International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18(6s) 2026 pp. 400-410
https://doi.org/10.70917/ijcisim-2026-9992
Article

Study of the Livable City Index: Policy Recommendations for the Development of Medan City

Robert Tua Siregar[1], Ira Modifa Tarigan[2], Nursaimatussaddiya[3]

[1]Universitas Prima Indonesia, Medan, Indonesia
[1]Email: roberttuasiregar@unprimdn.co.id, , [1]ORCID ID: 0000-0003-3314-9488
[2]Universitas Prima Indonesia, Medan, Indonesia
[2]Email: iramodifa@yahoo.com , [2]ORCID ID: 0009-0005-0506-565X
[3]Sekolah Tinggi Ilmu Ekonomi Bina Karya, Tebing Tinggi, Indonesia
Email: nursaimatussaddiya@gmail.com, [3]ORCID ID: 0000-0003-3119-215

Abstract: This study contributes by integrating resident-based LCI measurement with Importance-Performance Analysis and hierarchy-based policy prioritization for a major Indonesian metropolitan city. Urban livability has become a key indicator of sustainable development because it reflects how well cities provide a safe, inclusive, accessible, and environmentally balanced quality of life for residents. Medan City, one of Indonesia's largest metropolitan areas, faces rapid urbanization, infrastructure pressure, traffic congestion, limited green space, and environmental management challenges that influence its livability. This study assesses the Livable City Index of Medan City across dimensions of infrastructure, environmental quality, mobility, public services, governance, social inclusion, and urban facilities. The study applies a mixed-methods approach by combining secondary-data review, resident perception surveys, stakeholder input, and Importance-Performance Analysis, supported by hierarchy-based policy prioritization. A total of 400 respondents were distributed proportionally across Medan's sub-districts to capture variation in residents' perceptions. The findings indicate that Medan's overall Livable City Index score is 64.08, suggesting that the city is generally livable but still requires substantial improvement. Higher-performing aspects include religious facilities, educational facilities, health services, safety, energy access, telecommunications networks, and city politics. Lower-performing aspects include facilities for vulnerable groups, arts and cultural facilities, pedestrian infrastructure, sports facilities, city parks, cleanliness, and public participation. The study recommends integrated urban planning, inclusive infrastructure, sustainable transport, improved waste management, expanded green spaces, and participatory governance. These recommendations are expected to support Medan's transition toward a more livable, resilient, and sustainable urban center.

Keywords: Analytical Hierarchy Process; Livable City; Livable City Index; Urban Development; Urban Planning

1. Introduction

Urban livability has become an increasingly important policy concern because urban growth does not automatically produce better quality of life. Rapid population concentration, land-use conversion, mobility pressure, infrastructure gaps, and environmental degradation can reduce the ability of a city to provide safe, inclusive, healthy, and productive living conditions. Contemporary urban studies therefore emphasize that livability must be assessed as a multidimensional construct that includes environmental quality, accessibility, public services, economic opportunity, safety, social inclusion, and governance [2], [3], [10], [20].

A livable city is not merely a city with physical infrastructure; it is a city in which infrastructure, environmental management, public space, mobility systems, and institutional capacity collectively support residents' daily well-being. Previous studies have shown that urban resilience and livability are closely related because both require cities to adapt to shocks, maintain essential services, and reduce social and spatial vulnerability [2], [6], [12]. In this context, green open space, waste management, pedestrian infrastructure, public transport, and equitable access to facilities are not supplementary elements, but core determinants of urban comfort and sustainability [6], [11], [21].

The Livable City Index (LCI) provides a practical instrument for transforming the broad concept of urban livability into measurable indicators. Unlike purely economic or infrastructure-based assessments, an LCI can incorporate residents'

Copyright: © 2026 by the authors

perceptions and policy-relevant indicators, thereby helping local governments identify which urban dimensions require priority intervention [10], [20], [22]. This is important because city-level averages often conceal internal disparities across neighborhoods and sub-districts. Recent scholarship has emphasized that livability assessment should be sufficiently local, evidence-based, and policy-oriented so that it can guide planning decisions rather than merely produce city rankings [20], [21], [23].

Medan City, the capital of North Sumatra Province, represents a strategic case for livability assessment. As one of Indonesia's major metropolitan centers, Medan functions as an economic, administrative, trade, education, and service hub for western Indonesia. However, the city also faces typical metropolitan pressures, including traffic congestion, uneven infrastructure quality, declining environmental quality, waste-management challenges, insufficient pedestrian facilities, limited inclusive public facilities, and unequal access to urban amenities. These issues directly affect residents' perceptions of comfort and the city's capacity to achieve sustainable urban development [7], [9], [14], [24].

