

## **IMPLEMENTATION CHALLENGES OF INFRASTRUCTURE DEVELOPMENT PROGRAM FOR FLOOD MANAGEMENT IN MEDAN CITY**

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### **ABSTRACT**

This study aims to analyze the implementation of infrastructure development programs in flood management in Medan City. The city is often flooded due to high rainfall and inadequate drainage system. The Medan City Government has built various infrastructure projects such as the construction of drainage channels, river normalization, retention ponds, and road improvements. The research methods used include in-depth interviews, field observations, and secondary data analysis from relevant agencies. The results show that the infrastructure development program has successfully reduced the frequency and intensity of flooding, as well as improved the quality of life of the community through increased mobility and environmental safety. However, implementation challenges such as limited funding, lack of inter-agency coordination and low community participation remain significant obstacles. This study recommends the need for a collaborative strategy involving various stakeholders to overcome these challenges and ensure the sustainability of the infrastructure development program. With a comprehensive approach, it is expected that Medan City can more effectively manage flood risks and improve the quality of life of its citizens in a sustainable manner.

**Keywords: Control, Development, Flood, Implementation, Infrastructure, Management.**

### **INTRODUCTION**

Medan City, the capital of North Sumatra Province, is one of the important economic and social growth centres in Indonesia. With a growing population of approximately 2.5 million and a variety of dense economic activities, Medan City faces significant challenges, one of which is flooding. Flooding in Medan City is not a new phenomenon; it has become a chronic issue exacerbated by climate change, rapid urbanization, and lack of adequate infrastructure planning (Thamrin et al., 2022). Geographically, Medan City is located in the lowlands and has many rivers flowing through the area. High rainfall, especially during the rainy season, often causes rivers to overflow, inundating residential areas and public areas. In addition, many buildings and unplanned infrastructure prevent the flow of water, exacerbating the flooding problem. Data from the Meteorology, Climatology and Geophysics Agency (BMKG) shows that rainfall in Medan often reaches more than 300 mm in a month at the peak of the rainy season, which puts additional strain on the existing drainage system (Cdn.bmkg.go.id, 2024). Flooding in Medan City not only impacts people's daily lives but also causes huge economic losses. Damaged infrastructure, lost productivity,

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and increased expenditure on flood management are some of the consequences that must be faced (Dprd.pemkomedan.go.id, 2022). According to a report by the North Sumatra Regional Disaster Management Agency (BPBD), flood losses in Medan City amount to billions of rupiah annually, and the impact is felt in various sectors, including education, health, and transportation (Hasyim, 2024). Facing this challenge, the Medan City Government has implemented various infrastructure development programs as part of flood management efforts (Monica, 2022). Infrastructure development, such as drainage channels, river normalization, and retention ponds, are strategic measures that are expected to reduce the frequency and impact of flooding. These programs not only focus on physical development but also include efforts to maintain and manage sustainable water resources (Portal.medan.go.id, 2022a). One program that has received attention is the construction of efficient drainage channels. This program aims to increase the capacity of existing channels and build new channels that can accommodate the flow of rainwater. With good drainage channels, it is expected that waterlogging can be minimized, and the risk of flooding can be reduced. River normalization is also an important step, as a clean and wide river can drain water better, reducing the possibility of overflowing. Retention ponds are one of the innovations that have been applied to overcome flooding problems. These ponds serve as reservoirs for excess rainwater before it flows into drainage channels, giving the drainage system time to treat the water. The construction of retention ponds at strategic points in Medan City is part of the city's better spatial plan (Portal.medan.go.id, 2022b). However, although various efforts have been made, challenges remain in the implementation of these programs still need to be addressed. Budget limitations, lack of coordination between various government agencies, and low community participation are obstacles to achieving optimal results. Therefore, there is a need for in-depth research to evaluate the effectiveness of the programs that have been implemented and identify the challenges faced (Viral24.co.id, 2024). With the aim of providing a clear picture of the implementation of infrastructure development programs in flood management in Medan City, this study aims to analyze the types of programs implemented, assess the impact of these programs, and identify challenges faced in their implementation. Through this research, it is expected to provide useful recommendations for the government and related parties in an effort to improve the effectiveness of flood management programs in Medan City. As part of the flood management efforts, all parties need to work together to manage water resources and improve existing infrastructure. By improving understanding of the challenges and solutions, it is hoped that the community can play a more active role in protecting the environment and supporting the government's efforts to deal with flooding in a sustainable manner. This will not only improve the quality of life for the people of Medan City but also make a positive contribution to the city's overall development (Haryana & Firmansyah, 2024). Thus, this article aims to explain the implementation challenges of the Infrastructure Development Program for Flood Management in Medan City.

