on indicators of drivers, pressure, impact, responses. DPSIR is a framework for collating information by identifying a set of indicators for drivers, pressures, states, and impacts.

The major drivers in this research are identified to be population growth, land-use change, climate change, and urbanization. These drivers are strongly related. It is also seen from the secondary data that population growth due to urbanization in Balikpapan City is relatively high, which increases the demand for land in the city. As a result, climate change is likely being caused indirectly by the increasing number of present human activities. The most major impact of flooding in the study area was recognized as greater rainfall and warmth leading

to higher flood discharge and damage as the main causes of increasing flood rate. On the other hand, the response in Balikpapan is mostly aimed at building flood control and prevention infrastructures such as detention ponds, zero Q technology policies, and the provision of green open space. In the long run, the response applied in Balikpapan is leading to inefficient problem-solving results in terms of reducing flooding sensitivity. Moreover, the study findings suggest that using the DPSIR method can help combine data and allow flood adaptation and mitigation activities to be focused on vulnerable communities to lessen the impacts of climate change induced urban flooding. However, since the responses in this research are mainly based on government documents, the future scope of this study entails the consideration of more updated response data from the other stakeholders such as the local community and NGO. Further research applying Community Vulnerability-DPSIR framework should also be conducted to fill the research gaps in this study.

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Chapter 5
Evaluating Current Policies and Flood Resilience Strategies of Balikpapan

5.1 Introduction

Flooding, in general, refers to the temporary inundation of any land surface that becomes uninhabitable due to the presence of water (Ruffer, 1961). The increase in volume and distribution of precipitation in a drainage basin is the most common cause of river flooding; however, events like dam failure can also induce flooding (L. F. Chang & Huang, 2015; Sholihah et al., 2020). In the backdrop of the rising urban population, the risk of flooding has remarkably increased in many urban areas worldwide (Ahilan et al., 2018), affecting more than 2.3 billion people (UNISDR, 2015; UNISDR and CRED, 2015). While floods are increasingly becoming more common, the changing nature of floods is also becoming a serious concern (Konrad, 2003). For instance, the rapid urban development trends are leading to an increased volume of flood runoff, pressing the threshold capacity of river basins.

Indonesia, as a developing country, is today faced with severe flood problems in most of urban areas (Dwirahmadi et al., 2019; Ratih Indri Hapsari & Mohammad Zenurianto, 2016). To effectively address this challenge, the Government of Indonesia is currently planning to relocate the nation's capital, with the objective to create an ideal national government centre that embodies the country's identity while enabling the long-term visionary development (Tarigan et al., 2017). According to Indonesia's Ministry of National Development Planning (BAPPENAS) issued in 2020, more than 50,000 civil servants and their dependents are likely to be relocated because of the capital movement. As a result, the newly appointed capital and its surrounding cities, including Balikpapan, are required to accommodate around 1.5 million people (Wardhana, 2021). Correspondingly, the swift development of Indonesia's new capital city may raise drastic implications for surrounding areas, especially from the perspective of disaster vulnerability.

In the case of Balikpapan, flooding is a significant problem. Therein, the local government is already undertaking many efforts to protect people and the city from flooding (Aerts et al., 2014). Recently, the local government agencies have also attempted to develop a resilience concept considering the recurring flood disasters. Despite that, a genuine need has been recognized to improve the system's resilience at the municipal, provincial, and national levels (Singh et al., 2021). Recent studies suggest that disaster resilience is challenging to address in development plans. Conducting research in Melbourne, Australia, on adaptive capacity building, Moloney and Fünfgeld (in 2015) emphasized on the need for local government participation in reducing the flood (Moloney & Fünfgeld, 2015).

Further, Chmutina (Chmutina et al., 2016) also reviewed thirty government papers in the United Kingdom (UK) to understand how resilience is perceived and measures to improve community resilience. It has been realized that a flood protection program must essentially overcome barriers to information sharing and dissemination within the community. Flood working groups for priority catchments strive to reach as many individuals as possible, but in the future, innovative methods are required to reach all vulnerable community members (Auliagisni et al., 2022), as successful disaster risk management depends on the local community. Markedly, the focus of flood risk reduction in Indonesia remains to be on structural measures (Ratih Indri Hapsari & Mohammad Zenurianto, 2016) and little attention is being paid on community contribution (Maimunah, 2011).

Urban environments are today being perceived as dynamic social-ecological-technological (SETS) systems that are vulnerable to flooding from both within and outside of SETS domains and catch connections among their various components (Social-Ecological-Technological components) (Grimm et al., 2017; Markolf et al., 2018). A few of the issues associated with urban environments (for example, flood) can be addressed by shifting from traditional flood and water management approaches to "smart systems" approaches that are more resilient to natural disasters(van Hattum et al., 2016). This highlights the importance of identifying SETS as part of smart city planning and a prospective way of looking at urban risk in broader terms. Subsequently, a more comprehensive strategy for analyzing flood risk management in complex urban SETS is required, as well as for improving the resilience of SETS domains (Cheng et al., 2017; Hamstead et al., 2021). SETS provides an alternative approach for analyzing complex interactions between infrastructure, environment, and equality in society to understand the distribution of hazards in society better. The SETS framework has, therefore, lately been utilized in cross-comparison of flood risk management (H. Chang et al., 2021a). For example, there is a flood study using SETS in US cities (H. Chang et al., 2021b) and also integration of FRM (Flood Risk Management) and SETS Framework was used in Portland, Seoul, and Tokyo (H. Chang et al., 2020). In due consideration of the effectiveness of SETS in recent studies, this study attempts to implement SETS in context of Indonesia, as it is also faced with similar flood problems considering smart city planning.

The recent advancements of ICT, particularly in wireless communication, mobile communication devices, cloud technologies, and cloud computing, have encouraged the adoption of smart water management technologies(Gade, 2021). These advances enable continuous monitoring of water systems and their surroundings, real-time analysis and forecasting for early warning and decision-support systems, and quick responses to water-related emergencies. In addition, Smart Water Management has become an enabler for implementing Flood Resilience solutions and has excellent synergy with Flood Resilience concepts. The

Water Smart City strategy is also a forward-thinking method of integrating sustainable urban design and water management, mainly to lessen the negative effects of urbanization on the hydrological cycle(van Hattum et al., 2016). In parallel, the concept of "smart cities" is also growing worldwide as a new approach to managing urban environments (Keshavarzi et al., 2021). Smart cities have particularly gotten much attention in the last decade, wherein information and communications technology (ICT) has been adopted as a development strategy. Smart cities are areas that integrate digital infrastructure into their urban structure to serve their community better, while better managing the infrastructure, and fostering livelihood for their communities (Kitchin, 2014).

Nowadays, water infrastructure and their surroundings can accordingly be monitored in real-time, and real-time forecasts for the early warning and decision-support systems have become possible with the smart city concept. ICT is used in both Flood Resilience and Smart City to support the sustainable, well-coordinated development and management of water resources, laying the groundwork for a long-term approach to water management(Oberascher et al., 2022). In a Water Smart City, water needs to be seen as an asset rather than a problem. Prompt change is made possible through the combined efforts of companies, government agencies, academic institutions, and citizens (van Hattum et al., 2016). Recently, the Minister of Public Works in Indonesia, Mr. Basuki, has also corroborated that a water-smart city is an effective concept for reducing flood risk, and it will be implemented in Indonesia as well (Syalianda & Kusumastuti, 2021).

Studying how cities in Indonesia implement resilience policies and smart cities is critical. In addition, it is better to understand how they reduce risk, as there is no research discussing the SETS-FRC Framework integrated with the smart city in the context of flooding. Over that background, this chapter particularly examines the contribution of smart cities plan (especially water smart city) to flood risk management based on the integration of SETS and FRC (Flood Resilience Cycle) Framework, while addressing three key research questions: (i) What is the level of flood resilience based on SETS Framework? (ii) In what ways, does the water smart city concept contribute towards enhancing flood resilience? and (iii) What are the challenges within the current institutional arrangements for flood risk management? In recognition of the fact that the current strategies for facing floods are mostly focused on structural methods and are less comprehensive (Kitchin, 2014; Sukhwani et al., 2020), this research hopes to uncover new insights for enhancing flood risk reduction.

5.2 SETS Framework towards Flood Management and Resilience

Municipal governance is often influenced by a variety of factors, including but not limited to governing structures, policies, formal and informal codes, local knowledge systems, practitioners, public officials, and communities (Araos et al., 2016; Folke et al., 2005). Accordingly, the local flood management plans and

programs need to be designed as per each municipality's specific government systems and regional characteristics (Hamstead et al., 2021). The city plan reflects the goals created by various institutions. It embodies direct relations among them to accomplish goals, illustrates appropriate governance policies, and envisages feasible expectations and consequences of these efforts (Carmin et al., 2012). There are more than 70 recognized ways to define the concept of resilience. It is commonly referred to as the ability to anticipate, plan for, absorb, recover from, or adapt more successfully to existing or projected unfavorable events (Fisher, 2015). Adaptation, in particular, refer to the capacity to adapt to new situations successfully.

Further, the concept of resilience acknowledges "the existence of interconnected and interdependent sets of social, economic, natural, and manmade systems that support communities" (Cutter et al., 2013). As per the global disaster resilience framework, resilience is defined as a system, community, or society's ability to adapt and recover from disasters in the shortest time possible (Basabe, 2013). A few researchers have also developed a conceptual framework that demonstrates the essence of urban governance, although additional research is necessary to strengthen the implementation of resilience initiatives and plans (Cosco et al., 2017). The use of urban governance to improve the quality of life, spatial organization, environmental management, and economic activity is also highly recommended in urban resilience management (Attolico & Smaldone, 2020; Herdiyanti et al., 2019). Urban governance as a concept includes decision-making processes, inclusiveness, and collaboration. Correspondingly, a city's policies can impact how it builds a resilient city by guiding how to adapt resilience governance principles.

Moreover, there is no standardized framework in place to evaluate the value-sensitive resilience of decisions on disaster preparedness (Adedeji et al., 2019; H. Chang et al., 2021a; Moraci et al., 2020). As different urban crises continue to emerge, determining how to make cities more resilient necessitates a strategy that incorporates a diverse set of expertise, data, and perspectives (Muñoz-Erickson et al., 2017). Cities and their components, such as neighborhoods, parks, and other infrastructure, are all part of a more extensive system. Since all the city's components are interconnected, considering it as a distinct system (ecosystems, built environment, and communities) is impractical.

The SETS framework incorporates all the city's socio-political, political, cultural, and economic dynamics, as well as those of its decision-makers. The ecological features of cities include nature's biophysical aspects and processes, such as tree growth and soil development. The constructed components and associated activities of urban systems, such as roads or public transit networks, buildings, and the knowledge encoded in technologies, are the key examples of what is included in the technological dimensions of an urban environment (Markolf et al., 2018). When looking at cities through the lens of SETS, a few other

fundamental questions regarding governance also come up. These questions include which institutions and areas of expertise are necessary, as well as who is impacted by changes in infrastructure (Kim et al., 2019). How can the built environment reap the benefits of natural ecosystem services? How might technological advances be applied to infrastructure to make it more flexible or redundant? These issues need to be addressed for the SETS strategy to develop resilience and encourage sustainable paths (Hamstead et al., 2021).

Overall, there are four phases of intervention to achieve resilience, for this case is in Flood Resilience Cycle: prevention, preparation, response, and recovery phases. Prevention basically refers to flood avoidance which involves activities that are required prior to a flood (Adedeji et al., 2019). Accurate flood risk assessment requires identifying potential hazards and collaborating with those at risk to develop strategies for minimizing individual and communal vulnerability. Both structural and non-structural measures have been taken to prevent the expansion of the flood-prone area. The structural measures include building dams, levees, dikes, and diverging channels.

Meanwhile, the non-structural measures relate to the campaigns of awareness and educating the people about flooding. In addition, since it is difficult to eliminate the risk of flooding, preparedness also focuses on mitigating the effects of flooding. If greater effort is put into planning, cities will be better equipped to deal with severe and unexpected events.

The flood emergency plan calls for several actions to be taken in "response." Emergency response can be made more efficient by adequately assigning rescue resources and developing evacuation strategies that minimize the effects of flooding(Adedeji et al., 2019). A study in Hawkesbury-Nepean River, NSW, Australia has created new model to improve the preparedness of flood (Yazdani et al., 2022). Floods not only cause problems on settlements, but also on critical public facilities like hospitals. As response tools, mathematical methods were used in that study so that if a flood occurs, the government and hospital residents can survive.

Furthermore, the Local Resilience Forum plans need to be nested within the community plans to allow smooth collaboration from the top-down and bottom-up. It is a standard error to impose top-down strategies on community-level plans (Heinzlef et al., 2020). Recovery will enable cities to recover promptly and perhaps even better than before a flood. Among the initiatives are strategies for rebuilding or reconstruction, which may provide an opportunity to improve the city's resilience to future disasters. Reconstruction is a two-pronged procedure that ensures that a city can be restored to its pre-disaster state while reducing the project's completion time (Adedeji et al., 2019). Also, the processes for reducing flood risk can affect a city's components comprehensively. Integrating the Flood Risk Management System into social, ecological, and technological systems is therefore advantageous (H. Chang et al., 2021a, 2021b; Markolf et al., 2018).

5.3 Significance of Water Smart City

Water-smart cities are intended to make cities more sustainable, efficient, and livable. It serves as a holistic approach of water infrastructure management, that includes sourcing, treatment, and distribution—integration of stormwater and groundwater with wastewater management (Kitchin, 2015). To accomplish the water smart cities, there is a need for investing in Internet of Things (IoT) water infrastructure. Earlier, ICT was commonly utilized in centralized facilities within urban water infrastructure, such as drinking water and wastewater treatment plants (Newhart et al., 2019; Yang et al., 2020), while control options for system components are now concentrated on a few key points. In urban drainage systems, for example, ICT is used to monitor combined sewer overflows (CSOs) (Mollerup et al., 2017; Yuan et al., 2019) or distribution network inlet points for district meter s(Creaco et al., 2019). These data are collected and analyzed by a supervisory control and data acquisition (SCADA) system, which is also used at UWI (Urban Water Infrastructure) to control and regulate various pieces of control equipment (Yuan et al., 2019). New approaches of monitoring and management of network-based UWI can be developed with the help of the IoTs (Wasko et al., 2021; Yang et al., 2020). UWI's integrated control and system-wide management are applied only occasionally, as described by Yuan et al. (2019) (Yuan et al., 2019). It is highly recommended that advanced technologies be used in conjunction with UWIs.

Water management issues in Smart Cities have lately been discussed in term of technological breakthroughs in water and energy use (Helena M. Ramos & Pérez-Sánchez, 2019; Ramos et al., 2020). Furthermore, the water management technology (Sinha et al., 2018) has been introduced to support the smart cities. For Smart Cities, a water resource cycle can be provided by leveraging the existing IT infrastructure and high-quality recycled water technology that is already in use in many cities (Oberascher et al., 2022). In recent years, researchers have successfully integrated the Water Smart City system using an information and control system. This water system focuses more on reusing water for industrial and residential purposes. Water plays a vital role in smart city resilience (Sukhwani et al., 2020). Hence, there must be an integration of multiple infrastructure areas such as water and energy, for a smart city to function optimally (Garau & Pavan, 2018; Ler, 2018). According to Babel et al. (in 2020), when water and energy networks are managed together, both water and energy savings can be achieved (Babel et al., 2020). Sewage and river water quality monitoring is becoming more widespread like sensor networks, which are built on top of the most recent digital communication technologies (Ewing & Demir, 2021; Jones et al., 2018; Keshavarzi et al., 2021; Mullapudi et al., 2017; Yildirim & Demir, 2019).

5.4 Research Methods and Framework

This study intends to develop a method for evaluating and comparing the composition of two different frameworks (SETS and Flood Resilience) and an approach to linking the resilience phase into smart city concept. Accordingly, this study applies the proposed strategy in the two selected cities, with a purpose to see how effective it can be and to gain comparative insights. To achieve the same, relevant policy documents were chosen for analysis **(Table 5.2).** Since this sub-chapter focuses on municipal governance strategies for flood management, only those plans that were created and published by the government agencies, such as national, provincial, and municipal levels have been adopted for this study. The following three criteria were adopted for document analysis: (*i) The document must be relevant to flood disaster; (ii) The document must be categorized in PPP document (Planning-Plan-Program); and (iii) Match the plans to the spatial scale under consideration (e.g., neighborhood, city-wide, regional, national).* Overall, nine documents were selected for Balikpapan City.

The authors retrieved the materials from a database on the government's website and also analyzed the PPP (Policy-Plan-Program) that explains flood risk. A detailed analysis of selected documents was conducted to study the flood management strategies. Relevant documents were collected from government online databases, https://jdih2.balikpapan.go.id/. After gathering secondary data, purposive sampling is utilized to conduct in-depth interviews for exploring deeper into the subject of flood risk management in the study area. In the next phase of research, key stakeholders from Balikpapan City were interviewed. Also, the stakeholder input is used to confirm the current situation in the field.

Table 5.1. SETS domains and Codes

SETS Domain	Category	SETS code
Social	Emergency planning/preparation/safety/ management, response	S1
	Laws, regulations, standards	S2
	Promotion of participation and collaboration	S3
	Knowledge transfer and communication	S4
	Economic mechanisms (e.g., insurance, land purchase, etc.)	S5
Ecological	Conservation, preservation, and restoration	E1
	Green infrastructure and ecological engineering	E2
	Ecological services (e.g., benefits obtained from natural floodplains or improvement of floodplains)	E3
Technological	Design standards and codes (e.g., design storm criteria, buildings codes, etc.)	T1
	Construction of engineered infrastructure (e.g., dams, levees, pumps)	T2
	Operation and maintenance of existing engineered infrastructure	T3
	Development and implementation of data-driven solutions (e.g., hazard	T4

	mappings, Web-based platforms, sensing, simulation)	

(Source: modified by authors from Hamstead et al, 2021)

Table 5.2 List of Local Government Documents

No	Document Name	Strategies Extracted and Strategy Code
	Balikpapan	
1	Government Regulation Number 13 of 2017 concerning National Spatial Planning	Zero Delta Q policy is suggested to be one of the benchmarks of successful implementations of the regional drainage system (T1)
2	Regional Action Plan for Reducing Greenhouse Gas Emissions in East Kalimantan Province,	Development of irrigation network, paddy field network (E3), Flood control facilities and infrastructure (E2)
3	Regional Regulation Of East Kalimantan Province Number 2 Year 2013 Concerning Regional Disaster Management	Conducting disaster risk analysis, monitoring and evaluation (T4), Organizing disaster management education and training in accordance with its mandate and authority, based on the guidelines set by the Regional Disaster Management Agency (S4), Implementing of preparedness and early warning activities (S4), Implementing of disaster management at the post-disaster phase (rehabilitation and reconstruction) (T1,T2)
4	Spatial Plan of Balikpapan City (RTRW)	More than a dozen flood-prone areas in Balikpapan City have been designated for 13 *Bendali* (Flood Control Dams). However, only three city-government-owned dams have been constructed (Dam 3, Dam 4, and *Wonorejo* Dam) (T1)
5	Flood Management Study Documents	Provision of detention ponds with2.5 meters in depth dimension (T1), The scenario of providing detention ponds with the depth dimension of 3 meters (T1), The scenario for maintaining the green area in the design year, in 2032 at least 20% and with the direction of providing a detention pond dimension of 2.5 meters, (E1), Maintain green cover area in planned year (2032) with minimum of 20% and with the direction of the dimensions of providing a detention pond of 3 meters. (E1)
6	Balikpapan City Drainage Master Plan	Development of an environmental-friendly drainage system (E3), Determine priorities for handling, development, and improvement in strategic areas that are vulnerabile to inundation (S2), Create a coordination mechanism, assign the roles and responsibilities of the government, private sector, and community in handling drainage, strengthen institutional capacity, and increase human resources for drainage management. (S3)
7	Balikpapan City Regulation Number 5 of 2013 concerning Provision of Infrastructure, Facilities and Utilities in Residential Areas	Balikpapan sets 4% of the site area for the provision of green open space (E1)

No	Document Name	Strategies Extracted and Strategy Code
8	Mayor Regulation Number 22 year 2021 concerning Detailed Spatial Planning and Zoning Regulations of Balikpapan City for 2021-2041	Structuring the area around the reservoir (T1), Reforestation around the reservoirs (E1), Revitalisation of urban slum areas (E1)
9	Regional Regulation No 2 year 2018 Concerning Regional Disaster Management Implementation	Determine areas that are vulnerable to natural disasters (floods) to be away from human settlements (S2), Installation and testing of early warning system, Preparation of evacuation locations (S1), Develop Vulnerability Map including Flood (T4)

Officials from three government agencies have been interviewed, which include the Disaster Management Agency, Environmental Agency, and Public Works Agency. Furthermore, the author has incorporated the models from SETS and Flood Resilience. The SETS components are initially coded and then mapped in the Flood Resilience. As discussed earlier, there are four phases of intervention to flood resilience in Flood Resilience Cycle, which are prevention, preparation, response, and recovery phases. Mapping SET domain and Flood Resilience Cycle will help to understand the current position of flood management in each city, while at the same time serving as an input for proposing water smart city.

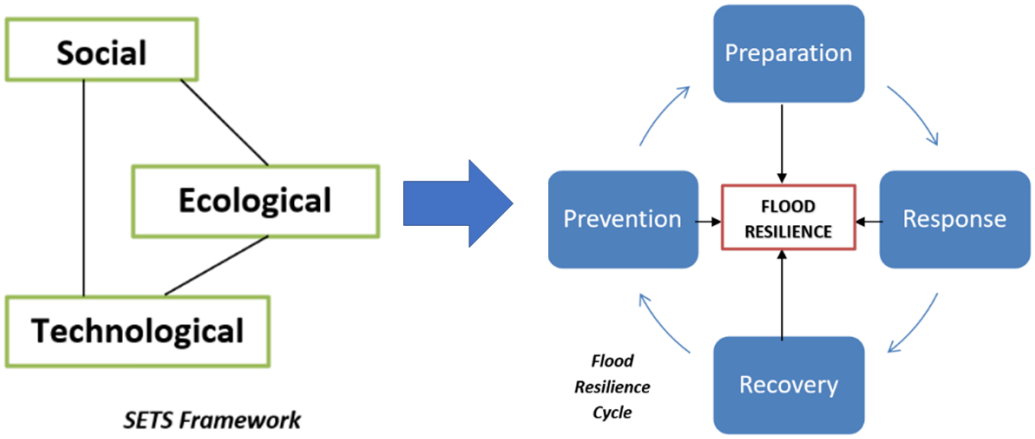


Figure 5.1. Research Framework (Source: authors)

The framework presented in Figure 5.1 is used to evaluate flood risk management in the local government documents and for classifying the Flood Resilience Cycle, in line with the SETS domains into four phases: prevention, preparation, response, and recovery. To examine its distribution, specific flood management strategies are described in coded documents, which are categorised

by S, E, and T elements. The current flood resilience phase will be the input for proposing smart flood risk management integrated with master plan of smart city in selected cities.

5.5 SETS in Local Government Documents

As a buffer area of Indonesia's new capital city, Balikpapan needs to essentially strengthen their resilience, to accommodate the projected massive growth in population and urbanization. From the perspective of disaster vulnerability, flooding is the most serious disaster in Balikpapan, followed by landslides (Ariyaningsih et al., 2021) but for the past quarter-century, flooding has also been a concern in Indonesia (Benny Sukmara & Shyan Wu, 2021). It is also clear that the local governments in the both the cities consider flooding as a critical disaster that must be prevented.

Table 5.3. Selected City Characteristics.

Aspects	**Balikpapan**
Temperature (average)	31 degrees Celsius
Population	688,318 people
Flood events (2021)	30
Area	503.3 km²
Major cause of flood	Heavy precipitation
Topography	Coastal city, 85% of the area are hilly

Based on the analysis of municipal planning documents, emphasis has been laid to comprehend how flood management is planned by urban governance systems (with various socio-political-cultural and biophysical contexts). This allows us to assess whether the proposed solutions are successful and feasible, and how well they are integrated into local governance. By acquiring specific quotes from papers, governance strategies are identified from a selection of municipal plans in each city. The extraction focused on quotes describing implementation strategies for flooding, actions, approaches to flood adaptation in general, and governance mechanisms to mitigate, adapt, and respond to flood disasters.

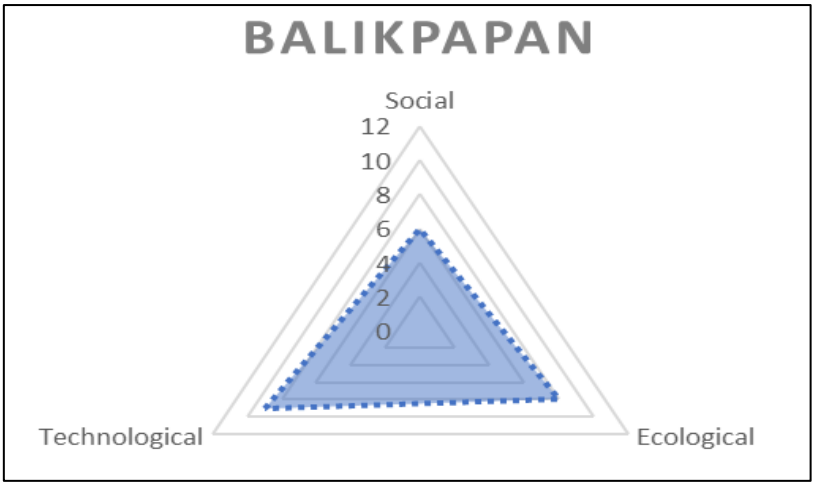


Figure 5.2 Distribution of SETS dimensions in Balikpapan City (Source : authors)

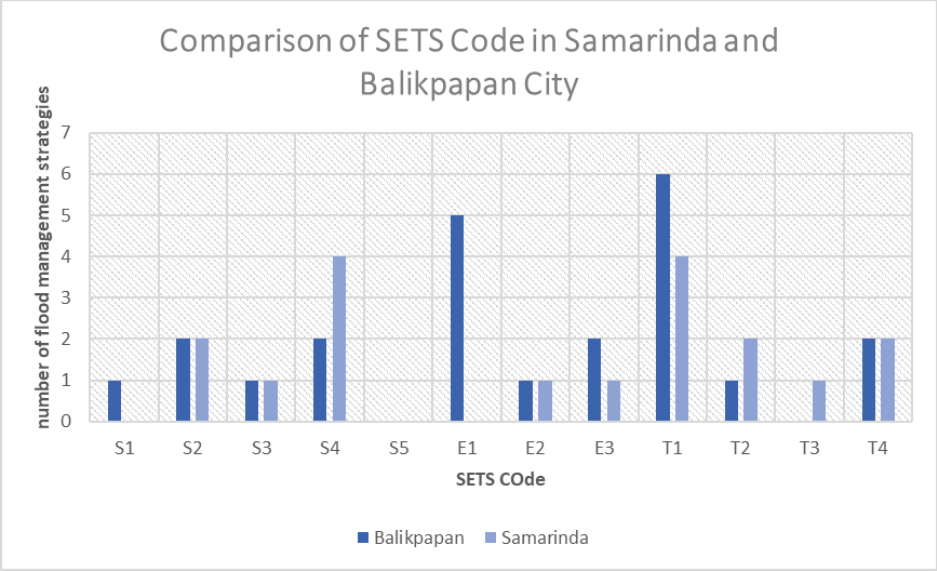
Table 5.4 enlists the documents which meet the research criteria. Herein, the authors have laid forth the key strategies for flooding, based on the government documents which are obtained from online government databases *(https://jdih2.balikpapan.go.id).* There are nine documents for Balikpapan City regarding flood management strategies. In addition, the authors developed the SETS codebook based on Berbés-Blázquez et al., (in 2017) and Hamstead et al., (in 2021) to better comprehend the SETS components of governance strategies (Hamstead et al., 2021)(Berbés-Blázquez et al., 2017). Then, the strategies have been organized according to the SETS domain, and a SETS code is assigned to each of them. Each strategy has been identified in the two cities according to the SETS domain.

Table 5.4 List of Local Government Documents

No	Document Name	Strategies Extracted and Strategy Code
	Balikpapan	
1	Government Regulation Number 13 of 2017 concerning National Spatial Planning	Zero Delta Q policy is suggested to be one of the benchmarks of successful implementations of the regional drainage system (T1)
2	Regional Action Plan for Reducing Greenhouse Gas Emissions in East Kalimantan Province,	Development of irrigation network, paddy field network (E3), Flood control facilities and infrastructure (E2)
3	Regional Regulation Of East Kalimantan Province Number 2 Year 2013 Concerning Regional Disaster Management	Conducting disaster risk analysis, monitoring and evaluation (T4), Organizing disaster management education and training in accordance with its mandate and authority, based on the guidelines set by the Regional Disaster Management Agency (S4), Implementing of preparedness and early warning activities (S4), Implementing of disaster management at the post-disaster phase (rehabilitation and reconstruction) (T1,T2)
4	Spatial Plan of Balikpapan City (RTRW)	More than a dozen flood-prone areas in Balikpapan City have been designated for 13 *Bendali* (Flood Control Dams).However, only three city-government-owned dams have been constructed (Dam 3, Dam 4, and *Wonorejo* Dam) (T1)
5	Flood Management Study Documents	Provision of detention ponds with2.5 meters in depth dimension (T1), The scenario of providing detention ponds with the depth dimension of 3 meters (T1), The scenario for maintaining the green area in the design year, in 2032 at least 20% and with the direction of providing a detention pond dimension of 2.5 meters, (E1), Maintain green cover area in planned year (2032) with minimum of 20% and with the direction of the dimensions of providing a detention pond of 3 meters. (E1)
6	Balikpapan City Drainage Master Plan	Development of an environmental-friendly drainage system (E3), Determine priorities for handling, development, and improvement in strategic areas that are vulnerabile to

No	Document Name	Strategies Extracted and Strategy Code
		inundation (S2), Create a coordination mechanism, assign the roles and responsibilities of the government, private sector, and community in handling drainage, strengthen institutional capacity, and increase human resources for drainage management. (S3)
7	Balikpapan City Regulation Number 5 of 2013 concerning Provision of Infrastructure, Facilities and Utilities in Residential Areas	Balikpapan sets 4% of the site area for the provision of green open space (E1)
8	Mayor Regulation Number 22 year 2021 concerning Detailed Spatial Planning and Zoning Regulations of Balikpapan City for 2021-2041	Structuring the area around the reservoir (T1), Reforestation around the reservoirs (E1), Revitalisation of urban slum areas (E1)
9	Regional Regulation No 2 year 2018 Concerning Regional Disaster Management Implementation	Determine areas that are vulnerable to natural disasters (floods) to be away from human settlements (S2), Installation and testing of early warning system, Preparation of evacuation locations (S1), Develop Vulnerability Map including Flood (T4)

Based on the results derived through the coding, it is inferred that in Balikpapan there are 6 social domain strategies, 8 ecological domain strategies, and 9 technological domain strategies. The distribution of SETS domain for each city is presented in Figure 5.3. Balikpapan follows a rather balanced strategy in the Technological and Ecological domains. Balikpapan City is dominated by flood strategies, which leads to the ecological code-1 (E-1) of conservation, preservation, and restoration. Furthermore, Technological-1 (T-1) leads the way in Balikpapan City, particularly in design standards and codes (e.g., design storm criteria, buildings codes, etc.). This is evident as the Balikpapan city government prioritizes technological and technological domains, in addition to having a national policy to implement design and technology standards at the municipal level. As a key cause of urban flooding in Balikpapan is revealed to be the drainage issue, the city government consequently prioritizes the technological and ecological domains. At the same time, the social domain also plays a role in making the city more resilient



Legend

S1 : Emergency planning/preparation/safety/ management, response
S2 : Laws, regulations, standards
S3 : Promotion of participation and collaboration
S4 : Knowledge transfer and communication
S5 : Economic mechanisms (e.g., insurance, land purchase, etc.)
E1 : Conservation, preservation, and restoration
E2 : Green infrastructure and ecological engineering
E3 : Ecological services (e.g., benefits obtained from natural floodplains or improvement of floodplains)
T1 : Design standards and codes (e.g., design storm criteria, buildings codes, etc.)
T2 : Construction of engineered infrastructure (e.g., dams, levees, pumps)
T3 : Operation and maintenance of existing engineered infrastructure
T4 : Development and implementation of data-driven solutions (e.g., hazard mappings, Web-based platforms, sensing, simulation)

Figure 5.3. SETS Code in local government documents (Source : Authors)

5.5.1 Mapping SETS and FRC in Current Flood Management Strategies

Following the identification of the SETs domain in flood management strategies, this section tries to understand these strategies using the Flood Resilience Cycle developed by Royal Haskoning (Adedeji et al., 2019). The purpose is to find out the position of each city based on an adapted version of the flood resilience circle, which can be applied to enhance cities resilience to flooding. There are four phases of intervention in the Flood Resilience Cycle: prevention, preparation, response, and recovery phases. The collected data on the flood strategies in Balikpapan has been mapped according to the Flood Resilience Strategy **(Table 5.5),** the comparison of which can be seen in the Figure 5.4. The two cities are seen to have almost the same approach in dealing with floods. As for prevention cycle, regulations have been legislated by the Mayor of Balikpapan, as well as the Indonesian Ministry of Public Works (MoPW). The regulations issued by the MoPW named Zero Delta Q or Zero Run-Off need to be followed by the flood-prone cities as a mandatory program.

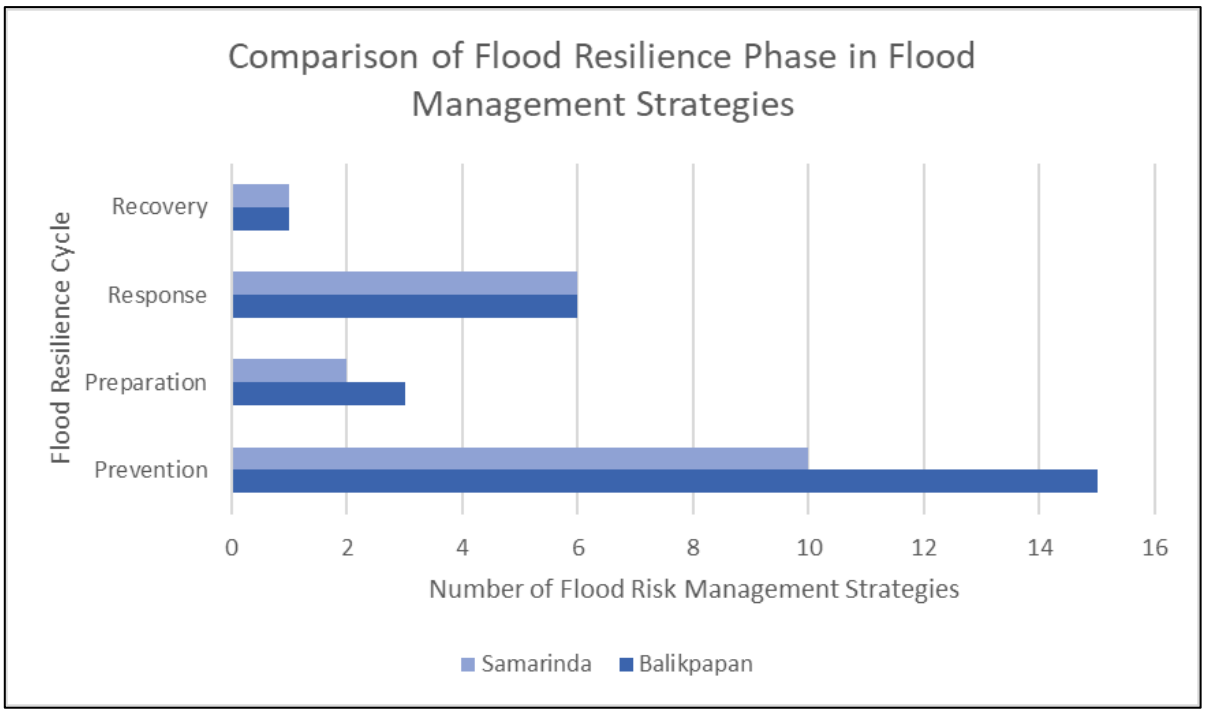


Figure 5.4. Flood management strategies in government documents as per the flood resilience phase

Further, Balikpapan seems to be more focused on the prevention phase. It is known that every government document always has a prevention strategy. Balikpapan is a coastal city with the majority of its area (85%) being mountainous. As per the study results, the key prevention strategies in Balikpapan's documents are found to be retention ponds and detention ponds. These pools are designed to absorb water. Further, Balikpapan also has a master plan that designs drainage networks to mitigate flooding. Moreover, there are plans found in the documents to develop new flood warning and forecasting system. Flood warnings are issued in both the cities so the at-risk communities can take preventive measures to minimize the damage (Russo et al., 2020). The case study's preparation phase includes establishing the Disaster Agency's Early Warning System. Remarkably, based on an interview with local community member, it has been realized that both the selected cities lack real-time flood warnings.

