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Urgency in Urban Flood Disaster Mitigation: Response and Policy Initiation by Makassar City Government

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Keyword:
Urban flooding;
Risk mitigation;
Government policy;
Urban resilience.

Abstract: This study examines the urgency and efforts to mitigate urban flood risk in Makassar City by identifying the factors that cause high flood risk and analyzing the steps taken by the government. This research method uses a qualitative approach. The data collection stage involves interviews, observation, and document review. The data obtained is then transferred into an analysis tool for data coding using Nvivo 12 Plus. The research findings indicate that Makassar City faces a significant risk of flooding caused by high rainfall, increasingly extreme climate change, rapid population growth, poor land use change, and ineffective water management. Makassar City Government has responded by increasing budget capacity, improving drainage systems, developing early warning systems, conducting public awareness campaigns, and adopting cross-sectoral cooperation. This study can become policy recommendations in the future with a focus on expanding drainage infrastructure, more coordinated spatial planning, monitoring climate change, increasing public awareness, and strengthening inter-agency collaboration.

Kata Kunci:
Banjir perkotaan;
Mitigasi risiko;
Kebijakan pemerintah;
Ketahanan kota

Abstrak: *Penelitian ini mengkaji urgensi dan upaya mitigasi risiko banjir perkotaan di Kota Makassar dengan mengidentifikasi faktor-faktor yang menyebabkan tingginya risiko banjir dan menganalisis langkah-langkah yang telah diambil oleh pemerintah. Metode penelitian ini menggunakan pendekatan kualitatif. Tahap pengumpulan data yaitu dilakukan melalui wawancara, observasi, dan telaah dokumen. Data yang diperoleh kemudian dipindahkan ke dalam alat analisis untuk pengodean data menggunakan Nvivo 12 Plus. Temuan penelitian menunjukkan bahwa Kota Makassar menghadapi risiko banjir yang signifikan yang disebabkan oleh curah hujan tinggi, perubahan iklim yang semakin ekstrem, pertumbuhan penduduk yang cepat, perubahan tata guna lahan yang buruk, dan tidak efektifnya pengelolaan air. Pemerintah Kota Makassar telah merespons dengan meningkatkan kapasitas anggaran, memperbaiki sistem drainase, mengembangkan sistem peringatan dini, melakukan kampanye kesadaran masyarakat, dan mengadopsi kerjasama lintas sektoral. Studi ini dapat menjadi rekomendasi kebijakan di masa depan dengan fokus pada perluasan infrastruktur drainase, perencanaan tata ruang yang lebih terkoordinasi, pemantauan perubahan iklim, peningkatan kesadaran masyarakat, dan penguatan kerjasama antarlembaga.*

INTRODUCTION

The impacts of urban flooding can be highly destructive and cause significant economic and social losses (Pour et al., 2020), including infrastructure damage (Vamvakeridou-Lyroudia et al., 2020), loss of resources (Kundzewicz et al., 2019), and even fatalities (Qi et al., 2021). The flood disaster also recently occurred in Makassar City in early 2023. The Makassar City Regional Disaster Management Agency (BPBD) report identified the number of victims affected by the flood disaster as 1,366 (Fatir, 2023). The floods in Makassar City have made local and national news, showing that this flood is one of the disasters that continues to be highlighted. Several studies show that urban flooding is generally caused by various factors such as high rainfall (Vemula et al., 2019), the inability of existing drainage and sewerage systems (Zhou et al., 2019), and the reduction in water catchment areas caused by urbanization (Singh et al., 2020). Several steps can be taken to reduce the risk of urban flooding, namely by handling waste (Phonphoton

& Pharino, 2019), and good drainage management (Gimenez-Maranges et al., 2020), including cleaning drainage channels regularly (Bosseler et al., 2021). Building flood control infrastructure, such as embankments and dams, is also considered an appropriate step (Mohanty et al., 2020). It also really needs the awareness of all parties, including the community (Venkataramanan et al., 2020).