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### METHODS

This research uses a qualitative approach to evaluate the implementation of infrastructure development programs in flood management in Medan City. The research design used is a case study with a focus on specific programs that the Medan City Government has implemented. Data collection was conducted through in-depth interviews with various stakeholders, including government officials, members of the Regional Disaster Management Agency (BPBD), and communities affected by flooding. These interviews aimed to gain a more in-depth perspective on the effectiveness of the infrastructure programs that have been implemented, as well as the challenges faced during the implementation process. In addition, direct observations of the program's targeted locations, such as drainage channels, retention ponds and normalized rivers, were conducted to obtain empirical data on the physical condition of the infrastructure and its impact on flood risk reduction. Relevant documents, such as government annual reports, rainfall data, and flood loss records, were also analyzed to complete the understanding of the context and outcomes of the programs. Data analysis was conducted using the thematic analysis method, where patterns and themes that emerged from the interviews and observations were categorized to generate a comprehensive understanding of the implementation of infrastructure programs and their impact on flood management in Medan City. With this methodology, the research is expected to provide a clear and comprehensive picture of the effectiveness and challenges faced in efforts to address flooding problems in urban areas (Creswell & Poth, 2018; Saldana, 2014).

### RESULTS AND DISCUSSION

#### **Construction of drainage channels, river normalization, retention ponds, and road improvements**

This study identifies and analyses several infrastructure development programs that the Medan City Government has implemented in response to the frequent flooding problems in the area. These programs include the construction of drainage channels, river normalization, retention pond construction, and road improvements. The construction of efficient drainage channels is one of the key measures in managing stormwater flows in urban areas. In recent years, the Medan City Government has undertaken the construction and improvement of drainage channels at various flood-prone points. The project aims to increase the channel's capacity to collect rainwater and drain it to rivers or larger retention ponds. Research shows that the newly constructed drainage channels are better sized and designed, taking into account factors such as land slope and water flow patterns. With better drainage channels in place, waterlogging time after rainfall is reduced, and water flow is smoother (Rajagukguk, 2024). River normalization is also an important step in improving the capacity of rivers in Medan City. Existing rivers are often silted up and blocked due to sedimentation, waste, and litter (Thamrin et al., 2022). The normalization programme involves clearing the river of materials that interfere with the flow, excavating the riverbed, and arranging the riverbanks to make them safer. The results of the study show that river normalization can increase the capacity of water flow, reduce the risk of flooding, and improve the quality of the environment around the river. The community also reported that

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with normalization, the previously dirty river is now cleaner and can be used as a green open space. In addition, the construction of retention ponds is an innovation made to deal with flooding by storing excess rainwater. Retention ponds function as temporary water reservoirs before being channelled into drainage channels. In this study, retention ponds built in strategic locations showed efficiency in reducing peak water flow during heavy rains. The placement of retention ponds in areas frequently affected by flooding proved effective in reducing the risk of inundation in residential areas. In addition, retention ponds also provide additional benefits as public spaces that the community can use for various activities (Thamrin et al., 2021). Road repair is an important aspect of the infrastructure development program that aims to improve community accessibility and mobility (Kuncoro et al., 2024). Roads that are often submerged in water due to flooding can hamper economic and social activities. In this study, road improvements were carried out by increasing road elevation in flood-prone areas and improving the drainage system along the road. The results show that improving road infrastructure not only improves transportation access but also reduces economic losses due to infrastructure damage. From the results, it can be concluded that the infrastructure development programs that have been implemented in Medan City have a significant impact on flood management. The development of efficient drainage channels, river normalization, construction of retention ponds, and road improvements are strategic measures that are interrelated in the effort to reduce flood risks. One of the key findings of this study is the direct effect of good infrastructure on flood frequency and intensity. With well-designed drainage channels and river normalization, the capacity to collect and drain stormwater is increased, reducing the likelihood of flooding. Field observations show that in areas that have received government attention, the incidence of flooding has significantly decreased, especially during the rainy season. However, implementation challenges remain. While these programs have yielded positive results, funding issues, inter-agency coordination, and community participation still need to be addressed to ensure program sustainability and effectiveness. Some projects have been halted or scaled back due to budget constraints, impacting the quality and reach of the infrastructure built. Coordination between different agencies is also a determining factor in program success. The research found that there is a need to strengthen collaboration between the city, provincial and private governments in the planning and implementation of infrastructure projects. With good collaboration, resource allocation can be done more effectively, and problems that arise can be addressed more quickly. On the other hand, community participation in infrastructure monitoring and maintenance is also very important. Although public awareness about the importance of keeping the environment clean is increasing, their involvement in maintaining the facilities that have been built still needs to be higher (Regif & Pattipeilohy, 2024). Therefore, the government needs to create mechanisms that can encourage community participation in infrastructure management, for example, through educational programs and involvement in gotong royong activities. Overall, the results show that despite the challenges in the implementation of infrastructure development programs, the steps taken by the Medan City Government show great potential in addressing flooding issues. The long-term success of the program will depend on the continued commitment of all stakeholders to support and

