

## Optimizing City Spatial Plans: Development Strategy Urban Sustainability in Medan

Muhammad Aris<sup>1</sup>, Cut Nuraini<sup>2</sup>

<sup>1</sup>*Student, Master of Regional and City Planning, Panca Budi Development University, Medan, North Sumatra*

<sup>2</sup>*Lecturer, Master of Regional and City Planning and Department of Architecture, Panca Budi Development University, Medan, North Sumatra*

e-mail: muhammadaris@gmail.com

### Abstract

This research aims to investigate the optimization of urban spatial planning as a sustainable development strategy in the city of Medan. Medan, as one of the largest cities in Indonesia, faces various challenges in managing rapid urban growth. Using qualitative and quantitative approaches, this research analyzes current urban conditions, the sustainable development challenges faced, and strategies that can be adopted to achieve sustainable development goals. The research findings highlight the need for integration between spatial planning policies, environmental management, transportation and infrastructure in designing sustainable urban development plans. In addition, community participation and cross-sector collaboration are also needed to ensure broad acceptance of development plans. This research provides valuable insights for policy makers, stakeholders and academics in designing sustainable urban development strategies in Medan and other cities.

### Keywords:

Strategy; City Spatial Planning; Sustainability; Medan City

## INTRODUCTION

Urban spatial planning is a fundamental element in shaping city development, and optimization of urban planning strategies is crucial for sustainable urban development. In the context of Medan City, Indonesia, several key aspects need to be considered to improve urban planning and development.

First of all, waste management is a critical issue that requires attention in urban planning (Ferronato & Torretta, 2019). The development of integrated solid waste collection and processing systems can significantly improve sustainability globally. Apart from that, the availability of green open space is very important for environmental sustainability and community welfare in Medan City (Tambunan,

2023). Involving community participation and implementing the Green City concept can contribute to achieving these goals.

Furthermore, understanding the historical significance of areas such as Merdeka-Kesawan is essential for comprehensive planning and development (Fitri et al., 2020). Analyzing the spatial management of Medan City and its relationship with regional development planning is very important for effective urban development (Matondang, 2022). In addition, increasing community participation in spatial planning, especially in river basin areas, can overcome problems such as flooding and sedimentation in Medan City (Thamrin et al., 2022).

Amid challenges such as the impact of industry 4.0 on poor urban communities, sustainable development practices must be integrated into urban planning efforts (Nainggolan & Ginting, 2021). Restoring historic sites such as ex-Warenhuis through an adaptive reuse approach can contribute to the preservation of cultural heritage while encouraging economic development (Fitri et al., 2023).

Additionally, building urban resilience with nature-based solutions and evaluating urban quality through smart sustainable city indicators are key considerations for effective urban planning in Medan (Garau & Pavan, 2018; Bush & Doyon, 2019). Strengthening the role of cooperatives in developing small businesses can also encourage economic growth and community empowerment in cities (Siregar & Marliyah, 2022).

By combining insights from waste management, green space availability, historical significance, spatial analysis, community participation, and sustainability practices, urban planning strategies in Medan can be optimized to promote holistic urban development and improve the quality of life for its residents.

Medan, the capital of North Sumatra, Indonesia, is a fast-growing city with significant population growth. This growth has resulted in greater pressure on resources, infrastructure, and the environment. Effective spatial planning is essential to manage these challenges and ensure sustainable and beneficial urban development for its citizens.

#### Formulation of the problem

- 1) What are the underlying considerations for the Medan district/city government in determining urban development and development policies?
- 2) How are Medan district/city government policies implemented as a form of urban development concept?
- 3) What is the urgency of development policy and development of residential areas in the context of optimizing urban spatial planning: urban development strategy in Medan?

## LITERATURE REVIEW

### City Planning and Sustainability Concepts

Urban planning is critical to the sustainability and resilience of cities. Several studies highlight the importance of integrating environmental sustainability principles in smart city development. Trindade et al. (2017) found that the smart city concept must include resource efficiency and climate change mitigation to achieve urban sustainability. Pera (2020) emphasizes the role of public governance in

achieving urban sustainability and resilience goals. A good governance structure can direct city transformation in a more sustainable direction. Permana & Harsanto (2020) reviewed sustainable urban planning strategies in developing economies. They found that these cities face unique challenges but also have great opportunities to promote sustainability.

