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Implementation of Infrastructure Development Program in Flood Handling in Medan Selayang District, Medan City

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A B S T R A C T
This study examines the implementation of infrastructure development in flood management in Medan Selayang District, Medan City. Medan Selayang, being one of the flood-prone areas in the city, faces significant challenges due to rapid urbanization, inadequate drainage systems, and poor waste management. The objective of this research is to assess the effectiveness of infrastructure interventions, such as the construction of drainage channels, flood retention ponds, and river embankments, in mitigating flood risks and improving public resilience. Data collection was conducted through field observations, interviews with local authorities and community members, and analysis of flood occurrence records. The results indicate that while there has been notable progress in infrastructure development, challenges remain in terms of the sustainability and maintenance of these systems. Issues such as insufficient funding, lack of coordination between stakeholders, and limited public awareness of flood prevention measures have hindered the optimal functioning of flood management infrastructure. This study emphasizes the need for integrated planning, enhanced community participation, and continued investment in infrastructure to effectively address flood risks in Medan Selayang. The findings provide valuable insights for policymakers and urban planners in designing more resili.

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INTRODUCTION

The Unitary State of the Republic of Indonesia has a vast territory and is located on the equator in a cross position between two continents and two oceans with natural conditions that have various advantages, but on the other hand its position is in an area that has geographical, geological, hydrological and demographic conditions that are prone to disasters with a fairly high frequency, so that it requires systematic, integrated and coordinated handling. The potential causes of disasters in the territory of the unitary state of Indonesia can be grouped into 3 (three) types of disasters, namely natural disasters, non-natural disasters and social disasters. The equatorial position of the State of Indonesia has a vulnerable factor to the existence of natural conditions that are always changing so that it is anticipated to always be ready for all the worst possibilities of natural conditions that occur, namely natural disasters. It is stated that a disaster here is an event/series of events that threaten and disrupt the lives and livelihoods of the community caused by both natural factors and/or non-natural factors and human factors, resulting in human casualties, environmental damage, property losses and psychological impacts and beyond the capabilities of the community with all its resources. This is a serious threat and can disrupt community activities.

Medan City is the capital of North Sumatra Province. In 2022, the population of Medan City reached 2,494,512 people. With an area of 265.10 km2, the population density reached 9,410 people/km2 (BPS, 2023). Like most areas of Indonesia located in the tropics, the climate of Medan City is also greatly influenced by the monsoons. This means that the climate will be characterized by relatively high temperatures, high humidity and accompanied by a lot of rain (Silitonga, 2019). The floods that hit Medan City recently have made the situation a flood emergency, and seem to repeat the annual tradition where floods continue to occur as in previous years. BPS Medan City (2023) said that the average rainy days in Medan Region I in 2022 were 19 days per month. The fairly high rainfall intensity makes Medan City one of the areas included in the flood-prone category in North Sumatra. This is supported by research by Anggraini et al (2021) which states that all areas in Medan City are flood-prone areas, and 31.07% have a very high level of flood risk (Tampubolon, 2018).

According to Hasibuan et al., (2005) flooding in Medan City is almost an average of 10-12 times/year. The Medan City BPBD (2002) added that flood disasters in Medan City occurred 32 times in 2020 and there were 38 flood and inundation points in 2021 where the highest intensity of events was in Medan Maimun District, followed by Medan Selayang District and Medan Johor.

The causes of flooding in Medan City are relatively the same, although with different intensities, namely: (1) high rainfall; (2) high population density and number; (3) uncontrolled urban development, not in accordance with regional spatial planning, and 4 not environmentally aware, resulting in reduced water catchment and reservoir areas; (4) inadequate drainage due to inappropriate drainage systems, lack of drainage infrastructure, and lack of maintenance; (5) unclear status and function of channels, (6) Lack of public awareness due to

littering, (7) The length of the repair or construction process carried out by the PU Service due to budget. One example of a flood that hit Medan City was the one that occurred on December 4, 2020. The flood submerged at least 2,773 houses in seven sub-districts in Medan City. As a result, 5,965 people felt the impact of the flood in Medan City. The seven sub-districts that were submerged in floods were Medan Maimun, Medan Johor, Medan Selayang, Medan Tuntungan, Medan Baru, Medan Petisah and Medan Polonia. Heavy rain that poured from December 3 to 5, 2020 made the condition worse by the overflowing of water from a number of rivers in Medan City, namely the Sikambing River, Sunggal River, Deli River, Babura River and Denai River. In relation to disaster management in Medan City, the Medan City government has a plan to deal with disasters that occur (Monica & Nur, 2022).