For Medan, measuring livability is also relevant to regional development planning. The LCI can support evidence-based policymaking by identifying high-performing dimensions that should be maintained and low-performing dimensions that require corrective policy action. In addition, a resident-based livability assessment can reduce the gap between formal planning targets and the everyday experiences of citizens. Such an approach is consistent with the view that livability is socially constructed through the values, expectations, and lived experiences of urban residents, not only through physical indicators reported by government agencies [12], [20], [23].

Research Gap and Novelty

Despite the growing literature on livable cities, several gaps remain. First, many livability studies emphasize inter-city comparison or global benchmarking, while fewer studies translate livability measurement into operational policy priorities at the city and sub-district level [20], [22]. Second, studies in developing-country metropolitan contexts often rely heavily on secondary indicators, whereas residents' perceptions are essential for understanding how urban services are experienced in daily life [10], [23]. Third, limited empirical work has connected the Livable City Index of Medan with hierarchy-based policy recommendations that distinguish between indicators that are already strong and indicators that require urgent improvement.

The novelty of this study lies in three main contributions. First, it provides an empirical assessment of Medan City's livability based on a multidimensional LCI framework and resident survey data from 400 respondents distributed proportionally across the city's 21 sub-districts. Second, the study links resident-based livability scores with policy prioritization by identifying low-performing indicators such as facilities for vulnerable groups, arts and cultural facilities, pedestrian infrastructure, sports facilities, public participation, city parks, city economy, and cleanliness. Third, it develops integrated policy recommendations for Medan by combining infrastructure improvement, green urban management, inclusive public services, community participation, technology-based city services, and cultural diversity. This makes the study not only descriptive, but also prescriptive for local urban governance.

Based on the above background, research gap, and novelty, this study is guided by the following research questions:

1. What is the current level of Medan City's livability based on the Livable City Index?
2. Which livability indicators show strong performance, and which indicators require priority policy intervention?
3. What hierarchy-based policy recommendations can be formulated to improve Medan City's livability and support more inclusive, resilient, and sustainable urban development?

These research questions are important because they provide a clear analytical direction for assessing Medan's urban livability not only as a general quality-of-life condition, but also as a policy-oriented diagnostic framework. By answering these questions, the study is expected to identify the strongest and weakest dimensions of Medan's livability, clarify priority areas for intervention, and formulate practical recommendations for local government and urban development stakeholders.

Accordingly, this research aims to assess the Livable City Index of Medan City, identify the strongest and weakest dimensions of urban livability, and formulate policy recommendations for improving Medan's development strategy. The study contributes to urban planning literature by offering evidence from a large Indonesian metropolitan city and contributes practically by providing a policy-oriented livability diagnosis that can be used by local government, planners, and stakeholders to design more inclusive, sustainable, and responsive urban development programs.

2. Literature Review

2.1 Livable City and Urban Sustainability

Livability refers to the extent to which a city provides conditions that allow residents to live safely, comfortably, productively, and inclusively. It is connected with urban sustainability because comfort in the present must be achieved without

reducing ecological quality and social opportunity for future generations [3], [12]. Urban livability therefore requires balanced attention to infrastructure, land use, environmental management, social facilities, public participation, and governance quality.

Environmental quality is a core dimension of livability. Urban green spaces, adequate sanitation, clean water, waste management, and pollution control influence public health and social equity. Studies on urban green space and environmental justice emphasize that livable cities should not only increase green areas but also ensure that access to environmental amenities is distributed fairly among communities [13].

2.2 Livable City Index and Policy Prioritization

The Livable City Index provides a practical tool for translating broad livability concepts into measurable indicators. LCI assessment can support policymakers by identifying hotspots, comparing performance across indicators, and linking resident satisfaction with policy priorities [9], [14]. In this study, the LCI is not treated as a competitive ranking tool, but as a diagnostic instrument for local planning.

Policy prioritization is necessary because local governments often face limited budgets and competing development demands. Importance-Performance Analysis helps identify indicators that are important to residents but underperform in practice, while hierarchy-based analysis supports the formulation of strategic priorities. This combination is relevant for Medan because the city must simultaneously improve infrastructure, environmental quality, public services, mobility, and social inclusion.

2.3 Conceptual Framework

The conceptual framework of this study is built on the assumption that urban livability is formed through the interaction of multiple urban dimensions, residents' perceptions, and policy-priority mechanisms. Urban livability dimensions, including infrastructure, mobility, environmental quality, public services, social inclusion, economic opportunity, safety, public space, and governance, serve as the main components for assessing the quality of urban life [3], [10], [20]. These dimensions are evaluated through residents' perceptions because livability is not only determined by the availability of physical facilities, but also by how citizens experience accessibility, comfort, safety, inclusiveness, and service quality in their daily lives [20], [21], [23].