Putra et al. (2022) emphasize the need for an approach that combines urban planning and the environment to create green cities. They emphasize the importance of a holistic approach that prioritizes environmental conservation and sustainable practices. Overall, the literature shows that good urban planning must integrate environmental sustainability, effective governance, and compact city models to create resilient and livable cities. A holistic and integrated approach is critical to achieving this goal.

An ecological city or green city is a healthy city, where there is a balance between sustainable development and environmental preservation. This city can function as an ecosystem that regulates ecological systems such as temperature, erosion and flooding, as well as supporting social systems such as community harmony, housing, schools and hospitals, and economic systems such as job creation. This concept is very relevant for cities in Indonesia, including Medan.

According to Hadi S. Alikodra, an environmental and urban planning expert, cities are a microcosm of various environmental problems that continue to develop along with population growth. Even though humans interact with nature, their destructive behavior often damages the environment. Limited environmental absorption and assimilation capacity causes damage and pollution to the urban environment (ecological scarcity) due to human activities.

In Indonesia, city infrastructure development, including in Medan, still focuses on exploitation and increasing production that is purely economically oriented. This approach causes uncontrolled development of urban space and triggers environmental problems in both biotic and abiotic components. If urban development is not controlled, this will increase the burden on the carrying capacity of the urban environment and widen the gap between the city and the surrounding areas (hinterland).

For the city of Medan, implementing the green city concept must be a priority in spatial planning and infrastructure development. This includes the development of green open spaces, effective waste management, use of renewable energy, and environmentally friendly transportation. In this way, Medan can move towards a balance between economic growth and environmental sustainability, ultimately improving the quality of life for all its citizens.

## **RESEARCH METHOD**

This research adopts a descriptive analytical approach to comprehensively describe the problems related to the development of residential areas based on the City Spatial Plan in Medan City. The descriptive approach allows researchers to understand in depth the characteristics, dynamics and challenges faced in implementing urban development policies.

The approach method used in this research is policy analysis. This approach involves an in-depth study of policy objectives, the validity of relevant government regulations, the norm concepts contained therein, and the underlying values of justice. This policy analysis was carried out

contextually, linking regulations and policies for residential area development with concrete conditions existing in the city of Medan. Through a policy analysis approach, this research aims to provide an in-depth understanding of the implementation of the City Spatial Plan-based residential area development concept in Medan City, as well as evaluating the effectiveness and relevance of existing policies in achieving sustainable urban development goals.

## **FINDINGS AND DUSCUSSION**

### **1. Environmental Supervision and Management: Authority of State Administrative Agency/Department**

Article 22 of Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management states:

"The Minister supervises those responsible for business and/or activities regarding the provisions stipulated in environmental laws and regulations."

The formulation of Article 22 of Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management gives attribution authority to the Minister of the Environment to carry out supervision. However, sectorally (especially in relation to permits to carry out business and/or activities), the minister involved in this matter also has the authority to supervise and grant permits.

Regarding the delegation of supervisory authority to Regional Governments, Article 22 paragraph (3) of Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management states:

"In the event that supervisory authority is handed over to the Regional Government, the Regional Head shall determine the official who has the authority to carry out supervision."

Furthermore, in the Explanation section it is stated:

"In the framework of implementing environmental management, the Government can hand over some matters to the Regional Government to become its household affairs."

Thus, the authority possessed by the Regency/City Government, including the City of Medan, is the delegation of affairs based on the principle of decentralization. This means that the Medan City Regional Government has the authority to regulate, supervise and manage the environment in its area in accordance with the provisions set by the central government, but with adjustments and implementation that are appropriate to local conditions.

Environmental monitoring in Medan City must be carried out by officials appointed by the Regional Head. This official is responsible for ensuring that all business and development activities in the city comply with applicable laws and regulations in the environmental sector. Apart from that, the Medan

City Government can also develop local policies and strategies to address specific environmental problems in its area, such as waste management, air pollution and natural resource conservation.

With this decentralization, the City of Medan can be more flexible and responsive in dealing with environmental problems, as well as ensuring that city development takes place in a sustainable and environmentally friendly manner.