Analysis of the flood inundation area mapping of the Sei Sikambing Watershed conducted by Zevri (2019) concluded that the vast flood inundation area resulted in flooding impacts on 5 sub-districts in Medan City and one of them was Medan Selayang Sub-district which reached a flood inundation area of 0.42 km. Flooding is a problem that still requires special serious handling from various parties, both from the government and the community. Flooding is not a minor problem, but a problem that has a relatively large impact on society. According to (Waruwu et al., 2022), flooding is the overflowing of a river flow due to water exceeding the capacity of the river so that it overflows and inundates the plains or lower areas around it. Flooding is actually a "normal" natural phenomenon that often occurs in almost all countries in the world, including Indonesia. Because according to its nature, water will flow and inundate lower places. The occurrence of inundation/flooding is still one of the main problems in the city of Medan. Based on the revision of the drainage network master plan carried out by the Medan City Water Resources, Highways and Construction Services, it is known that the number of inundation/flood points is 2,575 points spread across 940 roads. A number of efforts in the form of drainage management have been carried out where in 2022 the remaining unresolved inundation/flooding points are still 617 points spread throughout Medan City.

Medan City has a vision of "Realizing a Blessed, Advanced and Conducive Medan City Society". Paying special attention to the vision in question, as well as the reality of existing developments, Medan City is expected to play a role in changes at the local, national, regional and global levels. Quoted from Medan City Regional Regulation Number 7 of 2023 concerning the Medan City Medium-Term Development Plan for 2021-2026 In realizing this Vision, several medium-term development missions for Medan City for 2021-2026 have been determined, namely:

Mission 1: Medan Berkah This mission is intended to improve the distribution of public welfare which makes Medan Berkah a commitment of Medan City to build community income and reduce the poor population. In this mission, Medan City also seeks to reduce the unemployment rate and reduce inequality that occurs in Medan City.

Mission 2: Medan Maju This mission is abbreviated as Medan Maju. The context of progress that Medan City aspires to is to achieve an increasingly advanced society, measured by improving the quality of Human Resources. Medan City is committed to improving education and health services that support the progress of Medan City's civilization.

Mission 3: Medan Bersih This mission is Medan City's commitment to realizing an increase in the quality of clean governance and serving the community wholeheartedly and free from corruption, collusion and nepotism. The Medan City Government strives for transparency in public services to achieve public satisfaction.

Mission 4: Medan Membangun This mission seeks to optimize the development of facilities and infrastructure that will support various community activities in Medan City. In this mission, Medan City is committed to providing comprehensive basic services and building an environmentally friendly city. The government will also strive to build a livable city by overcoming problems such as flooding and implementing good city planning.

Mission 5: Conducive Medan This mission seeks to provide a sense of security and comfort for all Medan residents by increasing the supremacy of law based on community participation. In this mission, Medan City will focus on maintaining public order and tranquility. The government is committed to improving the enforcement of regional regulations towards governance that protects and provides a sense of security and comfort.

Mission 6: Innovative Medan This mission seeks to optimize the increase in inclusive economic growth for all Medan residents. Through Innovative Medan, it is hoped that various innovations and investment opportunities will be born to build Medan City which will make Medan City more independent through the ability to generate regional income and encourage innovation in its governance.

Mission 7: Medan with Identity This mission was prepared as a commitment by Medan City to build Medan's image as a cultural tourist city by making people outside Medan City more familiar with Medan as a tourist city and maintaining and preserving cultural heritage. In achieving the objectives of the fourth mission, there are targets that are set as an effort to achieve the objectives of the mission.

The problem of flooding is also a major issue for Medan City and is a major focus for the Medan City Government. The Medan City Government needs to normalize rivers and improve drainage channels, especially in flood-prone areas. In an effort to maintain better urban planning, it is necessary to control the area of slum areas. Slum areas also refer to housing development that is too dense and does not comply with the RTRW in Medan City. Therefore, urban development and planning need to refer to the RTRW. Improvements in infrastructure and street lighting also help organize the city through LPJU. In addition, it is necessary to optimize waste management to control slums in Medan City. In addition, it is necessary to identify flood points and make efforts to handle flooding in Medan City so that Medan is free from flooding.