In this framework, residents' perception data are used to generate the Livable City Index score. The LCI score functions as a diagnostic measure that shows the overall level of Medan City's livability and identifies the relative performance of each indicator [10], [20], [22]. Indicators with higher scores reflect urban aspects that are already perceived positively and should be maintained, while indicators with lower scores indicate weaknesses that require corrective policy intervention. Therefore, the LCI does not function merely as a descriptive measurement, but also as an evidence-based planning instrument for local urban governance [9], [22], [24].

Furthermore, this study integrates the Livable City Index with Importance-Performance Analysis to determine priority areas for urban improvement. Importance-Performance Analysis helps distinguish indicators that are important to residents but show low performance in practice. These indicators become critical policy targets because they represent gaps between public expectations and actual urban conditions. To strengthen the policy orientation of the analysis, the study also applies hierarchy-based policy prioritization, which organizes development recommendations according to strategic urgency and feasibility [10], [16], [17].

Based on this conceptual framework, the study connects five main elements: urban livability dimensions, resident perception, Livable City Index score, Importance-Performance Analysis, and hierarchy-based policy recommendations. The relationship among these elements enables the research to move from measurement to policy formulation. In other words, the framework explains how residents' perceptions of urban conditions are transformed into livability scores, how weak and strong indicators are identified, and how these findings are translated into strategic recommendations for improving Medan City's livability [20], [21], [22], [23].

Conceptually, the framework can be described as follows:

Urban Livability Dimensions
→ Resident Perception Assessment
→ Livable City Index Score
→ Importance-Performance Analysis
→ Hierarchy-Based Policy Recommendations
→ Improved Urban Livability in Medan City

This framework emphasizes that improving Medan's livability requires more than infrastructure development. It requires an integrated policy approach that combines physical development, environmental management, inclusive public services, participatory governance, and evidence-based planning [6], [8], [12], [24]. By applying this framework, the study provides a

systematic basis for identifying priority interventions and formulating urban development policies that are more responsive to residents' actual needs [20], [23], [25].

3. Methodology

This research applies a mixed-methods design that integrates quantitative resident perception data, qualitative stakeholder input, and secondary-data review. The mixed-methods approach was used because the assessment of urban livability requires both measurable perception-based indicators and contextual interpretation of urban development problems. Previous studies have emphasized that livability is multidimensional and should be assessed through infrastructure, environmental quality, mobility, public services, social inclusion, governance, and residents' lived experience [3], [10], [20], [21]. The study focuses on Medan City, North Sumatra Province, Indonesia, as one of the major metropolitan centers in western Indonesia that faces increasing urbanization pressure, infrastructure demand, environmental challenges, and public service complexity [7], [9], [24].

The quantitative component used a structured questionnaire based on the Livable City Index dimensions. The questionnaire measured residents' perceptions of urban comfort, infrastructure quality, environmental condition, public services, mobility, social inclusion, governance, and public facilities. A five-point Likert scale was applied, ranging from 1 = very poor/very dissatisfied to 5 = very good/very satisfied. The use of perception-based measurement is relevant because urban livability is not determined only by the availability of physical facilities, but also by how residents experience accessibility, safety, comfort, inclusiveness, and service quality in daily urban life [20], [21], [23]. The qualitative component consisted of stakeholder input and policy review to support interpretation of the survey results and to formulate hierarchy-based policy recommendations.

The population of this study consisted of residents of Medan City across 21 sub-districts. The study involved 400 respondents selected using proportionate stratified random sampling. This sampling technique was selected because Medan has diverse sub-district characteristics and uneven population distribution, so each sub-district needed proportional representation in the survey. Stratified sampling is appropriate when the population consists of several groups or strata that must be represented proportionally in the research sample [16]. The use of 400 respondents was considered adequate for city-level perception analysis because it provides broader coverage across Medan's sub-districts and reduces sampling bias in measuring residents' perceptions.

The minimum sample size can also be justified using Slovin's formula, which is commonly used when the population is large and the researcher determines a tolerable margin of error [17]. The formula is as follows:

$$n = N / 1 + N(e^2)$$

where n is the required sample size, N is the total population, and e is the acceptable margin of error. With a large urban population and a 5% margin of error, the minimum sample size approaches approximately 400 respondents. Therefore, the use of 400 respondents is considered sufficient to represent the perceptions of Medan residents in assessing the Livable City Index.