Table 5.5 Mapping SETS and Flood Resilience in Balikpapan

	Prevention	Preparation	Response	Recovery
Balikpapan	Zero Delta Q policy (T1)	Flood control facilities and infrastructure (E2)	Conducting disaster risk analysis, monitoring and evaluation (T4),	Implementing of disaster management at the post-disaster stage (rehabilitation and reconstruction) (T1,T2)
	Development of irrigation network, paddy field network (E3)	Implementing of preparedness and early warning activities (S4),	Create a coordination mechanism, determine the roles and responsibilities of the government, the private sector, and the community in handling drainage, strengthen institutional capacity, and increase human resources for drainage management. (S3)	
	Organizing disaster management education and training (S4)	Organizing disaster management education and training (S4),		
	More than a dozen flood-vulnerability areas in Balikpapan City have been designated for 13 Bendali (Flood Control Dams) (T1)	Determine priorities for flood handling, development, and improvement in strategic areas vulnerability to inundation (S2)		
	Provision of detention ponds with the direction of the depth dimension of the detention pond being 2.5 meters (T1)	Installation and testing of early warning system, Preparation of evacuation locations (S1)		
	The scenario of providing detention ponds with the direction of the depth dimension of the detention pond is 3 meters (T1),			
	The scenario for maintaining the green cover area in the design year, in 2032 at least 20% and with the direction of providing a detention pond dimension of 2.5 meters, (E1)			
	Maintain green cover area in plan year (2032) with minimum of 20% and with the direction of the dimensions of providing a detention pond of 3 meters. (E1)			
	Development of an environmentally drainage system (E3)			

	Prevention	Preparation	Response	Recovery
	Balikpapan sets 4% of the site area for the provision of green open space (E1)			
	Structuring the area around the reservoir (T1)			
	Reforestation around reservoirs (E1)			
	Revitalization of urban slum areas (E1)			
	Determine areas vulnerability to natural disasters (floods) far from settlements (S2),			
	Develop Vulnerability Map including Flood (T4)			

Social

Ecological

Technological

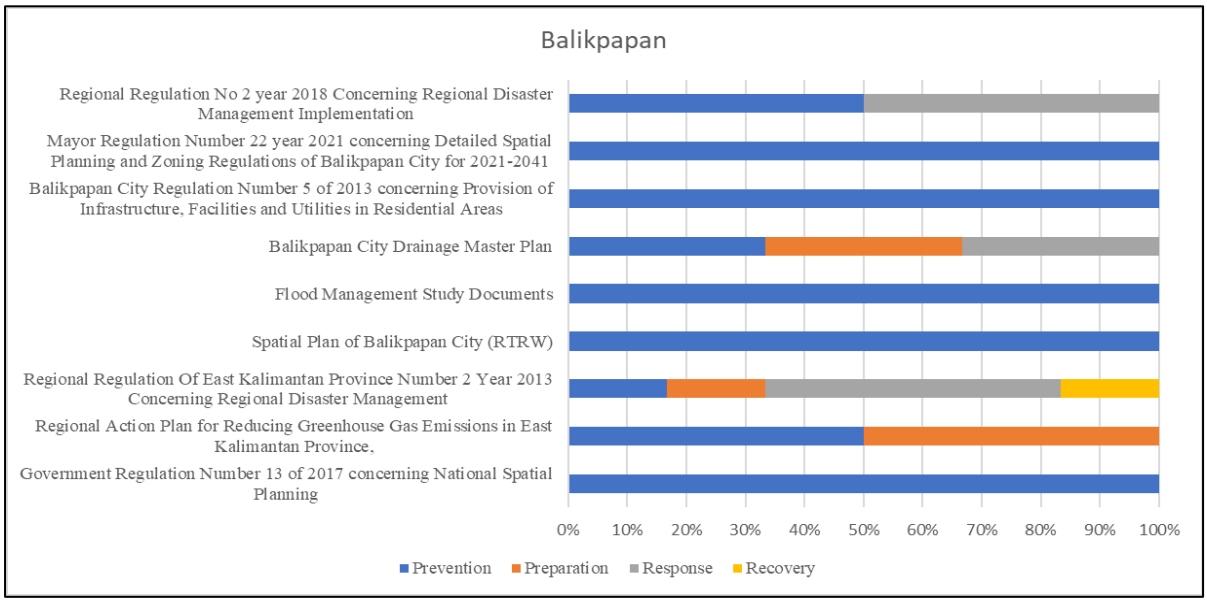


Figure 5.5. Distribution of flood resilience strategies in selected local government documents in Balikpapan City

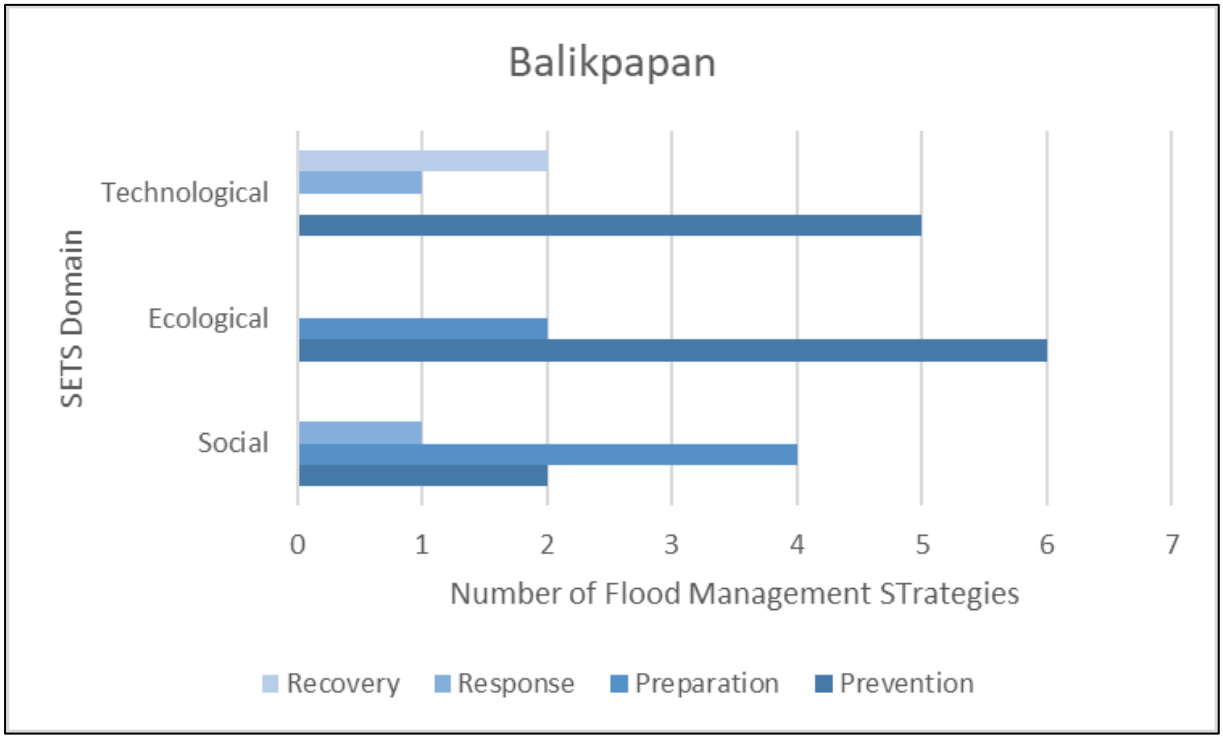
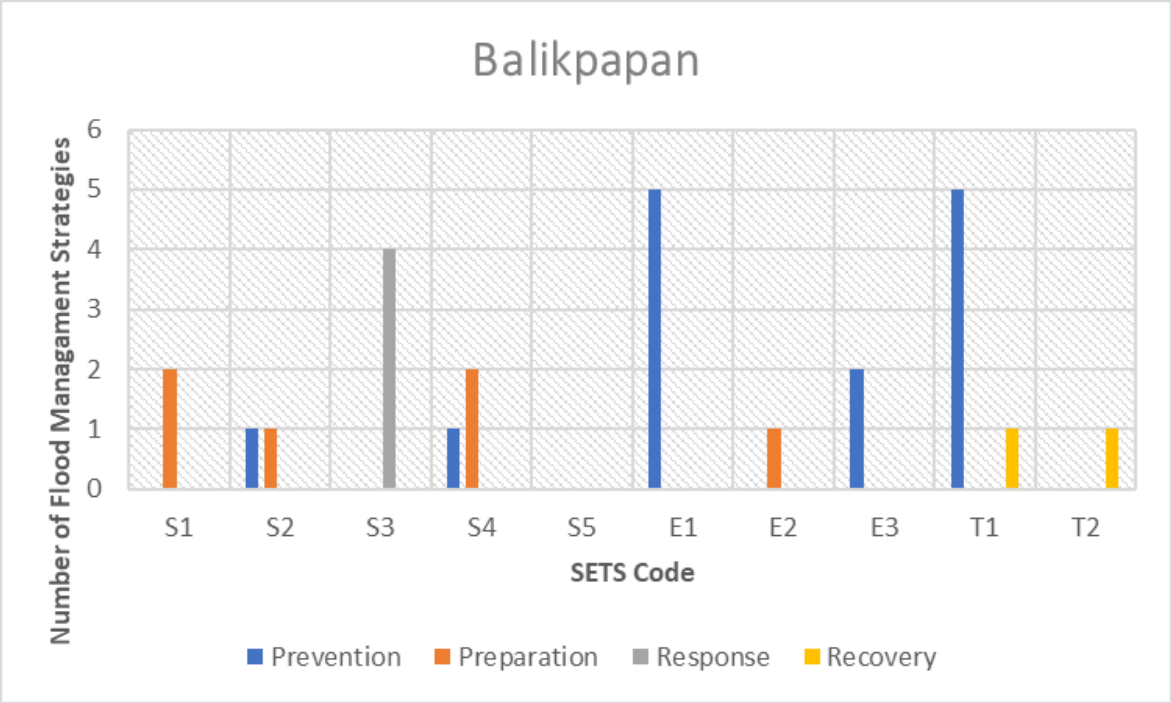


Figure 5.6. Flood Resilience Phase for SETS domains in Balikpapan (Source : authors)



Legend

S1 : Emergency planning/preparation/safety/ management, response
S2 : Laws, regulations, standards
S3 : Promotion of participation and collaboration
S4 : Knowledge transfer and communication
S5 : Economic mechanisms (e.g., insurance, land purchase, etc.)
E1 : Conservation, preservation, and restoration
E2 : Green infrastructure and ecological engineering
E3 : Ecological services (e.g., benefits obtained from natural floodplains or improvement of floodplains)
T1 : Design standards and codes (e.g., design storm criteria, buildings codes, etc.)
T2 : Construction of engineered infrastructure (e.g., dams, levees, pumps)
T3 : Operation and maintenance of existing engineered infrastructure
T4 : Development and implementation of data-driven solutions (e.g., hazard mappings, Web-based platforms, sensing, simulation)

Figure 5.7. Comparison of SETS Code in Each Flood Resilience Phase (Source : authors)

Figure 5.6 and Figure 5.7 illustrate a comparison of the Flood Resilience Cycle and SETS. In Balikpapan City, the prevention phase is more on ecological and technological dimension,. Figure 5.7 shows the distribution of each SETS code in Flood Resilience Cycles / Phase. Based on the comparison in Figure 5.7, in Balikpapan, the highest at the prevention phase are the E1 and T1 codes, which stand for "Conservation, preservation, and restoration" and "Design standards and codes (e.g., design storm criteria, building codes, etc.)." Balikpapan has focused on S3 which means promoting participation and collaboration in response phase.

5.5.2 Water Smart City Approach for Flood Resilience in Balikpapan City

The pillars of Indonesia 2015-2045 include smart and competitive cities for improving quality of life. Thus, all the cities are aiming for 100 percent of smart

city indicators (Syalianda & Kusumastuti, 2021). Besides, the 100 Smart Cities initiative is a collaboration between the Ministries of Communication and Information, Home Affairs, Ministry of Public Works, BAPPENAS, and the Presidential Staff Office. The movement seeks to guide Regencies/Cities in developing Smart City Masterplans to optimize the use of technology in improving public services and accelerate the potential that exists in each region. Flood management is included in Balikpapan's 2019 smart city master plan document. Figure 5.8 summarizes the programs in the smart city master plan.

Table 5.6. Summary of Smart City Masterplan regarding disaster management in Balikpapan

Aspects	Objective's Program in Smart City
Smart Living	1. Early Warning System, Development for flood and landslides, based on information technology and communication. 2. Utilization of sensor technology on the internet of Things (IoT) in reporting and monitoring water and air pollution
Smart Branding	1. Developing Tourism Branding for Balikpapan and New Capital City 2. Creating a livable city which resilience to disaster
Smart Environment	Developing Strategies for Supporting Sustainable Development Goals in Balikpapan
Smart Society	Enhancing community capacity for adapting to disaster

Source : Smart City of Masterplan Balikpapan (2019)

A Water Smart City can help to reduce flood risk by integrating various systems and providing real-time data. To successfully incorporate all the different systems, it is important to use an information system that can save all relevant data, including the information on hydrology and hydraulics, land management, the characteristics of various water infrastructures, and information on how these infrastructures function. In the smart city documents of both selected cities, there are only a few programs on flood disasters. Both the cities focus on the early warning system, that allows the local government to receive real-time reports from the public regarding incidents that occur in certain locations, including floods. The early warning system feature provides warning notifications through several channels such as the website (desktop/command center), mobile apps, and SMS. These notification appear when the sensor indicates an incident that has exceeded certain parameters. Referring to the results of identifying SETS domains and the results of mapping and integration , the authors proposed an approach for implementing smart water city as flood risk management. In addition, the general approach to water smart city is shown in Figure 5.8. Integration between the SETS (Social-Ecological-Technological System) and Flood Resilience should be considered as a new approach for supporting smart city in each city. However, this

is a summary and proposed technical Water Smart City strategy for the two selected cities.

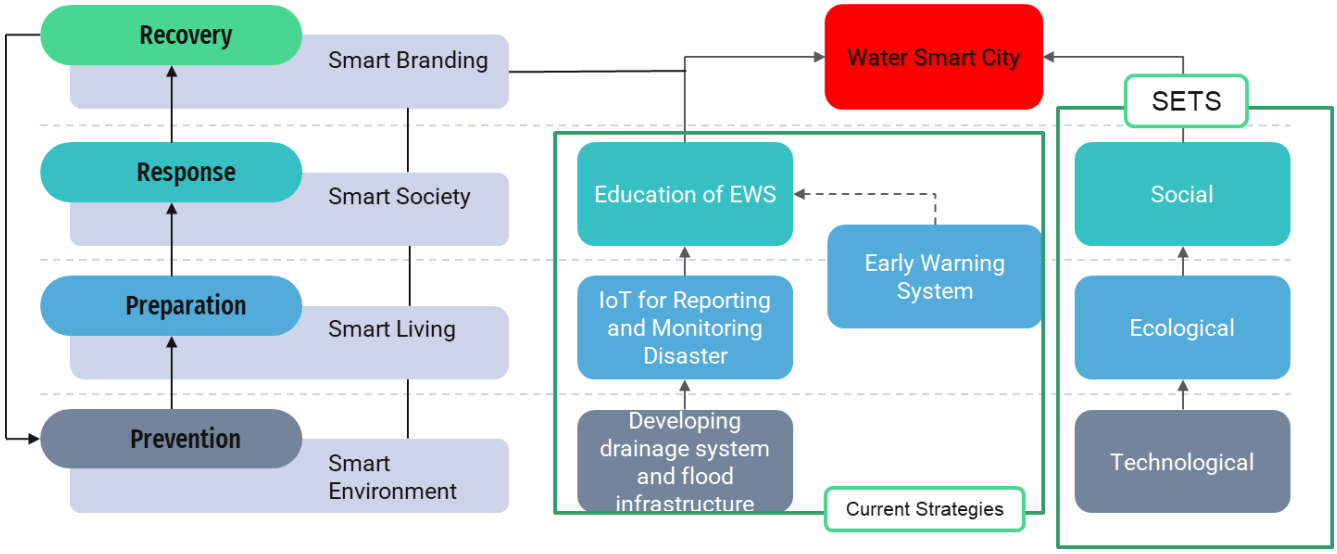


Figure 9. Water Smart City Approach in Balikpapan City (Source: authors analysis and consensus stakeholders)

A. Water Smart City–Ecological Domains

A key example of a measure that can help achieve multiple goals in the ecological domains simultaneously is to increase and preserve the natural capacity of aquifers, soils, and ecosystems to retain and store water. Water quality and availability, habitat preservation, and climate change resilience can all be improved by measures such as reconnecting floodplains to rivers, re-meandering, and wetland restoration. In addition, many urban areas have implemented green roof technology to improve stormwater management by lowering peak flow rates and total amounts of rooftop runoff during heavy rains. Various conditions and design parameters (such as rainfall, soil type, building resistance, and plant species) have been studied to determine how well the green roofs retain water quantity. In periods of light to moderate rainfall, as well as during more extreme weather, green roofs can absorb large amounts of stormwater, delaying and reducing peak flows(Jhong et al., 2020). Considering the multi-faced benefits, the study strongly emphasizes on the need for strengthening the prevention phase, which focuses on strengthening the ecological dimension, by installing green roofs to prevent flooding and increasing real-data-based nature characteristics for different types of floods in both the selected cities.

B. Water Smart City–Technological Domain

In Indonesia, the embankment construction has been the most common structural method of flood control/mitigation. Flood control structures need to be operated to consider past and current flood, river, drainage system, and rainfall conditions and future predictions. Based on the radar measurements and nowcasts, an integrated model for the hydrological cycle is used to forecast river

flows and water levels in real time. Urban runoff and storm water drainage models were created using real-time radar measurements. When it comes to dealing with flooding, the city has made a significant investment. Real-time control, model-based real-time forecasting, and operational rules can help the city get the most return on its investment. Fast river runoff mitigation and water quality improvement go hand in hand. It is therefore a must to have an accurate forecast system for realizing an effective flood warning system. As the warning messages need to be sent to relevant parties as quickly as possible, an effective communication system is also required.

C. Water Smart City–Social Domain

Insurance scheme need to be considered to connect the preparation phase, while focusing on the social domain and supporting the Water Smart City to reduce flood risk. Balikpapan already has had a program to educate people in how to address risk, but external support is still needed. There are a wide variety of flood insurance policies in place across the globe, and they vary significantly in terms of coverage and risk management policies. It is therefore possible to bundle the flood insurance with coverage for other perils such as fire, thief or even earthquake. The Indonesian planning system includes zoning regulations, as well as land use and building codes, which can assist in reducing the risk of flooding. Flood insurance, on the other hand, can help to mitigate the economic impact of flooding.

5.6 Key Findings and Discussion

To substantiate the findings derived through document analysis, secondary surveys and interviews were conducted in this study to better understand the challenges in the buffer area of Indonesia's new capital, mainly those related to flood risk and the implementation of smart city. As per the interview results, the cities of Balikpapan lacks adequate water capacity (rivers and drainage) and are unable to accommodate flood discharges. This is a serious problem that exists in both the selected cities. Further, property developers have been transforming the open spaces into built-up area, to fulfill the increasing housing demand because of urbanization, even though green open space is essential to prevent flooding in urban areas (Brody et al., 2017). Since open green space is limited in Balikpapan, the city is likely to suffer from flooding in future. Furthermore, a study done by Alexander et al. in 2019 shows that changing climate (flood driver) necessitates the need to plan and implement integrated stormwater management features into urban landscapes to ensure the protection of human life and property (Alexander et al., 2019).

Remarkably, numerous best practices for reducing flood risk in ecological terms can be seen in the case of Denmark. Green areas, pocket parks, green roofs, and green walls are installed as part of Denmark's "Adaption Imitative 2" plan to help the country in coping with the climate change by 2025. Green roofs not only hold 60% of the rain, but they also improve air quality, plant life, and wildlife

habitat (Ler, 2018). The amount of rainwater that runs off an asphalt road can be reduced by as much as 30% by using permeable pavement, according to a research done in South Korea (*Development of Urban Flood Forecasting System*, n.d.)(Ler, 2018). The adoption of this technique is very relevant in the case of Kalimantan cities such as Balikpapan, as the soil is suitable for permeable pavement. A study conducted in Samarinda city shows that the local Kalimantan island material can absorb water with maximum compression strength of 11.6 MPa with addition of 7.5% sand (Pranoto et al., 2021).

It is important to note that the management of water resources involves a wide range of stakeholders, including water utilities, water authorities and regulators, and end-users. Water treatment and distribution have real-time monitoring and control systems, but these systems do not effectively coordinate with each other. This necessitates a framework that integrates all these applications so that they can communicate with each other in the future (Newhart et al., 2019). It indicates that preparing urban landscapes, including green open space is critical in preventing the city from flooding (Song & Li, 2019). However, the Public Works Department in the City of Balikpapan underline that many developers have not built Green Open Spaces per the City's Site Plan and Environmental Permit. In this case, the local government needs to strengthen the regulation regarding green space as ecological domains for managing flood risk in Balikpapan City.

The Ministry of Public Works' directive falls within the "Technological" dimension of the SETS (Social-Ecological-Technological). Balikpapan has a master plan for smart city. In both their documents, it is stated that water smart city can be implemented to support technological domain. However, the cities can complement and mutually assist one another by aligning their flood strategy with the three domains of SETS (H. Chang et al., 2020). This confirms that flood vulnerability's technological, social, and ecological domains are highly associated. It gives the impression that these cities can potentially improve vulnerable environments on both the social and ecological level. In this scenario, urban planners can construct green open spaces with a focus on adequate distribution throughout cities, while simultaneously realizing the goal of increasing social capital to increase the adaptive capacity in underprivileged neighborhoods (H. Chang et al., 2021a).

Based on the interviews, another identified challenge is on the technological domain, namely the implementation of the sediment dredging program, that is neither periodic nor comprehensive, which is resulting in a decrease in the river's capacity or channel. Furthermore, the monthly rainfall in Balikpapan City ranges from light to moderate, with varied intensities (Ariyaningsih et al., 2022). Floods are also known to occur in Samarinda because of fluctuating rainfall(Ghozali et al., 2016). However, in SETS, technological domain in combination with the ecological and social domains, can play an essential role in addressing these

difficulties. Green infrastructure, for example, demonstrates technology adaptive capacity by absorbing floodwaters and primarily filtering to support water quality (Cheng et al., 2017). However, the idea of a smart city is not always related to technological advancements; rather, it also involves a shift in people's mindsets (Oberascher et al., 2022; Setiawan et al., 2020). Apart from the IoT water level sensor, the early warning system feature that Balikpapan will own is expected to allow the government to receive real-time reports from the public regarding incidents that occur in specific locations, including floods. Thus, the government can make decisions quickly based on the information displayed.

The conventional method of flood control concentrates on reactive solutions, such as reducing exposure to flooding and vulnerabilities to flood damage. This is accomplished primarily through structural measures, such as dykes, which involve the construction of a wall between rivers and floodplains (Dwirahmadi et al., 2019; Thanvisitthpon et al., 2018). On the other hand, this strategy is only partially effective because it only serves to shift the risks of flooding, rather than completely reducing them. Consequently, there is a need for a more comprehensive multi-disciplinary approach, which can result in a paradigm shift away from conventional flood control and toward intelligent flood management (De Angeli et al., 2022; Feofilovs et al., 2020).

Moreover, without any water ICT standards, interoperability is hindered, which increases the cost and maintenance of such applications (Gade, 2021). ICTs can be used to improve water management productivity and efficiency, maximize resource allocation using advanced information technologies for observing, storing, processing, and analyzing the system monitoring data; and presenting the analysis results. ICT-enabled solutions for managing water resources are becoming more widely available, resulting in Water Smart City management. Local governments and other stakeholders in Balikpapan should accordingly incorporate IT into water management, transportation, and the environment to achieve water security at all levels (building, city, and regional) using information technology. In the policy documents of both the cities, the local government has been planning to implement early warning system, but it is identifiably too difficult to implement due to the data and real time technology.

Also, there is a lack of coordination between the institutional agency or local government and overlapped tasks. For example, the Disaster Agency in Balikpapan underscores that their responsibility is limited to flood response rather than flood prevention. During the interview, the Disaster Agency anticipates the flood situations by monitoring the fluctuating water level. Stakeholder engagement is an essential aspect of a more inclusive and participatory type of Flood Risk Management Governance(Berbés-Blázquez et al., 2017; Blázquez et al., 2021; Serra-Llobet et al., 2016). Thus, it is suggested that the stakeholders and government agencies need to be mapped with SETS and Flood Resilience to better coordinate flood management in each city. In terms of

ecological matters, the stakeholder's involvement in a complex socio-environmental issue like integrated FRM requires complex, multifaceted interactions amongst various stakeholders (Blázquez et al., 2021). Further, in addition, it is important to bring together urban planners, flood risk experts, and other stakeholders to enhance their awareness and raise their knowledge of collaboration and an understanding of the data and the methodologies as a first step for flood risk management.

Adaptive governance, which includes adapting and learning, is essential to achieve resilience. Herein, adaptive governance is a collaborative effort to improve the city's adaptability capacity. Cities may strengthen their resilience and adaptability by engaging in a continual learning process (Moloney & Fünfgeld, 2015; Roggema, 2014). Building consensus and accommodating the interests and needs of a wide range of stakeholders interested in spatial planning necessitates effective governance. Good governance relies heavily on the ability of institutions to adapt to changing circumstances (Blázquez et al., 2021). However, every stakeholder has a role in reducing the risk of flooding. It is unlikely that the efforts of the government and the community alone will be sufficient. Individual flood prevention measures ought to be implemented, but to do so; it is first necessary to conduct the required education and perception work regarding floods. Last, using a questionnaire to understand community participation and time series data can also enhance smart flood risk management by mapping flood risk (Agonafir et al., 2022; Rüttinger et al., 2016; Tierolf et al., 2021).

6. Conclusion

As buffer areas of the Indonesia's new capital, Balikpapan is expected to be disaster-resilient, particularly for flooding. As flooding is a major problem in these two cities, it can take a serious toll on the economy. Through this study, the authors have tried to comprehend the SETS (Social-Ecological-Technological) system as it relates to Flood Resilience Cycle by reviewing the policy documents related to flooding and spatial planning at the national, provincial, and local levels generated mapping of flood strategies. The government database entailed 9 documents for Balikpapan. According to the findings, Balikpapan city is observed to be concentrating on the Technological and Ecological domains,. Flood strategies are limited in these two cities, which are resulting in social problems. Therefore, the SETS is considered ineffective in Balikpapan. Several strategies for addressing the challenges are yet to be executed, even though they are typical flood management such as river capacity, drainage capacity, soil infiltration, etc. For instance, there has been no follow-up on installing 35 flood warning systems even though EWS is one program in their masterplan of smart city. Many government programs have been implemented; however, they are not shown to be effective in dealing with flooding. The water smart city approach has been suggested to achieve flood risk management based on integrating the flood

resilience phase and SETS frameworks. In light of that, three key approaches have been identified for strengthening the smart city strategies: 'Water Smart City Management for Ecological Domains', Water Smart City Management for Technological Domains', and Water Smart City Management for Social Domains'. Since the smart city of Balikpapan is still in the early stage, it is difficult to identify the challenges from the field. Due to this research limitation, deeper data collection and evaluating smart city masterplan lies in the future scope of this study.

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Chapter 6
Assessment of Community Disaster Resilience in Balikpapan City

6.1 Introduction

In recent years, the concept of flood hazard has emerged to better understand the effects. In addition, combined natural hazards and the COVID-19 pandemic have had major impacts on the community and the environment, and consequently increased the virus spread(Izumi et al., 2022). Furthermore, recent studies have looked at different types of compound hazards for various regions of the world using a number of methods (Ming et al., 2022; Phillips et al., 2020; Trias & Cook, 2021). On the other hands, community resilience has attracted increased attention due to recent natural and human-caused disasters. Resilience itself is a multidisciplinary and broad concept. In engineering, resilience is the ability to "withstand stress, survive, adapt and bounce back from a crisis or disaster and rapidly move on" (Wagner and Breil 2013). Community resilience indicates the capability of people and communities to retain optimal performance in the event of various natural and anthropogenic crises(Sharifi, 2016). There has been a growing awareness of the need to establish methodologies and tools for evaluating community resilience as the idea of it has developed(Marasco et al., 2022; Ningrum & Subroto, 2022; Tariq et al., 2021). In addition, many regions around the globe have made it a top priority to strengthen community resilience, which includes both physical and interpersonal aspects (Suleimany et al., 2022). Research on resilience in the fields of urban planning and social science focuses on three distinct scales: the individual, the community (whether urban or rural), and the national or international.(Santos et al., 2020).

There are a number of methods for determining resilience that can be found in published literature(Attolico & Smaldone, 2020; Magoni, 2017). The disaster resilience of communities can be quantitatively assessed using a measurement framework that was introduced by Chang and Shinozuka (2004). Another top down measurement tool is the Baseline Resilience Indicator for Communities (BRIC)(Agonafir et al., 2022; Javadpoor et al., 2021). Although quantitative in nature, this instrument places greater emphasis on the innate resilience of communities. Fieldwork is the practical focus of BRIC. Furthermore, using the Hyogo Framework for Action (HFA), Kammouh et al. (2017a) presented a quantitative approach to evaluating resilience on a state-level (UNISDR 2007). .The approach introduced was an evolution of the risk assessment concept. To evaluate community resilience, Kwasinski et al. (2016) put out a hierarchical model. Community dimensions and the connections between them and community resources, systems, and services constitute the model. We have identified several challenges that can impact a comprehensive methodology for community

resilience assessments. There is a lack of consideration for natural resources in the proposed framework, despite their importance in resilience planning(Zeng et al., 2022).

The pandemic-related factors should be incorporated into emergency management policies and practices. Given the compound risks include not only flood but also wild-fires, earthquakes, drought, food security, and rising temperature, various stakeholders need to cooperate and address these multiple-risks, and prepare for the increase in compound pandemic–hazard threats(Ishiwatari et al., 2020; Izumi et al., 2022; Santos et al., 2020). The new approach has to focus more on disaster resilience, which can be a rather proactive and positive approach, as well as action-based resilience planning, rather than focusing on one hazard at a time. It is also vital to understand people's behavior to communicate what is resilience and how to prepare for and respond to these complicated events(Fisher, 2015; Lassa, 2019; Marasco et al., 2022).

Several other works have been carried out to define and quantify the resilience of communities, but mostly with a focus on engineering systems (e.g., Woods 2017; Park et al. 2013; Hosseini et al. 2016; Jovanovi´c et al. 2016). Based on those experiences of compound hazard management under the COVID-19 situation, some research has emphasized the need for new policies and approaches to compound hazard management(Izumi et al., 2022). Kruczkiewicz et al. stressed that the existing frameworks and guidelines do not apply to compound hazards, therefore, it is crucial to redesign the institutional regulations and structures including the funding mechanism to address compound risks. Even though much effort has already been expended to boost research on community resilience indicators (Cutter et al. 2010; Norris et al. 2008; Twigg 2009a), there is still no acceptable method for the evaluation of community in term of compound hazard especially flood during covid-19 (Abeling et al. 2014).

A comprehensive framework for assessing the resilience of communities to compound hazards (for example, floods and pandemics) and the generation of a community disaster resilience map are the key objectives of this chapter. In light of this, the primary questions that this research endeavors to answer are: what are the indicators and variables that pertain to the resilience of communities to compound hazards? On the basis of a comprehensive literature review, the authors have also attempted to identify and evaluate community resilience frameworks in order to provide an answer to the question mentioned earlier. In addition, this study has the potential to contribute to the evaluation of community resilience for compound hazards, as well as to inform stakeholders and policymakers about the necessary measures to develop a city that is more prepared to deal with compound risks.

6.2 Developing Community Disaster Resilience Framework

6.2.1 Review Existing Frameworks

According to Azizi et al., (2022 and Djalante et al., 2020) community resilience is defined as the capacity of individuals who are vulnerable to disasters, crises, and underlying vulnerabilities to anticipate, prepare for, mitigate, cope with, and recover from the effects of shocks and stresses without threatening their long-term prospects. Also, three key components of community resilience: reducing impacts or consequences, reducing recovery time, and reducing future vulnerabilities. Furthermore, it was observed that the resilience of communities can become diminished when they are confronted with multiple crises at the same time. The impact of disasters can be mitigated through the implementation of community resilience measures, which include both prevention and preparation(Heinzlef et al., 2020; Magnuszewski et al., 2019; Song & Li, 2019). It is possible to define resilience as the degree to which a community is able to withstand the effects of external shocks, including the ability to respond to emergencies and strategies to reduce the likelihood of future harm.

The literature review on the framework or method to measure resilience was done. The Systematic Review using PRISMA framework of current community resilience frameworks was conducted to assess their applicability in the community resilience context. The PRISMA method is a widely used literature review methodology and has four steps: identification, screening & eligibility, and inclusion. The databased used in scopus and sciencedirect with keywords "Resilience", "resilience assessment", "disaster resilience", "community resilience", "framework", "tools". For first stage, 143 articles were identified in Sciencedirect and Scopus, there was only 3 articles. After removing duplicates, 144 articles were identified. In the last stage, 37 articles were reviewed. List of reviewed papers is available in Annex 1.

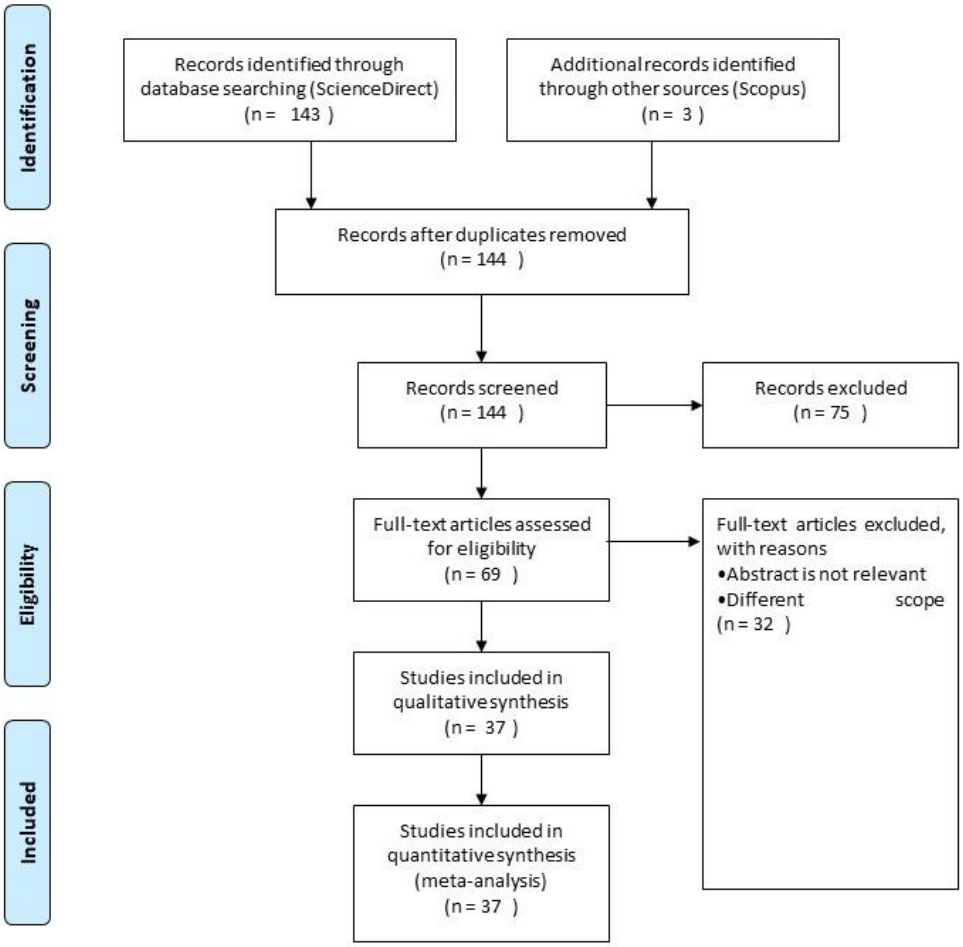

Figure 6.1 PRISMA Framework Step for Reviewing Existing Framework

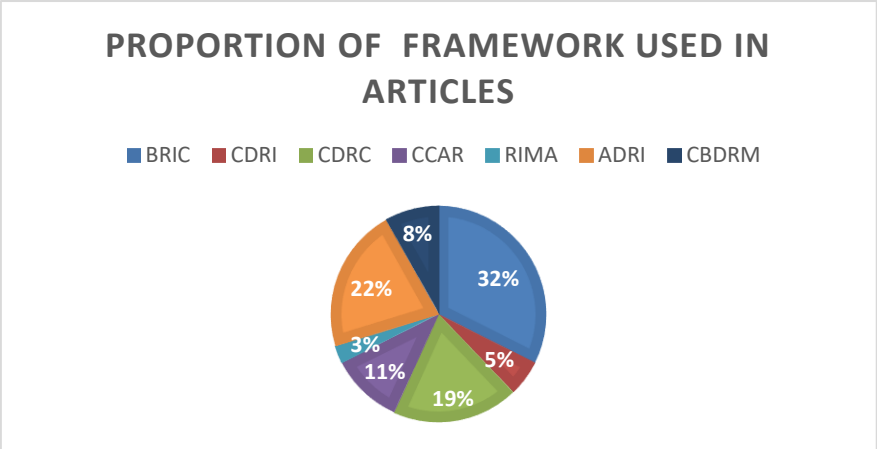

Figure 6.2 Number of Framework Used in Selected Articles

In the articles identified by the literature review, there are 7 existing frameworks that are often used to assess community resilience, namely: BRIC, CDRI, CDRC, CCAR, RIMA. The following is a brief explanation and key highlights of the framework and the summary of dimensions and indicators can be seen at Table 6.1:

1) BRIC : Using a comparative community resilience score, the Baseline Resilience Indicators for Communities (BRIC) provides a description of the differences in community resilience that exist between counties within the state and between counties within the nation. There are six broader categories of community disaster resilience that make up the BRIC framework. An initial baseline for monitoring existing attributes of resilience to natural hazards, the BRIC can be used to compare places to one another, to determine the specific drivers of resilience for counties, and to monitor improvements in resilience over time. BRIC can also be used to monitor the progression of resilience over time.
2) CDRI : There are five main dimensions that make up the Climate Disaster Resilience Index (CDRI) approach. These dimensions are physical, social, economic, institutional, and natural. Additionally, there are several parameters and variables that reflect the capabilities, strengths, and threats of case study cities in terms of their ability to deal with potential climate-related disasters.
3) CDRC: The CDRC method, which stands for community disaster resilience clustering, is used to evaluate the levels of disaster resilience of community building portfolios. Both the socioeconomic recoverability and the physical vulnerability are evaluated independently by the CDRC, with the former using open GIS building databases and the latter using census databases. In order to characterize the disaster resilience of the community in terms of both its physical vulnerability and its socioeconomic recoverability, the method then integrates the two measures through the process of clustering.
4) CCAR : Coastal cities adaptive resilience is abbreviated as CCAR. A collection of generic system dynamics simulation models that can be used with the City Resilience Simulator are referred to as Coastal Cities at Risk (CCaR). The purpose of this framework is to simulate the dynamic resilience of coastal megacities to natural disasters that are caused by climate change.
5) RIMA : Since 2008, the Food and Agriculture Organization (FAO) has been at the forefront of efforts to measure resilience to food insecurity. It has also been a pioneer in the development and utilization of the Resilience Index Measurement and Analysis (RIMA), which is a quantitative approach that enables a rigorous analysis of how households cope with shocks and stressors.
6) ADRI : Factors that allow learning, adaptation, and problem solving are included in the Australian Disaster Resilience Index's assessment of disaster resilience. These factors also include the resources and abilities to prepare for, absorb, and recover from natural hazards, which are collectively referred to as Coping Capacity (Adaptive Capacity). By combining information from secondary sources with a formative assessment model, the Australian Disaster Resilience Index employs a top-down

evaluation strategy (see below). The Australian Disaster Resilience Index evaluates the capabilities for disaster resilience that arise from structural settings, in conjunction with the capacities approach.