LITERATURE REVIEW

Implementation of Public Policy

Literally, implementation is often equated with an implementation, whereas implementation is more than just an implementation of a desire. Implementation as a concept has a much broader scope of meaning and understanding than just a word of implementation of a hope and desire. A real action or action towards something that is expected or desired to be achieved is an implementation, but it is not the same as the meaning and intent of implementation as a concept (Jumroh & Pratama, 2022).

Thus, what is called policy implementation, especially public policy, is something that is not just an implementation in the literal sense. Policy implementation is a concept in which there are a number of principles and factors that make a policy considered successful or conversely fail in achieving its goals. According to Sutmasa (2021), ensuring the effectiveness of public policy implementation is very important, namely by understanding the entire public policy process well and overseeing the implementation of public policies with full responsibility through monitoring, evaluation and awards. In order for policy implementation to be effective, Edward suggests that we pay attention to four main issues, namely: communication, resources, disposition or attitudes and bureaucratic structures. Referring to Edward III's view, the researcher knows, analyzes, and describes the readiness of the Medan City Government in implementing infrastructure development programs.

Concept of Development

Development is an effort of growth and change that is planned and carried out consciously by a nation and state and government towards modernization in the context of national development (Yonatan et al., 2014). According to (Ramadhayanti, 2014) development is a process of social change accompanied by broad participation in a society in order to improve the standard of living of the community, from a less than good condition to a better one through greater control that they obtain over their environment. This opinion shows that development requires careful planning and is carried out consciously towards a better change.

Development programs can be implemented well if they have natural resources, human resources and other potential resources such as finance, technology or other parties that utilize the results of the development itself. Development in a country cannot be separated from the ideals and goals of an independent, united, sovereign country in realizing a just and prosperous society. Development in Indonesia is multi-complex, in which there is social development, economic development, defense and security development and political development. Development always results in social change and development is social change itself.

Flood Management

Judging from the geographical and geological characteristics of its region, Indonesia is one of the areas prone to flooding. Around 30% of the 500 rivers in Indonesia cross densely populated areas. Flooding is a seasonal threat that occurs when a body of water overflows from existing channels and inundates the surrounding area. Flooding is the most frequent natural threat and is the most detrimental in terms of humanity and economy. According to (Marlina, 2011) flooding is an event where land is submerged by water. This is due to the increasing volume of water. Flooding can occur due to excessive overflow of water in a place due to heavy rainfall, overflowing rivers, or the breaking of river dams.

According to (Rambe, 2014) one of the areas that often experiences flooding in Medan Selayang District is Jalan Jamin Ginting Pasar 7 Padang Bulan precisely in front of Balai Namaken, when it rains with high intensity and with a duration of rain of only 1-2 hours, it has caused several spaces in this area to face the danger of flooding. Likewise, with Jalan Cempaka before and after the Medan Selayang District Office. When heavy rain falls, the drainage channels or ditches cannot accommodate the entire volume of rainwater, causing water to overflow from the ditch and inundate residential areas and roads. In addition, the Jalan Dr. Mansyur area also has the same problem. When rainfall is high, water often pools in the area both on the body and shoulders of the road. Based on the results of the analysis conducted by Suita and Simorangkir (2018) in their research, the capacity of the channel on Jalan Dr. Mansyur is actually able to accommodate flood discharge, but poorly maintained drainage causes sedimentation in the drainage channel to be quite high so that water quickly overflows on Jalan Dr. Mansyur.

METHODOLOGY

The purpose of qualitative research is to ask or want to know about the meaning in the form of concepts behind the detailed stories of respondents and the social background studied with a sociological approach. Intensively studying the background, and environmental interactions that occur in a social unit such as individuals, groups, institutions or communities. The approach used uses a qualitative approach technique, a qualitative approach is one approach that primarily uses a knowledge paradigm based on constructivism (such as plural meanings) from individual experiences, meanings that are socially and historically constructed with the intention of developing a theory or pattern.

Descriptive analytical method designed to obtain information about the Implementation of the Infrastructure Development Program in Flood Management in Medan Selayang District, Medan City. The purpose of this descriptive analytical research is to create a systematic, factual and accurate description, picture or painting of the facts, characteristics and relationships between the phenomena being investigated.

The descriptive-qualitative research method focuses on problems based on facts carried out by means of observation, interviews, and studying documents.

This method was chosen as one of the writing methods in order to obtain a picture in the field and the Implementation of the Infrastructure Development Program in Flood Management in Medan Selayang District, Medan City.

