
Regional Development Planning and Policy in the Aspects of Vulnerability and Disaster Resilient Cities: A Review

Heinrich Rakuasa¹, Philia Christi Latue²

¹Universitas Indonesia, Indonesia

²Universitas Pattimura, Indonesia

Correspondent: heinrich.rakuasa@ui.ac.id¹

Received : May 16, 2023

Accepted : August 17, 2023

Published : August 31, 2023

Citation: Rakuasa, H., & Latue, P.C. (2023). Regional Development Planning and Policy in the Aspects of Vulnerability and Disaster Resilient Cities: A Review. Sinergi International Journal of Communication Sciences, 1(2), 64-77

ABSTRACT: Disaster management in the world has undergone a paradigm change that is from responsive to preventive, from sectoral to multi-sector, from government responsibility solely to joint responsibility, centralization to decentralization and from emergency response to disaster risk reduction. Based on 6 directives of the President of the Republic of Indonesia delivered during the Rakornas PB (Disaster Management) at Surabaya, February 2, 2019 one of which is "Regional development planning must be based on aspects of DRR (Disaster Risk Reduction)". Disaster risk-based regional development planning aims to reduce the impact of disaster risk including, threats, vulnerabilities, and capacity. Vulnerability assessment in areas that have the potential to experience disaster events is one of the important factors that must be reviewed in disaster mitigation efforts. Vulnerability assessment with the concept of data from wisdom allows local policymakers to recognize their specific situation in the broader context of a similar situation, providing regional perspectives and important connections between regions. Based on the efforts that have been integrated between the program into city spatial planning, it is hoped that it can increase the resilience of the City in facing disasters and adapt to climate change.

Keywords: Disaster Risk Reduction, Development, Vulnerability, Capacity, Resilience City



This is an open access article under the CC-BY 4.0 license

INTRODUCTION

Based on geographical location and geological conditions, Indonesia is located in an area prone to natural disasters (Djalante et al., 2017). The confluence of three active tectonic plates, namely the Indo-Australian Plate in the south, the Eurasian Plate in the north and the Pacific Plate in the east, which move and collide with each other, giving rise to earthquake paths and active volcanic chains along the islands of Sumatra, Java, Bali and Nusa Tenggara, which are parallel to the subduction paths of the two plates, namely the Indo-Australian Plate and the Eurasian Plate (Fahlevi et al., 2019). More specifically, earthquake paths also occur on regional fault lines such as the Sumatra /

Semangko Fault. In addition to these geological factors, Indonesia is located around the Equator with a tropical climate and is an archipelago. Hydro-geographically, Indonesia is prone to floods, landslides, extreme weather, extreme waves, droughts, forest fires and abrasion. The negative impacts of global climate change are increasingly making the Indonesian region vulnerable to various disasters related to the impacts of climate change (BNPB, 2022).

In 2018, Indonesia experienced the highest death toll in more than a decade caused by natural disasters, mainly from three major catastrophic events. First, in July and August 2018, a series of earthquakes in West Nusa Tenggara (NTB) impacted the island's estimated 3.5 million residents, as well as thousands of tourists. The National Disaster Management Agency (BNPB) reported that the earthquakes caused 561 fatalities and left more than 396,000 people homeless, destroying around 110,000 houses, 663 schools, 52 health facilities, 6 bridges and many roads. The second, in September 2018, was an M7.5 earthquake with an epicenter located 81 km north of Palu City in Central Sulawesi that caused strong ground shaking and a tsunami that damaged coastal settlements along Palu Bay. The disaster caused an estimated 4,402 fatalities and displaced around 165,000 people. Thirdly, in December 2018, the eruption and subsequent partial collapse of Mount Anak Krakatau caused a tsunami that impacted coastal settlements in Banten and Lampung Provinces along the Sunda Strait, leading to 437 fatalities, and approximately 34,000 people displaced (Djalante & Garschagen, 2017).

Disaster management in the world has undergone a paradigm shift from responsive to preventive, from sectoral to multi-sectoral, from government responsibility to shared responsibility, from centralization to decentralization and from emergency response to disaster risk reduction. Disaster risk reduction is very important because: Disaster is a complex problem from environmental factors to development; Conventional preparedness is necessary, but not yet complete and comprehensive; Integration and mainstreaming of disaster risk reduction in decision-making and daily activities contribute to sustainable development. Based on the 6 directives of the President of the Republic of Indonesia delivered during the National Coordination Meeting on Disaster Management in Surabaya, February 2, 2019, one of them is "Regional development planning must be based on aspects of Disaster Risk Reduction (Arifin et al., 2021).

There has been a paradigm shift in disaster management, so that development planning must include elements of disaster management. The Disaster Management Plan (RPB) can be categorized as a "master plan" or master plan for the implementation of disaster management in a region for a period of 5 (five) years. As a regional plan, the RPB must summarize the perspectives of disaster management implementation from all local government agencies involved. Therefore, the RPB needs to be stipulated in a clear legal regulation so that it can provide strength in its implementation. In addition, the legal force given to the RPB will make it easier for non-government institutions to plan and determine their contribution to the implementation of regional disaster management (Oktari et al., 2020).