7) CBDRM：A method of conducting disaster risk management (DRM) and conducting risk assessments that originates from local communities and is organized by those communities is referred to as community-based disaster risk management (CRM). At the community level, sustaining interest in and motivation for DRM in addition to incorporating CBDRM approaches at the national policy level are the two most important factors that will determine the success of CBDRM. Within the context of CBDRM, one of the most significant processes is the Hazard, Vulnerability, and Capacity Assessments (HVCAs).

6.2.2 Validation of Dimension and Indicators

After reviewing the existing framework, the next step is to validate the indicators and dimensions in the existing framework. A strong connection between specialists and the community and region under study would enhance the case study's validity, as my research is context-specific and DRM is one of the new challenges in Indonesia following the 2004 Aceh Tsunami. So, I decided that experts were people who had either direct experience with or knowledge of the floods and community resilience. Stakeholders were subsequently defined for them. It was also crucial to have many experts or representative stakeholders participate, since studying vulnerability calls for an interdisciplinary approach. Consequently, it was crucial to select stakeholders from a variety of community groups. A thorough understanding of each stakeholder's significance and impact was attained through a stakeholder's analysis, which guaranteed this. To validate, the author used purposive sampling method. The following experts were selected,:

- Ministry of Public Works
- Directorate General of Regional Administration Development – Ministry of Internal Affairs
- National Agency for Disaster Countermeasures (BNPB)
- Regional Disaster Management Agency of East Borneo Province (BPBD)
- Expert from Institut Teknologi Bandung

Table 6.1 Summary of Existing frameworks with dimensions and indicators. (green = covered, red = not covered).

No	Dimension	Indicator	Framework							
			BRIC	CDRI	CDRC	CCAR		RIMA	ADRI	CBDRM
						CCaR	CCR			
1.	Social	Gender								
		Education level								
		Race/Ethnicity								
		Awareness								
		National language speaking								
		Preparedness								
		Training and Education								
		Social Capital								
		Risk Perceptions								
		Number of special need people								
		Age								
		Community participation to DRR								
		Number of family member								
		Years of Residence in a community								
2.	Environmental	Hazard intensity								
		Hazard frequency								
		Number of different hazard								
		Biodiversity Index								
		Environmental Policy								
		Land use type								
3.	Economic	Disaster insurance								
		Income								
		Employment								
		Home ownership								
		Saving and budget								
		Household assets								
4.	Governance	Disaster Plan, Policy, and Program								
		Institutional network/collaboration								
		Infection control								
		Availability of subsidies								
		Disaster aid experience								

No	Dimension	Indicator	Framework							
			BRIC	CDRI	CDRC	CCAR		RIMA	ADRI	CBDRM
						CCaR	CCR			
		volunteerism								
5.	Physical	Evacuation route								
		Population density								
		Access to clean water and sanitation								
		Access to health facilities								
		Temporary housing								
		Water supply								
		Electricity supply								
		Accessibility								
		Building density								
		Housing type								
		Number of medical institutions								
		Warning System								

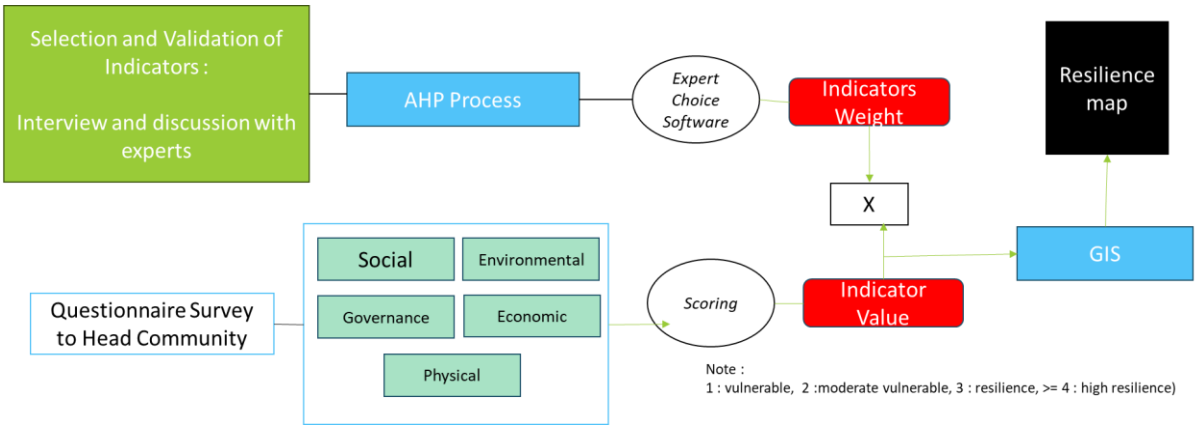

Figure 6.3 Framework to assess community resilience in Balikpapan City

This study implemented a GIS to visualize the level of resilience in Balikpapan City. The participation of locals in the various stages of the development process was given a significant amount of attention in this research. Furthermore, academic institutions and government agencies were also intended to be interviewed for the study. Factors and sub-factors were compared pairwise using the Analytic Hierarchy Process (AHP), which was subsequently converted into weights, for this study. The framework can be seen at Figure 6.3, . A closed-ended questionnaire was developed by selecting the most prioritised dimension and parameters in the first step. In the second step, an open questionnaire survey with the Balikpapan City head of community served as the basis to rate each

parameter and dimension. The head of the community in Balikpapan was able to select and rank the various dimensions and parameters through the use of the questionnaire. The results of AHP process at first step can be seen at Figure 6.4 until .6.8. In addition, sensitivity analysis can be found at Figure 6.9. In addition, the question of AHP is provided in the annex 2.

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Figure 6.4 Environmental Dimension Weight

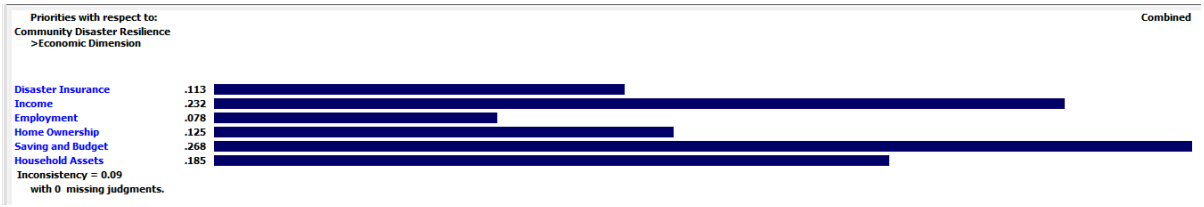

Figure 6.5 Economic Dimension Weight

Figure 6.7 Economic Dimension Weight

Figure 6.8 Physical Dimension Weight

Figure 6.8 Social Dimension Weight

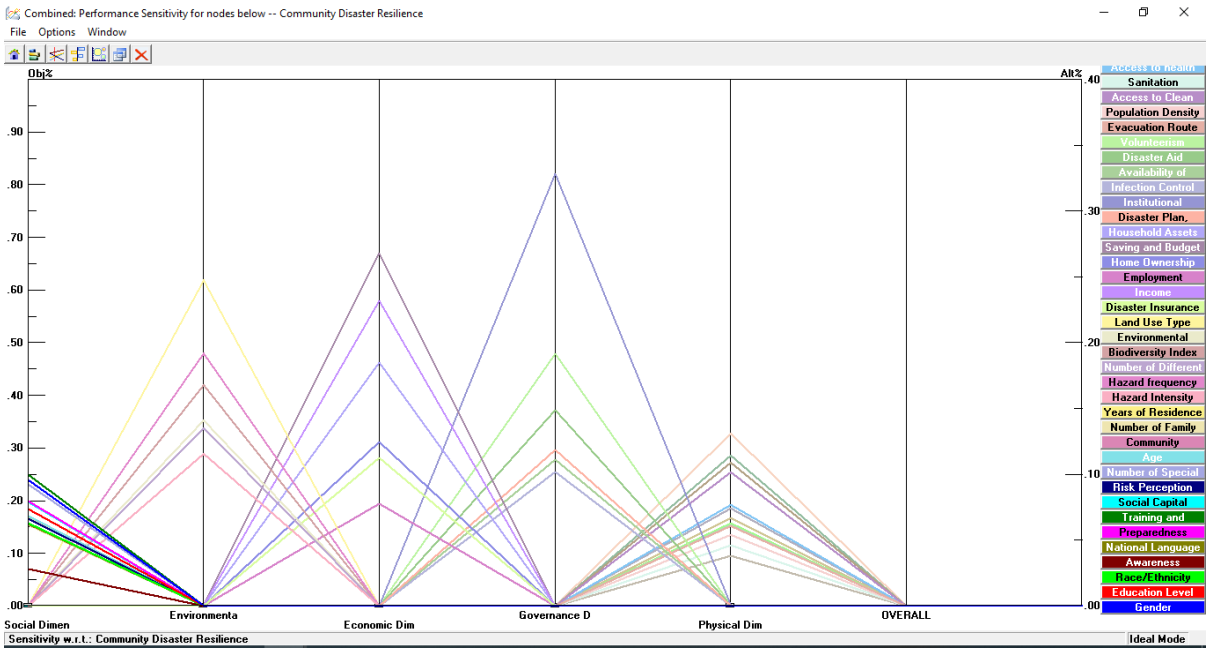

Figure 6.9 Social Dimension Weight

6.3 Community Disaster Resilience Assessment

After knowing the weight, the researcher distributed a questionnaire to the head of the community to find out the score. The head of the community was asked to fill in the range of 1-4 for each of the parameters in the dimensions that had been validated in the figure 6.10 (an example of a questionnaire is in the Annex 4).

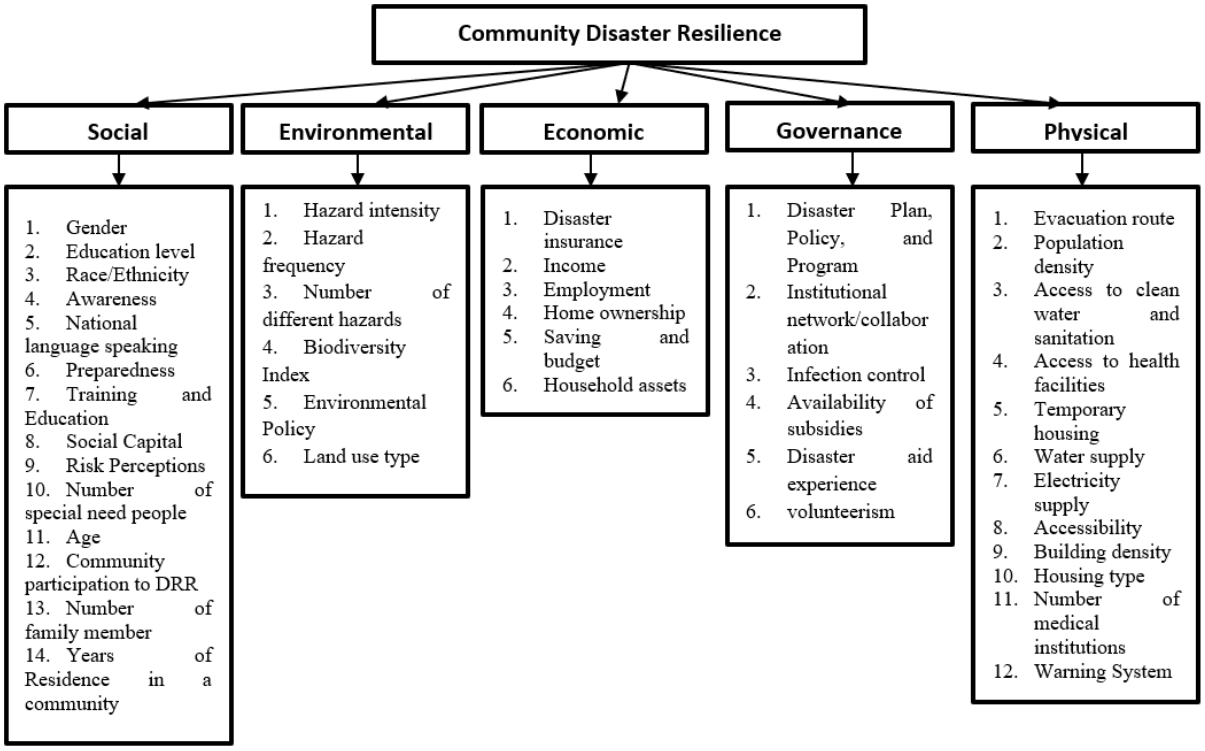

Figure 6.10 Validated Dimensions and Parameters

After obtaining validation, the authors grouped the same parameters as below.

Dimension				
Social	Environmental	Governance	Economic	Physical
Parameter				
Social Capital	hazard intensity and frequency	Disaster Insurance	Institution collaborations	Accessibility (Road and Basic Needs)
Awareness	number of different hazard	Income	Volunteerism	Electricity, Clean Sanitation, and Water Supply
Population	environmental policy	Employment	Disaster Aid Experience	Housing and building density
Health	biodiversity index	Assets	Availability of Subsidies	Evacuation route
Preparedness	land use policy	Saving and Budget	Disaster Plan, Policy, and Program	Temporary housing

The community Resilience score is calculated through questionnaires distributed in 6 sub-districts in Balikpapan City. There are 5 Dimensions with 44 parameters to measure the resilience in the local level. The lowest score states very low resilience, while the highest is five, which shows very high. Then after knowing the scores and weights, the following are the assessment results for Balikpapan city. There are 2 levels of community disaster resilience : moderate

vulnerable (South Balikpapan, North Balikpapan, Central Balikpapan, and Balikpapan Kota), vulnerable (West Balikpapan and East Balikpapan).

Table 6.2 Assessment Result

	South Balikpapan	North Balikpapan	Central balikpapan	Balikpapan Kota	West Balikpapan	East balikpapan
Social	1.64	2.8	1.3	1.8	1.5	1,7
Environmental	3.34	3.3	3.5	3.28	2.1	2.2
Economic	3.1	2.3	2.18	2.4	2.6	3
Governance	2.38	2.9	2.6	2.8	2	2.9
Physical	1.27	2.01	2	1.8	1.5	1.8
Overall Resilience	2.346	2.662	2.316	2.416	1.94	1.98

In the assessment result, it is found that in South Balikpapan the highest is Social Dimension (3.34). The responses of the questionnaire can be found at Annex 3. This is supported by the data and interview result that in this area there are many urban parks and has relatively safe land capacity for the future. then the second rank is occupied by Economic (3.1). South Balikpapan is the centre of trade and services in Balikpapan. There are many office centres in Balikpapan, in addition to upper middle-class housing concentrated in this area. So, this also proves that the economic value is quite high.

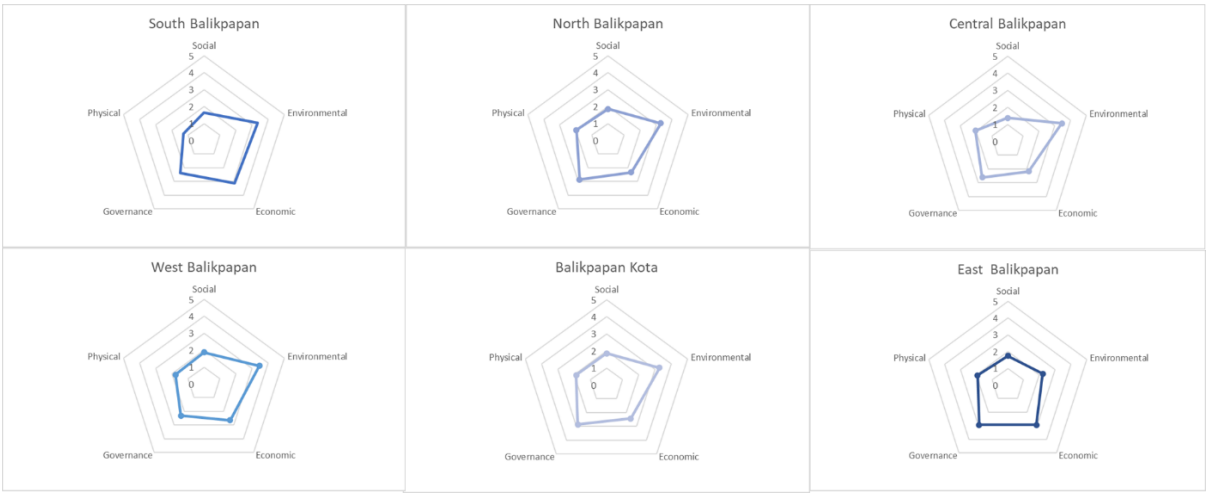

Figure 6.11 Community Disaster Resilience in Balikpapan Sub-District

The South Balikpapan sub-district comprises 7 urban settlements spanning an area of 37.82 square kilometres, with a population density of 3433 individuals per square kilometre. Kecamatan Balikpapan Selatan is characterised by a predominantly hilly topography, accounting for approximately 85% of its land area. The remaining 15% consists of a thin, flat coastal region. The soil composition in Kecamatan Balikpapan Selatan comprises yellow red podzolic, alluvial soil, and quartz sand. The predominant soil type in the South Balikpapan Sub-district is the yellow red podzolic soil, which is characterised by a thin topsoil layer and young rocks. This soil type has low fertility and is unstable, particularly in hilly areas with slopes exceeding 15%. High rainfall can lead to soil degradation

and erosion. The sub-district scores high on the economic dimension. Less than 15% of residents live below the poverty line, yet their income comes from only one source. Almost all residents have an income above the minimum wage of Balikpapan city, but less than 10% of households have disaster insurance. Although more than 50% of people save money. Then, there is no support or access to credit facilities during disasters for the urban poor or low-income groups. The intensity and severity of flooding is severe and occurs more than once per year in this area. Almost 73% of the area is built-up, with a loss of green space of only 20%. However, based on the questionnaire results, this area has a strong environmental policy for sustainable development.

The total area of North Balikpapan is 132.16 square kilometres, and it has a population density of 1077 individuals per square kilometre. Nevertheless, over 28% of the population residing in this region experiences poverty, with their income derived from two distinct sources. The unemployment rate in the formal sector exceeds 20%. Over half of the community actively participates in savings endeavours, whereas fewer than 10% of households possess insurance. Residents do not have access to subsidies or incentives to acquire alternative livelihoods and health services during disasters, notwithstanding the limited quantity available. In addition to economy, the region also exhibits low levels in terms of physical and social characteristicsApproximately one hundred percent of homes have access to electrical power. However, only fifty percent of solid trash is treated before it is disposed of, and only twenty-five percent of solid garbage is recycled, either formally or informally. This is despite the fact that 64 percent of the population has access to sanitation. When it comes to transportation, just twenty percent of the territory is utilised, and only fifty percent of the area is accessible through paved roads. In the areas that have been impacted by floods, more than 71% of roads are still accessible during regular flooding conditions; however, only 30% of roads have roadside drains that are closed. In spite of the fact that less than twenty percent of buildings are created in line with building requirements, up to nineteen percent of homes are erected with structures that are not permanent. Additionally, the region is a significant industrial sector, which raises concerns regarding the disposal of garbage. The Wein River Protection Forest, on the other hand, has resulted in a significant amount of green space being available in this region.

The area of Central Balikpapan Sub-District is 11.08 square kilometres. The social dimension has the lowest value in Balikpapan City, followed by the economic and physical dimensions. Like the South Balikpapan sub-district, the majority of residents in terms of their economy earn incomes that above the minimum wage set by the Balikpapan city. However, less than 10% of households possess catastrophe insurance. Although more than 50% of the people save money.

However, slightly more than one-third of the population falls within the age group of under 12 years old to over 62 years old. This is despite the fact that the population is growing at a high pace of 3.9%. It is estimated that approximately 17% of the population suffers from waterborne and vector-borne illnesses on a yearly basis, whereas as many as 90% of the population may make use of basic healthcare services. It is the responsibility of health facilities to be competent and capable of providing services to the population in times of emergency and before disasters. There are fewer than fifty percent of the population that is illiterate, and the government of the sub-district organises crisis exercises on several occasions each academic year. There is a rather seamless process of social integration across a wide range of nationalities, and over half of the population participates in activities that are organised by the community. It is possible for the community to efficiently respond to disasters because it is equipped with the essential resources and organisational structures, which include management, materials, and logistics. On top of that, in the aftermath of disasters, there is a certain amount of support that is supplied by non-governmental organisations (NGOs) and civil society organisations (CSOs).In the West Balikpapan Barat sub-district and Balikpapan Kota Sub-District, despite 20% of the region being impacted by the disruption, all families have access to power and 95% have access to drinking water supplies. Approximately 60% of the population has the ability to use sanitary facilities, yet only 25% of solid waste undergoes treatment prior to disposal, and merely 10% of solid trash is recycled, either through formal or informal means. Over 20% of the region is allocated for transport infrastructure. All of the area can be reached by paved roads, and over 71% of the remaining roads are accessible even during regular flooding in the affected regions. However, only up to 60% of the roads have covered drains on the sides. Approximately 19% of the dwellings are constructed using non-permanent structures, while fewer than 10% of the buildings adhere to building rules. The area is non-hazardous since there are no residents residing in close proximity to contaminated industry or landfills.

The population growth is highly considerable, particularly in metropolitan areas, reaching 3.9%; nevertheless, a little more than a third of the population is either under the age of 12 or above the age of 62. Approximately 17% of the population is affected by diseases that are transmitted through water and vectors on an annual basis, while up to 90% of the population has access to primary healthcare services. When disasters and emergencies occurred, health facilities were able to meet the requirements of the community because they had the capacity and capability to cater to those requirements. There are fewer than fifty percent of the population that is illiterate, and the sub-district authority organises a disaster exercise on multiple occasions throughout the year. A little less than half of the population is involved in community activities, and the process of social integration that occurs amongst people of different ethnicities is relatively

uncomplicated. After a disaster, there is a very small amount of support from non-governmental organisations (NGOs) and civil society organisations (CSOs), despite the fact that the people are prepared for a disaster in terms of logistics, materials, and management.

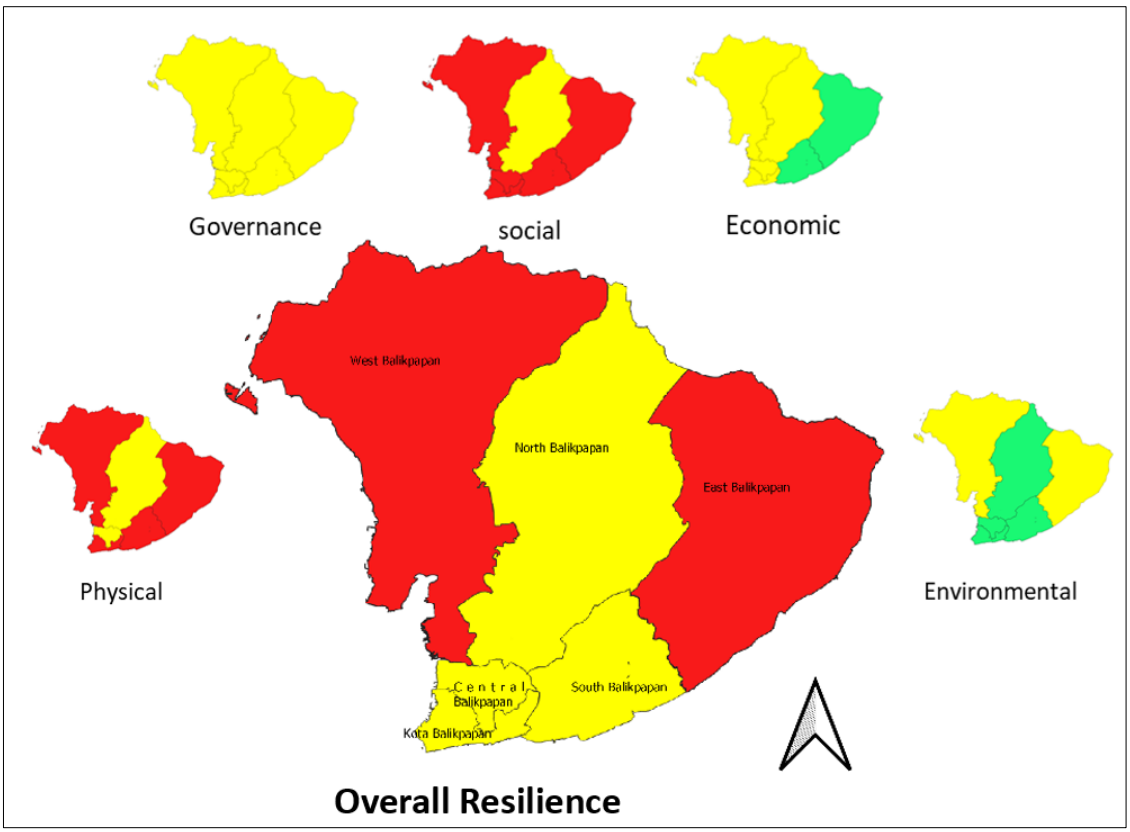

Table 6.3 Detailed Calculation of Dimension and Paramater

	Overall Balikpapan	North Balikpapan	South Balikpapan	Central Balikpapan	Balikpapan Kota	West Balikpapan	East Balikpapan
Social Dimension							
Social Capital	1.64	2.05	1.76	1.41	1.75	1.32	1.26
Awareness	1.72	2.98	1.42	1.01	1.9	1.38	1.64
Population	2.3	3.524	1.86	1.31	2.15	2.9	2.57
Health	1.7	2.481	1.33	1.72	1.53	1.25	1.89
Preparedness	1.6	2.98	1.85	1.12	1.77	1.05	1.22
Total	1.792	2.8	1.64	1.31	1.82	1.58	1.71
Environmental Dimension							
hazard intensity and frequency	2.1	2.17	2.9	2.89	2.56	1	1.11

	Overall Balikpapan	North Balikpapan	South Balikpapan	Central Balikpapan	Balikpapan Kota	West Balikpapan	East Balikpapan
number of different hazards	2	2.57	2	3.07	2	1.04	1.02
environmental policy	3.8	4	3.97	3.6	3.97	3.3	3.5
biodiversity index	3.4	3.8	3.89	4	3.87	2.22	1.95
land use policy	3.8	4	3.98	3.95	4	3.5	3.6
Total	3.02	3.3	3.34	3.5	3.28	2.1	2.2
Economic Dimension							
Disaster Insurance	1.8	1.75	2.1	1.48	2	1.55	2
Income	3.12	2.76	3.48	2.8	3.1	3.6	3.4
Employment	3.23	2.75	3.55	2.8	3.2	3.59	3.58
Assets	2.5	2.3	3.21	2	2.1	2.3	3.1
Saving and Budget	2.3	2.01	3.16	1.78	1.87	2	3
Total	2.59	2.3	3.1	2.18	2.4	2.6	3
Governance Dimension							
Institution collaborations	3.6	3.8	3.6	3.5	3.79	3.3	3.8
Volunterism	1.7	2	1	1.79	2	1	2.48
Disaster Aid Experience	2.1	2.98	2	1.93	2.11	1.41	2.26
Availability of Subsidies	1.7	1.74	1.5	1.8	2.1	1	1.97
Disaster Plan, Policy, and Program	3.9	4	3.8	4	4	3.5	4
Total	2.6	2.9	2.38	2.6	2.8	2	2.9
Physical Dimension							
Accessibility (Road and Basic Needs)	2.87	2.5	2.2	4	3	2.55	3
Electricity, Clean Sanitation, and Water Supply	2.95	2.6	2.33	3.8	3	3	3
Housing and building density	1.26	2.4	0.76	1.6	1	0.82	1
Evacuation route	1	1.45	0.82	1.14	1	0.64	1
Temporary housing	0.8	1.1	0.25	1.04	1	0.51	1
Total	1.73	2.01	1.27	2.316	1.8	1.5	1.8

In addition, the following table 6,3 is the calculation for overall resilience

Table 6.4 Overall Resilience

Dimension	Overall Resilience	Rank
Social	1.79	Vulnerable
Environmental	3.02	Resilience
Economic	2.59	Moderate Vulnerable
Governance	2.6	Moderate Vulnerable
Physical	1.73	Vulnerable

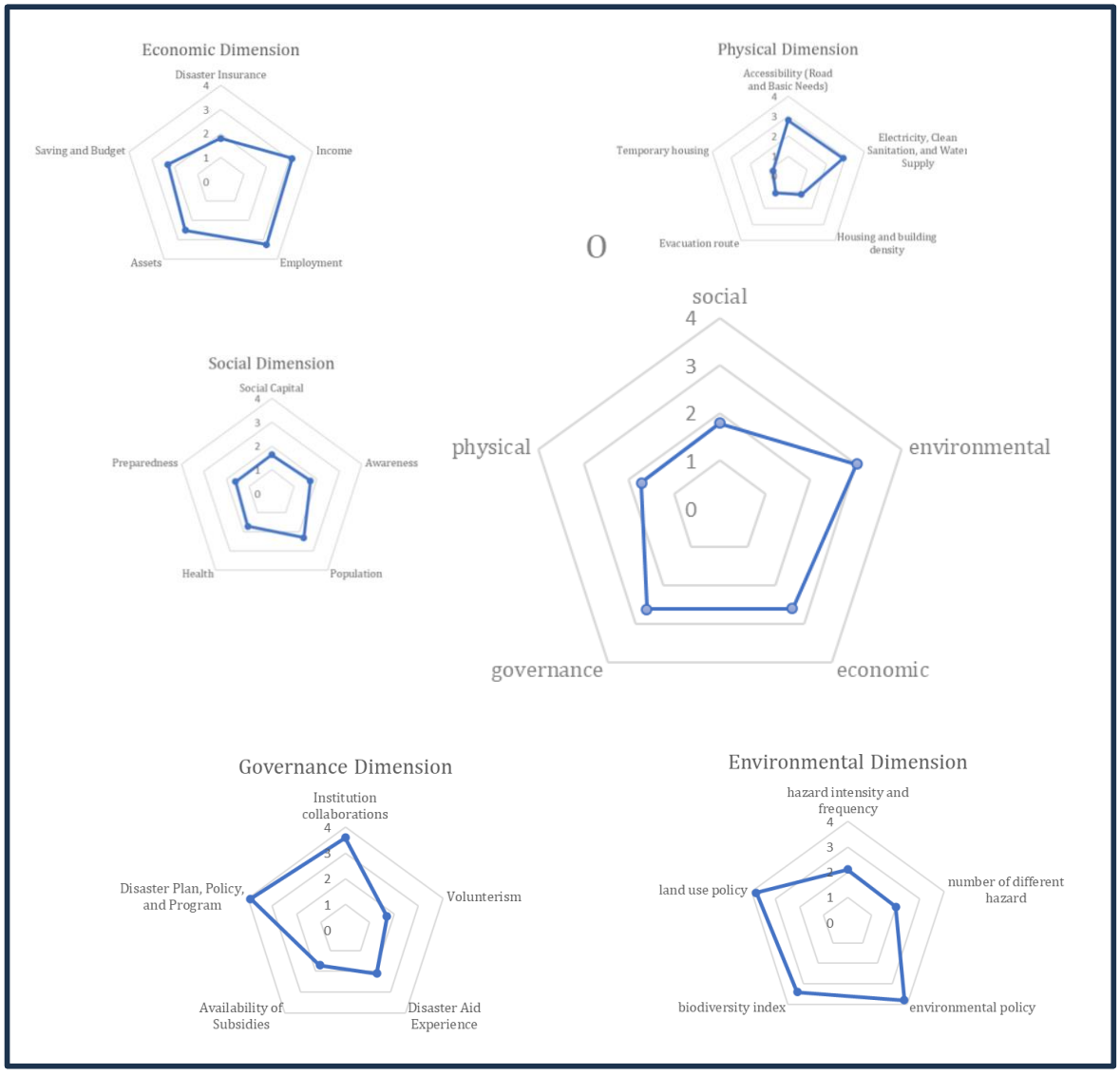

Figure 6.17 Resilience Result in City Level

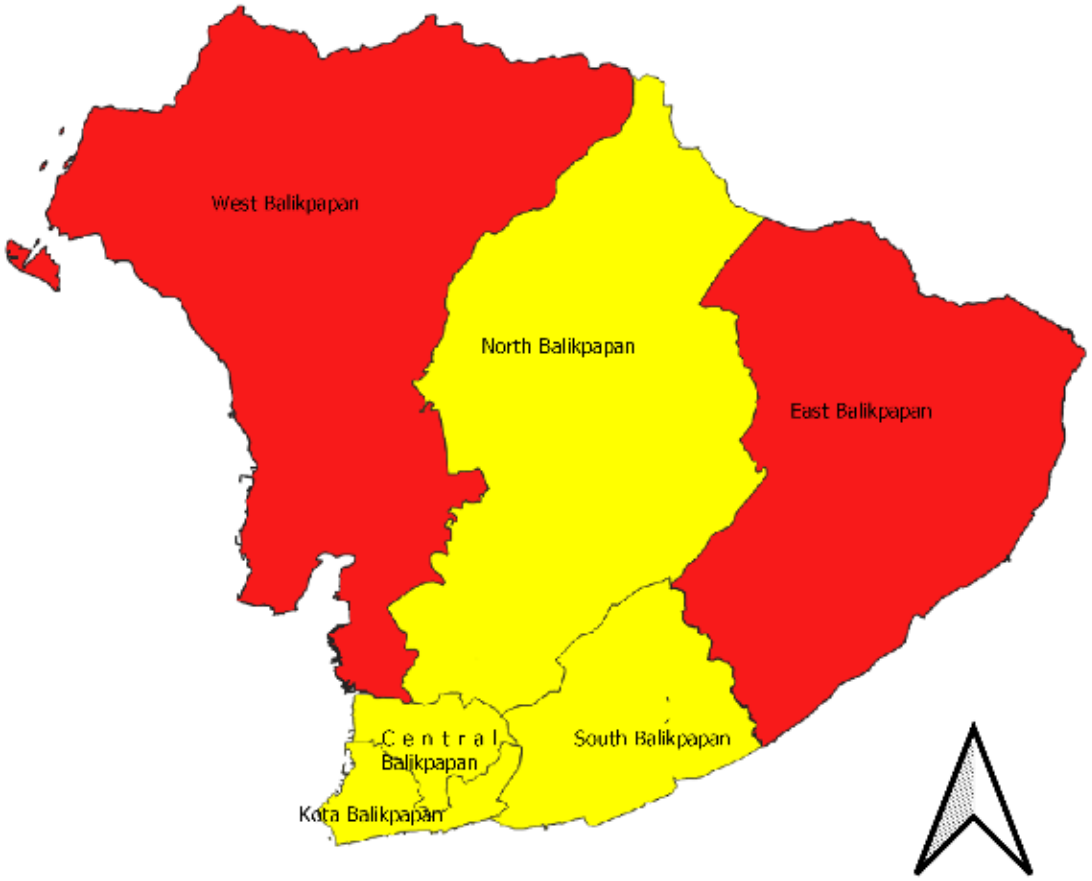

Figure 6.18 Overall Resilience

6.4 Risk Perception Analysis

In addition to deeper the study, researcher distributed to questionnaires to 156 respondents (72 for a vulnerable area and 84 for a moderately vulnerable area) using snowball sampling targeted in each selected area to analyse risk perception. The justification of sampling is based on Slovin calculation with the error 11% (0.11) and also number of neighbourhood, which can see in the table below.