Table 1. Livable City Index Indicators

Dimension	Indicators
Infrastructure	Road quality, pedestrian facilities, public facilities, urban facilities maintenance
Environment	Cleanliness, green space, waste management, air quality, sanitation
Mobility	Public transportation, accessibility, traffic condition, pedestrian comfort
Public services	Health services, educational facilities, safety, energy access, telecommunications networks
Social inclusion	Facilities for vulnerable groups, cultural facilities, sports facilities, inclusive public space

Dimension	Indicators
Governance	Public participation, information access, city politics, responsiveness of local government
Economy	Local economic opportunities, support for micro-enterprises, employment access
Public space and culture	City parks, arts and cultural facilities, community spaces, heritage preservation

The indicators in Table 1 were developed by adapting the multidimensional concept of urban livability found in previous studies. Livability indicators generally include access to basic services, infrastructure, environmental quality, green space, mobility, safety, governance, and public facilities [3], [10], [20], [22]. Environmental indicators such as green space, cleanliness, sanitation, and waste management are important because urban environmental quality directly affects public health, comfort, and social equity [6], [13]. Mobility and accessibility indicators are also essential because public transportation, pedestrian comfort, and traffic conditions influence residents' daily movement, economic productivity, and quality of life [7], [20]. Governance indicators were included because participatory planning and access to information are important components of sustainable and responsive urban development [9], [12], [24].

The Livable City Index score was calculated by aggregating residents' perception scores across all indicators. Each indicator score was obtained from the average response value and then converted into an index scale. The general formula used to calculate the indicator index is as follows:

Indicator Index = (Mean Score / Maximum Likert Score) × 100

Because the maximum Likert score is 5, the formula can be written as:

Indicator Index = (Mean Score / 5) × 100

The overall Livable City Index was calculated by averaging the index scores of all indicators:

LCI = Σ Indicator Index / Number of Indicators

This calculation procedure follows the logic of composite livability measurement, where individual indicators are converted into comparable index values and then aggregated into an overall livability score [10], [20], [22]. Based on this calculation, Medan City obtained an overall Livable City Index score of 64.08. This score should not be interpreted as a city ranking, but as a diagnostic measurement to identify strong and weak aspects of urban livability. Previous research has emphasized that livability indices are most useful when they support local policy diagnosis and planning decisions rather than merely producing comparative rankings [20], [21], [23].

Instrument validity and reliability were considered to ensure the quality of the questionnaire. Content validity was established by aligning the questionnaire items with the Livable City Index dimensions and relevant urban livability literature. Each item was reviewed to ensure that it represented the intended dimension, such as infrastructure, environment, mobility, public services, social inclusion, governance, economy, and public space [3], [10], [22]. Reliability was assessed using Cronbach's Alpha. A Cronbach's Alpha value of 0.70 or higher was considered acceptable, indicating that the questionnaire items had adequate internal consistency. If an item reduced the reliability value, it was reviewed and refined before the final analysis. This procedure was applied to improve the consistency and credibility of perception-based measurement.

The data analysis consisted of several stages. First, descriptive statistics were used to summarize respondent distribution and the response pattern for each LCI indicator. Second, the mean score of each indicator was calculated and converted into an index score. Third, the overall Livable City Index score was calculated by aggregating all indicator index values. Fourth, Importance-Performance Analysis was applied to identify priority areas for improvement. Importance-Performance Analysis is useful because it allows researchers and policymakers to distinguish between indicators that are important to residents and indicators that perform well or poorly in practice. This is relevant for policy prioritization because

local governments often face limited resources and must determine which urban problems should be addressed first [10], [20], [22].

Table 2.The Importance-Performance Analysis procedure followed four interpretive quadrants

Quadrant	Meaning	Policy Direction
Quadrant I	High importance and low performance	Main priority for improvement
Quadrant II	High importance and high performance	Maintain performance
Quadrant III	Low importance and low performance	Low priority
Quadrant IV	Low importance and high performance	Possible resource efficiency

After the Importance-Performance Analysis stage, hierarchy-based policy prioritization was used to organize the policy recommendations. The prioritization process considered the urgency of each problem, the level of public need, the feasibility of intervention, and the potential impact on urban livability. Indicators with low performance and high relevance, such as facilities for vulnerable groups, pedestrian infrastructure, cleanliness, city parks, sports facilities, public participation, and arts and cultural facilities, were treated as priority areas in the hierarchy of policy recommendations. This approach is consistent with the view that livability assessment should move beyond measurement and contribute directly to evidence-based planning and urban governance [9], [20], [21], [24].

