

FLOOD ISSUES AND THE IMPLEMENTATION OF INFRASTRUCTURE DEVELOPMENT PROGRAMS FOR FLOOD MITIGATION IN MEDAN CITY

PROBLEMAS RELACIONADOS ÀS INUNDAÇÕES E A IMPLEMENTAÇÃO DE PROGRAMAS DE DESENVOLVIMENTO DE INFRAESTRUTURA PARA A MITIGAÇÃO DE INUNDAÇÕES NA CIDADE DE MEDAN

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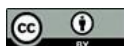
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Abstract

The development of Medan City has grown very rapidly. However, the rapid urban growth has not been balanced by adequate infrastructure development to support flood management. When heavy rain hits Medan City, the overflow of rainwater from residential areas and roads cannot be drained smoothly, resulting in stagnant water. Inadequate infrastructure is one of the main causes of flooding in Medan City. This study employs a descriptive qualitative approach to investigate the implementation of infrastructure development programs for flood mitigation in Medan City, North Sumatra, Indonesia. Data were collected through in-depth interviews, field observations, and document analysis. Results indicate that the implementation of infrastructure development in flood management in Medan City is relatively effective. This is evidenced by the construction of urban drainage channels at 8 drainage locations, totaling 4,905 meters; the improvement of Urban Drainage Channels at 26 locations, covering 17,173 meters; and the provision of Urban Drainage System facilities including retention ponds, floating pump machines, and embankments. While an 84

Resumo

O desenvolvimento da Cidade de Medan cresceu muito rapidamente. No entanto, o rápido crescimento urbano não foi acompanhado por um desenvolvimento de infraestrutura adequado para apoiar a gestão de inundações. Quando chuvas fortes atingem a Cidade de Medan, o escoamento de águas pluviais de áreas residenciais e estradas não pode ser drenado suavemente, resultando em acúmulo de água. A infraestrutura inadequada é uma das principais causas de inundações em Medan. Este estudo emprega uma abordagem qualitativa descritiva para investigar a implementação de programas de desenvolvimento de infraestrutura para mitigação de inundações na Cidade de Medan, Sumatra do Norte, Indonésia. Os dados foram coletados por meio de entrevistas em profundidade, observações de campo e análise de documentos. Os resultados indicam que a implementação do desenvolvimento de infraestrutura na gestão de inundações é relativamente eficaz, evidenciada pela construção de canais de drenagem urbana em 8 locais, totalizando 4.905 metros. Embora uma taxa de realização de 84 por cento reflita progresso significativo, desafios persistentes de



percent achievement rate reflects meaningful progress, persistent challenges in institutional coordination and community engagement indicate the need for continued improvement toward sustainable urban flood management.

Keywords: Infrastructure Development. Flooding. Drainage. Urban Resilience.

coordenação institucional indicam a necessidade de melhoria contínua.

Palavras-chave: *Desenvolvimento de Infraestrutura. Inundação. Drenagem. Resiliência Urbana.*

1 INTRODUCTION

At present, with the increasing pace of globalization, countries have put forward comprehensive development strategies as their top priority to maintain economic and geopolitical competitiveness. Development is fundamentally a reflection of planned governmental activities aimed at improving social institutions and conditions using resources in a responsible manner. It is within this perspective that infrastructure development, as a well-accepted mainstay of national development, also becomes one of the paramount indicators of leadership and governance, whether at the federal or state levels (Oyedele, 2012). It creates critical assets to address economic, societal, and cultural accessibility, promotes inter-region connectivity, and improves the performance of government tasks as well as service delivery to citizens.

The strategic value of strong infrastructure has always been recognized in major world economic policies. China's high-profile Belt and Road Initiative (BRI), for instance, has infrastructure, industrial development, and financial reform as a core priority (Darmawan & Dwianto, 2022). Likewise, Japan's "Abenomics" economic policy directed government funds toward infrastructure investment to realize domestic growth and attract foreign investments (Priangani *et al.*, 2021).

In Indonesia, the priority accorded to infrastructure is well integrated within the national policy context. Following the promulgation of regional autonomy laws (Law No. 32/2004 and Law No. 33/2004), local governments gained greater authority to administer and facilitate development at a local scale. This commitment was further cemented by the "Nawacita" program during President Joko Widodo's administration, which positioned infrastructure as a national priority to create connectivity and competitiveness.