Table sampling of Risk Perception Questionnaire

vulnerable			Moderate Vulnerable		
No	Sub-District	Neighbourhood	No	Sub-District	Neighbourhood
1.	West Balikpapan	223	1.	North Balikpapan	290
2.	East Balikpapan	93	2.	Central Balikpapan	285

vulnerable			Moderate Vulnerable		
			3.	Kota Balikpapan	200
			4.	South Balikpapan	269
	Total	316			1.044
	Sample minimal	65			76
	Actual Sample	72			84

$$n = \frac{N}{1 + Ne^2}$$

Slovin Equation

The results indicate that 55.8% of respondents were aware that they would experience greater impacts if they did not take preventive measures. Furthermore, the respondents said hazard that most threatens the community is flooding (51.9%) due to its frequency and damage cost. In addition, perception of the seriousness of natural hazards ：44.9% of respondents consider flood disasters in their area to be quite serious. However, only 44.9% of respondents put their trust in the disaster management program implemented by the government. Figure 6.17 illustrates the respondent characteristics. The questions and answer of risk perception are provided in Annex 4 and annex 5

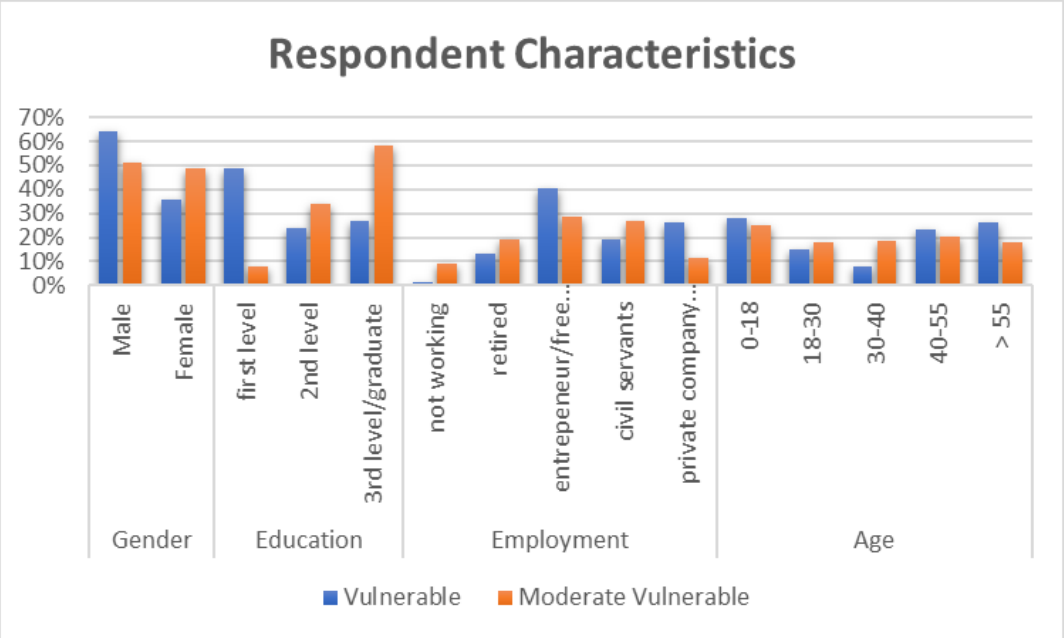

Figure 6.19 Respondent characteristics

The table above shows the characteristics of respondents to analyze risk perception. The characteristics of respondents vary greatly, but for vulnerable areas, it is dominated by male while in moderate vulnerable areas the proportion of men and female is the same. Likewise with the level of education. The hypothesis is that moderate vulnerable areas have a higher level of education than vulnerable areas. The questionnaire shows that this hypothesis is accepted or true. Then for employment, around 40% have livelihoods as freelancers or entrepreneurs.

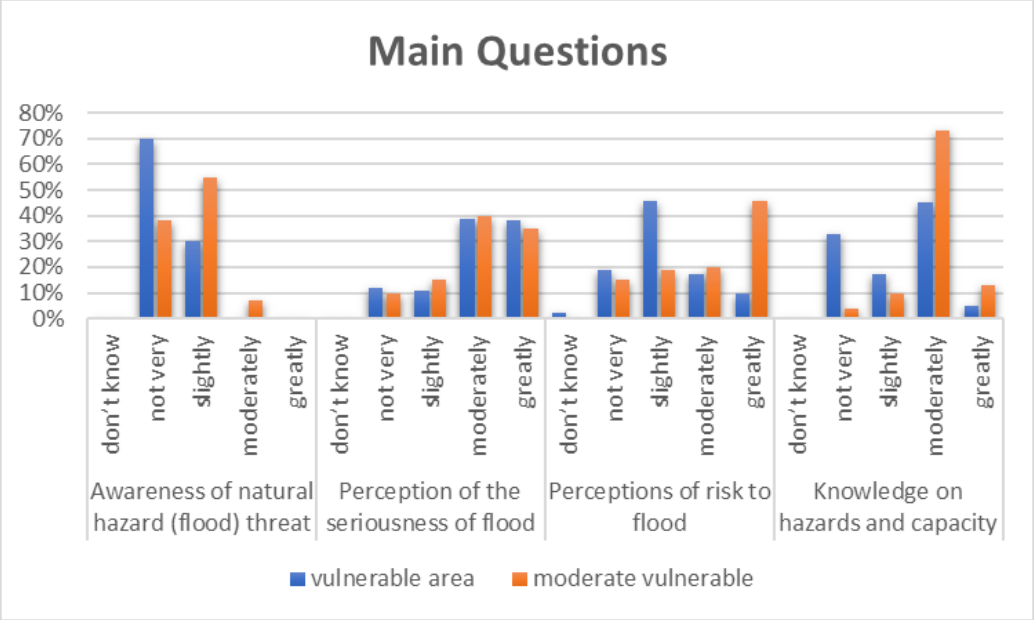

Figure 6.20 Main Questions of Risk Perception

To find out the risk perception, there are 4 main questions asked to respondents, the first is about their awareness of flood disasters. Then how seriously they take flooding as a disaster. The third question was about the perception of the risk of flooding in their area. Finally, they were asked about their knowledge and capacity on how to deal with flood disasters. In this case, there are several activities (Figure 6.19) carried out by the community to prevent flooding , which will be discussed in the next chapter. Herein, the analysis results of risk perception.

Table 6.5 Descriptive statistics of Flood Risk perceptions

Area	**Awareness**		**Seriousness**		**Risk**		**Knowledge**	
	mean	Standard deviation	mean	Standard deviation	mean	Standard deviation	mean	Standard deviation
Vulnerable	3.21	1.4	2.6	1.27	3.00	1.3	2.47	1.23
Moderate Vulnerable	3.69	1.46	3.63	1.41	3.98	1.15	3.38	1.32

There are some significant differences between vulnerable and moderately vulnerable areas related to risk perception. However, a significant difference occurs in the seriousness component, where people in vulnerable areas argue that they can live peacefully with disasters. they consider disasters to be a normal phenomenon. However, residents in moderate vulnerable areas, 55% of them already assume that if they do not take preventive action then they will be affected greatly in the future.

Figure 6.21 Community Key's Points of Flood Risk perceptions

Subsequently, during casual interviews, researchers endeavored to investigate the endeavors of locals in mitigating flooding. During the discussion, about 26 interviewees contended that elevating the foundation of their residences may effectively mitigate the risk of floods. Furthermore, they also install closed-circuit television (CCTV) systems as flood alarms and possess knowledge of the local environmental conditions. This is particularly important as the government does not provide any warning system in the event of significant rainfall. In addition, they proactively undertook the task of cleaning the drainage system to ensure the unobstructed movement of the river.

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Chapter 7

Community-Based Strategies to Enhance Resilience in Balikpapan City

7.1 Introduction

COVID-19 have been believed to be the most threatening biological hazard people have ever faced and draws attention to the severity of climate change. Since the COVID-19 outbreak, some researchers have discussed the urgency and its concerns related to climate change. Moreover, climate change issues have not been prioritized due to the COVID-19 impact(Loureiro & All, 2021). It is assumed that COVID-19 research and projects have the potential to put away from climate goals. However, climate-related disasters and COVID-19 have had the same massive influence(Izumi & Shaw, 2022). Evidence also showed that due to the government's lockdown strategy during COVID-19, economic activities in many sectors responsible for significant greenhouse gas (GHG) emissions have nearly collapsed (Leal et al., 2021). Moreover, current evidence in German shows that the staying-at-home strategy or isolating the effects of COVID-19 has increased energy consumption and greenhouse gas emissions (Halbrügge et al., 2021). In addition, the research conducted in Liberia revealed that climate-resilient initiatives also have adverse effects due to the COVID-19 crisis(Bodegom & Koopmanschap, 2020). Numerous studies on the correlation between COVID-19 and climate change have been examined during COVID-19. In the meantime, some researchers have questioned climate change's role as one of the possible causes of the emergence of this virus(Fuentes et al., 2020; Guo et al., 2020). However, only a few of them have researched incorporating climate change and COVID-19 as compound hazards into a concept of community resilience. For instance, previous research only discusses the relationship between climate change impact and COVID-19(Forster et al., 2020; Loureiro & All, 2021; Zou et al., 2020), COVID-19 and air quality (Vergata, 2020) and COVID-19 related to waste management (Singh et al., 2022; Szczygielski et al., 2022).

Climate change related disaster during COVID-19 negatively impact low-income communities in developing countries (John et al., 2022). As a developing country, Indonesia is simultaneously dealing with climate change impacts and COVID-19. According to the Indonesian Covid-19 task force website (covid-19.go.id), the total number of positive cases in January 2023 was 6,726,086 people, with 160,727 deaths. To deal with COVID-19, the Indonesian government (GoI) has implemented several national and regional policies, such as a lockdown strategy, social distancing and fund assistance (Ariyaningsih et al., 2021; Ayu et al., 2021). However, the COVID-19 outbreak has shown limitations in its regulations. Top-down approach has usually been used rather than the bottom-

up(Sacks et al., 2021). During COVID-19, Indonesia is still dealing with the climate change impacts and climate-related hazards, such as floods and landslides (Ariyaningsih et al., 2022; Ratih Indri Hapsari & Mohammad Zenurianto, 2016). From January 2022 to December 2022, 3,494 natural hazards were recorded in Indonesia. Floods are Indonesia's most common natural hazard, with 1,506 cases representing 43.1 per cent of total disaster cases. In addition, there were 1,045 extreme weather events, 633 landslides, 251 forest fires or land fires, 28 earthquakes, 26 erosions, and four droughts (BNPB, 2022). Developing and revising strategies or policies to manage not only the COVID-19 pandemic itself, but also potential impacts and interconnections with other crises such as climate crisis will be a constant challenge for countries while COVID-19 continues.

Comprehensive measures like climate change policies, legislation, strategies, and programs have been developed by Indonesia's government (GoI) to support adaptation and mitigation of climate change impacts (Net et al., 2019; Tacconi & Muttaqin, 2019). The government aims to reduce climate change impacts through land use planning, energy conservation, sustainable waste management, and clean and renewable energy sources. Unfortunately, the government cannot stand alone to tackle climate change impacts in the current era of global governance; instead, expanding the collaboration is highly required. Furthermore, a study conducted in Bangladesh highlights that the improved stakeholders' networks pattern is essential(Parvin et al., 2023). In line with that, the Government of Indonesia (GoI) has started collaboration among all stakeholders and communities to implement adaptation and mitigation actions effectively and achieve national climate goals ultimately (Net et al., 2019). As climatic hazards influence outbreak response worldwide, the COVID-19 pandemic will put governments at the greatest challenge in handling compound hazards. A long-term strategy for pandemic preparedness is necessary for climate adaptation, and immediate action is necessary to reduce deaths caused by climate change(Phillips et al., 2020).

Communities at the local level must be included in the planning process to mitigate the effects of climate change and the biological hazard (the COVID-19 pandemic) and disaster preparedness and response strategies. The community-based disaster approach has received much attention from researchers in recent years. For instance, this concept is used for flood disasters (Azizi et al., 2022), agriculture sectors (Gevaña et al., 2019; Ms, 2019), and other climate change issues (Busayo & Kalumba, 2021; Leknoi et al., 2022; Marasco et al., 2022). However, it is a well-known fact that the research discussing the role of the community in simultaneously coping with compound hazards like COVID-19 and climate change to assist government policies is extremely limited. The research on climate change and covid-19 only discuss the impacts of covid-19 or only focuses on the relationship (Fuentes et al., 2020; Ishiwatari et al., 2020; Sharifi & Khavarian-Garmsir, 2020; Vahidi et al., 2021). In light of the increasing amount

of evidence linking the COVID-19 pandemic and the growing frequency and severity of climatic hazards, this chapter tries to understand and measure the current condition of the local community to adapt to climate change related disaster during COVID-19. In addition, this chapter adopts a methodological literature review and interviews.

7.2 Identified Community-Based Strategies

It is well understood that communities stand to suffer the most in the event of a disaster(Phong & Shaw, 2009) because they are the first to experience the effects of disasters (Shaw, 2001). In the same situation when the pandemic was confirmed, most communities should be able to respond to this COVID-19. In some cases, the community are assisted by institutions to work together in dealing with this biological hazard (Botzen et al., 2021). Communities must be resilient in order to better prepare for, respond to, and recover from disasters. A people-centred DRR (Disaster Risk Reduction) program design is needed and understanding the community's exposure could help strengthen community disaster resilience(Mutiarni et al., 2022; Oktari et al., 2018). Moreover, there is growing evidence that a community-based approach can help to adapt and mitigate climate change's negative effects while fostering individual agency and societal resilience(Kirkby et al., 2018). Sustainable community resilience can only be encouraged with the local initiative's help and its residents' creativity. Therefore, international agencies, national and local governments, experts, academics, and NGO or non-profit organizations can help create locally relevant, sustainable, and culturally appropriate solutions by adequately supporting community-based approaches that directly engage the vulnerable population.

The resilience's capacity to ensure buffer capacity in the face of system damage can encourage scientifically grounded coordination and decision-making. When people have unequal opportunities to obtain necessities like food, water, and medical care, their social networks and social capital deteriorate as a result (Djalante et al., 2020). To survive the COVID-19 epidemic, people needed to rely on their connections to the community and traditional wisdom (Doren et al., 2023). However, local resilience to climate change has received little attention at Covid-19 since community resilience to disasters like climate change is tied to certain essential features inside the community, including social capital, local resources, social innovation, and centralized decision-making. In the meantime, technological infrastructure built into cities can help people cope better in the face of a pandemic (Ningrum & Subroto, 2022). Interventions to promote resilience at the local level should address the potential effects of the intervention on system resilience rather than focusing solely on one form of climate impact(Choko et al., n.d.). Thus, it is preferable to engage in measures that lessen the system's

exposure to risk as a whole rather than those that address a single risk factor (Choko et al., n.d.). Last, there are numerous aspects to consider. Yet, two key obstacles that question the environmental and social sustainability paradigms associated with resilience are climate change, urban planning in light of the COVID-19 outbreak, and post-COVID-19 challenges. Here is 7 autonomous adaptation that identified in Balikpapan to reduce climate-related disaster.

7.2.1 Mangrove conservation for preventing erosion and coastal flooding

One of the example mangrove area is Teritip. Teritip Mangrove Protection Area was initiated as a mangrove protection area since 2006 by the Teritip community group facilitated by the city government through the environmental agency. In its development strategy, this area is directed as an ecotourism area. In 2010, the Department of Agriculture, Marine and Fisheries of Balikpapan City has built ecotourism infrastructure facilities in the form of ironwood road (tracking), supporting buildings and accessibility improvement to the area has also been pursued by the Department of Public Works of Balikpapan City. Mangrove protection areas (DPM) are located along the Manggar River with an area of 168.73 hectares with more than 50% closure conditions. Mangrove areas in Manggar River are spread across 89.03 hectares of Manggar Village, 53.14 hectares of Lamaru Village and 25.53 hectares of Manggar Baru Village. Together with government, communities asked to implementing breakwaters and planting mangroves on the shore to mitigate the risk of floods caused by strong waves (Installation of wave-breaking structures). This kind of autonomous adaptation can reduce coastal flood risk for fisherman housing.

7.2.2 Stilt house

Stakeholders have expressed that relocating the dense population in locations prone to tidal flooding may not be feasible, and so the focus should be on improving construction arrangements. The building arrangement in question refers to the reconfiguration of buildings that were previously susceptible to tidal flooding in order to mitigate the impact of tidal flooding. Tidal flooding. The architectural layout prioritizes structures that are more susceptible to tidal floods, specifically those located at the river's edge. The building is designed in the shape of a house on stilts to mitigate the impact of periodic tidal floods, therefore ensuring minimal disruption due to its adaptive structure.

7.2.3 Rainwater harvesting System

Filtered rainwater harvesting is a method of gathering rainwater by directing it from the roof into a storage container using a pipe put at the roof's base. This method necessitates multiple filters, including small ball filters that effectively strain both fine and coarse dust particles from rainwater. Following is

a filtration system consisting of gravel and palm fiber, designed to effectively remove dust and other fine particles from the collected water, resulting in a low turbidity level and making it acceptable for various uses. Additionally, this filter aids in oxygenation of the rainwater throughout the collection process. The filter materials consist of gravel and palm fiber, which are put in successive layers with a thickness of 15 cm each. The construction of rainwater harvesting buildings can be expedited due to its straightforward and uncomplicated manufacturing process. The primary elements of rainwater harvesting infrastructure include: roof, collector channel, debris-filtering mechanism to remove leaves or other particles carried by the water, and rainwater catchment basin.

7.2.4 Biopore Absortion hole technology

The implementation of biopore infiltration holes (LRB) is crucial in mitigating flood disasters. The presence of LRB is anticipated to serve as a mechanism that can immediately yield advantages to the community. The advantages of LRB will manifest as enhanced rainwater absorption into the soil, hence mitigating stagnant water and the potential for flooding caused by overflowing rainwater. The LRB can function as a conventional facility for disposing of organic waste, wherein the organic waste will undergo decomposition by soil biota, resulting in the production of compost suitable for agricultural crops. The collaboration will persist, particularly by leveraging the government and community's support, spirit, and unity.

7.2.5 Climate Village

The Government of Indonesia (GoI) launched a ground-breaking project in 2012 through the Ministry of Environment and Forestry(MoEF), known as "Kampung Iklim" (or *ProKlim* (Sumbodo et al., n.d.). *ProKlim*'s primary goal is to raise public awareness of climate change and its impacts on Indonesia, strengthen community resilience, and promote a low-carbon lifestyle. In addition, based on Director General of Climate Change Number in 2017, Proklim's objectives include improving local communities' ability to adapt to climate change and involving more communities to share information and best adaptation and mitigation practices. According to legislation by Minister of Environment and Forestry of the Republic of Indonesia in 2016, *ProKlim* (Program Kampung Iklim) is an award that recognizes local climate actions taken by community villages. Proklim also aims to strengthen and enhance communities through government support and expand community participation and stakeholder involvement, such as the private sector, civil society organizations, NGOs, and academia. Furthermore, to prioritize this program, the government includes ProKlim in the national medium-term strategic program, which will continue to be strengthened and prioritized until 2030, with a target of 20,000 villages or sub-districts by 2025.

7.3 Material and Methods

A scoping review of grey literature is conducted to achieve our research goal. While systematic reviews are frequently used to report on the efficacy of interventions, scoping reviews are better suited to answering more broad questions, and it can be used to cover knowledge gaps in the current body of literature(Arksey & O'Malley, 2005). Documents from the grey literature can benefit practitioners and decision-makers in various sectors since they usually include policy and research information from credible sources and are easily accessible (Godin et al., 2015).

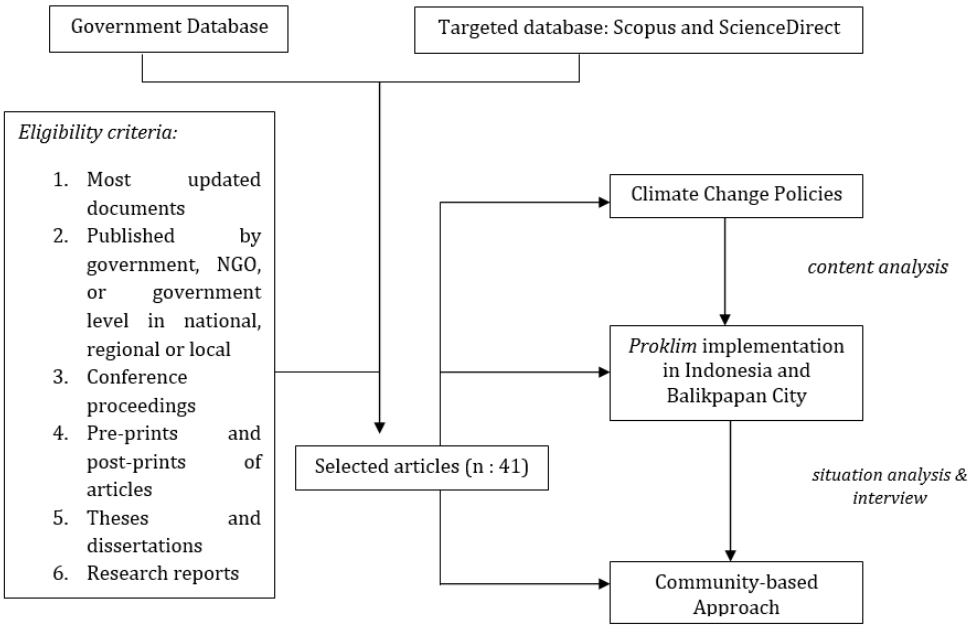

Figure 7.1 Research Flowchart (Source : authors)

The following is a description of the analysis stages carried out in this study, and the flow of the research can be seen in **Figure 7.1**

Step 1 : Content analysis. This step, regulations and literature were reviewed. The qualitative phase was done by analyzing relevant Indonesian laws in climate village (*ProKlim* Policy). Literature review related to climate-smart villages and community-based approach (the result of the literature review can be seen in the previous sub-section, which are 2.1 and 2.2). In addition, policy review and policy analysis are done in this step.

Step 2 : Situation analysis and interview. From Step 1, the policy and literature review results were compared to the climate village's current condition and implementation. The respondents were chosen based on purposive sampling from each village (15 villages selected). During the interview, respondents were asked about five indicators for measuring smart villages condition (Resilience, Mobility, Community, Perspectives, and Digitization). The scoring is used to describe the

state of Balikpapan villages. Each condition was rated between 1 (poor, not available/nonexistent) and 5 (good, fully sufficient). The combination of this process generates the strategies for a community-based approach for climate-smart communities for managing compound hazards: Climate Change and Covid-19.

7.4 *Kampung* Toward Climate Smart Village for Managing Multiple Hazard

After COVID-19 began, several climate hazards collided with the outbreak, putting vulnerable people at risk(Phillips et al., 2020). Besides the COVID-19's sudden impact, climate change's impact, such as flooding, landslides, and heatwave, worsens yearly. To overcome climate change issues, the village community has implemented an adaptation and mitigation plan at the lowest level to deal with climate change impacts, such as raising floors and roofs to avoid the flood risk that inundates the community house. COVID-19, on the other hand, significantly influences climate change adaptation and mitigation strategies (Science, 2021). The fact is that COVID-19 has caused significant delays in implementing many programs, including green and climate-smart initiatives in many countries(Bodegom & Koopmanschap, 2020). On the other hand, the lesson of the COVID-19 pandemic includes the importance of taking a holistic and balanced approach to managing environmental and climatic factors, especially at the local or village level (Rasul, 2021).

Kampungs are a type of settlement in Indonesia with unique characteristics (Funo et al., 2002). In Indonesia, the village (or *kampung*) is at the lowest administrative level and is particularly vulnerable to climate change(Wahyudi & Lasekti, 2020). *Kampung* means village (kampong in Malaysia-Melayu language) and it is applied to describe to administrative of a rural village in Indonesia, the same as the term “desa”(Funo et al., 2002; Sukotjo, 1965). Moreover, an urban *kampung* is typically populated by people who have relocated from a rural village searching for employment. As a result, the community shares the same characteristics. This urban *kampung* preserves the characteristics of a village in an urban area while also transforming the economic activity of its residents from primary (agriculture and livestock) to formal-informal livelihood(Funo et al., 2002; Sumbodo et al., n.d.).

At the village level, a climate-smart village is a grand European concept to tackle climate change locally. In this definition, the term “smart villages” refers to communities that refuse to expect change and instead take the idea and initiative, shifting from reactive to proactive (Sobolewska-mikulska & Mroczkowski, 2021). One envisioned outcome of a "smart village" is smart growth or an economy based on learning, discovery, and invention(Guzal-Dec et al., 2019). In addition, the smart village’s idea is represented as a development model centred on 5 (five) main

categories: Resilience, Mobility, Community, Perspectives, and Digitalization(Chmiel et al., 2023). In this classification, resilience means implementing pro-environmental policies and solutions, increasing local food production and availability, and strengthening working and pre-working-age citizens' hard and soft skills. For mobility, it guarantees public transport in those areas is integrated, including accessibility and condition of transport facilities and infrastructure. In addition, community in this category refers to community activity and social participation, whether active or passive. Perspectives define activities that foster a cohesive and active community as social participation. In the meantime, digitalization ensures Internet access, including for the elderly and those at risk of digital poverty or social exclusion; digitalization of public services(Chmiel et al., 2023; Komorowski, 2020; Sanogo et al., 2020; Zavratnik et al., 2018)

While the idea of a "smart village" is based on the larger model of a "smart city," the challenges that rural and urban areas face appear to be unique and require different solutions when these two ideas are implemented(Komorowski, 2020; Roidatua & Purbantara, 2021; Zavratnik et al., 2018). Watching the discrepancy between rural and urban areas, it argues that sustainable development in both "smart" settlements—cities and villages—requires a focus on the community rather than on other parts(Zavratnik et al., 2018). In addition, research on smart villages can be divided into 8 (eight) categories: social, material, technical, organizational, economic, administrative, technological, and auxiliary, which include public services and technology (e.g., objectives, challenges, and conditions)(Zavratnik et al., 2018). Even though culture is not discussed much in the current literature, it plays an essential role and should not be ignored in smart villages(Chmiel et al., 2023; Net et al., 2019; X. Wang et al., 2022). Although digitalization and inventiveness are central to the idea of smart villages, this term cannot be overly defined because it implies processes in the context of responses and transformations to the causing challenges rather than specific domains of activity.

The European Union has adopted a comprehensive and integrative strategy to achieve the same ends. For instance, the German project *Digitale Dörfer* running from 2015 to 2019, provides another example of implementing the Smart village concept (Development, 2019). Since most Germans (63.3 per cent) reside in rural areas, the smart strategy for rural development is consistent with the country's overall development objectives. Increasingly urbanization is not resistant to COVID-19 so the climate adaptation community needs to work on a long-term plan for COVID-19 preparedness (Carlson et al., 2021; Di et al., 2020; Phillips et al., 2020; Zavratnik et al., 2018). Environmental (sustainable management of resources, ecosystem resilience) and socioeconomic (institutional

organization, empowerment, food security) factors are both considered in the climate-smart village approach, which encourages the development of context-specific land management practices through community participation (Sanogo et al., 2020). When a climate-smart village strategy was implemented, an innovation platform emerged as the method's primary driving force (Raile et al., 2019; Sanogo et al., 2020). Finally, the smart abilities of the residents of a community determine how "smart" that community is. The extent to which we can shape knowledge is primarily determined by the community's needs (Q. Wang, 2022).

7.5 Climate Village (ProKlim) Policies on the National Level

Article 70 of the Law of the Republic of Indonesia No. 32 of 2009 on Environmental Protection and Management mentions that the community has the same rights and opportunities to participate actively in environmental protection and management. To support the community's rights and opportunities, the Indonesian government has been trying to improve environmental regulations related to village development, as seen in the **(Figure 7.2).** Climate change policies come in various forms, including laws, government regulations, and presidential decrees. Indonesia became aware of climate change since approving the UNFCC (United Nations Framework Convention on Climate Change); as a result, in 2010, Indonesia developed the Indonesia Climate Change Sectoral Roadmap (ICCSR), which was later translated into the 2014 National Action Plan for Climate Change Adaptation (RAN-API).

Indonesia has approved and signed the Paris Agreement through Law No. 16/2016 to increase its dedication to tackling climate change based on data Government of Indonesia in 2016(Oktari et al., 2022). To support Paris Agreement, at the end of 2016, Indonesia launched Climate Village Program (*ProKlim*) to enhance adaptation and mitigation of climate change regulation. *ProKlim* has a legislative framework for implementation in the structure of Minister of Environment Regulation No. 19/2012 on the Climate Village Program. The Regulation of the Minister of Environment and Forestry Number: P.84/MenLHK-Setjen/Kum.1/11/2016 on the Climate Village Program serves as the legal foundation or legal umbrella for *ProKlim*, which has been followed by the Regulation of the Director General of Climate Change Control Number: P.1/PPI/SET/KUM.1/2/2017 on Guidelines for Implementing the Climate Village Program. In addition, the updated regulation regarding *ProKlim* is Regulation of the Director General of Climate Change Number P.4/PPI/API/PPI.0/3/2021 Concerning Guidelines for Implementing the Climate Village Program.

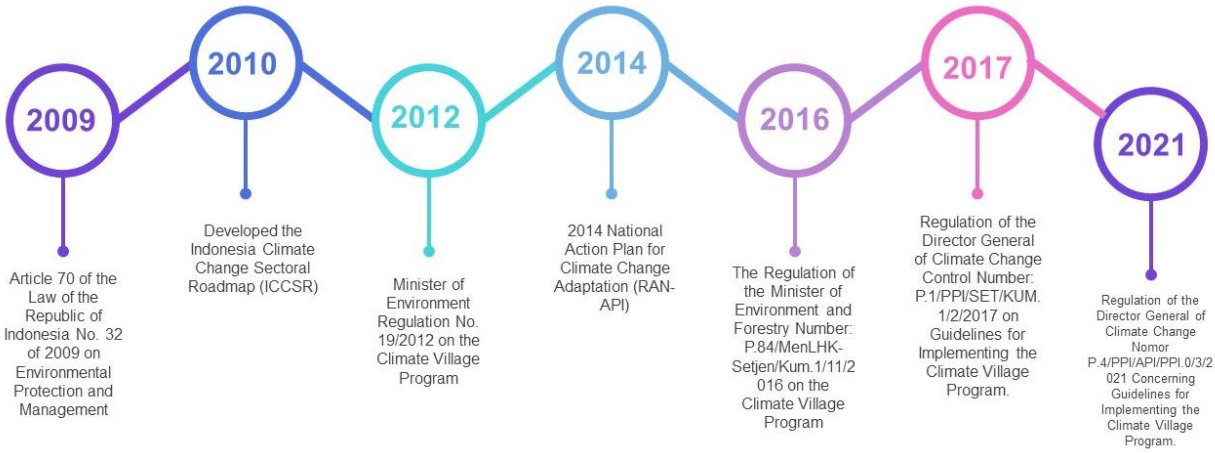

Figure 7.2 History of Climate Village (Kampung Iklim) Policy in Indonesia (source: authors, adapted from Ministry of Environment and Forestry (MoEF))

The Ministry of Environment and Forests (MoEF) is in charge of the national-level *ProKlim* program, which aims to enhance stakeholder participation, including the community, in building resilience to climate change impacts and decreasing GHG (Green Gas House) emissions, as well as recognizing mitigation and adaptation action plan that can improve local welfare (Nugroho et al., 2022). *ProKlim* has the potential to provide knowledge and skills to the community to face and tackle the climate change impacts as an empowerment approach to achieve local SDGs (sustainable development goals). *ProKlim* is a bottom-up policy set by the government to achieve the Nationally Determined Contribution (NDC) target in 2030, where Indonesia aims to reduce greenhouse gas emissions by 29 (twenty-nine) per cent by their (government) effort to 41 (fourty-one) percent (in collaboration with the international agency) as part of Indonesia's commitment to the Paris Agreement, which has previously been followed up in the form of the issuance of the Law of the Republic of Indonesia(Wiati et al., 2022). The growth of *ProKlim* through the enrichment of innovative climate change adaptation and mitigation initiatives implemented in collaboration between the government (party) and "Non-Party Stakeholders". The empowerment of communities in *ProKlim* is intended to improve their capacity to adapt to and mitigate climate change. In the practical sphere, community empowerment has guided the success of development programs, particularly in rural areas. *ProKlim* is thus handled to succeed in both community sustainability and independence(Wiati et al., 2022).

Climate change adaptation and mitigation measures are the key components of *ProKlim* implementation, with the types of activities chosen by the Ministry of Environment and Forestry. Adaptation measures include a) climate disaster management, b) boosting food security, c) dealing with or anticipating

climate disasters in coastal areas, and d) controlling climate-related diseases. While mitigation measures include a) waste and waste management, b) the application of new renewable energy and energy conservation, c) low GHG emission agricultural production, d) increasing plant cover, and e) forest and land fire prevention and control. The government intends to record *ProKlim* activities in more than 10,000 Climate Village locations scattered across all provinces in Indonesia to indicate *ProKlim*'s success in achieving Indonesia's 2030 NDC objective. By 2030, each district/city in Indonesia is scheduled to have at least 20 *ProKlim* locations of various types, including Pratama, Madya, Utama, and Lestari.

7.6 Implementation Climate Village (Kampung Iklim) in Balikpapan City

Balikpapan City relies on the direct trade and industry centre for its economy. (Lahjie et al., 2019) so there are many urban villages in this city. In addition, Balikpapan City was also chosen because of its vulnerability to climate change issues, particularly flood risk, and community interest in understanding climate change and developing strategies to address negative impacts (Ariyaningsih et al., 2022). Furthermore, according to Covid-19 national data, Balikpapan City was the largest contributor to COVID-19 cases in has registered 15 *kampungs* of its communities in the government's climate village program. According to data from the Balikpapan City Environmental Agency (2022), only three villages were registered with *ProKlim* in 2018 (Teritip, Manggar, and Lamaru). Further, in 2019, villages were registered, namely the Kariangau and Karangjoang villages. When the pandemic started in 2020, surprisingly, Balikpapan city increased a total of 12 climate villages which was reported in *ProKlim*. However, in 2021, only three villages took part in this program. Finally, Balikpapan city has 15 *ProKlim* villages until now. **Figure 7.3** shows the distribution of *Kampung* Iklim in (Balikpapan City), Indonesia.2021 compared to other cities in East Kalimantan Province. Moreover, Balikpapan

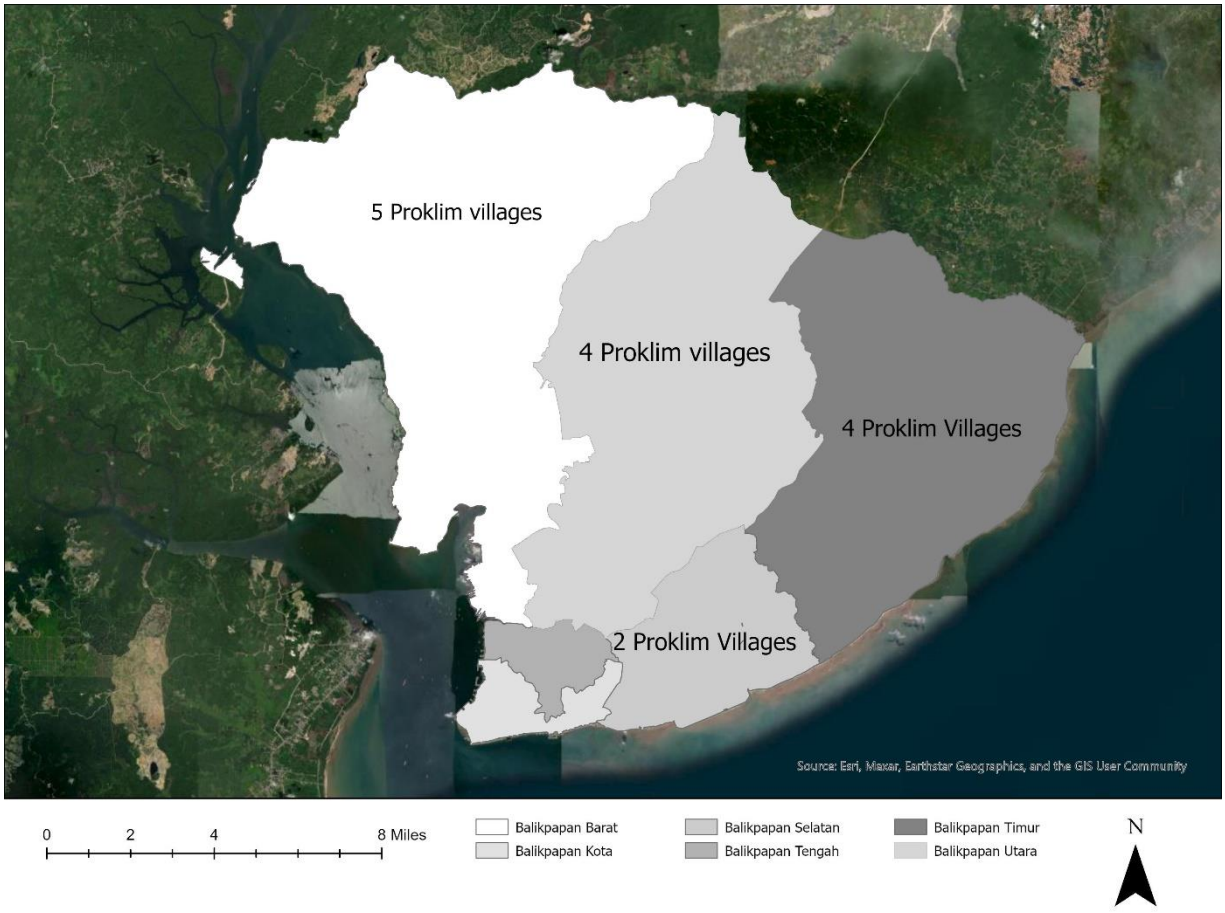

Figure 7.3 *ProKlim (Kampung Iklim)* in Balikpapan City (source : authors with data from Balikpapan City Environmental Agency, 2022)

East Kalimantan has joined FCPF (Forest Carbon Partnership Facility) program, a global partnership of government, business, civil society, and indigenous peoples that focuses on reducing deforestation and forest degradation emissions, conserving forest carbon stocks, implementing sustainable forest management, and increasing forest carbon stocks in national development. The activities are called REDD + (Reducing Emissions from Deforestation and Forest Degradation), a mechanism to reduce greenhouse gas emissions by compensating parties which prevent deforestation and forest degradation(Harris et al., 2008). The ERPD proposal document mentions the *Balikpapan's kampung iklim* (climate village program), demonstrating Balikpapan is prepared to implement the *ProKlim*'s adaptation and mitigation programs based on East Borneo Environmental Agency in 2022.