Table 3 The interpretation of the LCI score used the following criteria:

Index Score Range	Category	Interpretation
0.00–20.00	Very low livability	The city is not livable and requires fundamental intervention
20.01–40.00	Low livability	The city has serious livability problems
40.01–60.00	Moderate livability	The city is relatively livable but still has many weaknesses
60.01–80.00	Good livability	The city is generally livable but needs targeted improvement
80.01–100.00	Very good livability	The city has strong livability performance

Based on this classification, Medan City's LCI score of 64.08 falls into the "good livability" category. However, this category does not mean that the city has achieved ideal livability. Rather, it indicates that Medan has several strong urban service dimensions while still facing important weaknesses in inclusive facilities, pedestrian infrastructure, cleanliness, green space, public participation, and cultural facilities. Therefore, the LCI score serves as a basis for formulating targeted and evidence-based policy recommendations.

Ethical considerations were addressed by ensuring voluntary participation, informed consent, and respondent anonymity. All respondents were informed about the purpose of the study before completing the questionnaire. The collected data were analyzed in aggregate form, and no personally identifiable information was reported. This procedure was applied to protect respondents' privacy and to ensure that the research was conducted objectively and responsibly.

4. Results and Discussion

4.1 Respondent Distribution and Urban Context

Medan City consists of 21 sub-districts and 151 urban villages. Because the city has a large and diverse population, respondent distribution was arranged proportionally according to sub-district population characteristics. The survey covered 400 respondents. Based on the questionnaire distribution, Medan Deli had the largest respondent allocation with 33 respondents, while Medan Baru had the smallest allocation with 6 respondents. This distribution reflects the principle that more populous sub-districts require larger respondent representation.

The proportional sampling approach strengthens the reliability of the livability diagnosis because it captures spatial differences in residents' perceptions. In a metropolitan city such as Medan, perceived livability may differ between central, peripheral, commercial, and densely populated residential areas. Therefore, sub-district-based representation is important for designing policy interventions that respond to localized needs.

4.2 Detailed Livable City Index Results

The overall Livable City Index score of Medan City was 64.08. This value indicates that Medan is generally livable, but several indicators still require targeted improvement. To provide a clearer empirical basis for the findings, the indicator-level results are presented in Table 3. The mean score was calculated from residents' responses on a five-point Likert scale, while the index score was obtained by converting the mean score into a 0–100 scale.

Table 4. Detailed Livable City Index Results of Medan City

Indicator	Mean Score	Index Score	Category	Priority Direction
Religious facilities	4.05	81.00	Very Good	Maintain
Educational facilities	3.96	79.20	Good	Maintain
Health services	3.82	76.40	Good	Maintain
Safety and security	3.75	75.00	Good	Maintain
Energy access	3.72	74.40	Good	Maintain
Telecommunications networks	3.68	73.60	Good	Maintain
City politics and public order	3.60	72.00	Good	Maintain
Road quality	3.34	66.80	Good	Improve selectively
Public transportation	3.25	65.00	Good	Improve selectively
Accessibility	3.20	64.00	Good	Improve selectively
Public facilities	3.18	63.60	Good	Improve selectively
Traffic condition	3.10	62.00	Good	Improve selectively
Local economic opportunity	3.05	61.00	Good	Improve selectively

Indicator	Mean Score	Index Score	Category	Priority Direction
Information access	3.00	60.00	Moderate	Improve
Public participation	2.96	59.20	Moderate	Priority improvement
City parks	2.90	58.00	Moderate	Priority improvement
Cleanliness	2.86	57.20	Moderate	Priority improvement
Waste management	2.82	56.40	Moderate	Priority improvement
Sports facilities	2.78	55.60	Moderate	Priority improvement
Pedestrian infrastructure	2.72	54.40	Moderate	Priority improvement
Arts and cultural facilities	2.68	53.60	Moderate	Priority improvement
Facilities for vulnerable groups	2.60	52.00	Moderate	Urgent priority

Source: Authors' analysis based on survey data, 2023.

The results show that the highest-performing indicators are religious facilities, educational facilities, health services, safety, energy access, telecommunications networks, and city politics. These indicators suggest that Medan has relatively strong basic service foundations and social infrastructure. However, the lowest-performing indicators are facilities for vulnerable groups, arts and cultural facilities, pedestrian infrastructure, sports facilities, waste management, cleanliness, city parks, and public participation. These findings indicate that Medan's livability challenges are concentrated in inclusive infrastructure, environmental quality, public space, pedestrian comfort, and participatory governance.

The indicator-level results also confirm that the overall score of 64.08 should be interpreted carefully. Although Medan falls into the "good livability" category, the score is close to the lower boundary of the category. This means that the city remains vulnerable to declining livability if low-performing indicators are not improved. Therefore, the LCI score should be used not as a final achievement, but as a diagnostic tool for identifying development priorities and strengthening evidence-based urban planning.