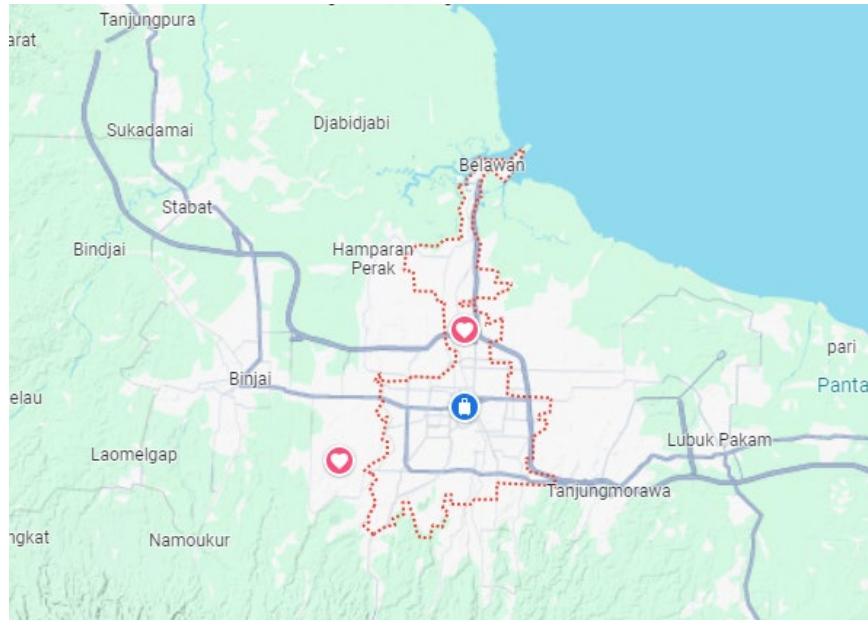


Image: Medan city area

source: <https://maps.app.goo.gl/xnGtLnEg9d4a1sDD9>

## **2. Basic Considerations for City Development Policy and Development of Sustainable Urban Settlement Areas**

Medan City, as the capital of North Sumatra Province, is located in the northern part of the island of Sumatra. Physically, the Medan City area consists of lowland areas, most of which function as centers of economic and residential activities. Functionally, the Medan City area is divided into areas that require special attention in terms of water absorption and flood control, as well as residential areas that require good environmental management to prevent land degradation and pollution.

Several areas of Medan City tend to be prone to flooding, especially in areas close to rivers and low-lying areas. Therefore, planning for the development and construction of housing must pay attention to geographical and land conditions so as not to worsen damage to the function and use of existing land. Starting from the geographical, topographical, environmental, social, economic, political and cultural conditions as well as the character of the local community as mentioned above, the Medan City government is required to be able to design urban planning policies and development of residential areas that are consistent in protecting and preserving the environment, balance between

human and natural resources, as well as synergy with other district/city areas as an optimal buffer (hinterland) for the realization of community welfare.

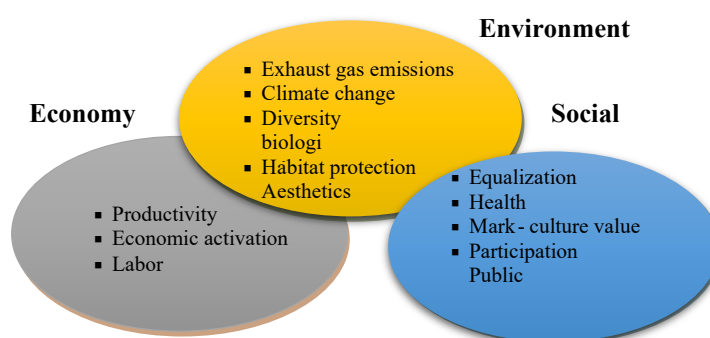
The results of a comparative study of development policies and development of sustainable-based urban residential areas in Medan City, which are based on differences and similarities in spatial, topographical, geographical conditions, as well as strategic developments in the social, economic and environmental fields, show that against the background of regional spatial conditions, economic, social and cultural, each government administrator in Medan is required to be able to establish sustainable environmentally based residential development policies.

The Medan City Government must integrate the principles of sustainable development in every urban planning policy and development of residential areas. This includes efforts to reduce the risk of natural disasters, such as floods and landslides, by considering appropriate land use and the application of environmentally friendly technology. Apart from that, policies must also include effective waste management, development of green open spaces, and community empowerment to increase awareness of the importance of preserving the environment.

Thus, development policies and development of residential areas in Medan City must be able to answer existing environmental challenges, as well as accommodate the social and economic needs of the community, towards a more sustainable and prosperous city.