In Balikpapan, the village program (Kampung Iklim program) is being implemented, and several villages are receiving financial assistance through CSR (Corporate Social Responsibilities). *ProKlim* in Manggar, for instance, is from the government and its community, The Agriculture and Fisheries Food Service, Non-Government Organization of Manggar Village, and public companies like *Pertamina RU (Refinery Unit) V*, *PT. Pama Persada*, and *PT. Thiess Haliburton*

Astra Group collaborated on this program as well. The activities at Manggar *ProKlim* include the conservation of mangrove forests for eco-tourism, waste management with a sanitary landfill system, and intercrop or polyculture for agricultural system. Meanwhile, in Kampung Baru village, the collaboration is with PT. Pama Persada and PT. THIESS, with supporting from the government program KOTAKU- "no slums in the cities" program.

Karangjoang's village program also collaborates under CSR (Corporate Social Responsibilities) scheme like Astra Company and State Electricity Company of Indonesia (PLN). According to observations and interview, *ProKlim* in Balikpapan have increased community awareness of nature. *Proklim* impacted the microclimate change by indirectly decreasing micro-temperature and contributing to lowering disaster risk by implementing mangrove conservation. Furthermore, *ProKlim* in Balikpapan is thought to be effective in preserving rainwater through rainwater harvesting, conserving biodiversity through mangrove conservation, securing food stock using hydroponic and aquaculture, providing green space for eco-tourism or leisure, and increasing social cohesion too. **Table 7.1** and **Figure 7.4** show the activities of *Proklim* in Balikpapan City.

Table 1 Climate Village (*ProKlim*) Activities in Balikpapan City, Indonesia

No	Location (Sub-Disctrict)	Location (Village)	Activities
1.	East Balikpapan (Balikpapan Timur)	Teritip	conservation of mangrove forests to address coastal abrasion and flooding
		Manggar	1. conservation of mangrove forests for eco-tourism 2. Balikpapan City waste management with a sanitary landfill system 3. Intercrop or polyculture
		Lamaru	conservation of mangrove forests to address coastal abrasion and flooding
		Manggar Baru	conservation of mangrove forests
2	North Balikpapan (Balikpapan Utara)	Karangjoang	agricultural cultivation
		Graha Indah	conservation of mangrove forests
		Batu Ampar	Waste management (3R) implementation
		Muara Rapak	conservation of mangrove forests
3	South Balikpapan (Balikpapan Selatan)	Sepinggan	1. agricultural cultivation 2. improved vegetation and land cover 3. Prevention of land and forest fire
		Sungai Nangka	Waste management (3R) implementation
4	West Balikpapan	Margasari	1. Implementation of rainwater harvesting 2. agricultural cultivation 3. eco-tourism of floating settlement

No	Location (Sub-Disctrict)	Location (Village)	Activities
	(Balikpapan Barat)	Baru Tengah	Waste management (3R) implementation
		Baru Ulu	Waste management (3R) implementation
		Kariangau	Agriculture, Forestry, and Land Use (AFOLU)
		Margomulyo	1. conservation of mangrove forests for eco-tourism 2. Implementation of waste bank

Source : authors, with data from Ministry of Environment and Forestry of the Republic of Indonesia (2022)

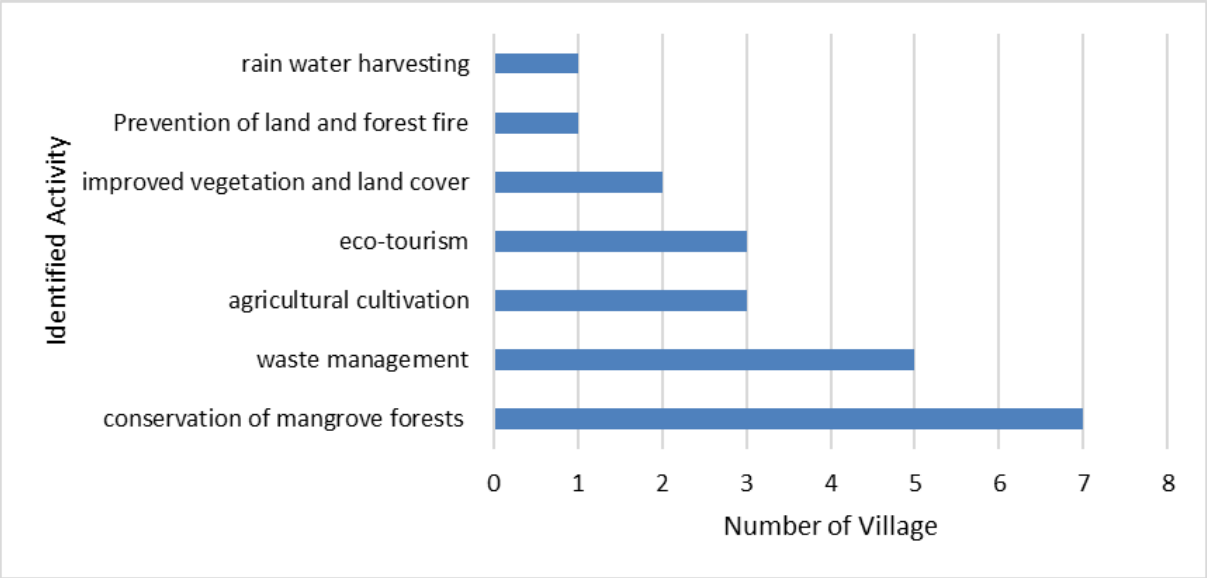

Figure 7.4 Number of Climate Village (*ProKlim*) Activity in Balikpapan City, Indonesia (Source : authors based on data collection)

In Balikpapan, where most of the area is coastal, mangrove conservation activities dominate the climate village program. Mangrove conservation activities in Balikpapan contribute to the local economy through eco-tourism, in addition to helping reduce the impact of climate change. It is emphasized that evolving forestry programs with the local community in Indonesia have improved the community's legal access to forest management to meet their livelihood needs while maintaining and improving forest cover (Indrajaya et al., 2022). Communities in Balikpapan Bay, East Kalimantan, whose livelihoods rely on the natural productivity of mangrove forests, have benefited economically from restoration activities through increased harvesting of wood and fish products (Indrajaya et al., 2022; Lahjie et al., 2019). In addition, here are the questions which are asked of respondents.

1. Digitalization : What importance using digital platform to this kampung

2. Resilience : Do this kampung have activities related to smart city to improve livelihood?
3. Mobility : Availability of network and accessibility to city centre and critical infrastructure
4. Perspective : How importance smart village to the community
5. Community : Avalilability of community organisastion and meeting (musrembang)

Furthermore, according to the respondents, *Kampung* Kangkung in Sumberejo village in Balikpapan City, established in 2019 by a community leader initiative, has the potential to become a climate village (kampung iklim) because the village has implemented food security measures and converted its garden land into educational tourism activities. Yet, that village does not have a *ProKlim* registration.

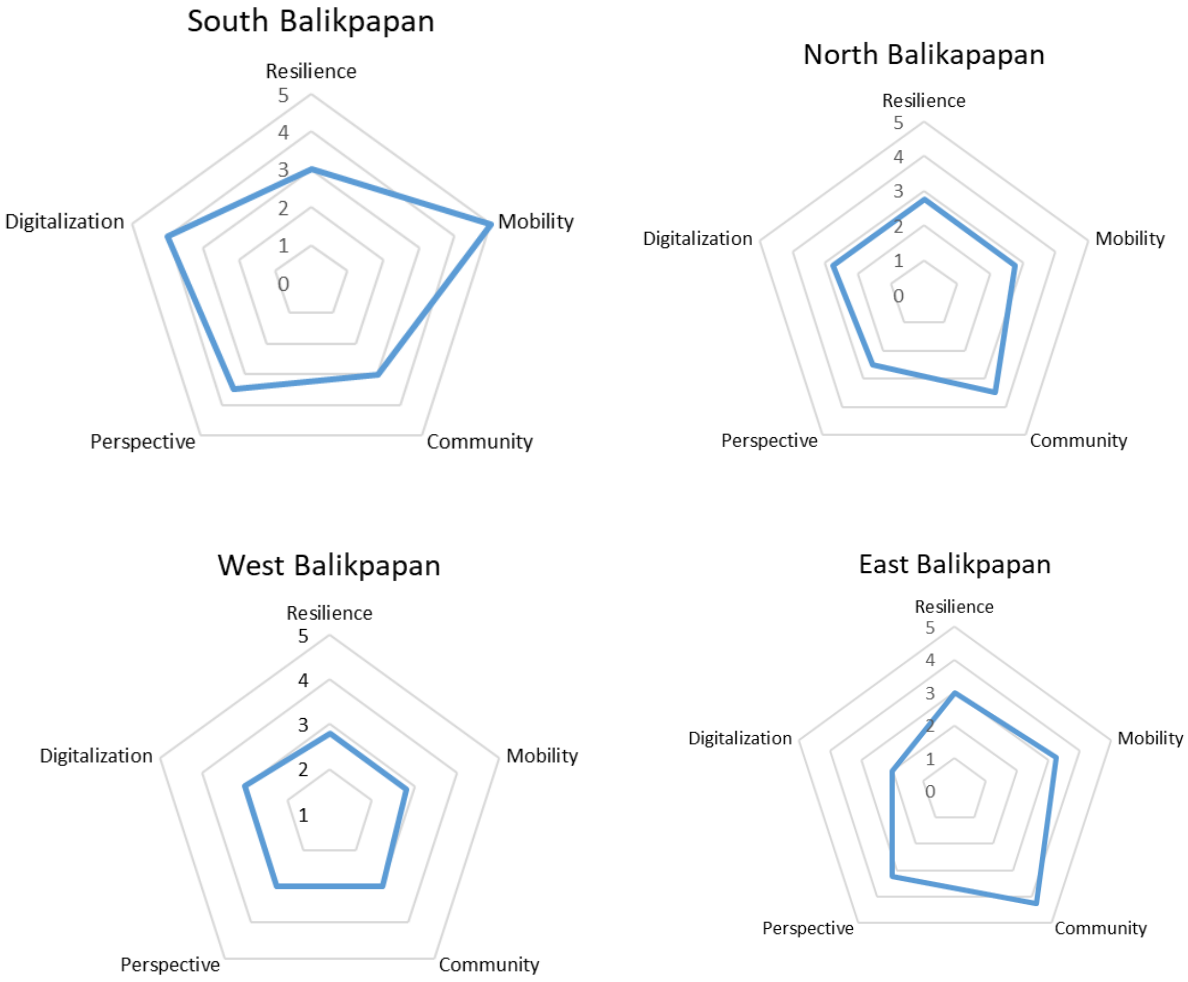

Figure 7.5 Smart Village Current Condition During Covid-19 in Balikpapan (source: authors analysis)

Waste management is the second most common activity in the climate village program. The construction of the Manggar landfill area is one example of waste management of innovations by using methane gas from waste as a source of electricity for lighting and an alternative fuel for gas stoves. Climate change mitigation activities in these kampungs include solid waste management through containerization and collection, processing, utilization, and application of the zero-waste concept. However, only one village used rainwater harvesting to address water issues in their community. Twelve of the fifteen respondents believe that the community has a deficient perception of the performance of *ProKlim* activities during covid-19; nonetheless, they are aware that the program is good and that the climate change issues are being addressed.

Regarding resilience, all respondents believe that implementing smart villages in *ProKlim* is still in its early stages and must seek innovation and system integration from smart cities and smart communities. Because most local governments and communities are used to working with individual systems, this integration is still a major challenge. **Figure 7.5** shows the community's perception of the existing conditions in the villages implementing *ProKlim* during covid-19. The clusters were divided into sub-districts by the researchers. According to the findings of the primary survey, East Balikpapan Sub-District ranks first in the community category. South Balikpapan, on the other hand, is positive in the Mobility category. South Balikpapan is a developed area that serves as the primary network for trade and business centres. Respondents agreed that mobility was their potential to implement the climate village program due to the good accessibility and well-connected road in South Balikpapan; on the other hand, people in East Balikpapan stated that the family character and community initiatives had a significant impact on the progress of *ProKlim* (climate village) program.

In North Balikpapan, the community category scores highly on the *Kampung Iklim (ProKlim)* activities. According to the interview results, many activities involve the community, which is classified as active in carrying out adaptation or mitigation in the climate village program. All categories in West Balikpapan have the same value. This category can be described as balanced, as nothing stands out. Overall, the climate village villages in Balikpapan have good implementation in terms of local food provision and sufficient participation to contribute to climate village program policies. However, digitalization is still far from expectations because some communities, especially elderly people, cannot access the internet due to a lack of Wi-Fi, and few residents have smartphones. In fact, digitalization is critical to implementing the smart village concept and supporting the village's goals. Moreover, respondents believe that social media platforms can help to communicate during covid-19, citizen participation, and interaction with local governments. Facebook, Twitter, and even Instagram are direct channels for citizens to communicate with local government and express

their desires. There is compelling evidence that social media assists governments in empowering citizens and expanding democracy, particularly in more open local governments(Bonsón et al., 2014, 2015).

7.7. Discussions

The current state of readiness of Balikpapan's climate villages to become smart villages is still in its early stages. This is proven by the fact that only a few villages have been registered in the climate village program (about 15 villages have been registered). They have the potential to become smart villages based on findings of the situation analysis. Digitalization technologies such as big data, AI, IoT used by the community can foster the smart village implementation. As stated in the literature review, digitalization is critical for the formation of smart villages and smart communities. As a result, digitalization has the potential to improve the innovation and transition that occurs in the traditional world, and digitalization in the village can be effectively implemented through the collaborative integration of businesses, community, and government municipalities (Kumar et al., 2022)

Stakeholders from the Government of East Kalimantan Province explained climate change policies in Regencies/Cities throughout East Kalimantan and climate change targets for 2030 aligned with Regional Strategic Planning.(Sumbodo et al., n.d.). Moreover, it is hoped that the City of Balikpapan can achieve climate resilience at the local level by reducing carbon emissions so that the threshold for increasing the earth's temperature below 2 degrees Celsius is maintained and that it can be reduced to 1.5 degrees Celsius. Mitigation and adaptation of climate change efforts at the site level are critical to building resilience in protecting food, water, and energy resources (Laukkonen et al., 2009). Current situation is that the government has fully supported it through *ProKlim*. Practically, however, community' readiness and awareness are still required to implement this program. *ProKlim* is intended to support low-carbon and climate-resilient development policies consistent with a commitment to contribute to global efforts to achieve the Sustainable Development Goals.

The active participation of the community and other stakeholders is required to build national resilience in the face of a changing climate and to meet the target of reducing GHG emissions set by Law Number 16 of 2016 (Net et al., 2019). With the preparation of the *ProKlim* Road Map, it is expected that strengthening local climate change adaptation and mitigation actions at the site level will run more efficiently, resulting in real positive benefits for the nation and state of Indonesia. Interventions and guidance provided by governments and multilateral institutions in response to COVID-19, the climate crisis, and their confluence must consider the communities' specific vulnerabilities, needs, and circumstances. Reflecting and conducting case studies at the community level, as well as investigating its integration with national regulations, the strategies that

can be implemented for the smart village program to support climate-smart communities showed at Figure 8 and described as follows:

A. Climate Village For Reducing Climate-Related Disaster.

The development of mangrove forests indirectly mitigates the impact of floods caused by tidal waves on land. Mangrove habitats have the ability to generate mud sedimentation, which serves as a natural barrier against tidal floods. Mangroves possess the ability to endure the movement of tidal water and also enhance the speed at which they absorb water. This climate village activity (conservation of mangrove) enables them to minimize the duration of inundation produced by floods. For coastal areas, the dissemination of hazard and risk maps depicting sea level rise can offer valuable insights to the community and external stakeholders about the patterns of sea level rise and the locations that are susceptible to coastal floods. Thus, it can serve as a valuable resource for the community to enhance and refurbish their residences while avoiding regions susceptible to tidal inundation. Furthermore, the presence of perils and dangers associated with the rise in sea levels can assist the government in developing regulatory measures to address the consequences of coastal floods.

Implementing a spatial design concept in a climatic village that is well-acquainted with catastrophes is essential for effectively mitigating the long-term consequences of floods. The existence of this spatial plan serves as a fundamental basis or point of reference for the organization and designation of buildings in the study area. Currently, the study area lacks organization and does not have a clear classification, which frequently exposes individuals to the risk of floods. Hence, there is a requirement for a spatial planning concept that takes into account both disaster and environmental factors, and is developed using field-specific case data. In order to mitigate the future impact of flooding, it is crucial to establish explicit regulations or zoning measures in areas prone to floods.

Prior to the occurrence of flooding in the study area, preparatory measures are undertaken to assess the community's preparation, evaluate evacuation equipment, and establish temporary evacuation locations. The community did not perceive the flood disaster as significant due to the relatively low height and intensity of the flood. Given the potential implications of climate change and the associated concerns, it is plausible that the sea level and rainfall will increase in the future as a result of the construction of the new capital city. As the height increases, the influence becomes more pronounced indirectly. Consequently, the implementation of evacuation training is being organized to assess the preparedness of the community, evacuation equipment, and temporary evacuation shelters, with the aim of enhancing long-term community readiness. The training enhances the community's confidence and proficiency in managing floods, although in an indirect manner.

B. Collaborative governance in the climate village program implementation

Problem-solving collaboration between departments or public organizations is possible(Lassa, 2019). This can require municipalities and/or government departments to share responsibility and authority with the private sector, local community, and stakeholders collaborating on problem-solving and decision-making (Meijer & Rodrı, 2016; Moloney & Fünfgeld, 2015; Roidatua & Purbantara, 2021). Based on the implementation of the *ProKlim* program in Balikpapan, it is possible to conclude that cities must address challenges, issues, and opportunities beyond policy enablers to control policies into relevant activities. Since the local government cannot achieve success on its own, it may be beneficial to enable the integration of policies at various levels of government, encouraging the participation of a diverse range of stakeholders, implementing an open data policy that makes data freely available to the public without restrictions, and investigating new and novel sources of funding that could assist cities in successfully implementing environmentally friendly projects(Hammi et al., 2018; Kitchin, 2014; Sobolewska-mikulska & Mroczkowski, 2021). Therefore, institutional design, which is based on participatory inclusiveness, forum exclusivity, clear ground rules, and process transparency, can support and collaborate with various parties in Smart Village activities (Roidatua & Purbantara, 2021).

The difficulty of collecting data, evaluating effectiveness, and considering potential trade-offs and synergies across domains is exacerbated because adaptation and mitigation cross traditional sectoral boundaries. For instance, adaptation measures are frequently associated with long timelines and ambiguous, potentially shifting goals. Measuring its impact using conventional government planning can be challenging. To address these issues, collaboration can occur at various levels and can be inter-organizational, cross-sectoral, or through government-community relations(Nam & Pardo, 2011, 2014; Tuya, 2021). Integration and collaboration between governments are also tricky when each government's programs and plans overlap(Roidatua & Purbantara, 2021; Takara, 2018). As a result, the program's implementation is rendered ineffective. As a result, the climate village program must be integrated with low-emission spatial planning and development plans and participatory and transparent management.

C. Promoting the climate village program to other sectors for ICT.

The findings show that digitalization is low in Balikpapan's *ProKlim*. On the other hand, technology incorporates a wide range of tools to facilitates data and information sharing between city administrations, government institutions and departments, citizens, and all parties involved in smart city projects. Some examples include wired, and wireless internet access, interconnected and ubiquitous computer networks, always-on systems, completely virtual technologies, and an architecture focused on providing user services (Anthopoulos

& Reddick, 2016; Gil-Garcia et al., 2015). Social media and other ICT-based applications can increase community engagement in public debates and inform government about community needs.

The community can then be viewed as one of the primary sources of information about what is going on in the site or village(Castelnovo & Savoldelli, n.d.; Krongthaeo et al., 2021; Marasco et al., 2022). The implementation stages of Kampung UKM Digital are carried out in stages by involving the existing pentahelix stakeholders including the Government, Community, Business Actors, Academics and also the Media. All of these parties are expected to collaborate to advance SMEs through the use of ICT. The implementation stages of this Digital SME Village include:

- Initiation of cooperation with existing pentahelix stakeholders (Government, Community, Business Actors, Academics and Media).
- Attraction of infrastructure networks to the SME Village location.
- ICT training and coaching for SME Village managers.
- Implementation of ICT services and solutions (online portals, bostoko, and other ICT services) in the SME village environment.
- Cooperation with other SME communities and related stakeholders for business coaching. for business coaching.
- Development or duplication of the implementation of Kampung UKM Digital implementation in other SME Villages that have not yet utilized ICT.
- Provision of other products and services for the extension of services to SME services, especially for the business environment.

Establishing smart communities in smart cities typically has intersectoral links and promotes community participation in decision-making, monitoring services, and supporting feedback beyond collaboration between government agencies(Alawadhi et al., 2017). Furthermore, external collaboration can be improved through involvement and partnership with stakeholders such as private companies, universities, community representatives, and specific groups (Haines et al., 2011; Hidayat, 2020; Roidatua & Purbantara, 2021). They collaborate with companies to ensure the success of *ProKlim* activities, just as the villages in Balikpapan have done. Public-private partnerships (P-P-Ps), inter-sectoral partnerships, and relationships with citizens whose lives are tangentially impacted by *ProKlim* activities are all examples of external collaboration. The local community must be able to keep up with the development of new technologies and smart processes, posing a challenge to government agencies(Nam & Pardo, 2011). In addition, this impedes the government's efforts to address human resources issues and the limited budget, limiting progress in some areas. Collaboration between universities, companies, and government are one strategy to overcome this issue.

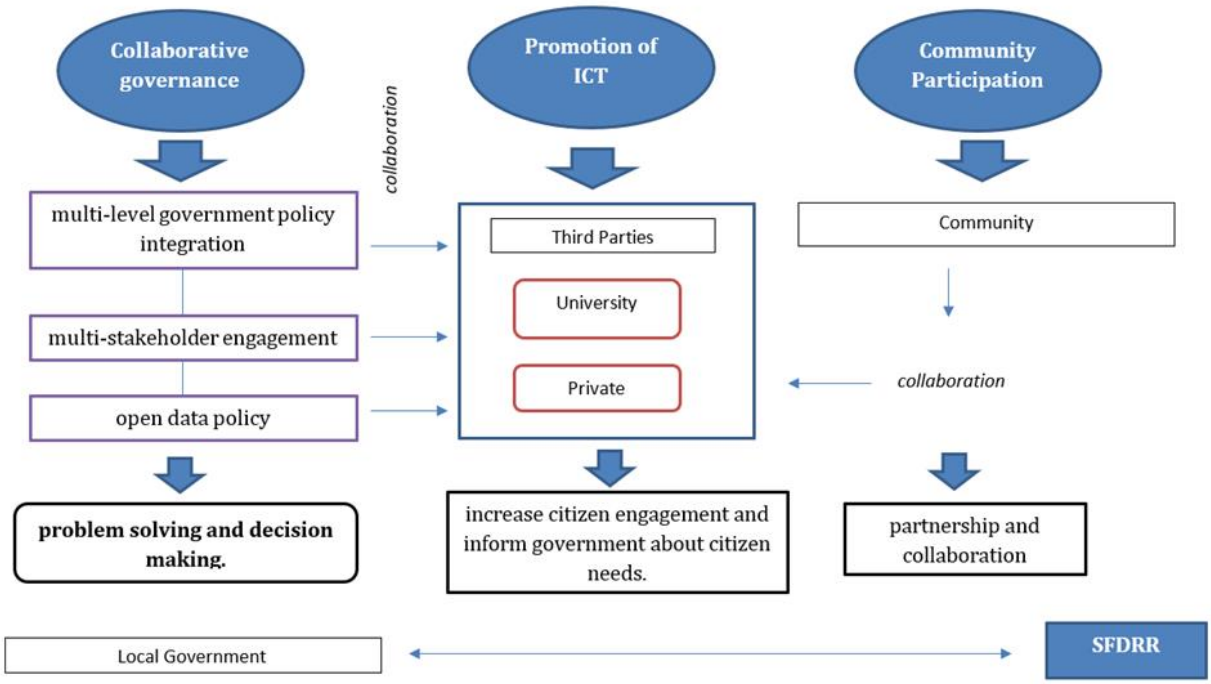

Figure 7.6 Feasible Framework to Support Smart Climate Communities for Climate Village (Source : authors)

D. Strengthening Community Participation in the Smart Village Concept Implementation

Consistent with the literature review, the data analysis reveals that ICT (Information and Communication Technology) significantly facilitates information and sharing and integrates government and community. The relationship between communities and governments can be improved through community engagement because it promotes two-way communication, collaboration, and participation(Gil-garcia et al., 2016). Adaptability, interaction patterns, and the capacity of communities in the digital transformation process all assist Smart Village implementation. In the face of climate change, local communities must take the lead to mitigate its effects and respond fairly to those it affects. When given the chance and resources, communities can plan for, adapt to, and respond to emergencies(Azizi et al., 2022; Karki et al., 2021; Kirkby et al., 2018).

Despite the global uncertainties, there is still hope for programs that use local knowledge and resources and involve the community participants in program implementation, design, and planning. The ability of communities to adapt conditions has been shown to improve when mitigation and adaptation processes are built from the ground up, as has been argued in the academic literature(Marasco et al., 2022; Shaw et al., 2021). It is essential to develop flexible strategies where the community like in Kampung Sumberejo may initiate programs. The process would consist of transformative action on national, regional, and international scales, participatory solutions, and iterative learning at the local level.

According to the findings(Phong & Shaw, 2009) the most critical part of the role of local actors is partnership and collaboration. Every organization has its own unique characteristics, resources, and knowledge bases. To improve the response to COVID-19, strategies are needed by putting SFDRR (Sendai Framework for Disaster Risk Reduction) into action. The currently in place strategies for community disaster resilience have the capability to improve the COVID-19 responses by supporting scientific knowledge in the understanding of risks, strengthening risk governance, and enhancing community-based activities(Shaw et al., 2020).

E. **Policy Implication of This Case Study**

The application of the strategies mentioned above is an important matter to community resilience at the local level. The implementation of smart villages or community-based approach which is integrated with the local level needs to be taken forward for the policy. The research findings and proposed strategies in this research generate prospects for the government or decision makers or other stakeholders to deliberately aspire for policy planning. Moreover, the method and approach which is adopted for the research can overcome the issue at the local level and identify the current potency or characteristic for smart village implementation. The indicators for identifying the current situation reflect the adaptation choices of communities which bring new insight to move towards resilience. In addition, for preparing disaster risk policy or community-based approach for compound hazards, the stakeholders can conduct more detailed studies to achieve community resilience. Generally, the study reflects that a community-based approach based on compound hazards for implementation of the smart village can be used, as an approach to prioritize interests and also identify the community in doing adaptation or mitigation for climate action at the lowest level.

7.8 Key Findings and Conlusions

This research contributes to a better understanding of implementing the community-based strategy in implementing climate villages. This research makes major contributions on feasible strategies to implement smart communities in climate village program. The research's evidence-based land literature review results show that the local community at the site level suffers from climate change and covid-19. Based a theoretical perspective, this research explains how to measure the readiness of climate village using five indicators (Resilience, Mobility, Community, Perspectives, and Digitalization). This study investigated the context of climate village program (*ProKlim*) from Central Government and implemented by local government and community. The proposed strategies divided into three: (i) Collaborative governance in the implementation of the climate village program, (ii) Promoting the climate village program to other sectors for ICT, and (iii)

Strengthening Community Participation to Implementing the Smart Village Concept. The limitation of this research is that the cases are only located at the *kampung* level-village level; as a result, the findings may only apply to this specific scenario. The future research should focus on higher levels of the development area to identify the challenges in each context. In addition, future research should be integrated with national planning. Regarding the constraints of the study, it is possible to point out that there were a restricted number of participants. Only one person in each *kampung* agreed to be interviewed by authors.

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Chapter 8
Approach For Community Disaster Resilience in the Local Level (Balikpapan)

8.1 Analysis for Developing Community Disaster Resilience Approach

According to the land use prediction results for Balikpapan City due to the relocation of New Capital City of Indonesia in SEA Document (2022), the dominant increase in land use area is observed in the settlement category, with a growth rate of 9%. This corresponds to an expansion of 4,482.38 hectares, primarily concentrated in the city centre and northern areas of Balikpapan City. Furthermore, the territory of Balikpapan City has expanded by 383.53 hectares as a result of the proposed construction of a coastal road situated in the southern region of Balikpapan City. According to the above table, it can be inferred that three land uses in Balikpapan City, namely settlements, industry, and commerce and services, have undergone significant growth. The following is a delineation of the three expansions in land utilisation.

New Capital City plan in East Kalimantan Province will have an impact on the alteration of land use in Balikpapan City by the year 2040. Balikpapan City has a buffer zone function from the IKN area, which necessitates an area design to support it. The plans in Balikpapan City include a coastline road plan, a KIK plan, a toll road plan, and an arterial road plan.

A. Trade and service

The implementation of the coastal road project in the southern region of Balikpapan City has a significant impact on the alteration of land use for trade and services. The analysis indicates that there is a discrepancy in the projected outcomes when comparing the trend-based prediction with the target-based projection. The observed disparity lies in the transformation of land utilisation from other purposes to trade and services by the year 2040, which exhibits a propensity to align with the proposed coastal road plan. According to the simulation results, an area of 160.28 hectares is projected to undergo a change in land use to trade and services within a 3 kilometre radius of the planned coastal road. This change is expected to occur closer to the position of the coastal road. This is attributed to the close proximity of the area to the coastline road and its strategic position as the hub for trade and services in Balikpapan.

B. Industry

The presence of the KIK Plan and arterial road plan in the western portion of Balikpapan City has influenced the transformation of industrial land use. The analysis utilising two different techniques, namely trend and target, has revealed notable disparities in the predicted outcomes. According to the trend prediction results, industrial land use is likely to develop in the central area of Balikpapan City. However, based on the prediction results using the target approach, there is

a tendency for land use to change into industrial land use closer to the location of the KIK plan and arterial road, covering an area of 498.8 hectares. This is because of the close vicinity to the KIK plan and major roads, which will make it easier to distribute industrial goods.

C. Settlement

Based on the predictions of land use in Balikpapan City in 2040 due to the relocation of the capital city, there is a significant growth in residential land use in the central and northern areas of Balikpapan City. In the city centre, there is a significant increase in residential development due to its proximity to residential areas, accessibility, urban services, and its closeness to other factors that drive changes in land use. The growth of residential areas in the northern region of Balikpapan City is primarily due to the proximity of this area to the toll exit leading to Samarinda City and the IKN area, thus facilitating access for residents in this area to reach IKN, Samarinda City, and the city centre of Balikpapan. Furthermore, in this area, there is a newly developing residential area from 2011 to 2019 due to its proximity to the campus of the Kalimantan Institute of Technology since 2015.

D. Role of Government

The role of local governments in preparing for, responding to, and recovering from disasters is the primary emphasis of this research. At the local level, as a result of risk local adaptation strategies such as climate village, it is the means by which risks are mitigated and resilience is improved. It is the primary means by which community members and local governments work together in disaster risk reduction (DRR) to increase resistance to floods and other natural hazards. The first research question of this thesis was “what is the level of community resilience in Balikpapan City?” The hypothesis to this question was that they are resilient enough to disasters . In order to answer the first question, an assessment was carried out to measure the resilience of Balikpapan city at 6 sub districts. In addition, the second research question is “How can community-based resilience strategies be integrated into other public policies, particularly in Indonesian planning systems?”. To answer this question, approach is developed in this chapter.

The analysis technique used in the formulation of resilient city strategy for buffer area of new capital city in was using triangulation technique. The data used are empirical facts in this research, interviews with stakeholders, and literature studies on other areas with the same regional characteristics as Balikpapan City. Empirical facts in this research are data and existing conditions of resilience criteria of Balikpapan City which are then compared with the strategy direction obtained from interviews with stakeholders and literature studies in the form of city resilience plans or strategies in other areas with the same characteristics, namely coastal areas that have flood threats.

According to the interviews conducted for this study, stakeholders place a high value on redeveloping and improving flood infrastructure in order to mitigate flood effects. Flood infrastructure redevelopment projects include river embankment enhancements, drainage system upgrades, and dam construction. Mangrove conservation (one of the climate village activities for climate adaptation) has not been a major concern because most stakeholders are focused on reactive and segmented actions. Furthermore, because mangrove conservation is required upstream of the village, this action may appear less under their control and thus not a priority.

The concept of urban resilience is based on the notion of a city form that is able to adapt, mitigate, and respond to shocks and pressures faced both from threats and other urban problems. Based on the results of this study, the threats faced by Balikpapan city are natural hazard, namely floods. The empirical fact is obtained after the researcher analyses the priority disaster assessment asked by stakeholders. From the threat of the city, the researcher formulates the dimensions and parameters of community resilience to be included in the concept of resilient city, which is the concept of city that is able to adapt, mitigate, and respond, to obtain the criteria which will then be followed by the formulation of an approach of enhancing resilience.

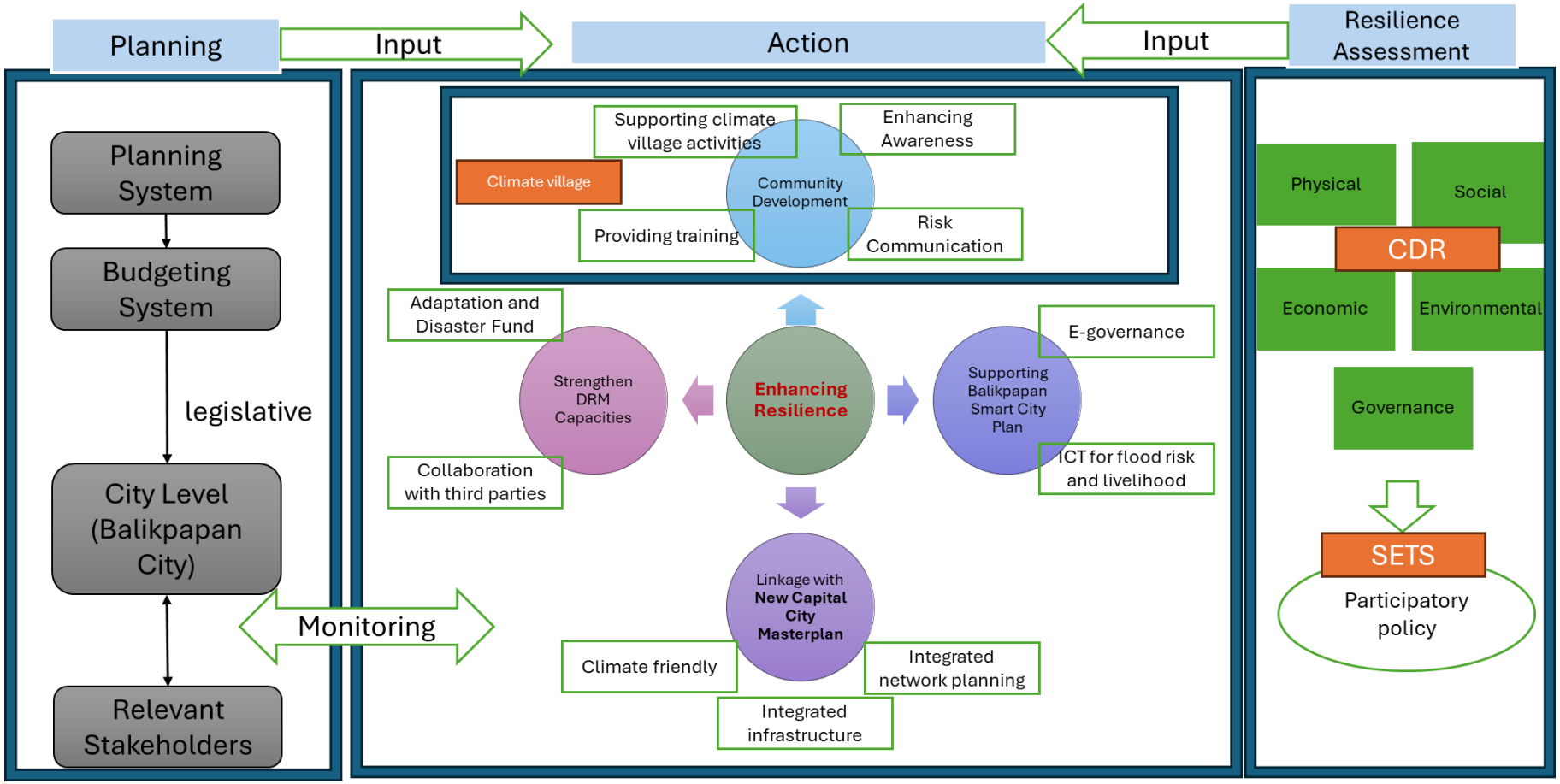

Figure 8.1 Proposed framework for enhancing community disaster resilience.