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maintain the infrastructure that has been built and increase community participation in flood management efforts. With a comprehensive and collaborative approach, it is expected that Medan City can continue to reduce flood risks and improve the quality of life of the community.

### **Impact on Flood Management**

This study evaluates the impact of the infrastructure development program implemented in Medan City as an effort to address the problem of frequent flooding in the area. The results of the analysis show two significant impacts resulting from this intervention, namely a reduction in the frequency and intensity of flooding and an improvement in the quality of life of the community.

### **Reduction in Flood Frequency and Intensity**

One of the main outcomes of this research is a significant reduction in the frequency and intensity of flooding events in areas that have undergone infrastructure development. Through the construction program of drainage channels, river normalization, and retention ponds, stormwater flow can be managed more effectively, which directly reduces the possibility of prolonged inundation. Data from the Public Works Office of Medan City shows that before the infrastructure intervention, the average frequency of flooding in vulnerable areas reached 10 times a year. However, after the implementation of this program, the frequency of flooding was reduced by 40%, with only six occurrences a year. Not only has the frequency of flooding been reduced but so has its intensity. Previously, during heavy rains, water could inundate roads and settlements to a height of more than 1 meter. After the program implementation, field data shows that the average water inundation height was reduced to 30-50 cm, depending on the location and volume of rainfall. This shows that the infrastructure built not only reduces the number of flood events but also reduces the impact of such events so that people do not have to face severe damage to their property.

### **Improved Quality of Life**

Another positive impact of infrastructure development is the improvement of people's quality of life. The reduction in the frequency and intensity of flooding has a direct impact on people's daily lives. Interviews with residents in the affected areas show that they now feel safer and more comfortable. Previously, frequent flooding caused disruptions in daily activities, such as access to schools and workplaces, as well as damage to personal belongings. Improved infrastructure, such as better roads and efficient drainage channels, have also made mobility easier. With less standing water on the roads, economic activities such as trading became smoother, which in turn increased people's income. Traders who previously had to close their businesses when it rained can now operate better, generating more stable profits. The construction of retention ponds also provides wider social benefits. These ponds not only serve as water reservoirs but have also been transformed into green open spaces that the community can use to relax, exercise and gather. This contributes to improving the quality of the living environment and public health, as well as building a sense

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of community among residents. Despite the many positive impacts of these programs, implementation challenges remain. Some communities still need to be fully aware of the importance of keeping drainage channels and retention ponds clean, which can reduce the effectiveness of the infrastructure systems that have been built. Hence, there is a need for ongoing educational campaigns to raise public awareness of the importance of their participation in maintaining this infrastructure. Overall, the results show that the infrastructure development program in Medan City has a significant impact on flood management. Reduction in the frequency and intensity of flooding and improvement in the quality of life of the community are important indicators of the program's success. To ensure the sustainability of the results achieved, collaboration between the government, the community, and the private sector is needed to maintain the infrastructure that has been built and educate the community about their responsibility to protect the environment. With a comprehensive and participatory approach, it is expected that Medan City can continue to reduce flood risks and improve the quality of life of its citizens.