### **3. Development Policy and Development of Urban Areas as Implementation of the Concept of Sustainable City Spatial Planning**

Like other cities in Indonesia, Medan has unique geographic and topographic characteristics. The city of Medan consists of dominant lowlands, with various landscape characters covering the urban area



and surrounding areas which influence interaction patterns between humans and nature. This diversity gives birth to various forms of social, cultural, economics, and politics with other buffer areas (hinterland).

Figure 1. Synergy of Social, Economic and Environmental Variables as a Basis for Sustainable City Planning Development Policy

Based on the geographical and topographical conditions of the region, there are several aspects that must be taken into consideration by local governments in carrying out regional development and expansion, namely:



- 1) **Safety Aspects of Disasters:**  
Regional development and development must pay attention to security from disasters. This mandate is in accordance with Articles 6 and 28 of Law no. 26 of 2007 concerning Spatial Planning and Article 35 and Article 51 of PP No. 15 of 2010 concerning Implementation of Spatial Planning. In the context of Medan City, this includes mitigating flood risks and dealing with the impacts of climate change.
- 2) **Aspects of Comfort in Urban Space:**  
Comfort is a demand that arises from various groups in society, including housing, recreation and cultural components. The Medan City Government can accommodate this need through structuring urban areas, providing green open space (RTH), as well as allocations for service activities and services in strategic areas.
- 3) **City Productivity Aspects:**  
City productivity can be achieved by creating employment opportunities for the community. Sustainable development of industrial and trade areas, as well as supporting MSMEs, are important steps in increasing economic productivity.
- 4) **Environmental Quality Aspects:**  
The quality of the environment must be maintained to ensure the sustainability of the city. This requires community awareness and responsibility in environmental management, which can be realized through the provision of supporting infrastructure and facilities, as well as enforcing sanctions for spatial planning violations that damage the environment.

In planning the development of urban and residential areas, there are several approaches that must be taken by the government, namely structural and non-structural approaches:

- 1) **Structural Approach:**  
Includes infrastructure development such as flood protection infrastructure and facilities, water treatment, reservoirs/dams, and so on.
- 2) **Non-Structural Approach:**  
This includes spatial planning through zoning arrangements, allocating activities based on disaster risk levels, urban forestation with mangroves in coastal areas, forestation of water catchment areas, as well as the formation of environmentally friendly and adaptive community behavior to climate change.

This requirement requires urban spatial planning that follows the dynamics of population, economic and social growth. Each city development policy and development of urban residential areas in Medan will face different issues, problems and needs according to its spatial specifications. Therefore, variables are needed that are able to create a safe, comfortable, productive and sustainable space.

For development planning and development of residential areas on a sustainable basis, an approach is needed that is sensitive to the diverse characteristics of Medan City. This approach must pay attention to the balance between development needs and environmental preservation, as well as supporting synergy with buffer areas to create optimal community welfare.

#### **4. Urgency of Sustainable Urban Area Development:**

Balance between Physical City Development, Quality of Life, and Sustainable Environmental Preservation. In development planning policies using environmental sustainability-based urban planning concepts, it is important to solve problems in a comprehensive manner that includes environmental, economic, and social aspects. These aspects are an integration of various human activities, so they require coordination between sectors and regions.

The concept of sustainability has developed into various issues of regional development and urban spatial planning in a comprehensive manner. The priority of city development policy makers and planning the development of urban residential areas is to consider all aspects with risks and impacts that have already been considered before a policy is realized.

The urgency of urban development and development of sustainable residential areas is based on the concept of sustainable development which was first coined by the World Commission on Environment and Development (WCED). Sustainable development is an approach to meeting the needs of present generations without reducing the ability of future generations to meet their own needs.

At the WCED session in Tokyo in 1987, the formulation and basic principles of sustainable development known as the Tokyo Declaration were produced. There are three main principles of sustainable development which are instruments for realizing city planning and urban residential areas that can guarantee the welfare of the entire community.

## **5. Strategy for Optimizing Spatial Planning**

### **1). Risk Management Integration:**

Integrating risk management strategies into spatial planning is especially important for Medan, which is vulnerable to natural disasters such as floods and earthquakes. This integration ensures that urban development is designed with resilience and adaptability to reduce the impact of disasters. Integrating risk management into spatial planning is an important aspect for cities like Medan, which face significant vulnerability to natural disasters such as floods and earthquakes. By incorporating risk management strategies into spatial planning, urban development can be designed with resilience and adaptability in mind, aiming to reduce the impact of disasters. This integration requires a comprehensive approach that considers various factors such as risk assessment, adaptation pathways, and interactions between various disaster risks and climate change impacts.