Referring to Law No. 24/2007 on Disaster Management, spatial planning plays a role in organizing disaster management at the pre-disaster stage, both in situations where no disaster occurs and there is a potential for disaster. In a situation where no disaster occurs, disaster management is carried

out through the implementation and enforcement of spatial plans, namely through controlling the use of space in accordance with regional spatial plans. Meanwhile, in situations where there is a potential for disaster, disaster mitigation is carried out through planning and implementing spatial planning based on disaster risk assessments.

The main foundation for the implementation of disaster management in Indonesia currently refers to Law No. 24 Year 2007 on Disaster Management. Based on this regulation, several derivative regulations, such as Government Regulations, Presidential Regulations, Ministerial Regulations, Regulations of the Head of BNPB, and other laws and regulations, are derived. In line with the regulation on disaster management, there are other regulatory frameworks that provide guidance on disaster management, including Law No. 26 of 2007 on Spatial Planning, Law No. 27 of 2007 on the Management of Coastal Areas and Small Islands, Law No. 32 of 2009 on Environmental Protection and Management. Based on the above, this paper aims to provide a perspective on regional development that includes disasters as a factor that can determine the failure and success of such development with a main focus on assessing disaster vulnerability and resilience.

METHOD

This research uses a descriptive qualitative approach. Qualitative research is a research procedure with descriptive data results in the form of written or oral words (Hamilton & Finley, 2019). Qualitative research aims to analyze the qualities of a study. The type of research used is a literature study which is research that has been carried out previously by collecting books, journals, magazines, and scientific papers that are interrelated with the research problems and objectives. Literature study is a data collection technique carried out by conducting a study of books or literature related to the problem being solved (Roller, 2019). The literature review database used is by searching on Google Scholar, Scopus, and Google Book. The search was conducted using the keywords disaster risk reduction, regional development, vulnerability, capacity, disaster resilient city.

RESULT AND DISCUSSION

1. Regional Planning and Development

According to Law No. 26 of 2007 on Spatial Planning, a region is defined as a space that is a geographical unit along with all related elements whose boundaries and systems are determined based on administrative and/or functional aspects. According to Rahma et al., (2019), regional development consists of two words; development and region. Development can be interpreted as certain efforts to change existing conditions for the better, while the region is part of the earth's surface that has a certain unity, which is larger than a city but smaller than a country. The large proportion of the population and economic life in agriculture is the most important feature of the regional development perspective in third world countries, this is because the population working in agriculture is generally a low-income population (Rakuasa et al., 2022). This has led to a lack of

interest from the government or private sector to invest in infrastructure in poorly populated areas due to the long payback period.

Ma'arif & Hizbaron, (2015), defines regional planning as a way of thinking primarily about social and economic problems that refer to the future, with in-depth attention related to the objectives to collect options and try with all their might to comprehend them in policies and programs. Disaster risk-based regional development is certainly faced with various options that occur in an area such as the type, number and intensity of disasters. The identification of disasters and development is an entry point in sustainable regional development efforts, thus, development can be an output (vulnerability) or as an input (capacity) (Manandhar & Siebeneck, 2021).

2. Vulnerability

The initial definition of vulnerability emphasized more on quantitative research of damage and losses caused by the occurrence of a disaster. However, in its development, the concept of vulnerability then changed due to the influence of the social context of the community, which later became social vulnerability (Ma'arif & Hizbaron, 2015). Vulnerability is not a natural thing. Vulnerability is a human dimension of danger that is the result of an array of economic, social, cultural, institutional, political and other related conditions (Sugandhi et al., 2023). There are several factors that cause a community group to be vulnerable to disasters, these factors include demographic factors such as age, ethnic minority status, education level, and socio-economic (Pakniyany et al., 2022). The second factor is related to the environment, such as limited economic resources, marginalized political status, and limited access to social networks (Salakory & Rakuasa, 2022). In general, weak groups in society suffer the most when disasters occur. These weak groups are the poor, the young, the old, the disabled, and some groups marginalized by race (Twigg, 2004). ISDR (2004) suggests that vulnerability is a situation or condition that is determined by one or more factors that cause increased weakness of a community to the impact of hazards. Westen (2009) explains that these factors include physical, social, economic and environmental conditions.

The use of the concept of vulnerability in disaster literature dates back to the 1970s (Emrich & Cutter, 2011). In 1972, the Office of Emergency Preparedness of the U.S. Office of the President presented a report that defined vulnerability as the propensity of a community, society, or larger jurisdiction as well as sectors such as the economy, agriculture, and infrastructure to be affected by the impacts of natural disasters (de León et al., 2006; Muin & Rakuasa, 2023). During the 1980s, recognition of the importance of underlying characteristics of environmental, economic, social, and political causes of vulnerability grew, with these characteristics including population density, gender discrimination, socioeconomic status, and public health conditions widely considered to be important causes of vulnerability of individuals exposed to disasters (Fatemi et al., 2017; Spielman et al., 2020; Rakuasa & Rifai, 2021; Latue & Rakuasa, 2022; Latue & Rakuasa, 2032; Manakane et al., 2023).