Medan City, the capital of North Sumatra Province, plays a significant role as an economic hub in the province. The city occupies mainly low-lying plains, with altitudes ranging from 2.5 to 37.5 meters above sea level, at the junction of two major rivers. The meteoric growth and physical expansion of Medan are essentially positive for economic development and public well-being, but an unchecked rate of urbanization carries the risk of generating environmental and social problems.

Perhaps the most pervasive and devastating challenge currently facing the city is chronic urban flooding. Flooding can be described as an abnormal outburst of water that overflows its drainage system to inundate a community and its environment (Suripin, 2003). With the expansion of impervious surfaces in the city, more stormwater is discharged, rapidly inundating what has been found to be an insufficient drainage network, which leads to frequent and disruptive flooding.

Empirical evidence demonstrates that the flood problem in Medan has become serious. Local authority statistics show that the city's most common natural disaster is flooding. Data from 2019 to 2023 reveal an upward trend in flood occurrences, from 29 incidents in 2019 to as many as 60 in 2022, slightly declining to 57 in 2023. The persistence and frequency of these floods have not only disrupted local economic and social activities but have also degraded the city's urban environment.

An underlying factor in this repeated problem is the significant discrepancy between the city's explosive development and its flood-handling capability. Supporting drainage systems have never been upgraded or expanded to match the rapid pace of development. On residential roads and arterial roads, stormwater runoff cannot be drained rapidly during heavy rainfall, resulting in quick inundation. Insufficient existing infrastructure is thus identified as the main factor causing Medan City's high susceptibility to flooding.

Public and local legislative bodies have strongly stated that despite allocating over IDR 1 trillion for the infrastructure fund, flooding continues to occur, suggesting that the execution stage requires significant improvement. This calls for an examination of policy implementation, which, as Udoji (cited in Agustino, 2006) emphasizes, is the most crucial stage in the public policy process, defining the extent to which desired goals and societal effects are achieved.

The sustained flooding implies that the Mayor's vision and the city's Mid-Term Regional Development Plan (RPJMD) for 2021-2026, with its focus on infrastructure and flood management, require more consistent implementation to effectively translate resources into deliverable outputs.

The paradox arising from the disconnect between political willingness, policy, and expenditure versus continuing poor outcomes on the ground is a central premise for this study. Accordingly, this study examines the implementation of infrastructure development programs in flood management in Medan City. More specifically, the objectives are threefold:

- a) to identify and analyze the root problems and public grievances associated with flooding in Medan City;
- b) to describe and analyze the policy of Medan City government in addressing public input through existing flood management programs and infrastructure; and
- c) to formulate and analyze the implementation of infrastructure development policies aimed at mitigating floods in Medan City.

2 THEORETICAL FRAMEWORK

2.1 The policy implementation model of Merilee S. Grindle

One of the most influential concepts for understanding how public policies are carried out is Merilee S. Grindle's (1980) model, *Implementation as a Political and Administrative Process*. Grindle regards implementation not simply as a technical exercise, but as an organic process influenced by political forces and administrative tools. She indicated that implementation begins when goals and objectives have been properly defined and programs designed from which desired results can be produced in an efficient manner (O'Mullane *et al.*, 2024).

Grindle's approach is characterized by two core analytical dimensions: the content of policy and the context of implementation. Policy content involves the internal nature of policy with respect to target groups, objectives, degree of change desired, decisional locus, behavioral and executional capacity, and availability of resources. All of these

dimensions shape the potential translation from formal intentions to practical effects (Fitri *et al.*, 2023).

Concerning the content of policy, implementation has a strong influence on outcomes through how interests align or clash within target groups. Real and perceived benefits weigh on public acceptance and involvement. The levels of change that a policy envisions, whether incremental or transformative, add up to the level of institutional and behavioral changes demanded from relevant actors. Successful implementation is also a function of the capability of implementers and the availability of resources, including funds, infrastructure, and human resources (Suprihatiningrum *et al.*, 2023).

The second dimension is the context of implementation, reflecting action within broader political and institutional settings. Power relations, actor strategies, and institutional features all shape how policies are interpreted and performed, as Grindle contends. Bureaucratic structure and administrative coordination may either promote or inhibit policy success. Lack of institutional capacity or decentralization of powers is responsible for most inefficiencies and delays in implementation (Prabawati *et al.*, 2023).