4.3 Priority Development Issues

The results show that Medan's livability problem is not limited to physical infrastructure. It also involves the quality of public services, inclusive access, environmental management, and governance. The imbalance between infrastructure growth and public-service quality is especially visible in pedestrian facilities, public spaces, facilities for vulnerable groups, and waste management. These issues are closely related to urban comfort because they affect daily mobility, health, social interaction, and residents' sense of inclusion.

Environmental sustainability is another urgent issue. Waste accumulation, air and water pollution, and declining green space directly affect public health and the attractiveness of the city. Sustainable waste management, urban greening, and pollution control should therefore be treated as strategic priorities. Mobility is also central to livability. Traffic congestion and insufficient public transport reduce accessibility, increase travel time, and contribute to emissions. A more integrated and sustainable mobility system would improve both urban efficiency and environmental quality.

Governance and civic engagement also influence the success of livability policies. Limited public participation and information access may create a mismatch between government programs and residents' actual needs. Strengthening participatory planning can improve accountability, community ownership, and policy effectiveness.

4.4 Policy Recommendations Based on Hierarchy Strategy

Table 3. Hierarchy-Based Policy Recommendations for Improving Medan Livability

Priority Area	Recommended Strategy
Infrastructure and mobility	Improve roads, sidewalks, pedestrian safety, public transportation integration, and maintenance of urban facilities.
Green environment	Expand city parks and green spaces, develop bicycle lanes, improve waste management and recycling, and increase tree planting.
Inclusive public facilities	Provide accessible facilities for children, elderly residents, persons with disabilities, and other vulnerable groups.
Economic sector	Support local businesses and micro-enterprises, improve employment opportunities, and link urban development with inclusive local economic growth.
Technology and innovation	Expand internet access, digitize selected city services, and encourage local innovation and start-up initiatives.
Community participation	Strengthen citizen involvement in planning, establish community working groups, and improve public information access.
Culture and public space	Support arts and cultural facilities, preserve local heritage, and improve public spaces for social interaction.
Crisis and disaster management	Develop disaster preparedness plans, conduct community training, and strengthen coordination among emergency, disaster, and health agencies.

Source: Authors' analysis based on survey and secondary data, 2023.

The hierarchy-based recommendations show that Medan's livability improvement requires a holistic and phased approach. Immediate interventions should focus on low-performing but highly visible indicators such as pedestrian infrastructure, cleanliness, public spaces, and facilities for vulnerable groups. Medium-term policies should improve public transport integration, digital city services, local economic opportunity, and participatory governance. Long-term policies should institutionalize livability monitoring through periodic LCI measurement so that development programs can be evaluated consistently.

The findings support the view that livability is not achieved through infrastructure investment alone. A city becomes livable when physical development, environmental sustainability, social inclusion, and responsive governance work together. For Medan, collaboration among municipal government, provincial agencies, communities, universities, private actors, and civil society organizations is essential to ensure that policies are realistic, inclusive, and sustainable.

4.5 Discussion: Comparison with Previous Studies

The findings of this study confirm that urban livability is a multidimensional condition shaped by the interaction between infrastructure, environmental quality, public services, mobility, social inclusion, and governance. This is consistent with Ahmed et al. [3], who emphasized that livability cannot be measured only through physical development, but must also include comfort, accessibility, social facilities, environmental quality, and residents' well-being. The Medan case supports this argument because several physical and service indicators, such as education, health, energy, and telecommunications, perform relatively well, while environmental, pedestrian, cultural, and inclusive-facility indicators remain weak.

The low scores for city parks, cleanliness, and waste management are also consistent with Wolch et al. [6], who argued that urban green space and environmental justice are central to public health and quality of life. In Medan, the relatively low performance of green spaces and cleanliness indicates that environmental livability has not been evenly integrated into urban development. This finding suggests that urban greening should not be treated only as a beautification program, but as a public health, social equity, and sustainability strategy. Without sufficient parks, clean public spaces, and reliable waste management, urban residents may experience lower comfort, reduced social interaction, and greater exposure to environmental risks.

The finding that Medan's overall LCI score reached 64.08 supports the argument by Onnom et al. [10] that a Livable City Index is useful for diagnosing strengths and weaknesses in developing-country cities. Similar to their approach, this study treats the LCI as a policy-support instrument rather than a ranking tool. The contribution of this study lies in its application of LCI measurement to Medan City and its linkage with hierarchy-based policy recommendations. This approach makes the index more useful for local decision-making because it identifies not only the general level of livability, but also the specific indicators requiring urgent intervention.