Increasing public awareness about protecting the environment is also crucial for disaster mitigation efforts (AlQahtany & Abubakar, 2020). Disaster mitigation is a series of actions to reduce disaster risk and minimize its impact on humans and the environment (Weichselgartner, 2001). The main goal of disaster mitigation is to reduce losses that may occur as a residue tour through the steps taken before, during, and after a disaster (Yoon et al., 2016). One of the disaster mitigation measures that can be taken is conducting risk mapping to identify areas vulnerable to disasters (Amarnath et al., 2021), including areas prone to flooding (Ahmed et al., 2022). Flood disaster risk mapping identifies areas at risk of being affected by floods and assesses potential losses to humans, the environment, and existing infrastructure (Uddin & Matin, 2021). Disaster risk mapping, including floods, is crucial to help governments and communities take effective mitigation actions to reduce the impact of disasters in urban areas (Baharuddin et al., 2022; Ntajal et al., 2017).

In addition, government policies are very important in handling flood disasters because flood disasters have a significant impact on humans, the environment, and the economy (Danhassan et al., 2023). Without appropriate government policies, efforts to deal with flood disasters can become uncoordinated and ineffective. Flood disaster management involves various sectors, such as infrastructure, health, and education (Bark et al., 2021; Graham et al., 2019; Rehman et al., 2019; Tsai et al., 2020). Government policies can facilitate coordination between these various sectors to ensure that flood disaster management efforts are carried out in an integrated and effective manner (Kuang & Liao, 2020). Government policies can assist in developing sustainable mitigation and adaptation strategies for flood disasters (Hurlimann et al., 2021). These efforts include green spatial planning, sustainable infrastructure development, and investment in green technology (Abass et al., 2020; Jeong et al., 2018; Shi, 2020).

Much research has been done on disaster management and mitigation. However, there are still very few specific research results that focus on urban disaster mitigation, especially in assessing the response and initiation of government policies in the case of flooding in Makassar City. However, some results of previous research are still considered relevant and support this research. First, the risk of flooding in urban areas can be very high due to rapid and dense developments and an increase in inappropriate land use (Y. Lee & Brody, 2018). Second, government policies in mitigating flood disasters can be carried out by building infrastructure to help reduce the risk of flooding (Shah et al., 2018). Third, to increase the effectiveness of flood disaster management, government policies must be supported by community participation (Wehn et al., 2015). Fourth, it is also possible for the government to educate about the dangers of flooding, how to reduce the risk of flooding, and how to act when it occurs (D. W. Lee, 2019).

This research aims to identify efforts to handle and mitigate urban flood disasters, including the response and policy initiation of the Makassar City government in dealing with flood disasters. This research question is described as follows. (a) What are the factors causing the high risk of flooding in urban areas, especially in Makassar City? (b) What are the Makassar City government's flood disaster mitigation efforts in dealing with flood disasters? (c) What obstacles does the government face in implementing flood disaster mitigation policies and efforts in Makassar City? The answers to these three research questions are useful for knowing the causal factors, mitigation efforts, and government obstacles in implementing urban flood disaster management policies in Makassar City. The contribution from the results of this study can assist in evaluating the mitigation policies that the government has implemented.

RESEARCH METHODS

This research method uses a qualitative approach. The data collection stage involves interviews, observation, and document review. This interview was conducted at the Makassar City Public Works Service (PU), the Makassar City Public Works Service (DPU) Drainage Task Force Team, and the Makassar City Regional Disaster Management Agency (BPBD). The observation of this research was carried out by making direct observations on the areas affected by the flood disaster in Makassar City. Document review is needed to collect data in the form of reports or information about the 2023 flood disaster in Makassar City. The document includes data on the number of flood victims, flood-prone area mapping reports, and other relevant Makassar City government work reports. After the data has been successfully collected, the processing and analysis of research data is carried out. The stages of processing and analyzing the research data are carried out by presenting data, reducing data, and drawing conclusions. The research data that has been processed is then validated by triangulating the research data. The research results that have been processed are then analyzed to answer research questions. The research results obtained are then compiled to be reported to inform the progress of the research results.

In addition to data collection methods, which include interviews, observation, and document review, this study also uses the NVivo analysis tool with the unit of analysis focusing on case classification. The use of the NVivo analysis tool is important in facilitating the process of analyzing qualitative data, especially in organizing and understanding the patterns that emerge from the data that has been collected. NVivo can assist researchers in classifying data based on certain characteristics and attributes, making it possible to identify relationships and patterns that arise in the government's response to flooding in Makassar City. As such, the NVivo analysis tool is a very useful instrument in understanding the complexity of the flood issue and contributes to developing more informed and relevant conclusions and policy recommendations. Visualization of coding results data is mapped in the form of images.