A framework for urban climate resilience focused on a structured and iterative collaborative learning approach for local planners to develop practical strategies for local action is proposed (Tyler & Moench, 2012). This approach emphasizes the importance of involving local stakeholders in the process of integrating risk management into spatial planning, ensuring that strategies are context specific and can be implemented at the local level. By involving local planners in determining factors related to resilience, this framework promotes a bottom-up approach to risk management integration.

Discussion of integrated disaster risk management and adaptation, which presents a holistic view of risk management that includes various aspects such as risk assessment methods, evaluation of risk management options, household risk reduction strategies, insurance schemes, and adaptation



pathways (Botzen et al., 2018) . This comprehensive perspective on integrated risk management emphasizes the need to consider multiple dimensions of risk, including social, economic, and environmental factors, in spatial planning to increase resilience and reduce vulnerability to disasters.

Multi-disaster risk assessment and integration of critical infrastructure in urban planning are key to improving cities' resilience to disasters. With a systematic approach, cities can better manage risk, ensuring the function of critical infrastructure during and after a disaster. Integrating risk management in spatial planning is important for cities like Medan, better preparing them for natural disasters. Involving stakeholders, considering critical infrastructure, and adopting a holistic approach are important steps in ensuring a city's resilience and adaptability to disasters.

## **2). Optimizing Land Use in Medan City:**

Optimizing land use in Medan City is an important aspect of urban planning to ensure efficient use of resources and minimize environmental impacts. Strategic spatial planning plays an important role in achieving these goals by implementing zoning regulations, integrating green open spaces, and promoting the development of diverse land uses to foster a balanced urban environment. Several studies have been conducted to analyze various aspects related to land use and environmental factors in Medan City, shedding light on key considerations for effective spatial planning.

One significant aspect that influences the optimization of land use in urban areas is the urban heat island (UHI) phenomenon. Research by Pohan & Sulistiyono (2023) discusses the relationship between UHI and land cover changes in Medan City using Landsat satellite imagery. This study highlights how increasing residential land in cities correlates with increasing land surface temperature (LST), emphasizing the importance of monitoring changes in land cover to reduce UHI effects and inform spatial planning decisions.

Apart from that, the distribution of land surface temperatures and the development of green open spaces (GOS) are important factors in optimizing land use in Medan City. Sulistiyono et al. (2018) explored the relationship between land surface temperature distribution, normalized difference vegetation index (NDVI), and GOS development priorities using satellite imagery. This research emphasizes the importance of integrating green open spaces into urban planning to regulate land surface temperatures, increase vegetation cover, and create a sustainable urban environment. Efficient infrastructure planning, optimizing tourism routes with algorithms, mapping land cover, and considering community views about the river environment are important steps in optimizing land use in Medan City. With Kruskal's algorithm, urban planners can improve accessibility to tourist attractions and transportation efficiency. Land cover mapping helps identify locations for green open space and infrastructure development. Analysis of public perceptions of the river environment allows the integration of public preferences into spatial planning. With this comprehensive approach, Medan City can develop strategic spatial planning that supports sustainable development and harmonization of the urban environment.

## **3). Inclusive Participation and Planning**

In the context of Medan City, the importance of citizen and stakeholder participation in spatial planning cannot be ignored. By involving communities and relevant stakeholders in the planning

process, cities can ensure that urban development initiatives are responsive to the needs and aspirations of the communities they serve. This participatory approach encourages a sense of ownership among residents, leads to increased cooperation, and ultimately contributes to more effective and sustainable urban development strategies.

Research by Onwujekwe et al. (2021) emphasize the importance of social justice and inclusiveness in urban development policies, especially in relation to health and nutrition. This highlights the need for cities like Medan to prioritize equitable access to quality health services and nutritional resources as part of their spatial planning efforts. By considering health and nutrition aspects in urban planning, cities can create environments that promote the well-being of their residents, thereby improving the overall quality of life in the city.

Brabham's (2009) work explores the concept of crowdsourcing in the process of public participation for planning projects. This approach can be valuable for cities like Medan that seek innovative solutions and ideas from a variety of stakeholders. By harnessing collective intelligence through crowdsourcing, urban planners can harness people's creativity and expertise, leading to more inclusive and informed decision-making processes in spatial planning initiatives.