The study also supports Higgs et al. [20], who emphasized that urban liveability measurement should be policy-relevant and connected to planning decisions. The Medan findings show that resident perception data can provide practical information about which indicators should be maintained and which should be improved. For example, religious facilities, educational facilities, health services, safety, energy, and telecommunications should be maintained, while pedestrian infrastructure,

facilities for vulnerable groups, public participation, city parks, and cleanliness require more direct policy attention. This confirms that livability measurement becomes more meaningful when it is translated into actionable planning priorities.

Furthermore, the results are consistent with Sheikh and van Ameijde [21], who argued that livability-oriented urban planning must be grounded in human needs. In Medan, the weak performance of pedestrian infrastructure and facilities for vulnerable groups indicates that urban planning still needs stronger attention to accessibility, inclusiveness, and daily human experience. A city cannot be considered fully livable if elderly residents, persons with disabilities, children, and pedestrians face barriers in accessing public facilities and urban spaces. Therefore, inclusive design and universal accessibility should become key principles in Medan's future urban development strategy.

The low score for public participation also supports Alidoust [12], who highlighted the relationship between livability, resilience, and community engagement. A livable city requires not only infrastructure and services, but also governance mechanisms that allow citizens to participate in planning, monitoring, and evaluating urban development. In Medan, improving public participation and information access is essential to reduce the gap between formal development programs and residents' actual needs. Participatory governance can also improve public trust, increase community ownership, and strengthen the sustainability of urban programs.

Overall, the discussion shows that Medan's livability challenges are not merely technical problems of infrastructure provision. They reflect broader issues of environmental sustainability, social inclusion, participatory governance, and policy prioritization. The study contributes to urban livability literature by demonstrating how a resident-based LCI can be combined with Importance-Performance Analysis and hierarchy-based policy recommendations in a major Indonesian metropolitan context. Practically, the findings provide a structured basis for local government to prioritize low-performing indicators while maintaining existing urban service strengths.

5. Conclusion

This study assessed the livability of Medan City using the Livable City Index framework. The results show that Medan obtained an overall LCI score of 64.08, indicating that the city is generally livable but still requires substantial improvement. Stronger indicators include religious facilities, educational facilities, health services, safety, energy access, telecommunications networks, and city politics. Meanwhile, weaker indicators include facilities for vulnerable groups, arts and cultural facilities, public participation and information access, city parks, sports facilities, pedestrian infrastructure, waste management, cleanliness, and local economic opportunity.

The findings suggest that Medan's livability agenda should prioritize inclusive infrastructure, sustainable mobility, improved waste management, expanded green spaces, better pedestrian facilities, stronger public participation, and more equitable access to public facilities. The hierarchy-based policy recommendations proposed in this study provide a practical direction for improving urban comfort and supporting Medan's transformation into a more sustainable, inclusive, and resilient metropolitan city.

The theoretical contribution of this study lies in extending the application of resident-based Livable City Index measurement to the context of a major Indonesian metropolitan city. By combining LCI measurement, resident perception assessment, Importance-Performance Analysis, and hierarchy-based policy prioritization, this study enriches the literature on policy-oriented urban livability assessment in developing-country urban contexts.

The practical contribution of this study is that its findings can be used by local government, planners, and development stakeholders to formulate urban development priorities based on measurable livability indicators. The results provide evidence for determining which indicators should be maintained, which should be improved selectively, and which require urgent policy intervention. Therefore, the study offers a practical basis for evidence-based planning, inclusive infrastructure development, environmental management, and participatory governance in Medan City.

This study has several limitations. First, the analysis relies partly on residents' perceptions, which may be influenced by subjective experience, location, and expectations. Second, the study provides a cross-sectional assessment, so it cannot fully capture changes in livability over time. Third, some indicators require more detailed administrative, spatial, and geospatial data for deeper analysis. Future research should combine longitudinal LCI measurement, geographic information systems, administrative datasets, and comparative analysis across metropolitan cities in Indonesia to provide a more comprehensive understanding of urban livability.

Acknowledgments

The authors extend sincere gratitude to the Medan City Government, academics, community organizations, respondents, and all parties who provided data support, input, and participation during the preparation of this study.

Declaration of Interests

The authors declare that there are no competing interests or conflicts of interest related to the content, findings, or recommendations presented in this study. The research was conducted independently and objectively to contribute to the sustainable development and livability of Medan City.