A final significant context-specific factor is the engagement and buy-in of policy implementers. Even well-designed policies fail when those who implement them are not committed, capable, or motivated to deliver. The Grindle model therefore emphasizes political will, administrative capacity, and implementer behavior as critical factors shaping policy effectiveness. Implementation is thus not a linear process but a dynamic negotiation between actors with different interests and powers (Oktaviranti, 2025).

In summary, Grindle's (1980) model depicts policy implementation as a multi-faceted combination of policy content and context. It demonstrates that effective implementation requires not only defined objectives and sufficient resources, but also strong institutional capacity and strategic action by actors within the political-administrative system. This model remains a useful tool for understanding how public policies are translated from design into real-world effects (Prasetyawan *et al.*, 2023).

2.2 Urban flood management and infrastructure development

According to Grigg (1988), infrastructure includes real physical systems that supply transportation, irrigation, water disposal, public buildings, and other basic services

that serve societal and economic functions. Similarly, Gregory Mankiw (2003) defines infrastructure as public capital investments such as roads, bridges, and drainage systems that enhance community productivity. Flood mitigation infrastructure in Medan City therefore plays a strategic role as public property to support social and economic life and improve the health of citizens.

Urban drainage systems are a core component of flood mitigation infrastructure. The Ministerial Regulation No. 12/2014 on Urban Drainage Systems mandates local governments to ensure the proper functioning of urban drainage to minimize flood risk. Adequate drainage systems must be designed to accommodate current rainfall intensity and the volume of surface runoff from urban expansion. Failure to maintain and upgrade these systems leads to the chronic flooding conditions observed in Medan City.

3 METHODOLOGY

Using the descriptive qualitative approach, this study investigates the infrastructure development programs to mitigate flooding in Medan City, North Sumatra, Indonesia. The qualitative design was selected because it allows for in-depth construction of social realities as they occur contextually. As Moleong (2006) suggests, qualitative research responds inductively to complex phenomena and facilitates understanding of the logic behind human behavior within particular social contexts. The descriptive-analytical approach is intended to identify implementation obstacles and arrive at interpretive insights from empirical evidence gathered in the field.

The analysis draws on Merilee S. Grindle's (1980) framework of policy implementation, which perceives implementation as an interactive process determined by two intertwined dimensions: the content dimension and the context dimension. The content refers to the benefits a policy aims to produce, the extent of change expected, and resource inputs, while the context encompasses the distribution of power among actors, their interest-based strategies, and institutional characteristics. This theoretical model enables analysis of how the Medan City government, particularly its Public Works Department, navigates the bureaucratic, technical, and political realities of flood management.

This study was conducted in Medan City, which is one of the largest cities in North Sumatra and is frequently inundated during heavy rainfall because drainage capacity is insufficient to manage overflow from rivers and rapid urbanization. The chosen site sits at the intersection of water infrastructure policy and environmental management, where the local government's flood risk mitigation plans can be observed and assessed.

Purposive sampling was applied for the selection of informants, enabling researchers to choose individuals based on their knowledge and experience in flood mitigation policies (Ibrahim, 2018). Key informants included government officials and area heads from the Medan City Public Works Department (Dinas SDABMBK) who hold responsibility for the coordination of planning, execution, and maintenance of drainage and water management systems, including the department head, the secretary, and a number of divisional heads directing units dealing with urban water, drainage planning, maintenance, and construction.

Information was obtained from both primary and secondary sources (Hamidi, 2004). Primary data were collected through direct observation in flood-prone areas and semi-structured interviews, which allowed for variation in comprehension at crucial moments. Secondary data were obtained from official documents, development plans, statistical publications, and papers related to flood management and urban infrastructure in Medan City. Triangulation between sources and methods was used to improve the validity and reliability of the collected data.

Data analysis adopted the interactive model by Miles and Huberman (1994) involving data reduction, data display, and drawing conclusions. Analysis occurred simultaneously with data collection such that patterns and themes emerged incrementally. Following verification, extracted data were coded into thematic categories according to their relevance to the two dimensions of Grindle's model. Results were subsequently compared and discussed in accordance with the theoretical framework and previous empirical work.

To establish the validity and reliability of data, this study employed several triangulation methods (Bungin, 2007; Moleong, 2017). Source triangulation was used to compare and cross-verify information between different informants and documentation. Method triangulation checked the agreement of findings across interview data,

observation, and document evidence. Theoretical triangulation enhanced interpretation by positioning findings within a range of theoretical frameworks beyond the principal implementation model. By these strategies, the study gained credibility, transferability, and dependability.