One of them is related to the introduction of a more systematic term vulnerability with reference to people and their livelihoods where vulnerability is understood as exposure to the possibility of future events and the pressures and difficulties experienced by people or a community in their efforts to survive these various pressures and difficulties (Drakes et al., 2021). Fatemi et al., (2017), describes two sides of vulnerability: external and internal, with the external side relating to exposure

to external shock and the internal side relating to the inability to survive without loss (Drakes et al., 2021). In 1993, the two sides of vulnerability expressed by Chambers were further clarified by Bohle where the external side is still about exposure to stress while the internal side is more about how people are able to maintain their assets when exposed to disasters. These assets include socio-economic, political, infrastructure, ecological and personal assets. The more people are able to control their assets, the lower their vulnerability because these assets increase their capacity to withstand risks and disasters (Drakes et al., 2021).

3. Disaster Resilient City

Disaster Resilience City is an urban planning concept where the city is expected to continue functioning its various systems when there is a disturbance such as a disaster. The application of the Resilience City concept is very important considering the position of most cities in Indonesia that are inseparable from various types of threats of natural disasters and disasters due to human behavior (Havko et al., 2017). Various organizations in the world and in Indonesia have developed an approach, guidelines and strategic planning tools for cities to adapt to become resilience cities. Resilient cities are one of the national goals. Efforts to realize resilient cities can simultaneously address national goals and sustainable development goals. Resilient cities are included in SDGs global target number 11, which is "to build inclusive, safe, resilient and sustainable cities and places to live".

The assessment of the level of disaster resilience is carried out through two measuring instruments, namely, 1) Assessment based on variables and criteria from the spatial aspect and 2) Assessment based on general variables and criteria adopted from the United Nations International Strategy for Disaster Reduction (UNISDR). The assessment is conducted comprehensively consisting of eight criteria which include: 1) Spatial Criteria, 2) Basic Infrastructure Criteria, 3) Public Service Facilities Criteria, 4) Socio-Economic Criteria 5) Technology and Ecosystem Research Criteria, 6) Planning and Licensing Criteria, 7) Basic Capability Criteria, and 8) Institutional and Budget Criteria. The resilience assessment is based on the method used by UNISDR, namely through scoring.

4. Disaster risk

Disaster risk is a complex interaction between the level of vulnerability and the existing hazards, this is based on the fact that disaster risk is largely determined by the level of vulnerability, the higher the threat value and the value of vulnerability, the higher the risk of disaster (Gall et al., 2015; Sugandhi et al., 2023). Social vulnerability describes the condition of the level of social fragility in the face of hazards. Social vulnerability is the diversity of pressures and shocks to complex social systems due to disasters (Spielman et al., 2020). Social vulnerability of people or communities is more problematic than vulnerability of structures and infrastructure (Rakuasa & Mehdila, 2023). Social vulnerability is not only limited to measuring human health in the context of physical threats that they may face, but the weakness of the community with some limitations in the scope of lack of protection, ability to survive or ability to recover (Tasnuva et al., 2021). Economic conditions greatly affect a person's level of vulnerability. Individuals with economic limitations and low income will have difficulties when facing disasters and the recovery process will take longer (Drakes et al., 2021). Economic limitations/poverty will affect the choice of residence, residential infrastructure and decision-making in the event of a disaster. People's choice

to live on riverbanks, landslide-prone areas, cliff edges, build houses without IMB (Building Construction Permit), build houses without meeting the quality of building standards, which is a common phenomenon today, is also indicated as a result of poverty (Spielman et al., 2020).

The rural poor who are most at risk are no longer self-sufficient farmers. Instead, rural dwellers rely on complex livelihood strategies, including seasonal migration or inputs or money sent by families living in urban areas or on different islands. It is these kinds of livelihood strategies that change the risks in rural areas. Often, the poorest people in rural areas own the least amount of land and this forces them to rely on the most disaster-prone livelihood, agriculture. In addition, when this low-return form of livelihood encounters a disaster, the rural population is isolated from the larger market and this limits the options available to survive the impact of the disaster (Sapountzaki et al., 2022).

5. Disaster risk-based area development planning

Disaster risk-based regional development planning aims to reduce the impact of disaster risk, which includes threats, vulnerabilities, and capacities. Thus, the aspect of disaster risk in regional development is for the prosperity of the region, which is in line with the aspects of livelihood sustainability, namely assets, access, and activities (Sapountzaki et al., 2022). Thus, examining vulnerability and capacity will provide crucial information used in determining the risk of an area, which in the concept of DRR-based regional development is directly proportional to how to recognize assets, access and activities in the development process. There are many indicators and variables that can be used in researching vulnerability, therefore, specific prerequisites need to be considered to ensure the relevance between the indicators used and the conditions of the area and the characteristics of the population at risk of disaster. According to Sapountzaki et al., (2022), post-disaster survival can be sustainable if victims can recover from the stress or shock of a natural disaster by using the assets and capabilities they have now without relying solely on natural resources (Rakuasa & Somae, 2022).