Furthermore, Rooij & Frank (2016) highlight the importance of education for spatial planners for the era of co-creation, emphasizing the need to involve communities, science and practice in planning programs and curricula. This suggests that training programs for urban planners in Medan should include elements of co-creation and community involvement to equip professionals with the skills necessary to effectively facilitate participatory planning processes. By integrating community engagement into planning education, cities can cultivate a new generation of planners skilled in collaborating with diverse stakeholders to achieve inclusive urban development outcomes.

A collaborative approach to modeling for water resources management has proven successful in Indonesia, demonstrating more inclusive and sustainable outcomes. Applying similar techniques in Medan City can increase the effectiveness of spatial planning, especially in water resource management and environmental sustainability. The study of urban residential satisfaction also provides valuable insights for the City of Medan. By understanding the factors that influence residential satisfaction, cities can identify areas for improvement and adjust planning strategies to better meet the needs and preferences of their residents. Through community involvement, collaborative decision making, and a focus on justice, the City of Medan can create an inclusive, responsive, and sustainable city.

#### **4). Sustainable Infrastructure Development**

Sustainable infrastructure development in Medan City is very important to reduce environmental impacts and improve the welfare of its residents. Investments in green buildings, public transportation, and waste management systems play an important role in achieving these goals. Green buildings not only reduce energy consumption and carbon emissions but also promote a healthier indoor environment for occupants. Public transportation systems help reduce traffic congestion, reduce air pollution, and provide more efficient mobility options for city residents. Additionally, an effective waste management system contributes to minimizing waste in landfills, encouraging recycling, and ensuring a cleaner and healthier urban environment.

Medan City, as a center of economic and social activities, faces challenges related to urban development, environmental sustainability and the quality of life of its residents. Management of inner-city slums, based on the principles of sustainable development, is important to address problems of human settlements, environmental health and social equality. By focusing on indicators that align with sustainable development goals, such as access to basic services, adequate housing, and community participation, cities can work toward improving living conditions for marginalized populations.

Mapping land cover and vegetation in urban areas such as Medan Baru and Medan Selayang provides valuable insight into the spatial distribution of green spaces, built-up areas and natural habitats within the city. Understanding these patterns is critical for urban planning, biodiversity conservation, and sustainable land management. By incorporating green spaces into urban design and development plans, Medan City can increase its resilience to climate change, improve air quality, and create a more comfortable residential environment for its residents.

Furthermore, maintaining the collective memory and identity of Medan City's diverse communities is critical to strengthening social cohesion, preserving cultural heritage, and promoting a sense of belonging among its residents. Recognizing and celebrating the historical significance of places like the plantation trail not only enriches the cultural fabric of the city, but also strengthens social ties and promotes the sharing of knowledge between generations. By integrating historical narratives into urban development strategies, Medan City can create a more inclusive and culturally rich environment for its residents. Sustainable infrastructure development in Medan City is an integrated effort that requires a holistic approach that includes green buildings, public transportation, waste management, slum management, land cover mapping, and cultural heritage preservation. By investing in sustainable infrastructure projects and incorporating environmental, social, and economic considerations into the urban planning process, Medan City can pave the way for a more resilient, inclusive, and environmentally friendly future for its residents.

## **5). Monitoring and Evaluation**

Monitoring and evaluation are important components of a successful spatial planning strategy in urban areas such as Medan City. Regular assessments of key performance indicators such as population growth, economic development, and environmental impacts enable urban planners to ensure the effectiveness and adaptability of their strategies (Indrajit et al., 2019). Indonesia's Spatial Planning Law provides a legal framework for citizen participation in the monitoring and evaluation of urban spatial planning, increasing transparency and effectiveness by incorporating diverse views and local knowledge.

Strategic leadership is very important in formulating spatial planning strategies that are in line with development goals and dynamic challenges. In Hainan Province, a proactive approach to spatial planning emphasizes goal setting, quality improvement, risk management, resource allocation, system configuration, and innovation (WU et al., 2023). This proactive strategy enables the preparation of accurate development plans and continuous optimization of the planning process, as demonstrated in the “Regional Spatial Planning of Hainan Province (2020–2035)”.

Community engagement and participatory approaches are valuable tools for monitoring and evaluating spatial planning initiatives. Community surveys and participatory mapping techniques provide insight into plan implementation and assess the impact on local residents (Brown et al., 2022). Involving community members in the evaluation process ensures planning decisions are responsive to community needs and aspirations, facilitating collaboration between planners and residents.