In descriptive research, researchers will try to see the events that are the center of attention, and then illustrate them as they are. Descriptive research is research that tries to describe something, events, incidents that occur at the present time. In other words, descriptive research takes problems or focuses on actual problems as they are when the research is carried out.

Research Location

The location used for study in this research is Medan Selayang Area. Medan Selayang District is one of 21 Districts located in the Southwest of Medan City, has an area of ± 2,379 Ha^2 or 4.83% of the total area of Medan City, divided into 6 (six) Sub-districts and 63 (sixty-three) neighborhoods, and is at an altitude of 26-50 m above sea level. Medan Selayang District borders Deli Serdang Regency to the west, Medan Johor and Medan Polonia to the east, Medan Tuntungan to the south, and Medan Sunggal and Medan Baru to the north.

Research Informants

Informants are people who can provide a rich, detailed and comprehensive explanation regarding the subject being sought for research data collection. So the selection of informants in this study is

1. Mayor of Medan
2. Head of the Public Works Department
3. Head of UPT Public Works Medan Selayang
4. BPKAD
5. Community Leaders.

Data Analysis Techniques

Data analysis is the process of organizing and sorting data into patterns, categories and basic units of description so that themes can be found and working hypotheses can be formulated as suggested by the data. (Moeleong, 2004). The research analysis technique used is a qualitative technique. Qualitative methods are defined as research procedures that produce descriptive data. This descriptive data can be in the form of speech or writing and behavior observed by people whose information is extracted through in-depth interviews and then categorized together with information obtained through literature searches to sharpen the analysis of research findings trends. This data analysis technique is intended so that case findings that occur at the research location can be studied more deeply and existing phenomena can be explained in detail, so that questions in the research can be answered accurately and optimally.

Qualitative data analysis is carried out if the empirical data obtained is qualitative data in the form of a collection of real words and not a series of numbers and cannot be arranged in categories / classification structures. Data can be collected in a variety of ways (observation, interviews, document digests,

tape recordings) and are usually processed before they are ready for use (through recording, typing, editing, or transcribing), but qualitative analysis still uses words that are usually organized into expanded text, and does not use mathematical or statistical calculations as analytical tools.

RESEARCH RESULT AND DISCUSSION

Analysis of the Implementation of Infrastructure Development in Flood Management in Medan Selayang District According to Edward III's Theory

The results of the study indicate that the development of flood management infrastructure in Medan Selayang District includes various important components, such as the construction of retention ponds, increasing the capacity of drainage channels, normalizing rivers, and building flood retaining walls in vulnerable areas. The construction of retention ponds, for example, is designed to accommodate excess rainwater, so that it can reduce the discharge of water flowing through small channels that are unable to accommodate the water load during heavy rain. One of the retention ponds built along the Selayang River has proven effective in reducing flood volume, although there are still several areas that require further improvement.

However, this study also revealed several challenges in the implementation of flood management infrastructure. One of them is the problem of land acquisition which affects the smoothness of development, considering that most of the flood management project locations are in densely populated residential areas. This process often requires a long time and negotiation between the government and landowners. In addition, the maintenance of the infrastructure that has been built is also a major problem, because many facilities are not managed properly after completion, such as drainage channels clogged with garbage or retention ponds that are not kept clean.

In terms of social and economic impacts, this study noted that although there has been an improvement in the quality of life of residents who were previously often affected by flooding, not all residents have felt the benefits equally. Several areas that are higher or far from the main channels still experience flooding, indicating an imbalance in the distribution of infrastructure development. This factor is an important concern for further development, considering the increasingly rapid urbanization trend in Medan City, which can increase pressure on existing drainage and water channel systems.

The data obtained in this study include the results of field surveys, interviews with residents and related parties such as the Public Works Department, and technical data from infrastructure projects that have been implemented. The data shows that retention ponds built at several points, for example, are able to reduce the duration of waterlogging during the rainy season by around 30-40%. In addition, increasing the capacity of drainage channels in several areas in Medan Selayang District shows a decrease in the volume of overflowing water by 25%. However, the data also shows that in some lower areas, the existing infrastructure is still not enough to fully address the flooding that occurs every year.

Overall, the results of the study indicate that although the efforts made in developing flood management infrastructure in Medan Selayang District are quite significant, there are still many challenges that need to be overcome to achieve an effective long-term solution. One important recommendation from this study is the need for better coordination between local governments and the community in maintaining infrastructure and increasing public awareness of the importance of maintaining clean water channels. In addition, policy improvements and budget allocations for flood management projects are expected to focus more on areas that have not received adequate attention, in order to create a more equitable solution. The author analyzes using the Policy Implementation theory by Edward III in Abdul Wahab (2001: 90-92). This theory is supported by four variables that are the center of attention, namely communication, bureaucratic structure, resources, and disposition.