RESULTS AND DISCUSSION

Urban flooding in Makassar City is one of the main challenges faced by the government and local communities. Makassar City, located on the east coast of Sulawesi Island, experiences high rainfall throughout the year, which often causes flooding. Floods in Makassar City often submerge main roads, residential areas, and even business centers. The impact extends to various sectors of life, including social, economic, and environmental. Houses were submerged in water, vehicles were disabled, businesses were forced to close, and many residents were forced to flee. This results in huge losses to the local economy and residents' quality of life.

Figure. 1
Floods in Makassar City in 2023
Source: Author documentation, 2023

Floods in Makassar City require a serious response from the government and the local community. The high level of flood risk, especially during the rainy season, has significantly impacted the lives of residents and the city's economy. Only with a serious and sustainable response can Makassar City reduce the risk of flooding and maintain the welfare of its residents. To understand and overcome the high risk of urban flooding in Makassar City, it is important to know the factors that cause it.

Factors causing the high risk of urban flooding in Makassar City

The urgency of knowing the factors that influence the high risk of urban flooding in Makassar City is very important because these factors have a significant impact on people's lives and the city's economy. With a better understanding of these factors, governments, and relevant stakeholders can design policies and strategies that are more effective in reducing flood risk, increasing city resilience, and protecting citizens from the destructive impacts of flooding. A deeper understanding of these factors will also enable more adaptive urban planning.

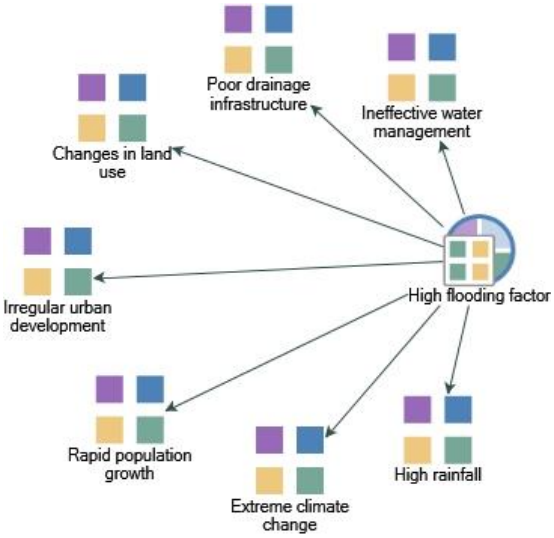

Figure. 1
Dominant factors influencing the high risk of urban flooding in Makassar
Source: Processed by researchers using Nvivo 12 Plus, 2023

The high risk of urban flooding in Makassar City is caused by several factors, including high rainfall, increasingly extreme climate change, rapid population growth, irregular urban development, changes in land use, lack of adequate drainage infrastructure, and ineffective water management. High rainfall is a weather condition in which the amount of rainfall that falls in a certain period exceeds the historical average usually received by an area in a similar period. Factors that can cause heavy rainfall include various atmosphere dynamics, such as air masses' movement, interactions between warm and cold air masses, and wind patterns. High rainfall can occur on different scales, ranging from heavy rain in a short period to constant rain over several days. In Makassar City, high rainfall is the main factor contributing to the risk of urban flooding. Its location in eastern Indonesia makes it vulnerable to long rainy seasons and high rainfall intensity. In addition, global climate change can also affect rainfall patterns, increasing the likelihood of extreme rains that can trigger flooding. This is of serious concern because of its damaging effects, such as submerging roads, houses, and land, as well as disruption to transportation and the local economy.

Increasingly extreme climate change is one of the main factors that significantly impacts the high risk of urban flooding, including in Makassar City. These climate changes include increasing global temperatures, more rain intensity, frequent extreme weather events, and rising sea levels. Climate change also contributes to extreme weather, such as hurricanes and tropical

cyclones, which can bring heavy rain and strong winds. With the intensity and frequency of storms increasing, the risk of flooding due to heavy rain and flash floods is also higher. Rising sea levels due to climate change can potentially threaten coastal areas such as Makassar City. Rising sea levels can cause seawater to submerge low-lying land areas, exacerbating the risk of flooding in coastal areas.