The mitigation-adaptation dichotomy presents challenges for spatial planners, especially regarding climate change and sustainable development. Balancing environmental mitigation with adaptation requires a holistic approach to spatial planning. Integrating climate change considerations into the planning process is critical to building resilience and promoting sustainable development practices (Biesbroek et al., 2009). By addressing mitigation and adaptation objectives within a spatial planning framework, cities like Medan can increase their capacity to respond to environmental challenges and create a resilient urban environment.

Geospatial tools and data-driven approaches support the evaluation and planning of disease control activities, such as Chagas disease in Argentina. Leveraging geospatial information and predictive modeling optimizes resource allocation for disease control interventions and increases the effectiveness of spraying strategies (Weinberg et al., 2019). Incorporating geospatial tools into monitoring and evaluation processes increases the precision and efficiency of spatial planning initiatives related to public health and environmental management.

Monitoring and evaluation are important for effective spatial planning in Medan City. A combination of citizen participation, strategic leadership, community engagement, climate change considerations, and geospatial tools is the key to success. Regular assessments and stakeholder engagement are necessary for adaptation and successful urban development. With this comprehensive and participatory approach, Medan can optimize its spatial planning, ensuring sustainability and a better quality of life for its citizens.

## **CONCLUSION AND RECOMMENDATION**

### **1. Conclusion**

From the research conducted, several important points can be concluded:

- 1) The Medan district/city government's considerations in determining urban development and development policies are based on factors such as geographical, demographic, social, economic and environmental conditions. This includes a thorough evaluation of the needs and potential of the region as well as the aspirations and needs of the local community.
- 2) Medan district/city government policies are implemented through various steps, including the preparation of integrated and sustainable spatial plans, implementation of zoning regulations and regulations, infrastructure development, and implementation of development programs that support the concept of urban area development.
- 3) The urgency of development policies and development of residential areas in Medan City is related to the significant impact on the environment and people's lives. Having an integrated and sustainable spatial plan is the key to directing sustainable city growth and maintaining a balance between development and environmental preservation.

## 2. Suggestion:

- 1) Close cooperation is needed between the Medan district/city government, the community, academics and the private sector in formulating development and development policies for urban areas. Active participation from various stakeholders will ensure that the policies adopted reflect the needs and aspirations of the community and support sustainable development.
- 2) It is necessary to carry out continuous monitoring and evaluation of the implementation of urban development policies in Medan City to evaluate the effectiveness of the steps taken and adjust policies according to changing conditions and needs.
- 3) Support the establishment of effective cross-sector coordination institutions or mechanisms to facilitate coordination between various relevant agencies in the implementation of development policies and development of urban areas. This will strengthen the synergy between various programs and activities implemented to achieve sustainable development goals.

## REFERENCES

- Biesbroek, R., Swart, R., & Knaap, W. (2009). The mitigation–adaptation dichotomy and the role of spatial planning. *Habitat International*, 33(3), 230-237. <https://doi.org/10.1016/j.habitatint.2008.10.001>
- Botzen, W., Bouwer, L., Scussolini, P., Kuik, O., Haasnoot, M., Lawrence, J., ... & Aerts, J. (2018). Integrated disaster risk management and adaptation., 287-315. [https://doi.org/10.1007/978-3-319-72026-5\\_12](https://doi.org/10.1007/978-3-319-72026-5_12)
- Brown, G., Kyttä, M., & Reed, P. (2022). Using community surveys with participatory mapping to monitor comprehensive plan implementation. *Landscape and Urban Planning*, 218, 104306. <https://doi.org/10.1016/j.landurbplan.2021.104306>
- Bush, J. and Doyon, A. (2019). Building urban resilience with nature-based solutions: how can urban planning contribute?. *Cities*, 95, 102483. <https://doi.org/10.1016/j.cities.2019.102483>
- Chang, J., Yin, Z., Zhang, Z., & Xu, X. (2023). Multi-disaster integrated risk assessment in city range—a case study of Jinan, China. *International Journal of Environmental Research and Public Health*, 20(4), 3483. <https://doi.org/10.3390/ijerph20043483>
- Fekete, A. (2019). Critical infrastructure and flood resilience: cascading effects beyond water. *Wiley Interdisciplinary Reviews Water*, 6(5). <https://doi.org/10.1002/wat2.1370>
- Ferronato, N. and Torretta, V. (2019). Waste mismanagement in developing countries: a review of global issues. *International Journal of Environmental Research and Public Health*, 16(6), 1060. <https://doi.org/10.3390/ijerph16061060>
- Fitri, I., Ratna, R., Marisa, A., & Sitorus, R. (2020). Understanding the historic center of merdeka-kesawan: heritage significance assessment in planning and development context. *Iop Conference Series Earth and Environmental Science*, 452(1), 012048. <https://doi.org/10.1088/1755-1315/452/1/012048>
- Fitri, I., Siregar, F., Ariffin, N., Ginting, R., & Indira, S. (2023). An adaptive reuse development through highest and best use assessment: case study the ex-warenhuis, Medan, Indonesia. *Iop*