This is consistent with the thoughts of Schipper et al., (2016), who describe that the core dimension of vulnerability in developing countries is characterized by increasing pressure on natural resources due to the increasing population, so that dependence on it must be minimized. Although natural resources can be categorized as assets, there are other assets such as material assets (physical capital), financial capital, skills of each family member/experience (human capital), and relationships with the surrounding community (social capital). Access differs from region to region and there may be regions that do not have access to markets (access to land, credit, etc.). Access to markets is also determined by several factors such as access to physical infrastructure, telecommunications, access to services, and others (Sapountzaki et al., 2022). Activities in this context can relate to types of work, agricultural production, trade and various other activities. Rakuasa & Latue, (2023), provide a perspective that is consistent with the previous authors' description of the pressures on natural resources, access and aspects that can lead to vulnerability to natural disasters as shown in Table 1.

Table 1. Core dimensions and vulnerability variables

Core Dimensions	Variables
Human Well-Being	Income Income Distribution
Pressure on Natural Resources	Need for water resources
Connectedness	Infrastructure
Natural Resources	Water Supply
Land Overuse	Soil quality Land Exploitation

Adaptation involves deliberate and gradual change and transformation of social, governmental and economic systems. The capacities that lead to adaptation relate to the existence of institutions and networks that learn and incorporate knowledge and experience, creating flexibility in problem solving and creating balance among interest groups (Drakes et al., 2021). Adaptive capacity has become a key component of disaster resilience (Latue et al., 2023), yet it is rarely used in disaster resilience assessments. Although this concept has been a core theme in the theoretical underpinnings of resilience, coping capacity is considered a new concept in resilience studies.

Adaptive capacity is a key concept of vulnerability analysis. Adaptive capacity is closely related to vulnerability and coping capacity as it is also understood as the ability of a system to adapt to disaster threats by cultivating and implementing new strategies or developing coping capacities to reduce vulnerability to the threat (Rakuasa & Rinaldi, 2023). Adaptive capacity relies on a range of environmental, social, economic and political rights that individuals, households or communities can use to deal with risk. According to (Schipper et al., 2016). Sapountzaki et al., (2022), rights are potential resources available to individuals from their own production and assets, including livestock and other forms of individual wealth such as agricultural land, protected areas, land tenure rights, gender norms, education, and reciprocal relationships that can generate resources (Muin & Rakuasa, 2023b). In summary, these rights are a collection of commodity bundles that can be totally controlled by an individual in a social community (Muin & Rakuasa, 2023). Social-ecological systems are closely related to capacity. In particular, adaptive capacity. This is based on the condition of the social-ecological system that is affected by changes that occur in it, and deals with these changes through its capacity to adapt and transform according to the changes that occur (Berkes et al, 2003), as shown in Figure 1.

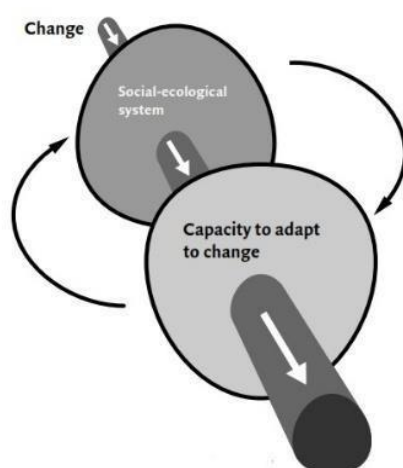


Figure 1. The relationship between social-ecological systems and adaptive capacity

The social system is all the elements that deal with government, property rights, and access to resources. An ecological system is a community or organism that stands alone, interacts with each other and has a close relationship with its environment (Muin & Rakuasa, 2023). Berkes and Folke (1998) stated that social systems and ecological systems are interconnected and cannot be separated, because the differences in the relationship between living things and their environment are artificial and cannot be clearly defined. Based on this thought, a social-ecological system (SSE) can be understood as a system formed from biological, geological, and physical (bio-geo-physical) components as well as various social actors and institutions related to these components.

In an effort to find patterns of vulnerability, it must be clearly defined the object to be assessed. This is because the vulnerability assessment depends on the dependency scale, one of which is the unit of analysis (Muin & Rakuasa, 2023). In studying the relationship between living things and their environment, the socio-ecological system is the right option because ecologically humans see themselves as an integral part of an ecosystem or living space with an inseparable functional relationship between social and biophysical systems (Abdoellah 2017)

Based on its relationship with capacity to adapt, socio-ecological systems can also be associated with resilience. This is because resilience is an important element of a community to adapt to changes caused by external factors such as environmental changes. Changes in the environment can mean changes in resources that can result from natural disasters as external factors that damage water sources and livelihoods such as agriculture. The adaptive capacity of all levels of the community is even bound by their dependence on the resilience of natural institutions and systems. The better the resilience of the community, the better its capacity to absorb pressure and to adapt to the changes that occur. Conversely, the weaker the resilience, the higher the vulnerability of institutions and communities in adapting and surviving the changes that occur within them. Resilience and vulnerability are interrelated and not contradictory to each other (Cutter, 2016). The concept of assessment between vulnerability and resilience has evolved over time and has the same considerations in assessment design (Hummell et al., 2016). In this study, to find appropriate indicators for coping capacity and adaptive capacity, the dimensions of the Australian Natural

Disaster Resilience Index were used in (Parsons et al., 2016). Table 2 shows the dimensions of capacity extracted from the index.