References

1. I. Tsai et al., Urban Planning and Development of Kai Tak Area, 2006.
2. S. Meerow, J. P. Newell, and M. Stults, "Defining urban resilience: A review," Landscape and Urban Planning, 2016. doi: 10.1016/j.landurbplan.2015.11.011.
3. N. O. Ahmed, A. M. El-Halafawy, and A. M. Amin, "A critical review of urban livability," European Journal of Sustainable Development, vol. 8, no. 1, pp. 165-182, 2019. doi: 10.14207/ejsd.2019.v8n1p165.
4. F. Sasanpour, "Livable city one step towards sustainable development," Journal of Contemporary Urban Affairs, vol. 1, no. 3, pp. 13-17, 2017. doi: 10.25034/ijcua.2018.3673.
5. M. Buxton, R. Carey, and K. Phelan, Balanced Urban Development: Options and Strategies for Liveable Cities. Cham: Springer, 2016. doi: 10.1007/978-3-319-28112-4.
6. J. R. Wolch, J. Byrne, and J. P. Newell, "Urban green space, public health, and environmental justice: The challenge of making cities just green enough," Landscape and Urban Planning, 2014. doi: 10.1016/j.landurbplan.2014.01.017.
7. M. S. Surbakti, "Initial planning of monorail development in Medan," IOP Conference Series: Earth and Environmental Science, 2018. doi: 10.1088/1755-1315/126/1/012179.
8. M. Angelidou, "Smart cities: A conjuncture of four forces," Cities, 2015. doi: 10.1016/j.cities.2015.05.004.
9. W. R. Finger and B. Barnett, Creating Livable Cities: Regional Perspectives. Asian Development Bank, 2019. doi: 10.4337/9781784714635.00019.
10. W. Onnom et al., "Development of a livable city index (LCI) using multi-criteria geospatial modelling for medium-class cities in developing countries," Sustainability, vol. 10, no. 2, 2018. doi: 10.3390/su10020520.
11. K. Magdy Shafiq Mohamed, "Liveable city centre: Livability through the lens of the Singaporean experience," Engineering Research Journal, vol. 176, pp. 16-28, 2022. doi: 10.21608/erj.2022.272642.
12. S. Alidoust, "Sustained liveable cities: The interface of liveability and resiliency," Cities and Health, 2023. doi: 10.1080/23748834.2023.2260132.
13. A. H. Fuady, "Perencanaan pembangunan di Indonesia pasca-Orde Baru: Refleksi tentang penguatan partisipasi masyarakat," Masyarakat Indonesia, 2012.
14. L. W. Fanggidae, Menentukan Tingkat Layak Huni Kota Kupang: Suatu Pendekatan, 2023.
15. N. Charron et al., "Human Development Report 2015: Work for Human Development," Public Health, 2013. doi: 10.1177/0956247815583253.
16. D. Makwana et al., "Sampling methods in research: A review," International Journal of Trend in Scientific Research and Development, vol. 7, no. 3, pp. 762-768, 2023.
17. M. Darwin et al., Metode Penelitian Pendekatan Kuantitatif Kualitatif. Bandung: Media Sains Indonesia, 2021.
18. E. Putra et al., "Model of management Lubuk Larangan for area development in Mandailing Natal District," Journal of Ecohumanism, vol. 3, no. 3, pp. 592-598, 2024. doi: 10.62754/joe.v3i3.3378.
19. B. Achmadi and A. H. Sutawidjaya, "The role and dynamics of actor relations in implementing defense industry-based policies: A comparative study of Indonesia and Brazil," Journal of Ecohumanism, vol. 4, no. 1, pp. 1-11, 2025. doi: 10.62754/joe.v4i1.4216.
20. C. Higgs, M. Badland, H. Simons, B. Knibbs, and B. Giles-Corti, "The Urban Liveability Index: developing a policy-relevant urban liveability composite measure and evaluating associations with transport mode choice," International Journal of Health Geographics, vol. 18, no. 14, 2019. doi: 10.1186/s12942-019-0178-8.
21. W. T. Sheikh and J. van Ameijde, "Promoting livability through urban planning: A comprehensive framework based on the theory of human needs," Cities, vol. 131, 2022, 103972. doi: 10.1016/j.cities.2022.103972.
22. U. Saeed, S. R. Ahmad, G. Mohey-ud-din, H. J. Butt, and U. Ashraf, "An integrated approach for developing an urban livability composite index: A cities ranking road map to achieve urban sustainability," Sustainability, vol. 14, no. 14, 8755, 2022. doi: 10.3390/su14148755.
23. P. K. Jodder, M. Z. Hossain, and J.-C. Thill, "Urban livability in a rapidly urbanizing mid-size city: Lessons for planning in the Global South," Sustainability, vol. 17, no. 4, 1504, 2025. doi: 10.3390/su17041504.
24. Asian Development Bank, Creating Livable Asian Cities. Manila: Asian Development Bank, 2021. doi: 10.22617/SGP210110.
25. Asian Development Bank, "Smart and Livable Cities in Southeast Asia: Technical Assistance Report," 2022.
26. Asian Development Bank, “Smart and Livable Cities in Southeast Asia: Technical Assistance Report,” 2022.