Spatial planning plays a key role as a policy instrument (Rozas-vásquez et al., 2018). This role is derived from the authoritative space within policy that enables (and forces) different sectors of activity and stakeholders to integrate and collaborate (Faludi, 2000). Furthermore, Faludi (2000) offers two spectrums in understanding spatial allocation policies, namely (i) bureaucratic space allocation policies, namely (i) binding policies; and (ii) indicative policies. Based on the scale of the resilience assessment, it will challenge the city of Balikpapan to support new capital city and the larger the area. As a bridge between the present and the future, spatial planning which integrated to disaster management is an effort to assist cities in dealing with uncertainty and uncertainty. In addition, it can also act as a tool to provide direction in the face of conflict. This, then relates to the security and comfort of regional space which is part of the spatial planning objectives according to Law 26/2007.

Based on the proposed framework (Figure 8.1), Indonesia has already has planning system (spatial plan and development plan), from planning and budgeting from national level to provincial level. My proposed framework is integrating planning system to action plan based on the assessment results from Community Disaster Resilience and SETS Framework. Within the climate village program, community empowerment is achieved through the existing spirit of mutual collaboration and cohesiveness. This nationwide initiative yields beneficial impacts for both humans and the environment. Nevertheless, among the individuals who possess a climate, there are also those who opt out of this program due to the limited space and the yard being already occupied by the house. Community participation is a key aspect in supporting Community Development through the Climate Village Program.

The Community Development via Climate Village Program in Balikpapan has implemented a series of community empowerment initiatives, encompassing the following scope and stages: Human development refers to the systematic efforts aimed at enhancing knowledge and skills within a community through activities such as socialization, supervision, and mentoring. In terms of business development, the community has derived advantages from pro-climate initiatives. However, these initiatives do not serve as the primary source of income for the families. Instead, they only provide assistance when there is surplus. Moreover, the small and medium-sized enterprises (SMEs) involved in these pro-climate efforts have not been operating at their full potential due to individual marketing strategies. The knowledge of the environmental community can influence environmental management through institutional development, increased institutional roles, and community participation in planning, implementing, and overseeing community empowerment. This aligns with the Proklim (Climate Village)guidelines and is exemplified by the climate village program.

Furthermore, in Figure 8.1, relevant stakeholders are also identified. Assistance from third parties, particularly the government, will be crucial because disasters have the ability to disrupt people's livelihoods. People in a community will struggle to meet their basic needs after a major disaster because it affects all aspects of life, including displacement. They are in a desperate situation in which they can only obtain basic necessities from places other than the impacted area. External parties that could provide assistance include governments, businesses, families, non-governmental organizations (NGOs), and other members of the affected community.

8.2 Implication of Resilience Assessment

During the assessment of community disaster resilience in Balikpapan City, the head of communities are the key object in the assessment process. It is important to share the findings with a larger audience because of the assessment's significance on a municipal and state level. Consequently, in a more localized setting, it is crucial to have DRR actors, a variety of local stakeholders, and local champions involved. As a result, the resilience assessment is encouraging local governance to work with various important stakeholders to reduce risks and build resilience.

Under climate change conditions, the threat of flooding in the Balikpapan case study area is predicted to increase substantially and cause greater impacts to local residents due to the relocation of the national capital. An increase in the average measurement indicates that flooding will be more frequent in the future compared to current conditions. In Chapter 7, adaptation by communities and activities classified as climate villages proved to be the most effective adaptation under current conditions. However, under climate change conditions, these adaptations proved to be very effective at indirectly reducing flood disasters and can therefore be considered a sustainable approach. This approach will help villagers in the long term.

The examination of community resilience can be connected to the future development of Balikpapan City in order to enhance the resilience of the New Capital City. The resilience assessment can enhance the government programme by establishing a connection between the risk assessment outcomes and the preexisting documents within the Balikpapan framework, including the Disaster Management (DM) Plan and the Local Action Plan (LAP) for Disaster Risk Reduction (DRR) alongside city development plan papers. The requirement for this connection was specified in the existing legal structure (DM Law No. 24/2007) of the nation (Chapter 2). Currently, Balikpapan lacks a Disaster Management (DM) Plan and Local Action Plan (LAP) for Disaster Risk Reduction (DRR). Therefore, the resilience/risk assessment results are crucial for the Government of Balikpapan City to guide them in developing the city in a manner that addresses disaster concerns.

There are fundamental principles that guide the integration of disaster risk reduction (DRR) into the processes of development planning, budgeting, and execution. In accordance with the laws and regulations of the Republic of Indonesia, all development planning, whether non-spatial or spatial, as stated in Government Regulation/PP No. 8/2008, must take into account the assessment of disaster risk in the planning process, based on risk/resilience evaluation.

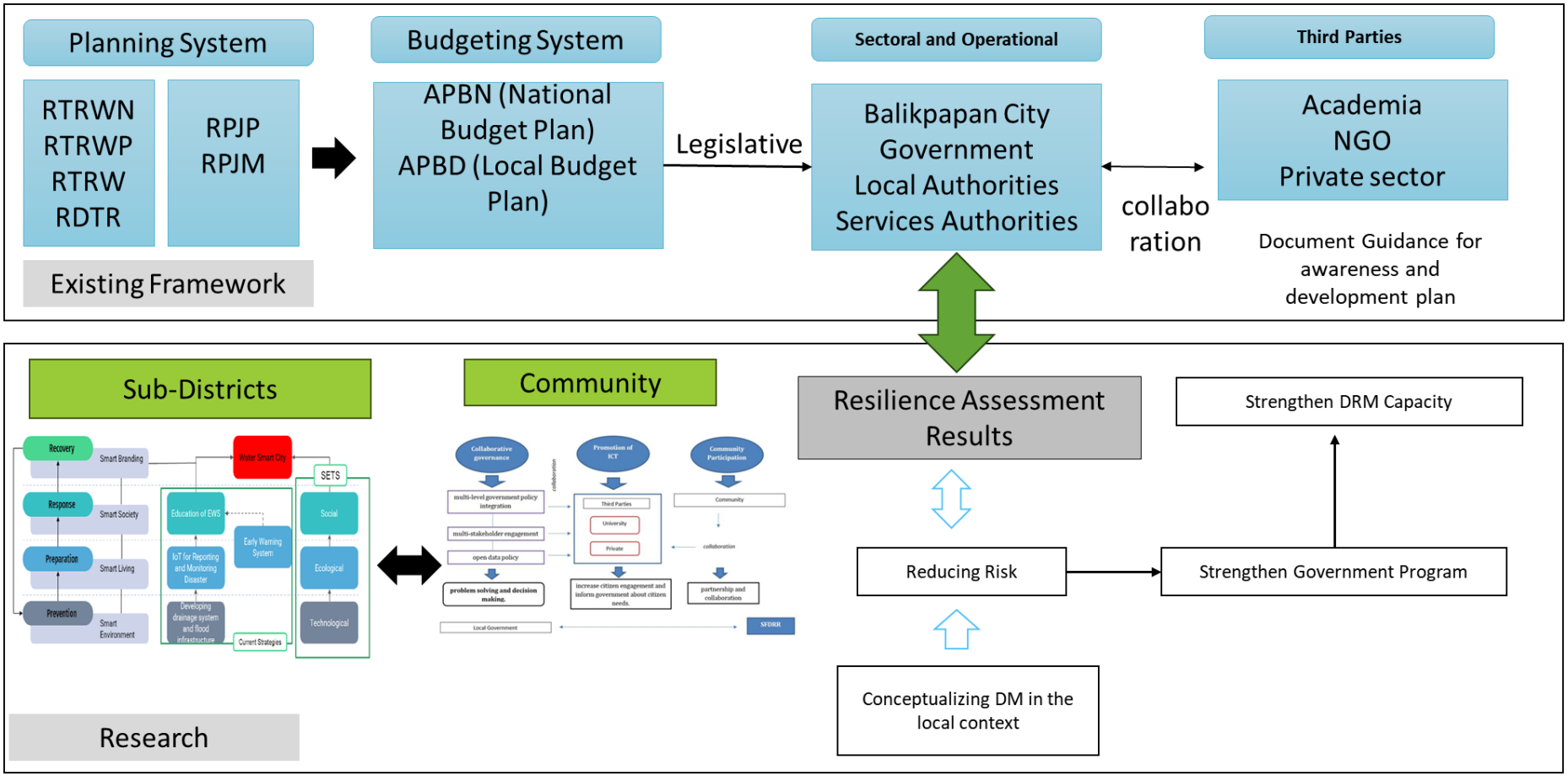

Figure 8.2 Linkages of research with development plan in the study area

Furthermore, it mandates that all disaster risk reduction strategies must be incorporated into all development planning documents, including long-term, mid-term development plans, and annual programmes. The legislative framework backdrop provides the rationale for incorporating risk/resilience assessment results into the budgeting system of the City Legislative/Council (House of Representatives of Balikpapan City). The formulation of the Disaster Risk Reduction (DRR) budget, which is determined by the evaluation of risks and resilience, should align with the established naming conventions. This alignment is based on the division of existing authorities as outlined in Government Regulation/PP No. 41/2007. Hence, the incorporation of disaster risk assessment and distribution, including climate village implementation, into city management activities is imperative due to the planning and budgeting process being governed by governmental rules.

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Presidential Regulation No. 47 of 2009 on the Establishment and Organization of State Ministries

Head of BNPB Regulation No. 4 of 2008 on Guidelines for the Preparation of Disaster Management Plans

Minister of Home Affairs Decree No. 46 of 2008 on the establishment of Regional Disaster Management Agencies.

Regulation of the Minister of Public Works No. 10 of 2008 on the Determination of Types of Business Plans and/or Activities in the Public Works Sector that Must be Licensed. and/or activities in the field of public works that must be equipped with UKL-UPL.

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Minister of Public Works Regulation Number 6 of 2011 on Guidelines for the Use of Water Resources
Minister of Environment Regulation Number 17 of 2012 on Guidelines for Community Involvement in the AMDAL Process Community Involvement in the AMDAL Process
Government Regulation No. 27 of 2012 on Environmental Permits
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Regulation of the Minister of Environment No. 5 of 2012 on Types of Business Plans and/or Activities Requiring Environmental Impact Assessment
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Chapter 9

Conclusions

9.1 Conclusions

While assessments of community resilience to disasters and to improve response to flood events are widely practiced, reducing their impact on communities is currently limited and lacks strong predictive capacity. Newer tools are needed to represent multiple dimensions of vulnerability and resilience and to support future decision-making. In this thesis, vulnerability assessment is conducted by reviewing existing frameworks and methods using literature review techniques and stakeholder interviews. The base model consists of five dimensions and 44 parameters that measure resilience indicators under existing flood disaster conditions. In addition, these are key findings of the thesis:.

A. The importance of institutionalizing local initiatives for DRR as an implication of institutional arrangements at the national level, stipulated in DM Law No.24/2007.

The relocation of Indonesia's new capital city was estimated to have an impact on resources and biodiversity due to rapid urbanization, and massive infrastructure development to accommodate the influx of migration to the new capital city. In addition, as a buffer area, the rapid migration to the surrounding city near the new capital city (urban sprawl) will trigger a new vulnerability in Balikpapan.In addition, Developing a local institutional framework to mitigate risks and increase resilience is an idea that has widespread support in Indonesia.Key Important implications for local level DRR have been found by the national level policy analysis of disaster management and disaster risk reduction. Accordingly, literature reviews indicate a critical need for DRR on a regional scale. Two key local DRR actors are highlighted by literature analysis as well.

B. Flood responses in Balikpapan haven't yet been found to be linked to drivers and other components which are usually just temporary or short-term responses.

In the case of Balikpapan City, the responses are only directed to “State” component. Furthermore, the responses that local government of Balikpapan have executed (the construction of detention ponds) are usually just temporary or short-term responses. However, responses can be directed to drivers, pressure, states, and impacts, so it can focus on the current situation of the problem. DPSIR's flood vulnerability, including and linking to climate change study, can result in long term responses and recommended flood adaptation and mitigation strategies. Considerations of responses to drivers, pressures, or impacts can lead to certain

reasonable outcomes, such as lower urbanization rates, deforestation, and land consolidation. These responses might also be used as a starting point for making decisions and it can help policy makers or stakeholders to understand the risk characteristic of their city's disaster especially in climate change induced urban flood.

In addition, based on the results derived through the coding, it is inferred that in Balikpapan there are six social domain strategies, eight ecological domain strategies, and nine technological domain strategies. This is evident as the Balikpapan city government prioritizes the ecological and technological domains. As a key cause of urban flooding in Balikpapan is revealed to be drainage issues, the city government consequently prioritizes the technological and ecological domains. Therefore, the SETS is considered ineffective in Balikpapan. Several strategies for addressing the challenges are yet to be executed, even though they are typical flood management such as river capacity, drainage capacity, soil infiltration, etc. For instance, there has been no follow-up on installing 35 flood warning systems even though EWS is one program in their masterplan of smart city. Many government programs have been implemented; however, they are not shown to be effective in dealing with flooding.

C. There are 2 levels of community disaster resilience: moderate vulnerable (South Balikpapan, North Balikpapan, Central Balikpapan, and Balikpapan Kota), vulnerable (West Balikpapan and East Balikpapan)

In order to formalize local efforts in risk reduction that are underrepresented in the national context, the study proposes implementing resilience assessment through community disaster resilience methodology. Key findings drew from the assessment at the city level supports the Balikpapan local government in pointing out weaker and stronger sectors in stimulating action planning of DRR and resilience activities. The community Resilience score is calculated through questionnaires distributed in 6 sub-districts in Balikpapan City. The lowest score states very low resilience, while the highest is five, which shows very high. Then after knowing the scores and weights, the following are the assessment results for Balikpapan city Social, economic, physical, environmental and governance are measured at city level and sub-district level . At the city level, the highest scoring resilience category is the environmental dimension (3.02), followed by the governance dimension (2.6) and economic dimension (2.52). The rest (social and physical) are the lowest scores and can be categorized as vulnerable.

D. There are 7 (seven) autonomous adaptations activities through climate village from the local community to reduce risk and strengthen resilience.

Prior to the occurrence of flooding in the study area, preparatory measures are undertaken to assess the community's preparation, evaluate evacuation equipment, and establish temporary evacuation locations. The community did not perceive the flood disaster as significant due to the relatively low height and intensity of the flood. Given the potential implications of climate change and the associated concerns, it is plausible that the sea level and rainfall will increase in the future as a result of the construction of the new capital city. As the height increases, the influence becomes more pronounced indirectly. Consequently, the implementation of evacuation training is being organized to assess the preparedness of the community, evacuation equipment, and temporary evacuation shelters, with the aim of enhancing long-term community readiness. The training enhances the community's confidence and proficiency in managing floods, although in an indirect manner

The current state of readiness of Balikpapan's climate villages to become smart villages is still in its early stages. The active participation of the community and other stakeholders is required to build national resilience in the face of a changing climate and to meet the target of reducing GHG emissions set by Law Number 16 of 2016. With the preparation of the ProKlim Road Map, it is expected that strengthening local climate change adaptation and mitigation actions at the site level will run more efficiently, resulting in real positive benefits for the nation and state of Indonesia.. The implementation of smart villages or community-based approach which is integrated with the local level needs to be taken forward for the policy.

E. An approach for community disaster resilience can be one of the useful entry points to increase resilience in the development of action plans incorporated into city-scale planning and implementation stages of resilient cities.

This thesis proposes combining the concepts of vulnerability, resilience, and adaptations to better manage disaster risk. This integration is critical for disaster response decision support systems to be available from both governmental and non-governmental organizations. A decision support system like this is required in the future to make the selected adjustments even more effective. As a result, the integration will improve decision-makers' ability to mitigate the effects of future disasters.

Under climate change conditions, the threat of flooding in the Balikpapan case study area is predicted to increase substantially and cause greater impacts

to local residents due to the relocation of the national capital. An increase in the average measurement indicates that flooding will be more frequent in the future compared to current conditions.

The examination of community resilience can be connected to the future development of Balikpapan City in order to enhance the resilience of the New Capital City. The resilience assessment can enhance the government programme by establishing a connection between the risk assessment outcomes and the preexisting documents within the Balikpapan framework, including the Disaster Management (DM) Plan and the Local Action Plan (LAP) for Disaster Risk Reduction (DRR) alongside city development plan papers. The requirement for this connection was specified in the existing legal structure (DM Law No. 24/2007) of the nation (Chapter 2). Currently, Balikpapan lacks a Disaster Management (DM) Plan and Local Action Plan (LAP) for Disaster Risk Reduction (DRR).

9.2 Limitations of Study

The current multidisciplinary perspective on the concept of resilience informed the development of the comprehensive predictive approach to assessment presented in this thesis. The need for a more comprehensive predictive approach is particularly evident in the context of engagement with climate change. In addition, the limitations of study are below:

- This thesis was limited by only considering resilience levels and one adaptation at a time. To address this in future research, it will be important to discuss proactive adaptation combinations with relevant stakeholders before finalizing the specific set of adaptations to be assessed.
- In order to accommodate the quantitative assessment approach required by type of modelling, a number of qualitative variables had to be transformed into numerical measurements. The precision of the evaluation may be compromised during the process of assigning a numerical value to qualitative factors.
- This research was limited to head of community perception. However, it cannot represent all the community perception and preferences in study area.

Annex 1 List of Reviewed Paper

Author	Framework
CARRI	Community Resilience Framework
Mayunga (2007)	capital based community disaster resilience
Cutter et al. (2008)	Disaster resilience of place (DROP)
Peacock et al. (2010), Texas A&M University	Community disaster resilience indicators
Sempier et al. (2010)	Coastal community resilience index
Cutter et al. (2010)	Disaster Resilience Indicators for Benchmarking Baseline Conditions
Shaw et al. (2014), Mulyasari (2014), Joerin (2012)	Climate Disaster Resilience Index
Kusumastuti et al. (2014)	Resilience index towards natural disasters
YOON (2016)	Community Disaster Resilience in Korea (CDRI) Community disaster resilience
Ostadtaghizadeh (2016) Qasim (2016)	Community resilience to flood hazards
Scherzer, S., Lujala, P. , Rød, J.K. (2019)	the Baseline Resilience Indicators for Communities (BRIC)
Choi, E., Song, J.(2022)	CDRC (Community Disaster Resilience of Costal City)
Twigg (2007)	CDRC
Prasad, N. et al., / The World Bank	Climate Resilient Cities
Buckle, P., et al. (2014), Henstra. et al.(2009)	Climate Disaster Resilience

Annex 2 AHP Questionnaire and Interview for Experts

1. Profile

Name :
Occupation :
Institutions :
No.hp/email :

2. Instructions

For each pair of dimensions and indicators, please express your expert judgement on which component or factor is more important by selecting on one of the scales. If the selected scale is on the left side of 1, then the component on the left side is judged as more important than the component on the right side, and vice versa.

AHP Scale:

1 = Equal importance;
3 = Moderate importance;
5 = Strong importance;
7 = Very strong importance;
9 = Extreme importance.

3. Questionnaire

3.1 Dimensions

Dimension										Dimension
	9	7	5	3	1	3	5	7	9	
Social										Governance
Social										Physical
Social										Environmental
Social										Economic
Governance										Physical
Governance										Environmental
Governance										Economic
Physical										Environmental
Physical										Economic
Environmental										Economic

Please give the specific reasons for the judgments:

.....

3.2 Social Dimensions

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Gender										Education level
Gender										Race/Ethnicity
Gender										Awareness
Gender										National language speaking
Gender										Preparedness

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Gender										Training and Education
Gender										Social Capital
Gender										Risk Perceptions
Gender										Number of special need people
Gender										Age
Gender										Community participation to DRR
Gender										Number of family member
Gender										Years of Residence
Education level										Race/Ethnicity
Education level										Awareness
Education level										National language speaking
Education level										Preparedness
Education level										Training and Education
Education level										Social Capital
Education level										Risk Perceptions
Education level										Number of special need people
Education level										Age
Education level										Community participation to DRR
Education level										Number of family member
Education level										Years of Residence
Race/Ethnicity										Awareness
Race/Ethnicity										National language speaking
Race/Ethnicity										Preparedness
Race/Ethnicity										Training and Education
Race/Ethnicity										Social Capital

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Race/Ethnicity										Risk Perceptions
Race/Ethnicity										Number of special need people
Race/Ethnicity										Age
Race/Ethnicity										Community participation to DRR
Race/Ethnicity										Number of family member
Race/Ethnicity										Years of Residence
Awareness										National language speaking
Awareness										Preparedness
Awareness										Training and Education
Awareness										Social Capital
Awareness										Risk Perceptions
Awareness										Number of special need people
Awareness										Age
Awareness										Community participation to DRR
Awareness										Number of family member
Awareness										Years of Residence
National language speaking										Preparedness
National language speaking										Training and Education
National language speaking										Social Capital
National language speaking										Risk Perceptions

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
National language speaking										Number of special need people
National language speaking										Age
National language speaking										Community participation to DRR
National language speaking										Number of family member
National language speaking										Years of Residence
Preparedness										Training and Education
Preparedness										Social Capital
Preparedness										Risk Perceptions
Preparedness										Number of special need people
Preparedness										Age
Preparedness										Community participation to DRR
Preparedness										Number of family member
Preparedness										Years of Residence
Training and Education										Social Capital
Training and Education										Risk Perceptions
Training and Education										Number of special need people
Training and Education										Age
Training and Education										Community participation to DRR
Training and Education										Number of family member
Training and Education										Years of Residence

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Training and Education										Risk Perceptions
Training and Education										Number of special need people
Training and Education										Age
Training and Education										Community participation to DRR
Training and Education										Number of family member
Training and Education										Years of Residence
Training and Education										
Risk Perceptions										Number of special need people
Risk Perceptions										Age
Risk Perceptions										Community participation to DRR
Risk Perceptions										Number of family member
Risk Perceptions										Years of Residence
Number of special need people										Age
Number of special need people										Community participation to DRR
Number of special need people										Number of family member
Number of special need people										Years of Residence
Age										Community participation to DRR
Age										Number of family member
Age										Years of Residence

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Community participation to DRR										Number of family member
Community participation to DRR										Years of Residence
Community participation to DRR										
Number of family member										Years of Residence

Please give the specific reasons for the judgments:

……

3.3 Environmental Dimension

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Hazards intensity										Hazard frequency
Hazards intensity										Number of different hazard
Hazards intensity										Biodiversity index
Hazards intensity										Environmental policy
Hazards intensity										Land use policy
Hazard frequency										Hazard intensity
Hazard frequency										Number of different hazard
Hazard frequency										Biodiversity index
Hazard frequency										Environmental policy
Hazard frequency										Land use policy
Biodiversity index										Hazard intensity
Biodiversity index										Hazard frequency
Biodiversity index										Environmental policy
Biodiversity index										Land use policy

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Environmental policy										Hazard intensity
Environmental policy										Hazard frequency
Land use policy										Environmental policy

Please give the specific reasons for the judgments:

……

3.4 Economic Dimension

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Disaster Insurance										Income
Disaster Insurance										Employment
Disaster Insurance										Home ownership
Disaster Insurance										Saving and budget
Disaster Insurance										Household asset
Income										Employment
Income										Home ownership
Income										Saving and budget
Income										Household asset
Income										Employment
Employment										Home ownership
Employment										Saving and budget
Employment										Household asset
Home ownership										Saving and budget
Home ownership										Household asset
Saving and budget										Household asset

Please give the specific reasons for the judgments:

……

3.5 Governance Dimension

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Disaster Plan, Policy, and Program										Institutional network/collaboration
Disaster Plan, Policy, and Program										Infection disease control
Disaster Plan, Policy, and Program										Availability of subsidies
Disaster Plan, Policy, and Program										Disaster Aid Experience
Disaster Plan, Policy, and Program										Volunteerism
Institutional network/collaboration										Infection disease control
Institutional network/collaboration										Availability of subsidies
Institutional network/collaboration										Disaster Aid Experience
Institutional network/collaboration										Volunteerism
Infection disease control										Availability of subsidies
Infection disease control										Disaster Aid Experience
Infection disease control										Volunteerism
Availability of subsidies										Disaster Aid Experience
Availability of subsidies										Volunteerism
Disaster Aid Experience										Volunteerism

Please give the specific reasons for the judgments:

……

3.6 Physical Dimension

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Evacuation route										Population density
Evacuation route										Access to clean water and sanitation

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Evacuation route										Access to health facility
Evacuation route										Temporary housing
Evacuation route										Water supply
Evacuation route										Electricity supply
Evacuation route										Transport Accessibility
Evacuation route										Building density
Evacuation route										Housing type
Evacuation route										Number of Medical Institution
Evacuation route										Warning system
Population density										Access to clean water and sanitation
Population density										Access to health facility
Population density										Temporary housing
Population density										Water supply
Population density										Electricity supply
Population density										Transport Accessibility
Population density										Building density
Population density										Housing type
Population density										Number of Medical Institution
Population density										Warning system
Access to clean water and sanitation										Access to health facility
Access to clean water and sanitation										Temporary housing

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Access to clean water and sanitation										Water supply
Access to clean water and sanitation										Electricity supply
Access to clean water and sanitation										Transport Accessibility
Access to clean water and sanitation										Building density
Access to clean water and sanitation										Housing type
Access to clean water and sanitation										Number of Medical Institution
Access to clean water and sanitation										Warning system
Access to health facility										Temporary housing
Access to health facility										Water supply
Access to health facility										Electricity supply
Access to health facility										Transport Accessibility
Access to health facility										Building density
Access to health facility										Housing type
Access to health facility										Number of Medical Institution
Access to health facility										Warning system
Temporary housing										Water supply
Temporary housing										Electricity supply
Temporary housing										Transport Accessibility
Temporary housing										Building density

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Temporary housing										Housing type
Temporary housing										Number of Medical Institution
Temporary housing										Warning system
Water supply										Electricity supply
Water supply										Transport Accessibility
Water supply										Building density
Water supply										Housing type
Water supply										Number of Medical Institution
Water supply										Warning system
Electricity supply										Transport Accessibility
Electricity supply										Building density
Electricity supply										Housing type
Electricity supply										Number of Medical Institution
Electricity supply										Warning system
Transport Accessibility										Building density
Transport Accessibility										Housing type
Transport Accessibility										Number of Medical Institution
Transport Accessibility										Warning system
Building density										Housing type
Building density										Number of Medical Institution
Building density										Warning system

Indicators										Indicators
	9	7	5	3	1	3	5	7	9	
Housing type										Number of Medical Institution
Housing type										Warning system
Number of Medical Institution										Warning system

Please give the specific reasons for the judgments:

……

Kuesioner *Analytic Hierarchy Process*

Responden yang terhormat, kami mengharapkan bantuan Bapak/Ibu untuk mengisi kuesioner yang akan digunakan sebagai bahan penelitian disertasi dengan Judul *"Assessing community disaster resilience in Balikpapan: Buffer Area of Indonesia's New Capital City*". Adapun tujuan dari kuesioner ini yaitu untuk mengetahui pendapat Bapak/Ibu sebagai expert mengenai indicator dan dimensi untuk pengukuran ketahanan komunitas. Hasil kuesioner akan dianalisis dengan menggunakan metode *Analytic Hierarchy Process* (AHP). Atas bantuan, ketersediaan waktu dan kerjasama Bapak/Ibu kami ucapkan terima kasih.

IDENTITAS RESPONDEN

Nama : Nurrahman Wijaya

Instansi/Alamat : Institut Teknologi Bandung

Bidang/Jabatan : dosen PWK

PETUNJUK PENGISIAN

1. Kriteria atau elemen pada setiap level/tingkatan hirarki didefinisikan dan dibatasi oleh penyusunankuesioner untuk menghindari asumsi yang terlalu luas dan terfokus.
2. Responden diminta untuk memberikan tanggapan/penilaian terhadap setiap perbandingan berpasangan berdasarkan pengalaman, pengetahuan, dan intuisi responden selama ini.
3. Tingkat kepentingan yang digunakan dalam kuesioner adalah sebagai berikut:

Intensitas Kepentingan atau Tingkat Preferensi	Definisi	Penjelasan
1	*Equal importance* (Kedua elemen sama penting)	Dua aktifitas (elemen) memeberikan kontribusi sama terhadap tujuan
3	*Moderate importance* (Elemen yang satu sedikit lebih penting dari yang lain)	Pengalaman dan penilaian memberikan nilai tidak jauh berbeda antara satu aktivitas (elemen) terhadap aktivitas (elemen) lainnya
5	*Strong importance* (Elemen yang satu lebih penting dari yang lain)	Pengalaman dan penilaian memberikan nilai kuat berbeda antara satu aktivitas (elemen) terhadap aktivitas lainnya
7	*Very Strong importance* (Elemen yang satu sangat lebih penting dari yang lain)	Satu aktivitas (elemen) sangat lebih disukai dibanding aktivitas (elemen) lainnya
9	*Extreme importance* (Elemen yang satu mutlak lebih penting dari yang lain)	Satu aktivitas (elemen) secara pasti menempati urutan tertinggi dalam tingkatan preferensi
2, 4, 6, 8	Nilai Kompromi atas nilai-nilai di atas (Nilai tengah antara dua pertimbangan yang berdekatan)	Penilaian Kompromi secara numeris dibutuhkan semenjak tidak ada kata yang tepat untuk menggambarkan tingkat preferensi
Kebalikan (1/2, 1/3...dst)	Jika elemen X mempunyai salah satu nilai diatas pada saat dibandingkan dengan elemen Y, maka elemen Y mempunyai nilai kebalikan jika dibandingkan dengan elemen Y	

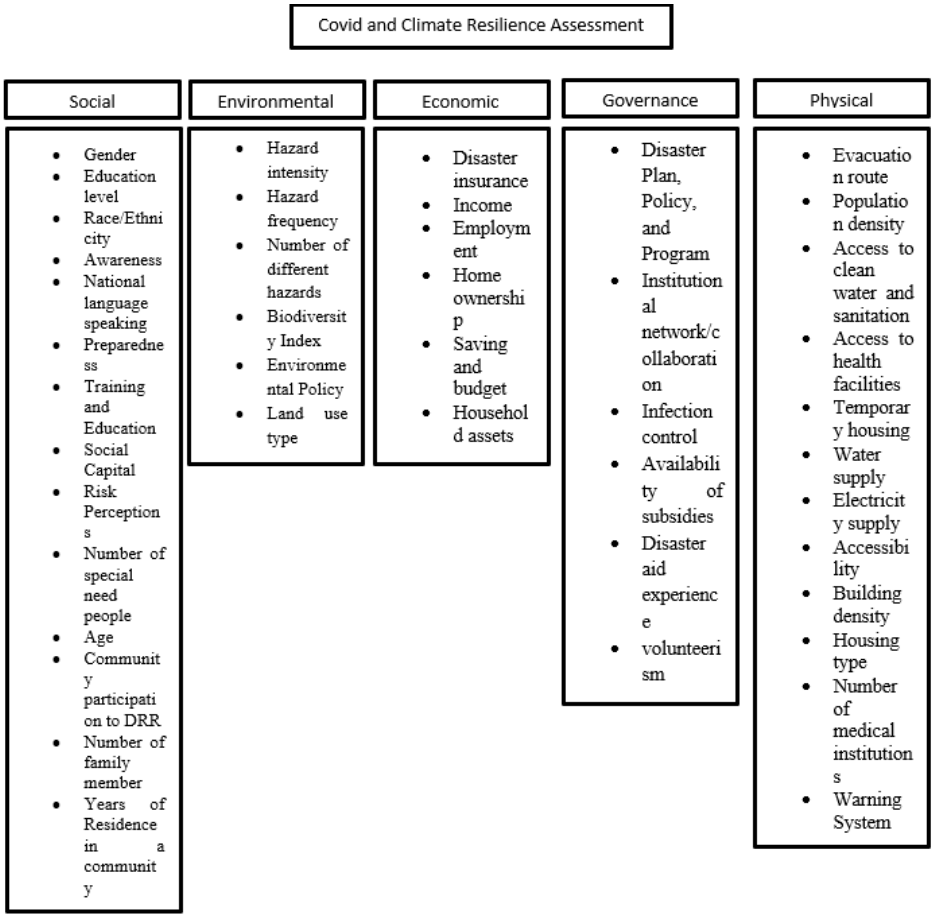
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9

Elemen X Elemen Y

Keterangan:

- Angka 1 jika elemen X memiliki tingkat kepentingan yang sama dengan elemen Y
- Bagian kiri, skala di isi jika elemen X memiliki tingkat kepentingan diatas elemen Y
- Bagian kanan, skala di isi jika elemen Y memiliki tingkat kepentingan diatas elemen X

Berikut merupakan penjelasan penggolongan dimensi dan parameter untuk pengukuran ketahanan komunitas.



Sumber : berdasarkan hasil systematic analysis dan review report oleh peneliti (2022)

KUESIONER

Keterangan : Lingkarilah kriteria nilai sesuai dengan persepsi Bapak/Ibu mengenai tingkat kepentingan antar dimensi berikut.

Dimensi (kiri)	Kriteria Nilai																	Dimensi (kanan)
Social (Sosial)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	**7**	8	9	Governance (Pemerintah)
Social (Sosial)	9	8	7	6	5	**4**	3	2	1	2	3	4	5	**6**	7	8	9	Physical (Fisik)
Social (Sosial)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	7	**8**	9	Environmental (Lingkungan)
Social (Sosial)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	**7**	8	9	Economic (Ekonomi)
Governance (Pemerintah)	9	8	7	**6**	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Physical (Fisik)
Governance (Pemerintah)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	**7**	8	9	Environmental (Lingkungan)
Governance (Pemerintah)	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Economic (Ekonomi)
Physical (Fisik)	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental (Lingkungan)
Physical (Fisik)	9	8	**7**	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Economic (Ekonomi)
Environmental (Lingkungan)	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Economic (Ekonomi)

Dimensi Sosial

Keterangan : Lingkarilah kriteria nilai sesuai dengan persepsi Bapak/Ibu mengenai tingkat kepentingan antar dimensi berikut.

Indikator (kiri)	Kriteria Nilai																	Indikator (kanan)
Gender	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Education level (Tingkat Pendidikan)
Gender	9	8	7	6	**5**	4	3	2	1	2	3	**4**	5	6	7	8	9	Race/Ethnicity (Suku atau ras)
Gender	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	8	**9**	Awareness (Kewaspadaan)
Gender	9	8	7	6	**5**	4	3	2	1	2	3	**4**	5	6	7	8	9	National language speaking (Kemampuan Berbahasa Indonesia)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Preparedness (Kesiapan)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Training and Education (pelatihan dan pendidikan)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Social Capital (kapital social)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	**5**	6	7	8	9	Risk Perceptions (persepsi tentang resiko
Gender	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	**7**	8	9	Number of special need people (jumlah orang berkebutuhan khusus)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Age (umur)
Gender	9	8	7	**6**	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Community participation to DRR (partisipasi komunitas untuk pengurangan risiko bencana)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Number of family member (jumlah anggota keluarga)
Gender	9	8	**7**	6	5	4	3	2	1	2	3	4	**5**	6	7	8	9	Years of Residence (lama tinggal)

Education level (Tingkat Pendidikan)	9	8	7	6	**5**	4	3	2	1	2	3	**4**	5	6	7	8	9	Race/Ethnicity
Education level (Tingkat Pendidikan)	9	8	7	**6**	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Awareness
Education level (Tingkat Pendidikan)	9	8	7	6	**5**	4	3	2	1	2	3	4	**5**	6	7	8	9	National language speaking
Education level (Tingkat Pendidikan)	9	8	7	**6**	5	4	3	2	1	2	3	**4**	5	6	7	8	9	Preparedness
Education level (Tingkat Pendidikan)	9	8	7	**6**	5	4	3	2	1	2	3	4	**5**	6	7	8	9	Training and Education
Education level (Tingkat Pendidikan)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	**6**	7	8	9	Social Capital
Education level (Tingkat Pendidikan)	9	8	**7**	6	5	4	3	2	1	2	3	**4**	5	6	7	8	9	Risk Perceptions
Education level (Tingkat Pendidikan)	9	8	**7**	6	5	4	3	2	1	2	3	4	**5**	6	7	8	9	Number of special need people
Education level (Tingkat Pendidikan)	9	8	**7**	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Age
Education level (Tingkat Pendidikan)	9	**8**	7	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Community participation to DRR
Education level (Tingkat Pendidikan)	9	**8**	7	6	5	4	3	2	1	2	3	**4**	5	6	7	8	9	Number of family member
Education level (Tingkat Pendidikan)	9	8	**7**	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Years of Residence
Race/Ethnicity (Suku atau ras)	9	8	7	6	**5**	4	3	2	1	2	3	4	**5**	6	7	8	9	Awareness
Race/Ethnicity (Suku atau ras)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	**7**	8	9	National language speaking
Race/Ethnicity (Suku atau ras)	9	8	7	6	**5**	4	3	2	1	2	3	4	5	**6**	7	8	9	Preparedness
Race/Ethnicity (Suku atau ras)	9	8	7	6	**5**	4	3	2	1	2	3	4	**5**	6	7	8	9	Training and Education
Race/Ethnicity (Suku atau ras)	9	8	7	6	**5**	4	3	2	1	2	3	4	**5**	6	7	8	9	Social Capital

Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions
Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community participation to DRR
Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of family member
Race/Ethnicity (Suku atau ras)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	National language speaking
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Preparedness
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Training and Education
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Social Capital
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community participation to DRR
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of family member
Awareness (Kewaspadaan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Preparedness
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Training and Education
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Social Capital
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions

National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community participation to DRR
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of family member
National language speaking (Kemampuan Berbahasa Indonesia)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Preparedness (Kesiapan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Training and Education
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Social Capital
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community participation to DRR
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of family member
Preparedness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Training and Education (pelatihan dan pendidikan)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Social Capital
Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions
Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community participation to DRR

Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of family member
Training and Education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk Perceptions
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community Participation to DRR
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of Family Member
Social Capital	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Risk Perceptions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of special need people
Risk Perceptions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Risk Perceptions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community Participation to DRR
Risk Perceptions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of Family Member
Risk Perceptions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Number of special need people	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Age
Number of special need people	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community Participation to DRR
Number of special need people	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of Family Member
Number of special need people	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Age	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Community Participation to DRR
Age	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of Family Member
Age	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Community Participation to DRR	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of Family Member
Community Participation to DRR	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence
Number of Family Member	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Years of Residence

Dimensi Pemerintah (Governance)

.