Communication in Policy Implementation

Communication is a vital factor in supporting life, including in policy communication. Policy communication carried out by the government is important to be carried out and considered in policy implementation. No matter how good the policy that has been made by the government, it will not be successful if it is not supported by good and effective policy communication. Communicating policies to the public is more important than simply socializing the policy. Policy communication means involving the public from the formation of the policy itself. A public policy can be carried out smoothly if there is good communication between the policy/program implementers and the parties involved in implementing the policy. With good communication, the goals and objectives to be achieved from a policy can be socialized well so that it can minimize or even eliminate distortion or rejection of the policy. There are three indicators in analyzing the communication carried out, namely transmission, clarity, and consistency.

Infrastructure development for flood management in Medan Selayang District, Medan City is an important step taken by the government to overcome problems that have been going on for years. However, the success of the implementation of this development is not only determined by technical aspects but also by communication factors which are one of the important elements in Edward III's implementation theory. In this context, communication plays a central role in ensuring that policies are implemented according to their objectives and accepted by the affected community. In this study, the analysis was conducted based on interviews with various related parties, including officials from the Public Works Agency (PU), the Medan Selayang Sub-district Head, and the local community. Communication between the government, policy implementers, and the community is the main focus to understand the extent to which coordination and information flow affect the success of the infrastructure development. The results of interviews and observations indicate a number of obstacles related to communication, both horizontally between agencies and vertically between the government and the community.

that communication in the implementation of flood management infrastructure development in Medan Selayang District is still far from optimal. Lack of transparency, ineffective communication media, and minimal coordination between agencies are the main obstacles that need to be overcome immediately.

As a step for improvement, the government needs to increase the frequency and quality of socialization to the community. One way that can be done is by utilizing social media as the main platform for conveying information. In addition, the government also needs to hold regular meetings with the community to provide updates on project progress and receive direct input. In terms of coordination between agencies, a more integrated communication system is needed to ensure a fast and accurate flow of information. By overcoming these communication barriers, it is hoped that policy implementation can run more effectively and provide real benefits to the community.

Overall, this study emphasizes the importance of communication as a key element in policy implementation. Without effective communication, even well-designed policies can fail in their implementation. Therefore, the government needs to make communication a priority in every stage of policy implementation, from planning to evaluation. Thus, the objectives of infrastructure development for flood management in Medan Selayang District can be achieved optimally and sustainably. Communication is an important aspect in policy implementation, especially in the development of flood management infrastructure. Based on the results of interviews with the Public Works Agency of Medan Selayang District, it was found that communication between agencies has been going quite well, especially in coordinating project planning and implementation. However, there are several obstacles, such as:

1. Lack of socialization to the local community about the objectives and benefits of the project.
2. Technical information regarding the construction schedule and its impact on community activities is often delivered late, causing confusion in the community.
3. Communication channels with the project implementers are sometimes ineffective, so that problems that arise in the field are not immediately resolved.

However, efforts to improve communication have been made by involving village officials to convey information directly to residents. This is an important step in ensuring that the community supports the implementation of the project.

Resources

The development of infrastructure for flood management in Medan Selayang District, Medan City, is one of the strategic steps taken by the government to overcome the flood problem that often hits the area. Various initiatives, including the construction of retention ponds, widening of drainage,

and river flow management, have been carried out to reduce the impact of flooding on the community.

However, the implementation of this policy faces significant challenges, especially related to the availability and management of resources. Based on Edward III's theory, resources are one of the crucial elements in the successful implementation of public policies. This study analyzes resource factors that influence the implementation of flood management infrastructure development in Medan Selayang District, with a focus on human, financial, material, and technological resources.

In the context of human resources, the results of the study indicate a shortage of competent workers to manage complex infrastructure projects. The Head of the Medan City Public Works Agency, in an interview, stated that the limited number of experts was one of the main obstacles. He added that this project requires workers with high technical skills, especially in operating heavy equipment and implementing technical designs, but many local workers do not have these skills.