### Challenges in Implementation

Although the infrastructure development program in Medan City has shown significant results in flood management, challenges in implementation also need serious attention. Some of the main challenges faced include funding issues, inter-agency coordination, and community participation.

### Funding Issues

One of the main challenges in implementing infrastructure development programs is funding. Large and complex infrastructure projects, such as the construction of drainage channels and river normalization, require considerable funds for implementation. However, the available budget often needs to be improved to meet these needs. Interviews with relevant officials show that the need for more budget allocations from the central and local governments is an obstacle to project implementation. In addition, reliance on foreign aid and international donor funds is also risky, as fluctuations in the availability of these funds can affect project sustainability. Lack of investment in infrastructure can also lead to delays in project implementation. In some areas, planned projects have had to be postponed or even cancelled due to funding issues. These delays not only hamper flood management efforts but also have an impact on people's trust in the government. The public tends to be sceptical of the government's commitment to addressing the flood problem, especially when promised projects still need to be implemented on schedule.

### Inter-agency Coordination

Another challenge is the need for inter-agency coordination in the implementation of infrastructure development programs (Bharosa et al., 2010). The large number of government agencies involved, such as the Public Works Agency, the Environment Agency, and the Regional Development Planning Agency (Bappeda), often leads to overlapping responsibilities. This can lead to confusion in decision-making and project implementation.

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For example, there are cases where one infrastructure project is not well integrated with other projects, resulting in suboptimal outcomes. Observations show that there are often differences in vision and mission between agencies when dealing with flooding issues. Some agencies may focus more on the technical aspects of infrastructure development, while others pay more attention to social and environmental impacts. The lack of effective communication between these agencies can cause delays in project completion and reduce the effectiveness of flood management efforts (Tamba et al., 2024).

### Community Participation

Community participation is also an important challenge in the implementation of infrastructure development programs. Although infrastructure development is designed to improve people's quality of life, communities often need to be more actively involved in the project planning and implementation process. Interviews with residents in the affected areas showed that many of them felt that they needed to be more involved in decision-making related to projects to be implemented in their areas. This leads to a lack of ownership of the project, potentially reducing the success of the program. The lack of community participation also impacts the effectiveness of maintaining the infrastructure that has been built. Without active community involvement, infrastructure such as drainage channels and retention ponds tend to be poorly maintained. Many communities need to realize the importance of keeping drainage channels and retention ponds clean and functioning properly. Therefore, education and counseling campaigns aimed at raising public awareness of the importance of their role in maintaining infrastructure are needed. Overall, challenges in the implementation of infrastructure development programs in Medan City related to funding issues, inter-agency coordination, and community participation must be addressed to ensure the success of the flood management program. Better strategies in budget allocation, improved coordination between government agencies, and increased community participation in the project planning and implementation process are required. By addressing these challenges, it is expected that the infrastructure development program can run more effectively and have a positive impact on flood management in Medan City.

### CONCLUSIONS

This study reveals that the infrastructure development program in Medan City has had a significant impact on flood management. Through the construction of drainage channels, river normalization, retention ponds, and road improvements, the frequency and intensity of flooding in the affected areas have decreased significantly. Data shows that after the implementation of the program, the frequency of flooding was reduced by 40%, while the height of standing water during heavy rains has also decreased substantially. This has not only increased the safety and comfort of the community but also improved their overall quality of life. However, the challenges in implementing the program must also be acknowledged. Issues of limited funding, lack of inter-agency coordination, and low community participation have been significant obstacles. Reliance on inconsistent funding, overlapping responsibilities between government agencies, and a lack of community

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involvement in the project planning and implementation process could have helped the program's effectiveness. Therefore, to ensure long-term success in flood management, more coordinated and participatory efforts are needed. Strengthening budget allocations, improving communication between agencies, and increasing community awareness and involvement are key to overcoming these challenges. With a comprehensive and collaborative approach, it is expected that Medan City can more effectively manage flood risks and sustainably improve the quality of life of its citizens. Overall, this study emphasizes the importance of integration between infrastructure development and community engagement and the need for support from various stakeholders to achieve greater goals in environmental management and disaster management.

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