4 RESULTS AND DISCUSSIONS

4.1 Public complaints and core flooding problems in Medan City

Medan City, as the capital of North Sumatra Province, holds a significant position as one of Indonesia's major metropolitan areas. With a total area of approximately 26,510 hectares and a population of over 2.4 million people in 2023, the city's density reached more than 9,000 inhabitants per square kilometer. Its strategic location bordering the Malacca Strait has made Medan an essential hub for trade, industry, and economic activity in western Indonesia. However, behind this rapid urban development lies a chronic environmental challenge: recurring floods that have become an almost annual disaster for its residents.

Statistical records indicate that Medan consistently ranks as the city with the highest number of flood events in North Sumatra. Data collected between 2019 and 2023 reveal an upward trend in flood occurrences, from 29 incidents in 2019 to as many as 60 in 2022, slightly declining to 57 in 2023. The persistence and frequency of these floods have not only disrupted local economic and social activities but have also degraded the city's urban aesthetics, turning several neighborhoods into waterlogged and unhygienic environments.

Table 1

Flood Occurrence Data in Medan City, 2019–2023

Year	Flood Events	Areas Affected	People Affected	Trend
2019	29	Multiple sub-districts	High	Baseline

2020	32	Multiple sub-districts	High	Increasing
2021	–	–	–	–
2022	60	10+ sub-districts	75,396+	Peak
2023	57	Multiple sub-districts	High	Slight decline

Source: Dinas SDABMBK Medan City (2024)

Residents' grievances point to several recurring issues: insufficient drainage capacity, deteriorating infrastructure, and poor waste management causing blockages in drainage channels. Many of the city's drainage systems, initially designed decades ago, can no longer accommodate current rainfall intensity or the volume of surface runoff from urban expansion. Sediment buildup, siltation, and garbage accumulation in drainage channels are commonly reported problems. In several sub-districts such as Medan Area, Medan Johor, and Medan Marelan, entire residential blocks experience inundation during moderate rainfall due to either damaged or nonexistent drainage infrastructure.

Public complaints regarding drainage issues are primarily directed at the Department of Water Resources, Highways, and Construction (Dinas SDABMBK) of Medan City. Interviews with key informants reveal that citizen complaints are a regular and recurring phenomenon. According to the Head of the Drainage Development Team, complaints typically reach the department through online platforms such as websites and social media. This official stated that while public grievances are frequent, the department consistently receives and processes them by conducting field surveys and identifying root causes before taking corrective measures.

Another official, the Head of the Planning Team for Water Resources and Drainage, emphasized that the majority of complaints arrive through formal channels such as letters from sub-districts (kecamatan), community proposals in musrenbang (development planning meetings), and council members' pokok pikiran (policy inputs). Citizens can also report drainage issues through the LAPOR! platform or Medan Rumah Kita, both of which serve as official complaint systems integrated into Indonesia's National Public Service Complaint Management System (SP4N). However, procedural constraints limit citizens' ability to report issues directly to the department; instead,

reports must first pass through neighborhood heads (kepling), urban village (kelurahan), and sub-district (kecamatan) offices.

This layered reporting structure creates delays and often weakens the immediacy of government response. The formal complaint flow from resident to neighborhood head, then to the village, and onward to the sub-district office before reaching Dinas SDABMBK illustrates a bureaucratic bottleneck that hinders effective problem-solving. As a result, many citizens prefer to voice their concerns through social media, where responses are perceived to be faster and more visible.

The LAPOR! website serves as one of the most accessible official channels for residents to submit complaints. Established as part of Indonesia's national SP4N system through Presidential Regulation No. 76 of 2013, LAPOR! provides a "no wrong door policy," ensuring that complaints are directed to the appropriate authority. Despite its potential, utilization remains limited in Medan; however, the number of complaints submitted shows a general increase, from 25 in 2021 to 37 in 2022, with a slight decline to 32 in 2023.

The overall findings reveal that the core flooding problems in Medan City stem not solely from natural factors such as heavy rainfall or low-lying geography, but from the mismanagement of urban drainage systems and weak institutional coordination. The combination of aging infrastructure, inconsistent maintenance, and limited public awareness about official complaint channels perpetuates the city's vulnerability to floods. In short, flooding in Medan represents both an environmental and a governance issue that requires integrated action between technical planning, policy enforcement, and citizen engagement.