Human resources are the main factor in the success or failure of a policy implementation. Human resources must have adequate skills and qualities. In addition, human resources must also have competencies in accordance with the field of the policy to be implemented. Implementation of flood management infrastructure development requires adequate resources, both in terms of budget, manpower, and equipment. From the results of the study, it can be concluded that:

1. Budget: This retention pond project is supported by funds from the Medan City Budget of Rp. 14,156,940,852,000, but often experiences delays in disbursement, which hinders development progress.
2. Manpower: Local workers are available, experts in construction as well as, cleaning and building maintenance workers. but the distribution of workers is uneven, so that several stages of construction are delayed.
3. Technology and Materials: Modern drainage technology such as soil permeability has been applied in several locations. However, the availability of construction materials, such as channel concrete, sometimes experiences delays in delivery.

The resource factor is one of the aspects that most influences the effectiveness of implementation. Further coordination is needed so that budget allocation and material distribution can be on time.

Disposition

Disposition is the attitude and commitment of the policy implementer. The existence of policy implementers plays an important role and is a determinant of the success of a policy in its implementation. Policy implementers cannot only know what is being done but must also have adequate competence in implementing it. Policy implementers must also support and have a positive attitude towards policy implementation so that the objectives to be achieved from the policy can be achieved. The attitude of the policy implementer, whether it is

an attitude of acceptance or rejection, has a major influence on the success or failure of policy implementation.

Many cases occur where decision makers do not understand or cannot even know the needs, desires or problems that must be resolved. Each policy implementer certainly has a different attitude in responding to a policy. The various attitudes of implementers will create obstacles that have an impact on the smooth implementation of the policy if the policy implementer does not implement the policy in accordance with the plan and objectives to be achieved.

Bureaucratic Structure

Policy implementation is a job or activity that is influenced by many factors, especially cooperation between the parties involved. When the bureaucratic structure does not have good relationships and cooperation, it will cause ineffectiveness and hinder the implementation of the policy. The bureaucratic structure can be assessed from the Standard Operating Procedure and Fragmentation/Distribution of Responsibility. Standard Operating Procedure is a guideline or reference in carrying out a task and work to facilitate, organize, and organize the work. SOP contains procedures that must be carried out chronologically to help complete the work and obtain effective work results. In implementing a policy, guidelines or procedures are needed to help implement the policy. SOP will make policy implementers understand what they have to do and is useful as a guide for policy implementers in working.

A complex bureaucratic structure is often an obstacle to policy implementation. Based on the results of the study, several findings were found:

1. The licensing process between related agencies often takes a long time, especially in land acquisition and processing technical documents.
2. Cross-sector coordination, such as between the Public Works Agency and the Environmental Agency, is not yet fully optimal. This causes the project feasibility verification process to be slow in some locations.

Complicated administrative procedures make adjustments to field conditions slower. For example, when there is a change in channel design due to geographical factors.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research and analysis on the implementation of infrastructure development programs in flood management in Medan Selayang District, it can be concluded that this project has shown significant progress, although it still faces several challenges that require more attention. The development of flood management infrastructure including drainage channels, automatic pumps, and increasing the capacity of old infrastructure has great potential to reduce the risk of flooding in the area. Collaboration across agencies, such as the Public Works Agency (PU), the Housing and Settlement Agency (Perkim), has been the main supporting factor in the implementation of this project, considering the complexity of the challenges faced. However, although this project has shown a positive impact, several inhibiting factors, such as land

acquisition, lack of public awareness in maintaining the cleanliness of drainage channels, budget constraints, and unfavorable geographical conditions, are still obstacles that must be overcome. The application of technology and innovation in the drainage system and increasing coordination between agencies and the community are crucial so that this project can run effectively and sustainably. Therefore, public awareness and adequate funding need to be continuously improved to ensure the long-term success of this flood management infrastructure.

ADVANCED RESEARCH

The implementation of flood management infrastructure in Medan Selayang District has demonstrated measurable advancements, yet it underscores the necessity for addressing persistent barriers through a multi-dimensional approach. Advanced research could focus on integrating smart technology into flood management systems, such as IoT-enabled sensors for real-time monitoring of drainage performance and flood risks. Additionally, predictive modeling using AI and machine learning could optimize resource allocation and enhance early warning systems. Socio-economic studies should also be prioritized to understand the behavioral patterns of the community regarding waste management and the adoption of sustainable practices. A comprehensive policy framework emphasizing inter-agency collaboration, public-private partnerships, and participatory governance can strengthen the institutional framework. Lastly, addressing funding constraints through innovative financing mechanisms, such as green bonds or international development grants, could ensure the scalability and sustainability of these initiatives, fostering a resilient urban environment in Medan Selayang.

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