Table 2. Survival and adaptive capacity of the Australian Natural Disaster Resilience Index

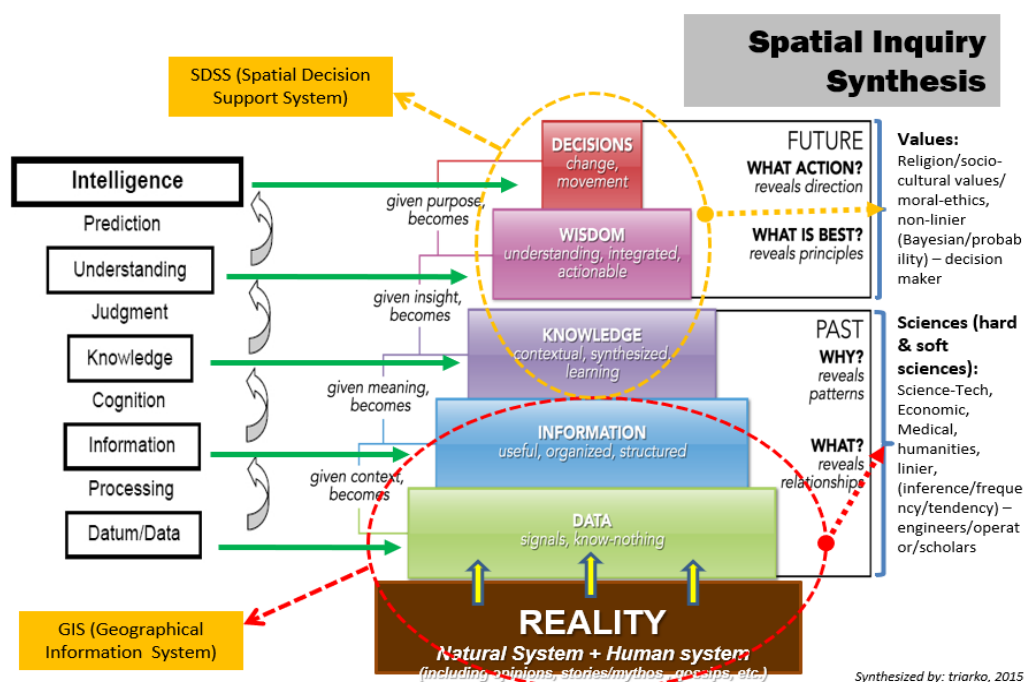
Dimensions	Description
Endurance Capacity	
Social Character Social character of the community	Represents social and demographic factors that influence the ability to prepare for and recover from natural disaster events.
Economic capital Economic characteristics of the community	Representing economic factors that affect the ability to prepare for and recover from natural disaster events
Planning and infrastructure Legislation, planning, structures and codes are in place to protect infrastructure.	Represents preparation for a natural disaster event using mitigation strategies or risk planning and management.
Emergency services Existence of emergency services and disaster management plans	Represents the potential to respond to natural disaster events
Social Capital Familiarity and close relationships within the community	Represents features of the community that facilitates the process of coordination and cooperation for mutual benefit
Information and cooperation Availability and accessibility of disaster-related information and community cooperation in promoting risk awareness.	Represents the relationship between the community and information, the uptake of risk information and the knowledge required for individual preparedness and protection.
Adaptive Capacity	
Government, policy and leadership Capacity within government agents to learn, adapt and transform	Represents the flexibility within the organization to adaptively learn, analyze and adjust existing policies and procedures or transform organizational practices.
Social and community covenants Capacity within the community to learn, adapt and transform	Representing social activists in community bodies for covenant, learning, adaptation and transformation

The conceptual description above illustrates a general framework that can be used to analyze the vulnerability pattern of an area at risk of disaster through three components, namely the core dimensions of vulnerability to determine the indicators used in the assessment, coping capacity, and adaptive capacity. It is important to highlight that vulnerability in its development cannot be separated from its external side, namely pressure, which in the context of this paper is a natural disaster, and its internal side, namely capacity as a crucial element in its function, which is the provision to withstand the pressure. The characteristics of the area where the exposed population lives and has a livelihood cannot be separated in analyzing vulnerability patterns, where this

element can be seen through ecological systems that examine the relationship between living things and their environment along with the assets, access, and activities that accompany them.

6. Spatial Policy for Regional Development

The definition of data in the discipline of geography is a description of the geographical location, dimensions or sizes, and/or characteristics of natural and/or man-made objects that are below, on, or above the earth's surface, while information is a tool in policy formulation, decision-making and/or implementation of spatially related activities. In a decision-making situation, in addition to data and information, several assessments are also needed to realize this, namely "knowledge" and "wisdom". The explanation of knowledge itself is a collection of facts and data from a case study that has been studied from data and information so that knowledge is obtained based on a fact study, research, observation or experience. Where data, information and knowledge itself must be supported by wisdom which is an ability to distinguish and assess aspects of knowledge that are strengthened by experts in a field / discipline in making an assessment and decision. Data and information must be strengthened with knowledge and wisdom in terms of decision making, as for the description can be seen below (Putri, 2022)



Gambar 2. From Data to Wisdom

The results of the integration of spatial pattern and spatial structure plans and special provisions that have been integrated can improve the city's ability to deal with disasters and adapt to climate change. The integrated city spatial structure plan and special provisions for spatial allocation are aimed at increasing the capacity to deal with disasters and climate change impacts. Integration into the city's spatial plan is aimed at improving the quality of disaster management by reducing risk through capacity building and reducing vulnerability.