Rapid population growth and irregular urban development are important factors in increasing the risk of urban flooding in Makassar City. The city of Makassar has witnessed rapid population growth over the past few years, which has prompted the development of new infrastructure and housing. However, this growth often occurs without adequate urban planning and following sustainable spatial planning. As a result, many urban areas in Makassar City have experienced land use changes that affect water flow and drainage. Increasing settlements, road construction, and uncoordinated land-use changes have blocked the flow of rainwater and resulted in waterlogging, which is often the cause of urban flooding. In addition, development without careful planning can also result in the loss of green open land, which functions as a natural water catchment and helps reduce the risk of flooding.

Land use changes that affect urban drainage are key factors contributing to the risk of urban flooding in Makassar City. Makassar City has experienced rapid urban growth and development, which is only sometimes matched by proper land use planning. As a result, several land-use changes have disrupted the city's stormwater flow and natural drainage systems. One of the main problems is the increase in housing and infrastructure development without adequate consideration of drainage. The construction of housing, highways, and commercial buildings often reduces green open land that can absorb rainwater. This results in increased surface runoff of rainwater into drainage channels, which may need help handling larger water volumes.

In addition, land use changes that change soil characteristics, such as excavating land for construction, can also affect the soil's ability to absorb water. This can cause rainwater to flow more quickly into surface runoff, increasing the risk of flooding. To overcome this problem, the Makassar City government needs strict land use planning and carefully monitor development. This could include regulations requiring the restoration or preservation of green watersheds, planning better drainage systems, and promoting environmentally friendly building designs.

Ineffective water management is one of the important factors that play a role in increasing the risk of urban flooding in Makassar City. This issue covers several very relevant aspects. First, the lack of adequate drainage infrastructure means that urban water drainage systems cannot handle high volumes of rainwater, so waterlogging on streets and residential areas becomes common, potentially triggering flooding. Second, the accumulation of waste in ditches and drainage systems blocks water flow, which can exacerbate the risk of flooding. In addition, sedimentation that occurs due to material such as soil being carried away by rainwater can also reduce the drainage system's capacity, making the situation worse. Incompetence in river management, including lack of river channel maintenance and inadequate flood control systems, also contributes to a higher risk of flooding, especially during heavy rain events. Therefore, efforts to improve water management and more effective drainage infrastructure are crucial in reducing the risk of urban flooding in Makassar City

Flood disaster mitigation efforts carried out by the government of Makassar City

Flood disaster mitigation efforts have an undeniable urgency in maintaining the safety and welfare of the community and protecting the environment. With increasingly extreme climate change, the intensity and impact of floods is increasing (Malik et al., 2021). Therefore, proactive steps are needed, especially the government's response (Malik et al., 2023). In the context of this research, the government of Makassar City has also made various important efforts, which are seen as follows:

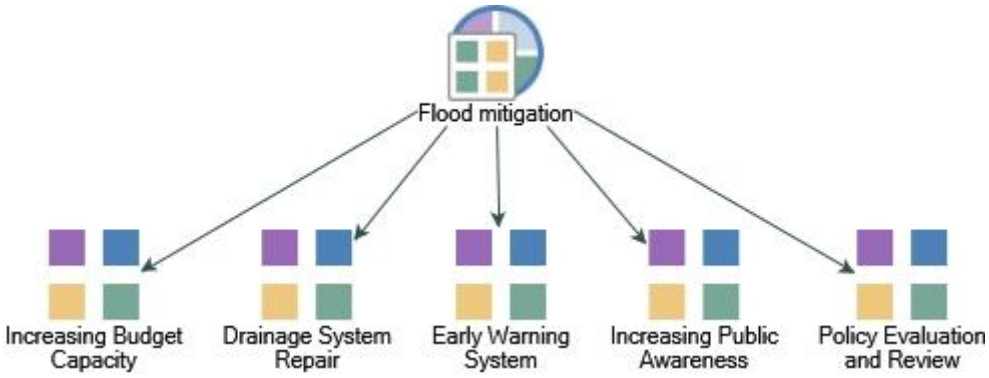

Figure. 1
Flood mitigation efforts in Makassar City
Source: Processed by researchers using Nvivo 12 Plus, 2023