4.2 Government response and policy actions in flood infrastructure development

The government's response to recurring flood problems in Medan City has evolved through a combination of structural and non-structural measures, reflecting its effort to balance infrastructure development with community engagement. The Medan City Government, through Dinas SDABMBK, serves as the main institution responsible for planning, implementing, and evaluating drainage infrastructure and flood control projects. This response framework aligns with the city's Medium-Term Regional

Development Plan (RPJMD) and the Annual Work Plan (RKPD), which prioritize infrastructure development as a core strategy for urban resilience.

The institutional mechanism positions flood management as a priority area. The Dinas SDABMBK functions both as a technical executor and as a policy implementer. According to one informant, the Head of Drainage Division, "Every year, the SDABMBK maps the flood-prone locations that often trigger public complaints and uses them as the basis for planning the next physical activities" (Interview, 2024). This illustrates how the department integrates community-sourced data into its infrastructure planning process.

The government's response is not merely reactive but also preventive. In 2024, SDABMBK identified around 1,078 flood-prone points across Medan City, which became the primary reference for construction and rehabilitation of drainage systems. The Head of Planning Division stated, "We aim to reduce these flood points through construction and normalization of drains every year, prioritizing locations with the most severe flooding" (Interview, 2024).

Planning in flood infrastructure development relies on multiple inputs, primarily community complaints, proposals from the Musyawarah Perencanaan Pembangunan (Musrenbang), and legislative suggestions from the Pokok Pikiran DPRD. This tri-source system ensures that the government captures diverse public needs. A staff member explained, "Community complaints are essential because often residents know the condition of the drains in their area better than field officers" (Interview, 2024).

Beyond physical projects, the government emphasizes effective complaint management as part of service delivery. According to Sofianti (2020), complaint systems act as corrective instruments in public service, and SDABMBK operationalizes this by treating complaints as data for continuous improvement. Complaint management follows a structured workflow: receiving the complaint, verifying its validity, conducting a site survey, and developing a response plan based on urgency. Bappenas (2010) emphasizes that such systems require clear planning and operational procedures.

Despite procedural improvements, implementation faces challenges. Informants noted, "Many drains are still blocked with sediment and garbage, so physical improvements alone cannot fully solve the flooding problem" (Interview, 2024). This indicates that technical improvements must be complemented by behavioral change and community participation, requiring continuous socialization by the government.

Community participation is a crucial element of flood management. SDABMBK operationalizes participatory governance through neighborhood-level socialization involving local leaders, kelurahan, and kecamatan officials. A field officer explained, "We often go to the field to educate residents not to dispose of garbage into drains and to participate in cleaning activities together with local leaders" (Interview, 2024). However, outreach coverage remains uneven; several residents reported that many areas are still unaware of joint drain cleaning programs.

From a governance perspective, SDABMBK's response aligns with good governance principles by integrating transparency, participation, and responsiveness. SDABMBK has demonstrated the ability to transform community input into concrete action. For instance, after receiving complaints regarding clogged drains in Medan Johor, the department coordinated a cleaning program with residents, local leaders, and contractors. A senior staff member stated, "Complaints are not problems; they are opportunities to improve services" (Interview, 2024), reflecting a cultural transformation toward citizen-centered governance.

4.3 Implementation of the flood mitigation infrastructure development program

The development of drainage infrastructure in Medan City is an important part of urban governance to lower flood risk and improve community security. Implementation, in the present study, refers to efforts taken to realize goals established in a policy or decision. Wahyu (cited in Mulyadi, 2015) notes that policy implementation studies examine whether policies align with what has been prepared and predefined, while also identifying existing obstacles and challenges. Grindle (cited in Mulyadi, 2015) characterizes implementation as administrative action measurable at the program level, signaling its importance to deliverables.

The Review Design Masterplan Drainage of Medan City estimates 940 segments of road interventions involving restructuring and culverts to be constructed, covering 2,575 flood-potential points. Focusing on 2023, the program prioritized improving drainage in 790 segments of road; 714 segments had already been treated by end-2022. Performance measurements show that 84 percent of the good drainage targets were

achieved by 2023, reflecting meaningful progress while also indicating persistent challenges.