- Conference Series Earth and Environmental Science, 1188(1), 012045. <https://doi.org/10.1088/1755-1315/1188/1/012045>
- Garau, C. and Pavan, V. (2018). Evaluating urban quality: indicators and assessment tools for smart sustainable cities. *Sustainability*, 10(3), 575. <https://doi.org/10.3390/su10030575>
- Indrajit, A., Loenen, B., & Oosterom, P. (2019). Assessing spatial information themes in the spatial information infrastructure for participatory urban planning monitoring: Indonesian cities. *Isprs International Journal of Geo-Information*, 8(7), 305. <https://doi.org/10.3390/ijgi8070305>
- Matondang, M. (2022). Analysis of spatial management in regional development planning (case study: Medan city). *Journal of Geography*, 14(2), 237. <https://doi.org/10.24114/jg.v14i2.36643>
- Miller, F., Osbahr, H., Boyd, E., Thomalla, F., Bharwani, S., Ziervogel, G., ... & Nelson, D. (2010). Resilience and vulnerability: complementary or conflicting concepts?. *Ecology and Society*, 15(3). <https://doi.org/10.5751/es-03378-150311>
- Nainggolan, H. and Ginting, A. (2021). The impact of the covid-19 pandemic on the social environmental aspects of the urban poverty in Medan City, North Sumatra Province, Indonesia. *Iop Conference Series Earth and Environmental Science*, 739(1), 012020. <https://doi.org/10.1088/1755-1315/739/1/012020>
- Pohan, S. and Sulistiyono, N. (2023). Analysis of the relationship between urban heat island (UHI) phenomenon and land cover change in Medan city using Landsat satellite imagery. *Journal of Physics Conference Series*, 2421(1), 012017. <https://doi.org/10.1088/1742-6596/2421/1/012017>
- Rachman, I., Hutagalung, I., & Matsumoto, T. (2021). Multi perception analysis of Medan city residents against the river environment. *Journal of Communication Media Precipitation and Environmental Engineering Development*, 18(2), 261-270. <https://doi.org/10.14710/precipitation.v18i2.261-270>
- Siregar, R. and Marliyah, M. (2022). The effectiveness of the role of cooperatives in developing small businesses in the city of Medan. *Dehasen Multidisciplinary Journal (Mude)*, 1(2). <https://doi.org/10.37676/mude.v1i2.2143>
- Sulistiyono, N., Basyuni, M., & Slamet, B. (2018). Land surface temperature distribution and development for green open space in Medan city using imagery-based satellite Landsat 8. *Iop Conference Series Earth and Environmental Science*, 126, 012128. <https://doi.org/10.1088/1755-1315/126/1/012128>
- Tambunan, A. (2023). Availability of green open space in Medan City. *Global Education Scientific Journal*, 4(4), 2208-2214. <https://doi.org/10.55681/jige.v4i4.1836>
- Thamrin, M., Ridho, H., & Nasution, F. (2022). Strengthening community participation in spatial planning of riverflow regions in Medan City. *International Journal of Sustainable Development and Planning*, 17(6), 1849-1854. <https://doi.org/10.18280/ijstdp.170619>
- Tyler, S. and Moench, M. (2012). A framework for urban climate resilience. *Climate and Development*, 4(4), 311-326. <https://doi.org/10.1080/17565529.2012.745389>
- Weinberg, D., Lanfri, M., Scavuzzo, C., Abril, M., & Lanfri, S. (2019). Evaluation and planning of chagas control activities using geospatial tools. *Geospatial Health*, 14(2). <https://doi.org/10.4081/gh.2019.786>



Zaitunah, A., Mandalahi, A., & Syaufina, L. (2022). Mapping land cover and vegetation detection in urban areas. *Journal of Sylva Indonesiana*, 5(01), 68-80.  
<https://doi.org/10.32734/jsi.v5i01.6904>