The flood disaster mitigation efforts that the government of Makassar City has implemented reflect a serious commitment to overcoming the risk of flooding that often haunts this city. Increasing budget capacity is a significant first step. With a larger allocation of funds for flood risk mitigation, the government can implement adequate infrastructure projects to tackle inundation and protect urban areas from damaging floods. This includes improving the drainage system, at the heart of flood mitigation, and ensuring that waterways can drain rainwater efficiently. Improvement of the drainage system is another important step. With regular maintenance, canal expansion, and better drainage infrastructure development, Makassar City can improve the ability of the drainage system to handle high rainfall. An effective early warning system is also an important element of mitigation efforts. Providing the public with accurate weather information and flood warnings is a proactive step in enabling them to take appropriate action against flood threats.

In addition to technical efforts, achieving higher public awareness about flood risks and actions to be taken during a disaster is important. Public awareness campaigns help change the behavior and mindset of residents regarding flooding, which can improve their preparedness. Ongoing policy evaluation and review is a wise approach to ensure flood mitigation measures remain relevant and effective. Cooperation with related parties is another important element. Flooding is a problem that involves many stakeholders, and cross-sectoral collaboration is the key to addressing this problem holistically. Makassar City can draw on additional resources and knowledge to strengthen mitigation efforts by engaging the provincial government, the private sector, and non-governmental organizations.

The flood disaster mitigation measures that the Makassar City government has implemented require an in-depth understanding of the complexity of this problem. Increasing budget capacity, as an important aspect of mitigation efforts, allows the government to invest in infrastructure that has long-term impacts. The government can plan and implement measurable projects with greater funds, such as building a larger and more efficient water system. This will help overcome waterlogging during heavy rains and create infrastructure resilient to increasingly extreme climate change. Improving the drainage system is also integral to the flood mitigation solution. These improvements include the maintenance and expansion of existing drainage channels and the construction of new infrastructure that utilizes the latest technology in water management. In this context, it is important to take into account that urban flooding is often caused not only by heavy rainfall, but also by adverse land use changes. Therefore, careful and coordinated planning between stakeholders, including private parties involved in city development, is very important.

An effective early warning system is another important aspect. Ensuring the public has accurate and timely information about extreme weather and potential flooding can save lives and property. The government needs to continue to improve the technology and infrastructure that supports early warning systems and carry out educational campaigns for the public on how to

respond to these warnings. Apart from that, efforts to increase public awareness are a factor that should be addressed. Communities must understand the risk of flooding and how their actions can influence its impact. Public awareness campaigns should focus on safe behavior during floods, including appropriate evacuation measures and keeping drainage systems and waterways clean and free of obstructions.

Ongoing policy evaluation and review are critical in dealing with the growing threat of flooding. The government needs to ensure that its mitigation strategies are still effective in dealing with changing conditions and new threats that may emerge. This involves continuously monitoring infrastructure performance, early warning systems, and community awareness. Repairs and adjustments must be made immediately if deficiencies or discrepancies are found. Collaboration with various stakeholders is one of the keys to overcoming urban flooding. Flood problems cannot be solved by one entity alone. Collaboration between local governments, provincial governments, specialized agencies, the private sector, and non-governmental organizations brings diverse resources, knowledge, and expertise to mitigation efforts. It also helps coordinate different efforts to achieve the same goal.

CONCLUSION

Tackling the risk of urban flooding in Makassar City is urgent, given the devastating impact on society and infrastructure. The research findings identify significant factors in increasing flood risk, including heavy rainfall, extreme climate change, rapid population growth, adverse land use changes, and ineffective water management. The government has tried to mitigate flood risks by increasing budget capacity, improving drainage systems, developing early warning systems, public awareness campaigns, policy evaluations, and collaborating with various related parties. Policy recommendations from this research involve improving drainage infrastructure, more coordinated spatial planning, monitoring climate change, increasing public awareness, and expanding inter-agency collaboration. The limitation of this research is that it focuses on the mitigation aspect without going in-depth into the climate change adaptation aspect, which could be a more comprehensive research theme. This allows it to be considered for further research.

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