Table 2

Summary of Infrastructure Development Activities for Flood Mitigation in Medan City (2024)

Activity Category	Scope / Volume	Description
Urban Drainage Channel Construction	8 locations / 4,905 m	New drainage links constructed to enhance flood mitigation connectivity
Urban Drainage Channel Improvement	26 locations / 17,173 m	Rehabilitation of existing channels in flood-prone areas
Retention Pond & Floating Pump (USU Complex)	1 unit	Construction of polder/retention pond and floating pump procurement
Flood Embankment – Parit Emas	220 m	Retention channel construction for discharge function in heavy rain
Sheet Pile – Martubung Retention Pond	1,464 m	Flood embankment to improve retention capacity
Drainage Maintenance (Labour Intensive)	32,148 m	Regular cleaning operation to maintain drainage performance
New Neighborhood Drainage Construction	7 sites / 10,904 m	Local drainage channels constructed in residential areas
Neighborhood Drainage Improvement	34 sites / 19,821 m	Upgrading of existing neighborhood drainage systems

Source: Dinas SDABMBK Medan City (2024)

Key activities in the Urban Drainage Management Programme include: consultancy services pertaining to urban drainage planning implemented at 21 district levels, producing 23 different types of documents including retention pond plans and comprehensive urban drainage masterplans; drainage construction supervision and monitoring across 8 supervisory batches to ensure implementation accordance with design requirements; and systematic regular operation and maintenance covering 32,148 meters of cleaning operations.

Stakeholder cooperation is important for the implementation of flood reduction projects. The Head of Balai Wilayah Sungai (BWS) Sumatera II, Dr. Mohammad Firman,

emphasized that the higher intensity of rainfall and land use changes at river valleys require mutual cooperation from related institutions at both central and local government levels. BWS Sumatera II has prioritized water normalization and revitalization at major rivers including the Deli River, Babura River, and Selayang River through dredging and river embankment reinforcement. The Sikambing-Belawan Floodway was built as strategic infrastructure to add water retention capacity and decrease discharge into urban waterways during heavy rain.

High results in meeting targets are attributable to factors such as early adoption of e-procurement, availability of detailed planning documents, and continuous assistance by supervising consultants. These checks helped ensure that construction work followed anticipated schedules and achieved desired results.

Barriers faced in implementing these programs include the lack of free space to build structures in dense urban settings, problems of sedimentation and clogging of rivers by trash, financial constraints, and changing climate patterns. Only 3.32 percent of construction workers in North Sumatra currently possess competency certificates, indicating a significant shortage of skilled labor. Dealing with these challenges requires long-term planning, adaptive design, and continuous observation of post-flood infrastructure functionality.

The integration of robust planning, multi-stakeholder collaboration, skilled human resources, and systematic monitoring forms the backbone of Medan City's flood mitigation strategy. Achieving optimal outcomes requires not only technical interventions but also the commitment of institutions and society to maintain infrastructure functionality and address emerging challenges.

5 CONCLUSION

The implementation of infrastructure development programs for flood mitigation in Medan City, conducted by the Department of Water Resources, Public Works, and Construction (Dinas SDABMBK), demonstrates meaningful progress toward improving the quality of life and well-being of the city's residents. City-wide drainage channels, dikes, and retention ponds have been systematically planned to control water flows more effectively, avoiding waterlogging and the associated economic disruption and damage

to community activities. This program is also part of Medan City's Regional Mid-Term Development Plan (RPJMD), which places public interest at the top of its priorities and encourages community participation at both planning and implementation levels.

While full completion has not yet been realized, with an achievement rate of 84 percent, the infrastructure development has effectively mitigated flooding, built urban resilience, and produced long-term positive impacts for Medan residents across economic, social, and health dimensions. The construction of urban drainage channels at 8 locations covering 4,905 meters, the improvement of drainage channels at 26 locations covering 17,173 meters, and the provision of supporting facilities including retention ponds, floating pump machines, and embankments represent substantial concrete achievements. Maintenance activities covering 32,148 meters of drainage cleaning and the construction and rehabilitation of neighborhood drainage systems at multiple sites further demonstrate the program's breadth.

The human resource performance of Dinas SDABMBK in Medan City is considered capable, with staff actively engaging in training opportunities to maintain professional standards. However, the broader challenge of an insufficient certified construction workforce in North Sumatra, at only 3.32 percent, underscores the need for sustained human resource development. The synergy of personnel competencies, good planning, and strong multi-stakeholder involvement will sustain the effectiveness of Medan City's flood infrastructure mitigation program.