CONCLUSION

The concept of regional development included in this paper leads to development that does not forget disasters with the aim of reducing the risk of such disasters. The concept helps provide a perspective for building a vulnerability assessment model for disaster-risk areas. The concept of vulnerability patterns that the authors will investigate through this paper also provides a regional perspective and important connections between regions as it does not just describe one particular situation, but rather focuses on the most important common traits of many cases that are pattern-building in nature. Recurring patterns of vulnerability can be found in many different places around the world, for example, in industrialized or developing regions, as well as urban and rural areas.

Capacity development for environmental and social management implementation should include: (i) institutional development strategies and organizational frameworks to manage affected areas and project activities; (ii) workshops and training programs to build capacity to implement approved safeguard action plans. Improved disaster risk knowledge will increase knowledge, understanding, and awareness of disaster risks and climate change risks, promote risk reduction actions and climate change adaptation measures to better prepare Indonesians for future natural and climate-related hazards, and inform analysis for multi-hazard early warning system platforms. Based on the efforts that have been integrated between the program and the city's spatial plan, it is expected to increase the City's resilience in facing disasters and adapting to climate change.

REFERENCE

- Abdoellah, S. O. (2017). *Ekologi Manusia dan Pembangunan Eerkelanjutan*. PT. Gramedia Pustaka Utama.
- Abdul Muin, & Heinrich Rakuasa. (2023). Spatial Analysis of Landslide Potential Using Modification of the Storie In-dex Method in the Wae Batu Gajah Watershed, Ambon City, Indonesia. *International Journal of Scientific Multidisciplinary Research*, 1(3), 107–116. <https://doi.org/10.55927/ijsmr.v1i3.3625>
- Arifin, S., Wicaksono, S. S., Sumarto, S., Martitah, M., & Sulistianingsih, D. (2021). Disaster resilient village-based approach to disaster risk reduction policy in Indonesia: A regulatory analysis. *Jàmbá Journal of Disaster Risk Studies*, 13(1). <https://doi.org/10.4102/jamba.v13i1.1021>
- BNPB. (2022). *Indeks Risiko Bencana Indonesia (RBI) Tahun 2022*. Pusat Data, Informasi dan Komunikasi Kebencanaan Badan Nasional Penanggulangan Bencana.
- Cutter, S. L. (2016). Resilience to What? Resilience for Whom? *The Geographical Journal*, 182(2), 110–113. <https://doi.org/10.1111/geoj.12174>
- de León, J.C.V., Bogardi, J., Dannenmann, S. and Basher, R. (2006). Early warning systems in the context of disaster risk management. *Entwicklung and Ländlicher Raum*, 2(1), 23–28.
- de Loyola Hummell, B. M., Cutter, S. L., & Emrich, C. T. (2016). Social Vulnerability to Natural Hazards in Brazil. *International Journal of Disaster Risk Science*, 7(2), 111–122. <https://doi.org/10.1007/s13753-016-0090-9>
- Djalante, R., & Garschagen, M. (2017). A Review of Disaster Trend and Disaster Risk Governance