Indikator (kiri)	Kriteria Nilai																	Indikator (kanan)
Disaster Plan, Policy, and Program	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Institutional network/collaboration
Disaster Plan, Policy, and Program	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Infection control
Disaster Plan, Policy, and Program	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Availability of subsidies
Disaster Plan, Policy, and Program	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Disaster aid experience
Disaster Plan, Policy, and Program	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	volunteerism
Institutional network/collaboration	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Infection control
Institutional network/collaboration	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Availability of subsidies
Institutional network/collaboration	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Disaster aid experience
Institutional network/collaboration	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	volunteerism
Infection control	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Availability of subsidies
Infection control	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Disaster aid experience
Infection control	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	volunteerism
Availability of subsidies	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Disaster aid experience
Availability of subsidies	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	volunteerism
Disaster aid experience	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	volunteerism

Dimensi Fisik (Physical Dimension)

Indikator (kiri)	Kriteria Nilai																	Indikator (kanan)
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Population density
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	**6**	7	8	9	Access to clean water and sanitation
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Access to health facilities
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Temporary housing
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Water supply
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	Electricity supply
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Accessibility
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Building density
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Housing type
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Number of medical institutions
Evacuation route	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Warning System
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Access to clean water and sanitation
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Access to health facilities
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Temporary housing
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Water supply
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Electricity supply
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Accessibility
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Building density
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Housing type
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Number of medical institutions
Population density	9	**8**	7	6	5	4	3	2	1	2	3	4	5	6	7	**8**	9	Warning System

Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Access to health facilities
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Temporary housing
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Water supply
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Electricity supply
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accessibility
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Access to clean water and sanitation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Temporary housing
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Water supply
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Electricity supply
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accessibility
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Access to health facilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Water supply
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Electricity supply

Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accessibility
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Temporary housing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Electricity supply
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accessibility
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Water supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Electricity supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accessibility
Electricity supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Electricity supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Electricity supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Electricity supply	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Accessibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Building density
Accessibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Accessibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Accessibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Building density	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Housing type
Building density	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Building density	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Housing type	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of medical institutions
Housing type	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System
Number of medical institutions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Warning System

Dimensi Lingkungan

Indikator (kiri)	Kriteria Nilai																	Indikator (kanan)
Hazard intensity	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Hazard frequency
Hazard intensity	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of different hazards
Hazard intensity	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Biodiversity Index
Hazard intensity	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Policy
Hazard intensity	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Land use type
Hazard frequency	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Number of different hazards
Hazard frequency	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Biodiversity Index
Hazard frequency	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Policy
Hazard frequency	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Land use type
Number of different hazards	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Biodiversity Index
Number of different hazards	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Policy
Number of different hazards	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Land use type
Biodiversity Index	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Environmental Policy
Environmental Policy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Land use type

Dimensi Ekonomi

Indikator (kiri)	Kriteria Nilai																	Indikator (kanan)
Disaster insurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Income
Disaster insurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Employment
Disaster insurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Home ownership
Disaster insurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Saving and budget
Disaster insurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Household assets
Income	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Employment
Income	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Home ownership
Income	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Saving and budget
Income	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Household assets
Employment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Home ownership
Employment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Saving and budget
Employment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Household assets
Home ownership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Saving and budget
Home ownership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Household assets
Saving and budget	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Household assets

--Terima Kasih--

Annex 4

Questionnaire Draft

A. Respondent Profile

Name :
Age :
Occupation :
Gender :
No. telp :
Email :
Address :

B. Area history and overview

Name of sub-district / ward :
Topography :
Hazard Type : Flood/Landslide/Coastal Flood/Covid-19
History of Hazards :
Loss and Damage Related Hazard :

C. Social Dimension

- Gender

Percentage of male population

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Education level

Percentage of population over 25 years old with college education

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Race/Ethnicity

Percentage of ethnicities (Inverted; lower percentage is more resilient)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Awareness

Percentage of household who aware about disaster

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- National language speaking

Percentage of population capable in Bahasa Indonesia

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Preparedness

Percentage of population joining disaster education or workshop

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Training and Education

Percentage of disaster training or disaster education held by government

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Social Capital

Percentage of community trust in government

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

Extent of city's population participate in community activities

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

Extent of city's population participate in a club or social activity group

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

Ability of city's communities to build consensus and deliver shared interest

1 (Not able)	2 (poor/limited)	3 (moderate)	4 (fully able)	Value

Level of democracy: city's communities have the opportunity to participate in thecity's decision making process

1 (no opportunity)	2 (poor/limited)	3 (moderate)	4 (fully able)	Value

- Risk Perceptions

Percentage of household who understand the risk

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Number of special need people

Percentage of population without sensory, physical, or mental disability

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Age

Percentage of population below 65 years of age

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Community participation to DRR

Percentage of community who participate actively in DRR events

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Number of family member

Average of number of family members in one household (inverted, more people willbe less resilience)

1 (more than 6 people)	2 (5-6 people)	3 (3-4 people)	4 (1-2 people)	Value

- Years of Residence in a community

Average years of living in the area

1 (0-1 year)	2 (>1 – 6 < years)	3 (6-10 years)	4 (more than 10 years)	Value

D. Environmental Dimension

- Hazard intensity

Percentage of hazard intensity happens in area

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Hazard frequency

Percentage of hazard frequency happens in area

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Number of different hazards

Number of different hazards happen in area within 1 year (inverted)

1 (more than 10 times)	2 (5-10 times)	3 (1-5< times)	4 (none)	Value

- Biodiversity Index

Percentage of diversity of plant and animal species

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Environmental Policy

Percentage of environmental policy which covers climate and biological disaster

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Land use type

Percentage of green open space

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

E. Economic Dimension

- Disaster insurance

Percentage of household who covered by disaster insurance

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Income

Percentage of household who have income above the average salary

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Employment

Percentage of Registered community employment rate

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Home ownership

Percentage of owner-occupied housing units

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Saving and budget

Percentage of household who have saving and budget for disaster loss

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Household assets

Percentage of city's population have mobile phone/telecommunication

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

Percentage of city's households have television or radio

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

Percentage of city's households have vehicle

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

F. Governance Dimension

- Disaster Plan, Policy, and Program

Percentage of Plan, Policy, and Program document issued by govenmrnt related to Climate and Covid-19

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Institutional network/collaboration

Percentage of collaboration between government and third parties to support disaster aid

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Infection control

Percentage of strategies for controlling covid-19 spread

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Availability of subsidies

Percentage of household get subsidies provided by government

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Disaster aid experience

Average of government experience in handling disaster

1 (0-5 years)	2 (6-10 years)	3 (11-15 years)	4 (more than 15 years)	Value

- Volunteerism

Percentage of disaster volunteers within 1 year

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

G. Physical Dimension

- Evacuation route

Percentage of major road egress points per area

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Population density

Average population divided by the land area (in habitat per km2)

1 (more than 1000)	2 (250 - 999)	3 (100 - 249)	4 (1-99)	Value

- Access to clean water and sanitation

Percentage of population with access to clean water and sanitation

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Access to health facilities

Percentage of population with access to health facilities

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Temporary housing

Percentage of temporary housing availability

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Water supply

Percentage of availability and supply capacity of water resources

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Electricity supply

Percentage of household supplied by electricity

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Accessibility

Percentage of public transport for every 10,000 people

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Building density

Percentage of building square footage divided by land area

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Housing type

Percentage of single housing within the area (Ward/sub-district)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Value

- Number of medical institutions

Number of medical institutions within area

1 (0-5%)	2 (6-10)	3 (11-15%)	4 (more than 15)	Value

- Warning System

Availability of warning system for disaster

1 (0)	2 (1-5)	3 (6-10)	4 (more than 10)	Value

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Community Resilience Index

Studi Kasus : Kota Balikpapan

Penelitian ini bertujuan untuk mengukur tingkat ketahanan bencana iklim dan bencana biologis (covid-19) eksisting di 6 kecamatan dan 34 kelurahan kota Balikpapan dengan menggunakan **Community Resilience Index untuk Covid-19 and Climate Disaster.** Ketahanan dinilai hanya terhadap bahaya alam terkait iklim, seperti angin topan, banjir, kenaikan permukaan laut, tanah longsor akibat curah hujan, kelangkaan air, dll. Sedangkan bahaya biologis dalam penelitian ini hanya Covid-19. Dengan demikian, gempa bumi, letusan gunung berapi, dan bahaya geologis lainnya tidak dianggap sebagai bagian dari pelajaran ini. Semua informasi yang diperoleh dari kuesioner ini hanya akan digunakan untuk tujuan penelitian akademis dan tidak diberikan kepada pihak lain, kecuali anggota tim peneliti dari Universitas Keio dan Institut Teknologi Kalimantan. Adapun pertanyaan terkait kuisoner ini bisa ditanyakan kepada peneliti di nomor 08111012224 atau email : ayya19@keio.jp (Ariyaningsih).

I.Contact Person di Kecamatan atau Kelurahan

Nama Pejabat : DADANG SAIFUDDIN RASYID
Instansi : KECAMATAN BALIKPAPAN SELATAN
Alamat : JL. RUHUI RAHAYU RT 23 NO 1
Telepon/Fax : 0813 5554 4944
Email :
Tanggal pengisian kuesioner : 7 NOVEMBER 2022

II.Profil Area

Nama Kelurahan/Kecamatan : KECAMATAN BALIKPAPAN SELATAN
Topografi (perbukitan, pesisir, dll) : PERBUKITAN
Bencana yang sering terjadi : BANJIR dan POHON TUMBANG
Kerugian akibat bencana : Rupiah/tahun

III.Petunjuk Pengisian

Kuesioner ini terdiri dari lima dimensi dengan setiap bagian memberikan beberapa pertanyaan untuk mengukur ketahanan kota terhadap bencana alam terkait iklim dan bencana biologis (COVID-19). Lima dimensi tersebut adalah: fisik, sosial, ekonomi, pemerintahan, dan lingkungan serta mencakup sejumlah parameter. Berikut merupakan list dimensi dan parameternya. Kuesioner harus berdasarkan nilai. Kerangka waktu tidak disebutkan secara spesifik, mohon berikan tanggapan menggunakan data selama 12 bulan terakhir. **Harap berikan referensi dan catatan/penjelasan singkat bila memungkinkan.** Mohon kembalikan kuesioner yang telah diisi pada atau sebelum tanggal **9 September 2022**. Terima kasih banyak atas kerjasamanya.

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Institut Teknologi Kalimantan

Tabel 1 Daftar Dimensi dan Parameter

Sosial	Lingkungan	Ekonomi	Kepemerintahan	Fisik
1. Jenis kelamin 2. Tingkat Pendidikan 3. Ras/Etnis 4. Kesadaran 5. Berbicara bahasa nasional 6. Keslapslagaan 7. Pelatihan dan Pendidikan 8. Modal Sosial 9. Persepsi Risiko 10. Jumlah orang berkebutuhan khusus 11. Usia 12. Partisipasi masyarakat dalam Pengurangan Risiko Bencana 13 Jumlah anggota keluarga 14. Tahun Tinggal di kelurahan/kecamatan 15 Jumlah warga dengan penyakit bawaan 16. Mobilitas 17. Penggunaan flatform online untuk makanan dan transportasi 18. Jumlah turis local dan luar kota yang datang ke kelurahan/kecamatan	1. Intensitas bahaya/bencana 2. Frekuensi bahaya/bencana 3. Jumlah bahaya/bencana yang berbeda 4. Indeks Keanekaragaman Hayati 5. Kebijakan lingkungan 6. Jenis penggunaan lahan 7. Ketersediaan ruang terbuka hijau 8. Muka air laut	1. Asuransi bencana 2. Penghasilan 3. Pekerjaan 4. Kepemilikan rumah 5. Hemat dan anggaran 6. Aset rumah tangga 7. Asuransi kesehatan	1. Rencana, Kebijakan, dan Program Bencana 2 Jaringan/kolaborasi kelembagaan 3. Pengendalian infeksi 4. Ketersediaan subsidi 5. Pengalaman bantuan bencana 6. Kesiapsiagaan	1. Jalur Evakuasi 2. Kepadatan penduduk 3. Akses ke air bersih dan sanitasi 4. Akses ke fasilitas Kesehatan 5. Perumahan sementara 6. Persediaan air 7. Pasokan listrik 8. Aksesibilitas 9. Kepadatan bangunan 10. Jenis perumahan 11. Jumlah institusi medis 12. Sistem Peringatan 13. Fasilitas persampahan

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A.DIMENSI SOSIAL

1.Gender

Presentase penduduk berkelamin laki-laki

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

2.Tingkat pendidikan

Persentase penduduk berusia di atas 25 tahun dengan pendidikan tinggi

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3.Ras atau Etnik

Persentase jumlah ras local yang ada (Terbalik; persentase yang lebih rendah lebih tangguh)

4 (0-25%)	3 (26-50%)	2 (51-75%)	1 (76-100%)	Nilai

4.Kesadaran

Persentase rumah tangga yang sadar akan bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

5.Kemampuan berbicara bahasa nasional (bahasa Indonesia)

Presentase penduduk yang bisa berbahasa Indonesia secara fasih

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.Keslapslagaan

Presentase penduduk yang ikut berpartisipasi di workshop kebencanaan

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

7.Pelatihan dan Kependidikan

Persentase pelatihan kebencanaan atau pendidikan kebencanaan yang diselenggarakan oleh pemerintah

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.Modal sosial

8.1Persentase kepercayaan masyarakat kepada pemerintah

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.2 Tingkat partisipasi penduduk dalam kegiatan masyarakat

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.3 Tingkat partisipasi penduduk kota dalam klub atau kelompok kegiatan sosial

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.4 Kemampuan penduduk untuk membangun konsensus dan menyampaikan kepentingan bersama

1 (Tidak mampu)	2 (Kurang/terbatas)	3 (Sedang)	4 (Mampu)	Nilai

8.5 Tingkat demokrasi: masyarakat memiliki kesempatan untuk berpartisipasi dalam proses pengambilan keputusan

1 (tidak ada kesempatan)	2 kurang atau terbatas)	3 (sedang)	4 (berkesempatan penuh)	Nilai

9.Persepsi Risiko

Persentase rumah tangga yang memahami risiko bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

10.Jumlah orang berkebutuhan khusus

Persentase penduduk tanpa cacat sensorik, fisik, atau mental

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

11.Usia

Persentase penduduk di bawah 65 tahun

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

12.Partisipasi masyarakat dalam Pengurangan Risiko Bencana

Persentase masyarakat yang berpartisipasi aktif dalam kegiatan Pengurangan Risiko Bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

13.Jumlah anggota keluarga

Rata-rata jumlah anggota keluarga dalam satu rumah tangga (terbalik, lebih banyak orang akan mengurangi ketahanan)

1 (lebih dari 6 orang)	2 (5-6 orang)	3 (3-4 orang)	4 (1-2 orang)	Nilai

14.Tahun Tinggal di kelurahan/kecamatan

Rata-rata tahun tinggal di daerah ini

1 (0-1 tahun)	2 (1 – 5 tahun)	3 (6-10 tahun)	4 (lebih dari 10 tahun)	Nilai

15.Warga dengan penyakit bawaan

15.1 Presentase jumlah warga dengan penyakit bawaan yang rentan terhadap covid (penilaian terbalik)

4 (0-25%)	3 (26-50%)	2 (51-75%)	1 (76-100%)	Nilai

15.2 Persentase penduduk menderita penyakit yang ditularkan melalui air vektor setiap tahun (penilaian terbalik)

4 (0-25%)	3 (26-50%)	2 (51-75%)	1 (76-100%)	Nilai

16.Mobilitas

Rata-rata jumlah mobilitas penduduk dalam sehari

1 (tidak ada mobilitas)	2 (1-2 kali)	3 (3-4 kali)	4 (lebih dari 5 kali)	Nilai

17.Penggunaan flatform online (gojek, grab, shopeefood, maxim) untuk beraktivitas

Rata-rata penggunaan flatform online (gojek, grab, shopeefood, maxim) untuk beraktivitas dalam satu minggu

1 (tidak ada)	2 (1-2 kali)	3 (3-4 kali)	4 (lebih dari 5 kali)	Nilai

18.Jumlah turis lokal dan luar kota yang datang ke kelurahan/kecamatan selama 1 minggu

1 (0-10)	2 (11-20 orang)	3 (21-50 orang)	4 (lebih dari 50 orang)	Nilai

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B. DIMENSI LINGKUNGAN

1. Intensitas bahaya/bencana

Persentase intensitas bencana/bahaya yang terjadi di wilayah (semua bencana seperti banjir, tanah longsor, dll)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

2. Frekuensi bahaya/bencana

Persentase frekuensi bencana/bahaya yang terjadi di wilayah (semua bencana seperti banjir, tanah longsor, dll)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3. Jumlah bahaya/bencana yang berbeda

Jumlah bahaya/bencana yang berbeda terjadi di daerah dalam waktu 1 tahun

1 (lebih dari 10 kali)	2 (5-10 kali)	3 (1-4 kali)	4 (tidak ada)	Nilai

4. Indeks Keanekaragaman Hayati

Persentase keanekaragaman jenis tumbuhan dan hewan

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

5. Kebijakan lingkungan

Persentase kebijakan lingkungan yang mencakup bencana iklim dan biologis

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6. Jenis penggunaan lahan

6.1 Persentase lahan terbangun dibandingkan dengan lahan tak terbangun

1 (lebih dari 76%)	2 (51-75%)	3 (26-50%)	4 (0-25%)	Nilai

6.2 Persentase lahan yang mengikuti peraturan zonasi

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.2 Persentase perumahan kumuh

1 (lebih dari 76%)	2 (51-75%)	3 (26-50%)	4 (0-25%)	Nilai

6.3 Persentase total penduduk yang tinggal di dekat industri yang berpolusi, tempat pembuangan sampah, dan tempat pembuangan sampah

1 (lebih dari 76%)	2 (51-75%)	3 (26-50%)	4 (0-25%)	Nilai

7. Ketersediaan ruang terbuka hijau

Persentase ruang terbuka hijau

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.Muka air laut

Kenaikan muka air laut selama sau tahun

1 (lebih dari 1cm)	2 (51mm- < 1cm)	3 (26-50mm)	4 (0-25 mm)	Nilai

C.DIMENSI EKONOMI

1.Asuransi bencana

Persentase rumah tangga yang memiliki asuransi bencana (bencana alam, atau bencana non alam)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

2.Penghasilan

Persentase rumah tangga yang memiliki pendapatan di atas gaji UMR

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3.Pekerjaan

Persentase penduduk yang memiliki pekerjaan tetap

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.Kepemilikan rumah

Persentase penduduk yang memiliki rumah sendiri

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

5.Tabungan dan anggaran

Persentase rumah tangga yang memiliki tabungan dan anggaran untuk kerugian bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.Aset rumah tangga

6.1 Persentase penduduk yang memiliki telepon seluler/telekomunikasi

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.2 Persentase rumah tangga yang memiliki televisi atau radio

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.3 Persentase rumah tangga yang memiliki kendaraan

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.4Persentase rumah tangga yang memiliki wifi atau internet di rumah

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

7.Asuransi kesehatan

Persentase rumah tangga yang memiliki asuransi Kesehatan (BPJS ataupun asuransi swasta)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

A.DIMENSI PEMERINTAHAN

1. Rencana, Kebijakan, dan Program Bencana

Persentase dokumen Rencana, Kebijakan, dan Program yang dikeluarkan oleh pemerintah terkait Iklim dan Covid-19

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

2. Jaringan/kolaborasi kelembagaan

Persentase kerjasama antara pemerintah dan pihak ketiga untuk mendukung bantuan bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3. Pengendalian Infeksi

Persentase strategi pengendalian penyebaran covid-19

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4. Ketersediaan subsidi dan anggaran

4.1 Persentase rumah tangga yang mendapatkan subsidi dari pemerintah

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.2 Persentase anggaran tahunan yang menargetkan manajemen risiko bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.3 Anggaran untuk langkah-langkah pengurangan risiko bencana terkait perubahan iklim

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.4 Tersedianya subsidi/insentif bagi warga/lembaga untuk membangun kembali rumah pasca bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.5 Tersedianya subsidi/insentif bagi warga/lembaga untuk menerima/memberikan alternatif mata pencaharian darurat saat terjadi bencana

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.6 Tersedianya subsidi/insentif bagi warga/lembaga untuk menerima/memberikan bantuan darurat Kesehatan

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

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5. Pengalaman bantuan bencana

Rata-rata pengalaman pemerintah dalam menangani bencana

1 (0-5 tahun)	2 (6-10 tahun)	3 (11-15 tahun)	4 (lebih dari 15 tahun)	Nilai

6.Kesukarelaan

Persentase relawan bencana dalam 1 tahun

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

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B.DIMENSI FISIK

1.Jalur Evakuasi

Persentase titik jalan keluar utama per area

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

2.Kepadatan penduduk

Rata-rata populasi dibagi luas daratan (dalam habitat per km2)

1 (lebih dari 1000)	2 (250 - 999)	3 (100 - 249)	4 (1-99)	Nilai

3.Akses ke air bersih dan sanitasi

3.1 Persentase penduduk yang memiliki akses terhadap air bersih

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3.2Persentase penduduk kota dengan akses sanitasi yang higienis (sambungan ke saluran pembuangan umum, sambungan ke sistem septik, pembuangan limbah padat, dll.)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

3.3Persentase penduduk kota yang memiliki akses ke toilet (jamban higienis: jamban sumur, jamban tertutup air, atau jamban sehat)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

4.Akses ke fasilitas Kesehatan

Persentase penduduk yang memiliki akses ke fasilitas kesehatan

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

5.Tempat tinggal sementara

Persentase ketersediaan penampungan sementara untuk bencana di wilayah anda

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.Persediaan air bersih

6.1 Persentase ketersediaan dan kapasitas suplai sumber daya air

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

6.2Persentase penduduk kota dengan akses legal ke pasokan air minum (termasuk air ledeng yang disalurkan oleh perusahaan air omestic dan sumur gali yang dilindungi, tetapi tidak termasuk stasiun pengisian air bersih, air minum kemasan, dll.)

1 (Up to 10%)	2 (11-25%)	3 (26-50%)	4 (51-75%)	Nilai

6.3 Status pasokan air (Status ketersediaan air harian)

1 (tersedia sampai 1 jam)	2 (tersedia 1-5 jam)	3 (tersedia 6-10 jam)	4 (lancar, tidak ad gangguan)	Nilai

6.4 Pasokan air bergantung pada penyediaan eksternal (misalnya, dari kota/daerah lain) selama terjadi bencana

1 (76-100%)	2 (51-75%)	3 (26-50%)	4 (kurang dari 50%)	Nilai

6.5 Tingkat kapasitas sistem pasokan air aman darurat alternatif (sistem pemurnian air, air yang disimpan, dll.)

1 (tidak ada penyimpanan)	2 (1-25% dari kebutuhan)	3 (26-50% dari kebutuhan)	4 (51-100% dari kebutuhan)	Nilai

7.Pasokan listrik

7.1 Persentase rumah tangga yang dipasok listrik secara legal(Indikator ini tidak memperhitungkan koneksi ilegal.)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

7.2 Status gangguan (Status ketersediaan listrik harian)

1 (gangguan lebih dari 1 hari)	2 (gangguan 12 jam sampai 24 jam)	3 (gangguan 5-12 jam)	4 (kurang dari 5 jam)	Nilai

7.3 Pasokan listrik kota tergantung pada penyediaan eksternal (misalnya, dari kota/daerah lain) selama bencana yang paling sering

1 (76-100%)	2 (51-75%)	3 (10-50%)	4 (less than 10%)	Nilai

7.4 Tingkat kapasitas sistem pasokan listrik darurat alternatif (mungkin termasuk cadangan di tempat pembangkit listrik, catu daya yang tidak pernah terputus, dll.) untuk menjaga layanan darurat berfungsi (misalnya, rumah sakit, pusat evakuasi, dll.)

1 (tidak ada cadangan)	2 (1-50% dari kebutuhan listrik)	3 (50-75% dari kebutuhan listrik)	4 (76-100% dari kebutuhan listrik)	Nilai

8.Aksesibilitas

8.1 Persentase angkutan umum untuk setiap 10.000 orang

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

8.2 Persentase lahan yang digunakan sebagai jaringan transportasi

1 (0-10%)	2 (11-20%)	3 (21-30%)	4 (lebih dari 30%)	Nilai

8.4 Persentase jalan beraspal (jalan aspal atau beton)

1 (Less than 50%)	2 (51-60%)	3 (61-70%)	4 (lebih dari 70%)	Nilai

8.5 Persentase jalan tetap dapat diakses selama banjir (misalnya, setelah hujan lebat, saat air pasang, dll.) di daerah yang terkena dampak

1 (Kurang dari 40%)	2 (41-50%)	3 (51-60%)	4 (lebih dari 60%)	Nilai

8.6 Persentase jalan tetap dapat diakses selama tanah longsor

1 (Kurang dari 40%)	2 (41-50%)	3 (51-60%)	4 (lebih dari 60%)	Nilai

8.7 Persentase jalan tetap dapat diakses selama PPKM

1 (Kurang dari 40%)	2 (41-50%)	3 (51-60%)	4 (lebih dari 60%)	Nilai

8.8 Persentase jalan yang memiliki saluran tertutup di tepi jalan

1 (Kurang dari 15%)	2 (16-30%)	3 (31-60%)	4 (lebih dari 60%)	Nilai

9.Kepadatan bangunan

Persentase luas bangunan dibagi luas tanah

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

10.Jenis perumahan

10.1 Persentase perumahan tunggal di dalam kawasan (Kelurahan/Kecamatan)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

10.2 Persentase bangunan yang tahan bencana (untuk bencana hidrometeorologi seperti banjir)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

10.3 Persentase rumah di atas genangan air normal/banjir (misalnya rumah panggung dan rumah yang didesain tinggi)

1 (0-25%)	2 (26-50%)	3 (51-75%)	4 (76-100%)	Nilai

11.Jumlah Institusi medis

Jumlah institusi medis di dalam wilayah

1 (0-5%)	2 (6-10)	3 (11-15%)	4 (more than 15)	Nilai

12.Sistem Peringatan dini

Tersedianya sistem peringatan bencana

1 (0)	2 (1-5)	3 (6-10)	4 (lebih dari 10)	Nilai

13.Fasilitas persampahan

13.1 Pengumpulan limbah padat yang dihasilkan per hari

1 (0)	2 (1-2)	3 (2-5)	4 (lebih dari 5)	Nilai

13.2 Persentase limbah padat yang diolah sebelum dibuang

1 (0%)	2 (1-5%)	3 (6-10%)	4 (lebih dari 10%)	Nilai

13.3 Persentase sampah yang didaur ulang (baik formal maupun informal: pengelolaan sampah kota dan kegiatan daur ulang sampah oleh pemulung dan pemulung)

1 (0%)	2 (1-5%)	3 (6-10%)	4 (lebih dari 10%)	Nilai

13.4 Presentase pemilihan sampah selama pandemic (pemilihan sampah medis dan non medis)

1 (0%)	2 (1-5%)	3 (6-10%)	4 (lebih dari 10%)	Nilai

Terimakasih atas Kerjasama dan waktunya.

Hormat saya,

Ariyaningsih

Risk Perception Questions

A. Respondent Characteristics

1. How old are you?
   a. *under 20 years old*
   b. *between 20 years and 40 years*
   c. *above 40 years, below 60 years*
   d. *above 60 years*
2. What is your gender?
   a. Female
   b. Male
3. What is your latest education?
   a. *Elementary*
   b. *Junior High*
   c. *High School*
   d. *Bachelor/Diploma*
   e. *Master/Doctor*
4. What is your occupation?
   a. Not working
   b. Self-employed
   c. Public employee
   d. Private employee
   e. Retired
   f. Student
5. In which village do you live?.....
6. How many years do you live in this area?
   a. less than a year
   b. 1-5 years
   c. 5-10 years
   d. more than 10 years
7. What are your strategies to address flooding in your area or your house?

.....
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……

B. Awareness of Natural hazards

1. Do you think climate-related hazard could threaten the community where you live?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*
2. Do you think flood disaster could threaten the community where you live?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*
3. Do you think flood disaster following by landslide could threaten the community where you live?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*

C. Perception of the seriousness of hazard

1. Do you think that flooding in your area is serious?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*
2. Do you think flood accompanied by landslides in your area is serious?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*
3. Do feel scared if you are affected by such a natural hazard soon?
   a. *Don't know*
   b. *Not very agree.*
   c. *Slightly agree.*
   d. *Moderately agree.*
   e. *Greatly agree*

D. Perception of flood risk

1. Are you worried about being affected by flooding?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree
2. Are you worried about losing your assets due to flood?

a. Don't know
b. Not very agree.
c. Slightly agree.
d. Moderately agree.
e. Greatly agree

3. Are you worried if your family affected by flood?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree

E. Knowledge on hazard and capacity

1. If you were to be affected by a future disaster, would you be able to mitigate the disaster under your current conditions?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree
2. Do you have confidence in the government's disaster control program especially on flood risk?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree
3. Do you think that giving risk information for vulnerable people is the solution for reducing flood risk?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree
4. Do you think that disasters will have a greater impact in the coming year if you or the government do not take precautions?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree
5. If you do not prevent or prepare for flood disasters, such as owning assets or obtaining disaster insurance. Do you think you are being able to recover from disasters in the upcoming years?
   a. Don't know
   b. Not very agree.
   c. Slightly agree.
   d. Moderately agree.
   e. Greatly agree

1. Berapakah umur an	2. Apa jenis kelamin ar	3. Apa pendidikan teral	4. Apakah pekerjaan a	5. Ada berapa orang di	6. Di Kecamatan mana
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Wiraswasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Kota
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	SMA	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	SMA	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	lebih dari 6 orang	Balikpapan Kota
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Wiraswasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	SMA	Tidak bekerja	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Kota
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Perempuan	SMA	Pelajar	4-6 orang	Balikpapan Utara

di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Wiraswasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Denpasar selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Timur
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	lebih dari 6 orang	Balikpapan Selatan
di bawah 20 tahun	Perempuan	Sarjana/Diploma	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	4-6 orang	Balikpapan Kota
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	lebih dari 6 orang	Balikpapan Timur
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Selatan

di atas 40 tahun, di bav	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Selatan
di bawah 20 tahun	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai swasta	4-6 orang	Balikpapan Timur
antara 20 tahun sampa	Laki-laki	SMA	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Tengah
di atas 40 tahun, di bav	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di atas 40 tahun, di bav	Laki-laki	Sarjana/Diploma	Wiraswasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
di atas 40 tahun, di bav	Perempuan	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Wiraswasta	1-4 orang	Surabaya
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai negeri	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di atas 40 tahun, di bav	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai negeri	1-4 orang	Balikpapan Timur
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Tidak bekerja	lebih dari 6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Timur

antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Wiraswasta	lebih dari 6 orang	Balikpapan Timur
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Kota
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	lebih dari 6 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Timur
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Pegawai swasta	4-6 orang	Balikpapan Timur
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	Sarjana/Diploma	Pelajar	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai swasta	4-6 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Tidak bekerja	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	SMA	Pelajar	4-6 orang	Balikpapan Utara

antara 20 tahun sampa	Laki-laki	SMA	Pelajar	4-6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Wiraswasta	4-6 orang	Balikpapan Kota
antara 20 tahun sampa	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	4-6 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	Sarjana/Diploma	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Sarjana/Diploma	Pelajar	lebih dari 6 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	SMA	Pelajar	4-6 orang	Balikpapan Selatan
antara 20 tahun sampa	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Perempuan	SMA	Pelajar	lebih dari 6 orang	Balikpapan Utara
di bawah 20 tahun	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Barat
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
antara 20 tahun sampa	Laki-laki	SMA	Pelajar	4-6 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Utara
di atas 40 tahun, di bav	Perempuan	Sarjana/Diploma	Tidak bekerja	1-4 orang	Balikpapan Utara
di atas 40 tahun, di bav	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Selatan
di atas 40 tahun, di bav	Laki-laki	Sarjana/Diploma	Pegawai swasta	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	4-6 orang	Balikpapan Utara
di atas 40 tahun, di bav	Laki-laki	SMA	Pegawai negeri	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Perempuan	SMA	Tidak bekerja	1-4 orang	Balikpapan Utara
di atas 40 tahun, di bav	Perempuan	SMP	Tidak bekerja	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Perempuan	SMA	Pelajar	4-6 orang	Balikpapan Selatan
di bawah 20 tahun	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Laki-laki	SMA	Pelajar	1-4 orang	Balikpapan Tengah
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai negeri	1-4 orang	Balikpapan Utara
di bawah 20 tahun	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Selatan
antara 20 tahun sampa	Perempuan	SMA	Pelajar	1-4 orang	Balikpapan Barat
antara 20 tahun sampa	Perempuan	Master/Doktor	Pegawai swasta	1-4 orang	Balikpapan Utara

7. Di Kelurahan mana a	8. Berapa lama anda ti	9. Bencana apakah yar	10. Apakah anda terke	11. Dalam skala 0-5, m	12. Dalam skala 0-5, m	13. Dalam skala 0-5, n
Gunung samarinda	lebih dari 10 tahun	Banjir	Tidak	4	4	4
karang joang	1-5 tahun	Kebakaran	tidak	5	5	5
Sepinggan baru	1-5 tahun	Banjir	Tidak ada bencana diru	1	2	2
Gunung Samarinda Ba	5-10 tahun	Banjir	Menaikan konstruksi ba	4	5	4
Sepinggan	5-10 tahun	Banjir	Tidak	4	4	4
Telagasari	5-10 tahun	Tanah Longsor	Tidak	5	5	4
Sepinggan	lebih dari 10 tahun	Kebakaran	Tidak terdampak, namu	3	3	4
Batu Ampar	1-5 tahun	Banjir	Iya terdampak, mengha	5	4	4
Karang joang	1-5 tahun	Tanah Longsor	Tidak	4	4	5
Karang Joang	1-5 tahun	Tanah Longsor	Tidak	5	5	5
Sepinggan	lebih dari 10 tahun	Banjir	Tidak	3	5	4
Karang Joang	5-10 tahun	Banjir	meninggikan pintu mas	4	4	5
Karangjoang	1-5 tahun	Tanah Longsor	Tidak	4	3	5
Karang Joang	1-5 tahun	Abrasi/Erosi	Tidak	4	4	4
Karang Joang	5-10 tahun	Tanah Longsor	Tidak	5	5	3
Karang joang	5-10 tahun	Tanah Longsor	Alhamdulillah tidak	3	4	2
Klandasan Ulu	lebih dari 10 tahun	Kebakaran	TidakMempersiapkan p	2	3	5
Karang Joang	1-5 tahun	Banjir	Ya , 2 kali rumah saya	5	4	5
Karang Joang	5-10 tahun	Tanah Longsor	Iyah, melaporkan pada	5	4	3
Karang joang	1-5 tahun	Tanah Longsor	Tidak Terdapak	3	3	2
Karang Joang	1-5 tahun	Tanah Longsor	Tidak terkena dampak	5	5	4
Karang Joang	1-5 tahun	Banjir	Tidak	3	5	5
gunung samarinda	1-5 tahun	Kebakaran	tidak	4	4	3
Karang Joang	1-5 tahun	Tanah Longsor	Terkena dampak penga	3	3	5
Sepinggan Baru	lebih dari 10 tahun	Kebakaran	Tidak	3	3	2
telaga sari	1-5 tahun	Tanah Longsor	alhamdulillah tidak	5	5	3
Mekar sari	kurang dari setahun	Banjir	Tidak begitu, hanya jal	4	4	3
Karang Joang	5-10 tahun	Tanah Longsor	Dampak bencana yang	2	5	5
Gunung Samarinda ba	1-5 tahun	Banjir	Iya saat melintas di dae	3	5	1
Batu Ampar	1-5 tahun	Banjir	Tidak secara langsung	4	4	4
Batu Ampar	lebih dari 10 tahun	Abrasi/Erosi	tidak	3	5	4