Future research recommendations include improving collaborative governance mechanisms between central government, local authorities, and communities; assessing the long-term effectiveness of flood mitigation infrastructures; examining the potential of community involvement in the operation and maintenance of drainage systems; evaluating the impact of trained construction workers on project quality and safety; and incorporating technological means such as hydrological monitoring systems and GIS mapping to enhance flood risk assessment and early warning capabilities.

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REFERENCES

- Agustino, L. (2006). *Politik dan kebijakan publik*. AIPI Bandung – Puslit KP2W Lemlit UNPAD.
- Agustino, L. (2008). *Dasar-dasar kebijakan publik*. Alfabeta.
- Bungin, B. (2007). *Penelitian kualitatif*. Kencana.
- Darmawan, A. B., & Dwianto, R. A. (2022). Konstruksi ide Xi Jinping dalam Belt and Road Initiative. *Sospol: Jurnal Sosial Politik*, 45–61.
- Fitri, A., Haning, M. T., & Lambali, S. (2023). Implementation of the Sustainable Food Garden Program (P2L) as an effort to accelerate the reduction of stunting in Bone Regency. *Jurnal Ilmiah Ilmu Administrasi Publik*, 13(2), Article 719. <https://doi.org/10.26858/JIAP.V13I2.50270>
- Grigg, N. S. (1988). *Infrastructure engineering and management*. Wiley.
- Grindle, M. S. (1980). *Politics and policy implementation in the third world*. Princeton University Press.
- Hamidi. (2004). *Metode penelitian kualitatif: Aplikasi praktis, pembuatan proposal dan laporan penelitian*. UMM Press.
- Ibrahim. (2018). *Metodologi penelitian kualitatif: Panduan penelitian beserta contoh proposal kualitatif*. Alfabeta.
- Mankiw, N. G. (2003). *Principles of economics* (3rd ed.). Thomson South-Western.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). SAGE Publications.
- Moleong, L. J. (2006). *Metodologi penelitian kualitatif*. PT Remaja Rosdakarya.
- Mulyadi, D. (2015). *Studi kebijakan publik dan pelayanan publik*. Alfabeta.
- O'Mullane, M., Kenny, T., Nash, K., McHugh, S., Kavanagh, P., & Smith, K. E. (2024). Development of a health impact assessment implementation model: Enhancing intersectoral approaches in tackling health inequalities — A mixed methods study

protocol. *HRB Open Research*, 7, Article 14. <https://doi.org/10.12688/HRBOPENRES.13873.1>

Oktaviranti, S. A. (2025). Implementasi e-purchasing dalam pengadaan barang/jasa pemerintah di OPD Kecamatan Prigen. *MAP (Jurnal Manajemen dan Administrasi Publik)*, 8(1), 68–84. <https://doi.org/10.37504/MAP.V8I1.698>

Oyedele, O. A. (2012). The challenges of infrastructure development in democratic governance. In *Proceedings of FIG Working Week 2012: Construction economics and management* (pp. 1–15). International Federation of Surveyors.

Prabawati, I., Meirinawati, Riyanto, Y., Hariyati, N., Indrasetianingsih, A., & Ladiqi, S. (2023). Implementation of learning curriculum in integrated independent campus learning program case study on KKNT village project. *International Journal of Learning, Teaching and Educational Research*, 22(3), 470–490. <https://doi.org/10.26803/IJLTER.22.3.28>

Prasetyawan, C. T., Supriyono, B., & Sentanu, I. G. E. P. S. (2023). Implementation of one-stop integrated services in Tulungagung Regency. *Advances in Social Science, Education and Humanities Research*, 75–85. https://doi.org/10.2991/978-2-38476-082-4_8

Priangani, A., Kunkunrat, & Saputra, R. M. (2021). Yoshihide Suga policy dalam melanjutkan Abenomics di kawasan Asia Timur dan Tenggara. *Jurnal Dinamika Global*, 1–19.

Purwanto, E. A., & Sulistyastuti, D. R. (2015). *Implementasi kebijakan publik: Konsep dan aplikasinya di Indonesia*. Gava Media.

Suprihatiningrum, J., Astuti, M. R., & Saputri, L. R. (2023). The shifting of special education orthodoxy in implementing inclusive education policies in Indonesia. *Jurnal Kependidikan*, 9(4), Article 1174. <https://doi.org/10.33394/JK.V9I4.8647>

Suripin. (2003). *Sistem drainase perkotaan yang berkelanjutan*. Andi.