- in Indonesia: 1900--2015. In R. Djalante, M. Garschagen, F. Thomalla, & R. Shaw (Eds.), *Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues* (pp. 21–56). Springer International Publishing. https://doi.org/10.1007/978-3-319-54466-3_2
- Djalante, R., Garschagen, M., Thomalla, F., & Shaw, R. (2017). Introduction: Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues. In R. Djalante, M. Garschagen, F. Thomalla, & R. Shaw (Eds.), *Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues* (pp. 1–17). Springer International Publishing. https://doi.org/10.1007/978-3-319-54466-3_1
- Drakes, O., Tate, E., Rainey, J., & Brody, S. (2021). Social vulnerability and short-term disaster assistance in the United States. *International Journal of Disaster Risk Reduction*, 53, 102010. <https://doi.org/https://doi.org/10.1016/j.ijdrr.2020.102010>
- Emrich, C. T., & Cutter, S. L. (2011). Social Vulnerability to Climate-Sensitive Hazards in the Southern United States. *Weather, Climate, and Society*, 3(3), 193–208. <https://doi.org/10.1175/2011WCAS1092.1>
- Fahlevi, H., Indriani, M., & Oktari, R. S. (2019). Is the Indonesian disaster response budget correlated with disaster risk? *Jambá Journal of Disaster Risk Studies*, 11(1). <https://doi.org/10.4102/jamba.v11i1.759>
- Fatemi, F., Ardalan, A., Aguirre, B., Mansouri, N., & Mohammadfam, I. (2017). Social vulnerability indicators in disasters: Findings from a systematic review. *International Journal of Disaster Risk Reduction*, 22, 219–227. <https://doi.org/https://doi.org/10.1016/j.ijdrr.2016.09.006>
- Gall, M., Nguyen, K. H., & Cutter, S. L. (2015). Integrated research on disaster risk: Is it really integrated? *International Journal of Disaster Risk Reduction*, 12, 255–267. <https://doi.org/https://doi.org/10.1016/j.ijdrr.2015.01.010>
- Hamilton, A. B., & Finley, E. P. (2019). Qualitative methods in implementation research: An introduction. *Psychiatry Research*, 280, 112516. <https://doi.org/10.1016/j.psychres.2019.112516>
- Havko, J., Mitašová, V., Pavlenko, T., Titko, M., & Kováčová, J. (2017). Financing the Disaster Resilient City in the Slovak Republic. *Procedia Engineering*, 192, 301–306. <https://doi.org/https://doi.org/10.1016/j.proeng.2017.06.052>
- Heinrich Rakuasa, G. S. (2022). Analisis Spasial Kesesuaian dan Evaluasi Lahan Permukiman di Kota Ambon. *Jurnal Sains Informasi Geografi (J SIG)*, 5(1), 1–9. <https://doi.org/DOI:http://dx.doi.org/10.31314/j%20sig.v5i1.1432>
- Latue, P. C., & Rakuasa, H. (2032). Identification of Flood-Prone Areas Using the Topographic Wetness Index Method in Fena Leisela District, Buru Regency. *Journal Basic Science and Technology*, 12(2). <https://doi.org/https://doi.org/10.35335/jbst.v12i1.3673>
- Latue, P. C., Manakane, S. E., & Rakuasa, H. (2023). Analisis Perkembangan Kepadatan Permukiman di Kota Ambon Tahun 2013 dan 2023 Menggunakan Metode Kernel Density. *Blend Sains Jurnal Teknik*, 2(1), 26–34. <https://doi.org/https://doi.org/10.56211/blendsains.v2i1.272>
- Ma'arif, Syamsul, dan Hizbaron. (2015). *Strategi Menuju Masyarakat Tangguh Bencana dalam Perspektif Sosial*. Gadjah Mada University Press.
- Manakane, S. E., Latue, P. C., & Rakuasa, H. (2023). Identifikasi Daerah Rawan Longsor Di DAS Wai Batu Gajah, Kota Ambon Menggunakan Metode Slope Morphology Dan Indeks Storie.

Gudang Jurnal Multidisiplin Ilmu, 1(1), 29–36.

- Manandhar, R., & Siebeneck, L. K. (2021). Information management and the return-entry process: Examining information needs, sources, and strategies after Superstorm Sandy. *International Journal of Disaster Risk Reduction*, 53, 102015. <https://doi.org/https://doi.org/10.1016/j.ijdr.2020.102015>
- Muin, A., & Rakuasa, H. (2023a). Evaluasi Rencana Tata Ruang Wilayah Kota Ambon Berdasarkan Aspek Kerawanan Banjir. *ULIL ALBAB: Jurnal Ilmiah Multidisiplin*, 2(5), 1727–1738. <https://doi.org/https://doi.org/10.56799/jim.v2i5.1485>
- Muin, A., & Rakuasa, H. (2023b). Pemanfaat Geographic Artificial Intelligence (Geo-AI) Untuk Identifikasi Daerah Rawan Banjir Di Kota Ambon. *Gudang Jurnal Multidisiplin Ilmu*, 1(2), 58–63. <https://doi.org/https://doi.org/10.59435/gjmi.v1i2.24>
- Muin, A., & Rakuasa, H. (2023c). Pemetaan Daerah Rawan Banjir di Desa Lokki Kecamatan Huamual Kabupaten Seram Bagian Barat. *Gudang Jurnal Multidisiplin Ilmu*, 1(2), 47–52. <https://doi.org/https://doi.org/10.59435/gjmi.v1i2.22>
- Muin, A., & Rakuasa, H. (2023). Sasi Laut as a Culture of Natural Resources Conservation to Overcome the Tragedy of the Commons in Maluku Province. *International Journal of Multidisciplinary Approach Research and Science*, 1(03), 277–287. <https://doi.org/10.59653/ijmars.v1i03.139>
- Oktari, R. S., Munadi, K., Idroes, R., & Sofyan, H. (2020). Knowledge management practices in disaster management: Systematic review. *International Journal of Disaster Risk Reduction*, 51, 101881. <https://doi.org/https://doi.org/10.1016/j.ijdr.2020.101881>
- Pakniany, Y., Tiwery, W. Y., & Rakuasa, H. (2022). Mitigasi Bencana Gempa Bumi Berbasis Kearifan Lokal di Desa Nuwewang Kecamatan Pulau Letti Kabupaten Maluku Barat Daya. *Dialektika: Jurnal Pemikiran Islam Dan Ilmu Sosial*, 15(1), 1–7.
- Parsons, M., Glavac, S., Hastings, P., Marshall, G., McGregor, J., McNeill, J., Morley, P., Reeve, I., & Stayner, R. (2016). Top-down assessment of disaster resilience: A conceptual framework using coping and adaptive capacities. *International Journal of Disaster Risk Reduction*, 19, 1–11. <https://doi.org/https://doi.org/10.1016/j.ijdr.2016.07.005>
- Philia Christi Latue, H. R. (2022). Dinamika Spasial Wilayah Rawan Tsunami di Kecamatan Nusaniwe, Kota Ambon, Provinsi Maluku. *Jurnal Geosains Dan Remote Sensing (JGRS)*, 3(2), 77–87. <https://doi.org/https://doi.org/10.23960/jgrs.2022.v3i2.98>
- Putri, A. (2022). Mitigasi Bencana Berbasis Kearifan Lokal (Local Knowledge, Local Wisdom, dan Local Genius). *Geodika: Jurnal Kajian Ilmu Dan Pendidikan Geografi*, 6(1), 89–98. <https://doi.org/10.29408/geodika.v6i1.5417>
- Rahma, H., Fauzi, A., Juanda, B., & Widjojanto, B. (2019). Development of a Composite Measure of Regional Sustainable Development in Indonesia. *Sustainability*, 11(20), 5861. <https://doi.org/10.3390/su11205861>
- Rakuasa, H., & Rinaldi, M. (2023). Pemetaan Daerah Potensi Genangan Banjir di Kecamatan Gunugputri, Kabupaten Bogor Menggunakan Data DEMNAS Dengan Metode Topographic Wetness Index. *ULIL ALBAB: Jurnal Ilmiah Multidisiplin*, 2(6), 2269–2280. <https://doi.org/https://doi.org/10.56799/jim.v2i6.1607>
- Rakuasa, H., Rifai, A. (2021). Pemetaan Kerentanan Bencana Tanah Longsor Berbasis Sistem Informasi Geografis di Kota Ambon. *Seminar Nasional Geomatika Tabun 2021*, 327–336.