Margasari	lebih dari 10 tahun	Kebakaran	Alhamdulillah rumah sa	4	4	3
Karang Joang	5-10 tahun	Abrasi/Erosi	tidak	2	2	3
Baru ilir	kurang dari setahun	Kebakaran	Sempat terjadi kebakar	5	5	3
Gunung samarinda	1-5 tahun	Abrasi/Erosi	Tidak terdampak	5	5	5
Marga sari	lebih dari 10 tahun	Kebakaran	Pernah, pasrah	3	3	3
Karang Joang	1-5 tahun	Banjir	Tidak terkena secara la	4	4	4
Sidakarya	1-5 tahun	Banjir	Tidak	3	4	4
Gunung bahagia	1-5 tahun	Banjir	Tidak. Hanya kadang b	4	3	4
Karang Jati	1-5 tahun	Kebakaran	Tidak terkena. Upaya y	5	5	3
Mekar Sari	lebih dari 10 tahun	Banjir	Iya berdampak sekali..l	5	5	5
Batu Ampar	lebih dari 10 tahun	Tanah Longsor	Tidak terdampak secar	3	4	4
Karang Joang	1-5 tahun	Banjir	Tidak	4	5	3
Gunung samarinda bar	lebih dari 10 tahun	Banjir	Tidak,di daerah rumah	3	3	2
Sungai Nangka	1-5 tahun	Banjir	tidak secara langsung,	3	3	5
Manggar	1-5 tahun	Tanah Longsor	Tidak	3	3	3
Karang Joang	5-10 tahun	Tanah Longsor	Tidak.	2	3	1
Karang joang	1-5 tahun	Banjir	Banjir bukan di daerah	5	5	5
Sungai nangka	1-5 tahun	Banjir	Iya, karena akses kelua	3	3	2
Sepinggan	lebih dari 10 tahun	Banjir	Menjaga kebersihan pa	4	2	5
Klandasan Ilir	1-5 tahun	Banjir	Tidak terdampak	0	0	3
karang joang	kurang dari setahun	Banjir	tidak	3	5	2
Karajoang	1-5 tahun	Banjir	Iyaa..biasanya sama w	3	3	3
Gunung Samarinda Ba	1-5 tahun	Banjir	Tidak	2	2	4
Gunung Samarinda Ba	1-5 tahun	Kebakaran	Terkena dampak. Lebil	5	4	3
Prapatan	5-10 tahun	Kebakaran	Tidak	4	4	3
Manggar Baru	lebih dari 10 tahun	Banjir	Banjir hanya terjadi di j	5	2	3
Karang Joang	5-10 tahun	Tanah Longsor	Tidak	4	4	5
Graha Indah	1-5 tahun	Tanah Longsor	Tidak	2	3	3
Sepinggan	lebih dari 10 tahun	Kebakaran	TIDAK. IKUT BERPAR	5	5	5
Mekar Sari	lebih dari 10 tahun	Kebakaran	Hampir terkena	4	5	3
Graha Indah	1-5 tahun	Banjir	Tidak, kebetulan pemu	5	5	5
Sepinggan	kurang dari setahun	Banjir	Tidak	3	5	4

Sepinggan	5-10 tahun	Banjir	Rumah tidak berdampa	3	2	3
Sepinggan	5-10 tahun	Banjir	Tidak terkena dampakr	3	3	2
Gn samarinda baru	kurang dari setahun	Banjir	Tidak	1	1	3
Damai	5-10 tahun	Banjir	Tidak terkena	4	5	5
Sepinggan Baru	kurang dari setahun	Banjir	tidak	3	3	3
Gunung Samarinda	5-10 tahun	Banjir	tidak	3	4	4
Manggar	1-5 tahun	Banjir	Banjir / genangan. Kare	3	4	2
Manggar	kurang dari setahun	Kebakaran	Tidak ada	3	4	3
Batu Ampar	lebih dari 10 tahun	Banjir	Tidak. karena lokasi ru	4	4	4
Karang Joang	kurang dari setahun	Banjir	jika terjadi banjir, biasa	3	3	4
Karang Joang	5-10 tahun	Banjir	Iya. Pasang pengaman	5	5	5
Sumber Rejo	1-5 tahun	Banjir	tidak	4	4	5
gunung bahagia	lebih dari 10 tahun	Banjir	menunggu air surut bai	3	3	3
Karangjoang	5-10 tahun	Banjir	Rumah ditinggikan lant	4	4	4
Karang Joang	5-10 tahun	Tanah Longsor	Tidak	1	0	5
Karang Joana	5-10 tahun	Banjir	Tidak. Posisi rumah ala	5	5	5
-	lebih dari 10 tahun	Banjir	Tdk	3	4	2
Sepinggan Baru	5-10 tahun	Banjir	Alhamdulillah tidak terk	5	4	5
Sumber Rejo	lebih dari 10 tahun	Banjir	Terkena dampak banjir	5	5	4
Karang Jati	lebih dari 10 tahun	Kebakaran	Iya, telpon pemadam	5	5	5
Kalirungkut	lebih dari 10 tahun	Banjir	Terkena. Memperbaiki	4	4	4
Karang joang	5-10 tahun	Tanah Longsor	Tidak. Sebaiknya peme	4	5	5
Sepinggan baru	lebih dari 10 tahun	Banjir	Tidak terkena dampak	4	4	3
batu ampar	5-10 tahun	Banjir	tidak	4	4	5
Karang Rejo	lebih dari 10 tahun	Banjir	Pernah, memperbesar	4	3	4
Manggar	1-5 tahun	Banjir	Tidak	3	4	5
Karang Joang	5-10 tahun	Banjir	Tidak. Membersihkan s	5	4	3
Karang Joang	1-5 tahun	Tanah Longsor	Tidak	3	3	3
Karang joang	5-10 tahun	Kebakaran	Tidak	4	2	4
Sepinggan Baru	1-5 tahun	Tanah Longsor	Belum pernah ada ben	3	4	4
Sepinggan	lebih dari 10 tahun	Tanah Longsor	Iya, sebenarnya tanah	2	5	0
Manggar	kurang dari setahun	Tanah Longsor	Belum pernah, mengat	3	4	4

Kelurahan graha indah	1-5 tahun	Banjir	Enggak karena kontrak	3	4	3
Karang Joang	5-10 tahun	Tanah Longsor	Tidak	3	4	1
Sepinggan	5-10 tahun	Banjir	Tidak	5	5	5
Gunung Samarinda	kurang dari setahun	Banjir	Ya. Caranya buang sar	3	3	3
Sepinggan raya	kurang dari setahun	Tanah Longsor	jalanan bergeser dan r	4	5	5
Sepinggan	lebih dari 10 tahun	Banjir	Tidak	3	3	3
Damai	lebih dari 10 tahun	Banjir	Ya, dampak yang saya	5	4	5
karang joang	1-5 tahun	Banjir	tidak	1	1	1
Perumahan nusantara	1-5 tahun	Banjir	Sering, dan jaga keber	5	5	3
gunung samarinda	kurang dari setahun	Banjir	tidak	0	1	2
Manggar sari	1-5 tahun	Banjir	Tidak	3	4	2
Batu Ampar	kurang dari setahun	Banjir	Tidak	2	2	3
Karang joang	1-5 tahun	Banjir	Tidak	3	4	3
Gunung Guntur	1-5 tahun	Banjir	dampak yang saya ras	1	1	2
Karang joang	1-5 tahun	Banjir	Tidak	0	4	4
Karang joang	1-5 tahun	Tanah Longsor	Tidak	2	3	4
Baru Tengah	lebih dari 10 tahun	Banjir	Iya, meninggikan ruma	5	5	5
Lamaru	lebih dari 10 tahun	Banjir	Tidak	2	3	3
Kelurahan Sepinggan B	1-5 tahun	Banjir	Tidak secara langsung	1	2	1
Strat3	kurang dari setahun	Tanah Longsor	Tidak	4	5	4
Karang Joang	5-10 tahun	Banjir	Menunggu banjir surut	4	4	5
Karang joang	1-5 tahun	Tanah Longsor	Tidak	3	3	2
Karang Joang	kurang dari setahun	Kebakaran	Tidak pernah / cara me	3	3	4
Karang joang	1-5 tahun	Tanah Longsor	Tidak	5	4	5
Sepinggan Baru	1-5 tahun	Kebakaran	Tidak terkena dampak	4	5	3
Karang Joang	lebih dari 10 tahun	Kebakaran	Tidak terdampak	3	3	1
Karang Joang	1-5 tahun	Tanah Longsor	Tidak, tidak terjadi di lir	2	4	4
Karang joang	1-5 tahun	Tanah Longsor	iya walaupun tidak terla	4	3	4
Graha indah	lebih dari 10 tahun	Banjir	Dulu jalan jembatan dip	3	0	2
Gunung Samarinda Ba	lebih dari 10 tahun	Banjir	Tidak, menghindari per	5	4	3
graha indah	lebih dari 10 tahun	Banjir	tidakkk	4	0	5
Graha indah	1-5 tahun	Tanah Longsor	Tidak	1	1	1

Karang Joang	1-5 tahun	Banjir	Tidak	3	4	4
Damai	1-5 tahun	Banjir	Ya, tidak membuang sa	3	5	3
karang joang	1-5 tahun	Tanah Longsor	tidak	4	4	4
Kelurahan Balikpapan	1-5 tahun	Abrasi/Erosi	Tidak	4	4	1
Graha	1-5 tahun	Tanah Longsor	tidak	5	5	4
karang joang kilo 15 ba	1-5 tahun	Banjir	iya, dengan konfirmasi	3	2	1
sepinggan	lebih dari 10 tahun	Banjir	terkena, dengan memb	4	5	4
Karangan joang	kurang dari setahun	Kebakaran	Tidak, dengan menyed	3	3	2
Karang joang	kurang dari setahun	Abrasi/Erosi	Lebih berhati hati dalar	3	3	3
Baru Ampar	lebih dari 10 tahun	Tanah Longsor	Iya, caranya dengan m	2	3	3
Baru Ilir	lebih dari 10 tahun	Kebakaran	Iya, dampaknya mati lis	3	5	3
Karang Joang	1-5 tahun	Abrasi/Erosi	Saya tidak terkena dan	5	4	3
Karang Joang	1-5 tahun	Banjir	Iya, lapor ke developer	5	4	5
Baru ulu	lebih dari 10 tahun	Kebakaran	Nenek saya pernah ter	4	2	3
Karang joang	5-10 tahun	Banjir	Terkadang, mengguna	4	4	3
Karang Joang	lebih dari 10 tahun	Tanah Longsor	Tidak	1	0	2
Karang Joang	1-5 tahun	Abrasi/Erosi	akses jalan kada terput	4	4	3
Sepinggan baru	5-10 tahun	Abrasi/Erosi	Tidak	1	1	1
karang joang	1-5 tahun	Kebakaran	tidak	2	3	0
Batu Ampar	lebih dari 10 tahun	Banjir	Membersihkan saluran	3	5	3
Graha indah	lebih dari 10 tahun	Tanah Longsor	Memberikan edukasi k	3	5	4
Batu Ampar	1-5 tahun	Tanah Longsor	tidak	4	4	5
Karang joang	lebih dari 10 tahun	Abrasi/Erosi	Tidak	0	0	0
Sepinggan	lebih dari 10 tahun	Banjir	Iyaa, cara menangani b	3	3	2
Karang Joang	1-5 tahun	Tanah Longsor	Tidak	4	4	4
Karang Jati	lebih dari 10 tahun	Kebakaran	Tidak terkena, akan tet	0	1	4
Karang Joang	1-5 tahun	Banjir	Ya. Terdampak banjir c	5	3	2
Sepinggan	1-5 tahun	Kebakaran	Tidak	4	4	4
Baru Tengah	lebih dari 10 tahun	Kebakaran	Tidak	3	3	3
Karang Joang	5-10 tahun	Banjir	Memasang tanggul di r	5	5	5

14. Dalam skala 0-5, m	15. Dalam skala 0-5, n	16. Menurut pendapat	17. Menurut Anda, seb	18. Menurut Anda, seb	19. Menurut Anda, seb	20. Bagaimana perasa
4	4	Banjir	Serius	serius	serius	serius memikirkannya
5	5	Kebakaran	Cukup serius	serius	serius	tidak memikirkan secar
3	3	Kekeringan	Serius	cukup serius	cukup serius	tidak memikirkan secar
3	3	Banjir	Sangat serius	serius	cukup serius	serius memikirkannya
4	4	Banjir	Serius	serius	cukup serius	serius memikirkannya
4	4	Tanah longsor	Serius	sangat serius	sangat serius	sangat serius sekali un
4	3	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
4	4	Banjir	Serius	sangat serius sekali	sangat serius sekali	sangat serius memikirk
3	3	Tanah longsor	Serius	sangat serius sekali	sangat serius	sangat serius memikirk
5	5	Kebakaran	Cukup serius	serius	serius	sangat serius sekali un
4	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
5	5	Banjir	Cukup serius	cukup serius	tidak serius sama seka	sangat serius memikirk
4	3	Tanah longsor	Cukup serius	sangat serius	cukup serius	sangat serius memikirk
3	3	Tanah longsor	Cukup serius	serius	tidak serius sama seka	sangat serius memikirk
5	3	Tanah longsor	Sangat serius	sangat serius sekali	serius	serius memikirkannya
1	2	Tanah longsor	Tidak serius sama sek	cukup serius	tidak serius sama seka	sangat serius sekali un
2	1	Kebakaran	Tidak serius sama sek	tidak serius sama seka	sangat serius	serius memikirkannya
2	4	Banjir	Sangat serius	serius	serius	sangat serius sekali un
5	3	Tanah longsor	Tidak serius sama sek	sangat serius sekali	cukup serius	sangat serius memikirk
3	5	Tanah longsor	Serius	sangat serius	serius	memikirkan secara cuk
5	5	Tanah longsor	Serius	sangat serius sekali	cukup serius	sangat serius sekali un
2	2	Banjir	Serius	serius	tidak serius sama seka	sangat serius sekali un
5	4	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	1	Kekeringan	Cukup serius	serius	serius	serius memikirkannya
3	3	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
5	2	Tanah longsor	Cukup serius	cukup serius	cukup serius	sangat serius sekali un
3	5	Tanah longsor	Cukup serius	sangat serius	sangat serius	memikirkan secara cuk
5	3	Tanah longsor	Cukup serius	sangat serius	cukup serius	sangat serius sekali un
5	3	Tanah longsor	Cukup serius	cukup serius	tidak serius sama seka	sangat serius sekali un
5	5	Banjir	Serius	sangat serius	sangat serius	sangat serius memikirk
4	5	Tanah longsor	Cukup serius	serius	cukup serius	sangat serius sekali un

3	5	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
4	2	Abrasi/Erosi	Serius	serius	serius	memikirkan secara cuk
5	4	Tanah longsor	Cukup serius	serius	sangat serius	sangat serius sekali un
5	5	Tanah longsor	Tidak serius sama sek	cukup serius	serius	sangat serius memikirk
3	2	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
4	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
4	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
3	3	Banjir	Serius	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
5	3	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
5	4	Banjir	Sangat serius sekali	serius	tidak serius sama seka	sangat serius sekali un
4	3	Tanah longsor	Tidak serius sama sek	sangat serius sekali	cukup serius	sangat serius sekali un
4	4	Banjir	Serius	serius	cukup serius	sangat serius sekali un
1	2	Banjir	Sangat serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	3	Banjir	Serius	serius	serius	sangat serius memikirk
3	3	Tanah longsor	Cukup serius	serius	cukup serius	serius memikirkannya
0	0	Tanah longsor	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
5	3	Banjir	Serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	2	Banjir	Sangat serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	3	Banjir	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
5	3	Banjir	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
2	2	Banjir	Cukup serius	serius	serius	memikirkan secara cuk
4	3	Kebakaran	Serius	serius	serius	sangat serius memikirk
5	5	Kebakaran	Cukup serius	cukup serius	cukup serius	serius memikirkannya
4	3	Kebakaran	Cukup serius	cukup serius	cukup serius	sangat serius memikirk
1	1	Banjir	Cukup serius	tidak serius sama seka	serius	sangat serius memikirk
3	3	Tanah longsor	Cukup serius	sangat serius	tidak serius sama seka	serius memikirkannya
3	3	Tanah longsor	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
5	5	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	3	Kebakaran	Tidak serius sama sek	serius	cukup serius	serius memikirkannya
5	3	Banjir	Cukup serius	cukup serius	cukup serius	serius memikirkannya
5	4	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un

2	1	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
4	3	Tanah longsor	Cukup serius	cukup serius	cukup serius	serius memikirkannya
5	1	Tanah longsor	Tidak serius sama sek	cukup serius	cukup serius	serius memikirkannya
5	2	Banjir	Cukup serius	cukup serius	serius	sangat serius sekali un
4	3	Banjir	Cukup serius	tidak serius sama seka	cukup serius	serius memikirkannya
5	3	Tanah longsor	Cukup serius	cukup serius	serius	serius memikirkannya
5	4	Banjir	Serius	tidak serius sama seka	cukup serius	tidak memikirkan secar
4	2	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
4	3	Banjir	Cukup serius	cukup serius	tidak serius sama seka	serius memikirkannya
2	4	Abrasi/Erosi	Cukup serius	cukup serius	serius	serius memikirkannya
5	3	Banjir	Sangat serius	cukup serius	cukup serius	sangat serius sekali un
3	3	Banjir	Cukup serius	serius	serius	memikirkan secara cuk
5	4	Banjir	Cukup serius	cukup serius	cukup serius	sangat serius sekali un
4	4	Banjir	Serius	cukup serius	cukup serius	sangat serius memikirk
1	3	Tanah longsor	Tidak serius sama sek	serius	tidak serius sama seka	sangat serius memikirk
5	4	Kekeringan	Serius	cukup serius	cukup serius	serius memikirkannya
3	3	Banjir	Cukup serius	cukup serius	cukup serius	serius memikirkannya
5	5	Banjir	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
4	3	Banjir	Serius	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
5	3	Kebakaran	Serius	serius	cukup serius	sangat serius memikirk
4	4	Banjir	Sangat serius	sangat serius	serius	sangat serius sekali un
4	4	Tanah longsor	Cukup serius	tidak serius sama seka	serius	sangat serius memikirk
4	3	Kekeringan	Serius	cukup serius	tidak serius sama seka	serius memikirkannya
5	3	Tanah longsor	Tidak serius sama sek	cukup serius	tidak serius sama seka	serius memikirkannya
4	4	Banjir	Serius	cukup serius	cukup serius	memikirkan secara cuk
5	3	Kekeringan	Cukup serius	tidak serius sama seka	cukup serius	serius memikirkannya
5	3	Kekeringan	Sangat serius	sangat serius	serius	sangat serius memikirk
4	3	Tanah longsor	Tidak serius sama sek	sangat serius	cukup serius	tidak memikirkan secar
4	1	Kebakaran	Serius	cukup serius	cukup serius	memikirkan secara cuk
4	3	Kekeringan	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
4	0	Tanah longsor	Tidak serius sama sek	cukup serius	cukup serius	memikirkan secara cuk
1	3	Tanah longsor	Tidak serius sama sek	serius	serius	memikirkan secara cuk

4	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
4	4	Tanah longsor	Cukup serius	serius	serius	serius memikirkannya
5	5	Banjir	Tidak serius sama seka	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
2	3	Banjir	Cukup serius	cukup serius	cukup serius	serius memikirkannya
3	4	Tanah longsor	Cukup serius	sangat serius sekali	sangat serius	serius memikirkannya
3	2	Kebakaran	Cukup serius	cukup serius	cukup serius	serius memikirkannya
2	4	Banjir	Sangat serius sekali	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
1	1	Kekeringan	Tidak serius sama seka	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
5	3	Banjir	Sangat serius	serius	serius	sangat serius sekali un
1	1	Kekeringan	Tidak serius sama seka	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
3	2	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
5	5	Banjir	Cukup serius	cukup serius	tidak serius sama seka	sangat serius memikirk
3	3	Kebakaran	Cukup serius	cukup serius	tidak serius sama seka	tidak memikirkan secar
3	2	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
4	3	Tanah longsor	Tidak serius sama seka	serius	tidak serius sama seka	serius memikirkannya
4	2	Tanah longsor	Cukup serius	serius	cukup serius	memikirkan secara cuk
1	1	Banjir	Serius	cukup serius	tidak serius sama seka	sangat serius sekali un
5	3	Kekeringan	Tidak serius sama seka	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
2	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
4	3	Kekeringan	Tidak serius sama seka	cukup serius	cukup serius	memikirkan secara cuk
2	1	Banjir	Serius	cukup serius	tidak serius sama seka	memikirkan secara cuk
4	4	Tanah longsor	Tidak serius sama seka	serius	serius	memikirkan secara cuk
4	4	Kebakaran	Serius	cukup serius	cukup serius	sangat serius sekali un
5	0	Kekeringan	Tidak serius sama seka	serius	serius	sangat serius sekali un
4	4	Kebakaran	Cukup serius	cukup serius	serius	memikirkan secara cuk
2	3	Kekeringan	Cukup serius	cukup serius	tidak serius sama seka	serius memikirkannya
4	4	Tanah longsor	Tidak serius sama seka	serius	cukup serius	memikirkan secara cuk
4	3	Abrasi/Erosi	Cukup serius	cukup serius	cukup serius	serius memikirkannya
2	0	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
5	4	Kekeringan	Cukup serius	cukup serius	tidak serius sama seka	memikirkan secara cuk
5	5	Kebakaran	Cukup serius	serius	serius	sangat serius sekali un
1	1	Kekeringan	Tidak serius sama seka	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar

4	4	Banjir	Serius	cukup serius	cukup serius	serius memikirkannya
5	1	Banjir	Cukup serius	cukup serius	tidak serius sama seka	sangat serius sekali un
5	3	Kebakaran	Tidak serius sama sek	cukup serius	serius	serius memikirkannya
4	1	Kekeringan	Tidak serius sama sek	tidak serius sama seka	cukup serius	memikirkan secara cuk
5	3	Tanah longsor	Cukup serius	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
2	3	Banjir	Cukup serius	cukup serius	tidak serius sama seka	sangat serius memikirk
4	2	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
3	1	Kebakaran	Tidak serius sama sek	cukup serius	tidak serius sama seka	sangat serius sekali un
3	3	Tanah longsor	Serius	sangat serius	sangat serius	serius memikirkannya
2	2	Tanah longsor	Tidak serius sama sek	cukup serius	tidak serius sama seka	sangat serius sekali un
2	1	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
5	3	Tanah longsor	Tidak serius sama sek	serius	sangat serius	sangat serius memikirk
5	2	Banjir	Serius	cukup serius	cukup serius	sangat serius memikirk
4	4	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
3	3	Kekeringan	Cukup serius	sangat serius	cukup serius	memikirkan secara cuk
5	5	Kekeringan	Cukup serius	cukup serius	tidak serius sama seka	sangat serius sekali un
3	3	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
4	3	Tanah longsor	Cukup serius	cukup serius	cukup serius	sangat serius sekali un
4	4	Banjir	Cukup serius	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
4	3	Kekeringan	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
1	5	Tanah longsor	Cukup serius	cukup serius	cukup serius	serius memikirkannya
5	4	Kekeringan	Cukup serius	serius	cukup serius	sangat serius memikirk
1	1	Kekeringan	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	memikirkan secara cuk
4	2	Banjir	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	serius memikirkannya
5	3	Tanah longsor	Tidak serius sama sek	serius	tidak serius sama seka	memikirkan secara cuk
4	1	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius sekali un
4	2	Banjir	Serius	serius	tidak serius sama seka	serius memikirkannya
4	2	Kebakaran	Tidak serius sama sek	tidak serius sama seka	tidak serius sama seka	sangat serius memikirk
5	3	Kebakaran	Cukup serius	tidak serius sama seka	tidak serius sama seka	tidak memikirkan secar
3	5	Tanah longsor	Serius	cukup serius	tidak serius sama seka	sangat serius sekali un

21. Apakah Anda berpi	21. Misalkan Anda tida	22. Seberapa khawatirl	23. Berapa kali anda te	24. Jika anda terkena c	25. Apakah anda menaruh kepercayaan terhac
Tentu saja tidak	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	tidak oernah	Sedikit mampu	Percaya
mungkin iya	tidak kecil dan juga tid	sangat khawatir	tidak oernah	tidak mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	Percaya
mungkin iya	tidak kecil dan juga tid	khawatir	tidak oernah	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinannya besa	khawatir	3-5 kali	Mampu	Percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tid	khawatir	tidak oernah	Mampu	Percaya
Bisa iya, bisa tidak	tidak kecil dan juga tid	Sedikit khawatir	tidak oernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Sedikit mampu	Sangat Percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	tidak oernah	Mampu	sedikit percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak oernah	tidak mampu	sedikit percaya
mungkin iya	kemungkinan kecil	khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya besa	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinan kecil	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Sedikit mampu	Percaya
mungkin iya	kemungkinan kecil	sangat khawatir	tidak oernah	tidak mampu	sedikit percaya
Bisa iya, bisa tidak	tidak kecil dan juga tid	sangat khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tid	khawatir	tidak oernah	Mampu	Percaya
sangat pasti	tidak kecil dan juga tid	khawatir	tidak oernah	tidak mampu	Sangat Percaya
sangat pasti	tidak kecil dan juga tid	khawatir	1-2 kali	Sedikit mampu	Tidak percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tid	khawatir	tidak oernah	tidak mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	3-5 kali	Mampu	sedikit percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Mampu	Percaya

sangat pasti	tidak kecil dan juga tida	khawatir	tidak oernah	Sedikit mampu	Percaya
Tentu saja tidak	kemungkinannya sang	Sedikit khawatir	tidak oernah	Mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	tidak mampu	Tidak percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Sedikit mampu	Percaya
mungkin tidak	tidak kecil dan juga tida	Sedikit khawatir	1-2 kali	Mampu	Percaya
sangat pasti	tidak kecil dan juga tida	sangat khawatir	tidak oernah	Sedikit mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tida	Sedikit khawatir	tidak oernah	Sedikit mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	3-5 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak oernah	Sedikit mampu	Sangat Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak oernah	Mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	Sedikit khawatir	tidak oernah	Mampu	sedikit percaya
Bisa iya, bisa tidak	tidak kecil dan juga tida	Sedikit khawatir	tidak oernah	Sedikit mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	tidak oernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	khawatir	lebih dari 5 kali	tidak mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak oernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak oernah	Mampu	Tidak percaya
sangat pasti	kemungkinannya besa	sangat khawatir	tidak oernah	Sedikit mampu	sedikit percaya
Bisa iya, bisa tidak	tidak kecil dan juga tida	Sedikit khawatir	lebih dari 5 kali	Sedikit mampu	Percaya
mungkin iya	tidak kecil dan juga tida	Sedikit khawatir	1-2 kali	Mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak oernah	Sedikit mampu	Percaya
Bisa iya, bisa tidak	kemungkinannya besa	Sedikit khawatir	1-2 kali	Mampu	Sangat Percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	1-2 kali	Mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinan kecil	Sedikit khawatir	tidak oernah	Mampu	sedikit percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak oernah	Sedikit mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinannya besa	Sedikit khawatir	tidak oernah	tidak mampu	sedikit percaya
mungkin tidak	kemungkinannya besa	Sedikit khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya

mungkin iya	kemungkinan kecil	Sedikit khawatir	3-5 kali	Mampu	Percaya
mungkin iya	kemungkinannya besa	sangat khawatir	tidak oernah	tidak mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	tidak oernah	Mampu	Percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Sedikit mampu	Percaya
mungkin iya	tidak kecil dan juga tid	khawatir	1-2 kali	Mampu	Percaya
mungkin iya	kemungkinannya besa	khawatir	tidak oernah	Mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tid	khawatir	1-2 kali	Mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	tidak oernah	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tid	khawatir	1-2 kali	Mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinannya besa	sangat khawatir	tidak oernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Sedikit mampu	Tidak percaya
sangat pasti	kemungkinannya sang	khawatir	1-2 kali	tidak mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tid	sangat khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya sang	Sedikit khawatir	tidak oernah	Mampu	Percaya
sangat pasti	kemungkinan kecil	khawatir	tidak oernah	Mampu	Percaya
sangat pasti	tidak kecil dan juga tid	Sedikit khawatir	tidak oernah	tidak mampu	sedikit percaya
sangat pasti	kemungkinannya besa	Sedikit khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	3-5 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Mampu	Percaya
sangat pasti	tidak kecil dan juga tid	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tid	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	Sedikit khawatir	tidak oernah	Sedikit mampu	Tidak percaya
sangat pasti	tidak kecil dan juga tid	Sedikit khawatir	3-5 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tid	Sedikit khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	khawatir	tidak oernah	Mampu	Sangat Percaya
mungkin iya	kemungkinannya besa	Sedikit khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya besa	Sedikit khawatir	tidak oernah	Mampu	Tidak percaya
mungkin iya	kemungkinannya sang	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinannya besa	Sedikit khawatir	tidak oernah	Sedikit mampu	Percaya

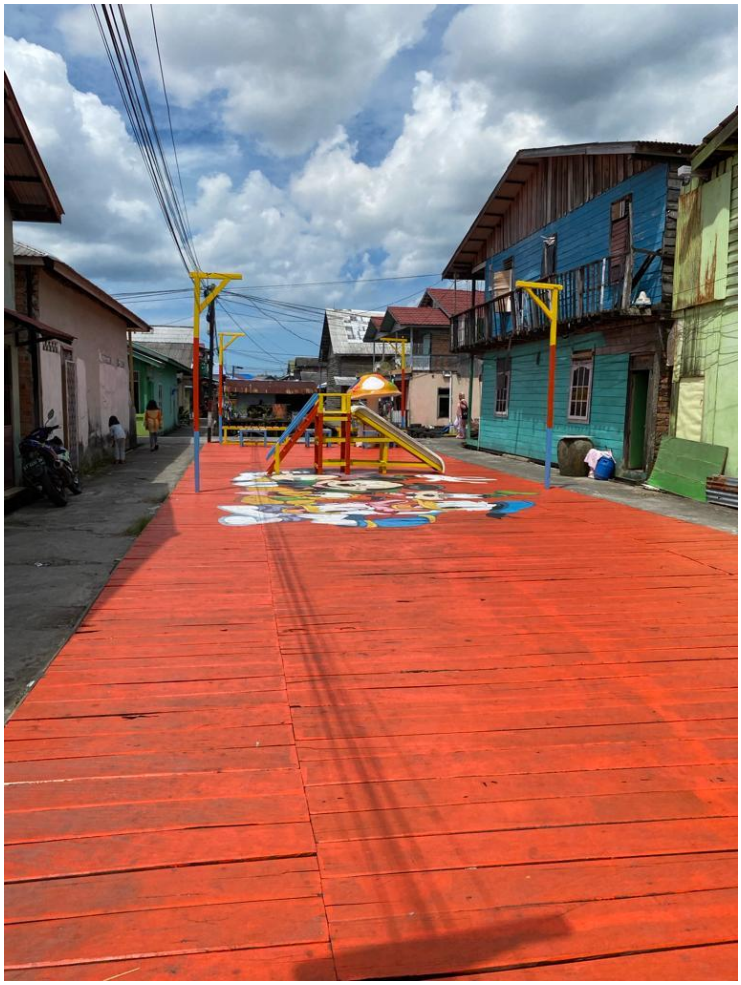
Bisa iya, bisa tidak	tidak kecil dan juga tida	Sedikit khawatir	lebih dari 5 kali	Mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tida	khawatir	tidak oernah	Sedikit mampu	Percaya
sangat pasti	tidak kecil dan juga tida	khawatir	1-2 kali	Sedikit mampu	Tidak percaya
sangat pasti	tidak kecil dan juga tida	khawatir	3-5 kali	Mampu	sedikit percaya
mungkin iya	kemungkinan kecil	sangat khawatir	tidak oernah	Sedikit mampu	Sangat Percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	tidak oernah	Mampu	Percaya
sangat pasti	tidak kecil dan juga tida	khawatir	lebih dari 5 kali	Mampu	Percaya
mungkin tidak	kemungkinan kecil	Sedikit khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Mampu	Percaya
mungkin iya	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya sang	sangat khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	tidak oernah	Sedikit mampu	Percaya
Bisa iya, bisa tidak	kemungkinannya besa	Sedikit khawatir	tidak pernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya besa	Tidak peduli	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	tidak pernah	Mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinannya besa	Sedikit khawatir	tidak pernah	tidak mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	sangat khawatir	1-2 kali	Mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	tidak pernah	Sedikit mampu	Tidak percaya
Bisa iya, bisa tidak	tidak kecil dan juga tida	Sedikit khawatir	3-5 kali	Mampu	sedikit percaya
sangat pasti	kemungkinannya besa	khawatir	tidak pernah	tidak mampu	Percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak pernah	Mampu	Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	tidak pernah	Sangat mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	tidak pernah	tidak mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak pernah	Mampu	sedikit percaya
mungkin iya	kemungkinan kecil	khawatir	tidak pernah	Mampu	Percaya
sangat pasti	tidak kecil dan juga tida	Sedikit khawatir	1-2 kali	Mampu	Percaya
mungkin iya	tidak kecil dan juga tida	khawatir	tidak pernah	Sedikit mampu	Sangat Percaya
sangat pasti	kemungkinannya sang	Sedikit khawatir	1-2 kali	Sangat mampu	Tidak percaya
sangat pasti	kemungkinannya besa	khawatir	1-2 kali	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinannya sang	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya sang	sangat khawatir	1-2 kali	Mampu	Percaya

mungkin iya	tidak kecil dan juga tida	khawatir	1-2 kali	Sedikit mampu	sedikit percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak pernah	Mampu	Percaya
sangat pasti	kemungkinannya besa	khawatir	tidak pernah	Sedikit mampu	Tidak percaya
mungkin iya	kemungkinannya besa	sangat khawatir	tidak pernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Mampu	sedikit percaya
mungkin iya	kemungkinannya sang	Sedikit khawatir	3-5 kali	tidak mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinan kecil	sangat khawatir	1-2 kali	tidak mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinan kecil	sangat khawatir	tidak pernah	Sedikit mampu	Percaya
mungkin iya	kemungkinannya besa	Sedikit khawatir	1-2 kali	Sedikit mampu	sedikit percaya
mungkin iya	kemungkinannya besa	khawatir	1-2 kali	Sedikit mampu	Percaya
sangat pasti	kemungkinannya besa	sangat khawatir	1-2 kali	Sedikit mampu	sedikit percaya
mungkin iya	tidak kecil dan juga tida	khawatir	tidak pernah	Sedikit mampu	Percaya
mungkin iya	tidak kecil dan juga tida	khawatir	1-2 kali	Sedikit mampu	Tidak percaya
mungkin tidak	kemungkinan kecil	Sedikit khawatir	tidak pernah	Mampu	Sangat Percaya
mungkin iya	kemungkinan kecil	sangat khawatir	3-5 kali	Sedikit mampu	Percaya
sangat pasti	tidak kecil dan juga tida	sangat khawatir	tidak pernah	Sedikit mampu	Percaya
mungkin iya	kemungkinannya besa	khawatir	1-2 kali	tidak mampu	Percaya
sangat pasti	kemungkinan kecil	khawatir	tidak pernah	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinan kecil	Sedikit khawatir	tidak pernah	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinan kecil	Sedikit khawatir	1-2 kali	tidak mampu	Tidak percaya
sangat pasti	tidak kecil dan juga tida	khawatir	tidak pernah	Mampu	Sangat Percaya
sangat pasti	kemungkinannya sang	sangat khawatir	1-2 kali	Mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinan kecil	Sedikit khawatir	tidak pernah	Sedikit mampu	Percaya
sangat pasti	tidak kecil dan juga tida	khawatir	1-2 kali	Mampu	sedikit percaya
Bisa iya, bisa tidak	tidak kecil dan juga tida	Sedikit khawatir	tidak pernah	Mampu	Percaya
mungkin iya	kemungkinannya sang	khawatir	tidak pernah	Sedikit mampu	sedikit percaya
sangat pasti	kemungkinan kecil	khawatir	1-2 kali	Mampu	sedikit percaya
Bisa iya, bisa tidak	kemungkinan kecil	Sedikit khawatir	tidak pernah	Mampu	Percaya
Bisa iya, bisa tidak	kemungkinan kecil	khawatir	tidak pernah	Sedikit mampu	Percaya
sangat pasti	kemungkinan kecil	sangat khawatir	1-2 kali	Sedikit mampu	Tidak percaya

dap program pengendalian bencana pemerintah?

Field Survey and Secondary Survey Documentation

Study Area Conditions



Public Space in Study Area