<https://doi.org/10.24895/SNG.2020.0-0.1148>

- Rakuasa, H., & Latue, P. C. (2023). ANALISIS SPASIAL DAERAH RAWAN BANJIR DI DAS WAE HERU, KOTA AMBON. *Jurnal Tanah Dan Sumberdaya Laban*, 10(1), 75–82. <https://doi.org/10.21776/ub.jtsl.2023.010.1.8>
- Rakuasa, H., & Mehdila, M. C. (2023). Penerapan Pendidikan Mitigasi Bencana Gempa Bumi untuk Siswa dan Guru di SD Negeri 1 Poka, Kota Ambon, Provinsi Maluku. *Jurnal Pengabdian Masyarakat Indonesia*, 3(3), 441–446. <https://doi.org/10.52436/1.jpmi.1138>
- Rakuasa, H., Supriatna, S., Karsidi, A., Rifai, A., Tambunan, M. ., & Poniman K, A. (2022). Spatial Dynamics Model of Earthquake Prone Area in Ambon City. *IOP Conference Series: Earth and Environmental Science*, 1039(1), 012057. <https://doi.org/10.1088/1755-1315/1039/1/012057>
- Roller, M. R. (2019). A quality approach to qualitative content analysis: Similarities and differences compared to other qualitative methods. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 20(9), 1–21. <https://doi.org/https://doi.org/10.17169/fqs-20.3.3385>
- Salakory, M., Rakuasa, H. (2022). Modeling of Cellular Automata Markov Chain for predicting the carrying capacity of Ambon City. *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan (JPSSL)*, 12(2), 372–387. <https://doi.org/https://doi.org/10.29244/jpsl.12.2.372-387>
- Sapountzaki, K., Michellier, C., Pigeon, P., Rebotier, J., & Daskalakis, I. (2022). A Risk-Based Approach to Development Planning. In S. Eslamian & F. Eslamian (Eds.), *Disaster Risk Reduction for Resilience: Disaster and Social Aspects* (pp. 265–311). Springer International Publishing. https://doi.org/10.1007/978-3-030-99063-3_12
- Schipper, E. L. F., Thomalla, F., Vulturius, G., Davis, M., & Johnson, K. (2016). Linking disaster risk reduction, climate change and development. *International Journal of Disaster Resilience in the Built Environment*, 7(2), 216–228. <https://doi.org/10.1108/IJDRBE-03-2015-0014>
- Spielman, S. E., Tuccillo, J., Folch, D. C., Schweikert, A., Davies, R., Wood, N., & Tate, E. (2020). Evaluating social vulnerability indicators: criteria and their application to the Social Vulnerability Index. *Natural Hazards*, 100(1), 417–436. <https://doi.org/10.1007/s11069-019-03820-z>
- Sugandhi, N., Supriatna, S., & Rakuasa, H. (2023). Identification of Landslide Prone Areas Using Slope Morphology Method in South Leitimur District, Ambon City. *Jambura Geoscience Review*, 5(1), 12–21. <https://doi.org/https://doi.org/10.34312/jgeosrev.v5i1.14810>
- Sugandhi, N., Supriatna, Kusratmoko, E., & Rakuasa, H. (2023). Spatial modelling of tsunami hazards and their exposure to settlements in Ambon City. *IOP Conference Series: Earth and Environmental Science*, 1173(1), 012013. <https://doi.org/10.1088/1755-1315/1173/1/012013>
- Tasnuva, A., Hossain, M. R., Salam, R., Islam, A. R. M. T., Patwary, M. M., & Ibrahim, S. M. (2021). Employing social vulnerability index to assess household social vulnerability of natural hazards: an evidence from southwest coastal Bangladesh. *Environment, Development and Sustainability*, 23(7), 10223–10245. <https://doi.org/10.1007/s10668-020-01054-9>