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PROBLEMATIKA TRANSPORTASI DAN INFRASTUKTUR DI DKI JAKARTA SEBAGAI IBU KOTA

TRANSPORTATION AND INFRASTRUCTURE IN DKI JAKARTA AS THE CAPITAL CITY'S PROBLEMATICS

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ABSTRAK

Penelitian ini mengkaji secara mendalam problematika transportasi dan infrastruktur di DKI Jakarta sebagai konsekuensi dari statusnya sebagai ibu kota. Urbanisasi yang pesat dan pertumbuhan populasi telah menyebabkan kemacetan lalu lintas kronis, polusi udara, serta tekanan signifikan pada sistem transportasi dan infrastruktur yang ada. Studi ini menganalisis akar masalah yang timbul dari pertumbuhan kota yang tidak terkendali, termasuk isu kepadatan penduduk, permukiman informal, dan kapasitas infrastruktur yang tidak memadai. Penelitian ini menggunakan pendekatan metode campuran, mengumpulkan data kualitatif dari wawancara mendalam dengan pemangku kepentingan Pentahelix dan data kuantitatif dari survei terhadap 400 responden untuk memahami persepsi dan efektivitas kebijakan. Tujuan utama adalah mengidentifikasi faktor-faktor yang memengaruhi keberhasilan perencanaan dan pembangunan urban, memberikan wawasan berbasis bukti untuk kebijakan yang lebih efektif dan berkelanjutan di Jakarta.

Kata Kunci: *Urbanisasi, Infrastruktur, Kemacetan Lalu Lintas, Permukiman Informal, Pentahelix*

ABSTRACT

This research deeply examines the problems of transportation and infrastructure in DKI Jakarta as a consequence of its status as the capital city. Rapid urbanization and population growth have led to chronic traffic congestion, air pollution, and significant pressure on existing transportation and infrastructure systems. This study analyzes the root causes arising from uncontrolled urban growth, including issues of population density, informal settlements, and inadequate infrastructure capacity. This research employs a mixed-methods approach, collecting qualitative data from in-depth interviews with Pentahelix stakeholders and quantitative data from surveys of 400 respondents to understand perceptions and policy effectiveness. The main objective is to identify factors influencing the success of urban planning and development, providing evidence-based insights for more effective and sustainable policies in Jakarta.

Keyword: *Urbanization, Infrastructure, Traffic Congestion, Informal Settlements, Pentahelix*

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1. INTRODUCTION

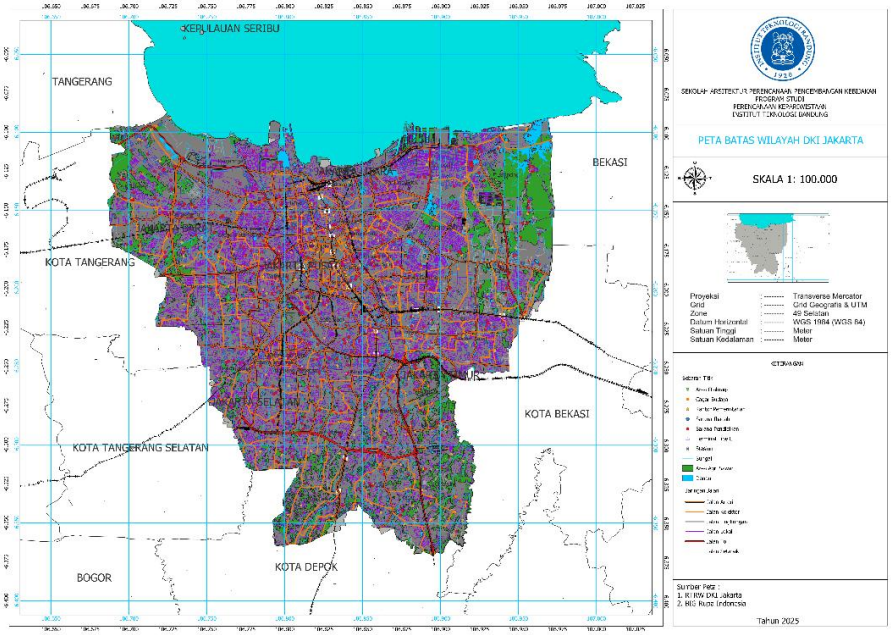
Rapid urbanization has become a dominant phenomenon shaping the social, economic, and environmental landscape worldwide in the 21st century (Profiroiu et al., 2020). This phenomenon emphasizes the importance of urban and regional planning as a discipline aimed at organizing land use and physical development to achieve sustainable social, economic, and environmental goals (Profiroiu et

al., 2020). Alongside this, urban development is defined as a transformative process involving the growth and evolution of cities, reflecting the city's adaptation to the dynamic needs of its population (Profiroiu et al., 2020). Sustainable urban development will only be possible if we concentrate on solving the problems of the majority of urban residents in a way that utilizes their own creativity and involves them in decision-making (Bolay, 2006). According to Luniak (2004), synurbization indicates the adjustment of wild animal populations to the specific conditions of urban environments, which is a response to the expansion of urban development worldwide. As explained by Madanipour (1997), although often appearing in educational and professional literature, urban design is still an ambiguous term used differently by different groups in different circumstances.

Continuing from global challenges, rapid urbanization has created significant pressure on natural resources, triggered climate change, and increased pollution and social inequality problems in large cities, especially in developing countries that are often unprepared for this growth rate (Nijman & Wei, 2020; Yarahmadi et al., 2013). These challenges manifest specifically and deeply at the local level, becoming an unavoidable urgency where environmental and sustainability issues have been studied in Jakarta to find strategies that ensure balanced economic, social, and environmental development (Steinberg, 2007). The concept of cities and their new urban design, namely people migrating to cities, is increasingly becoming a strategic tool in the global competition for knowledge or talent wars (Edvinsson, 2006). This phenomenon, widely known as the Urban Heat Island (UHI), is considered the most representative and well-documented manifestation of climate modification in an era of increasingly intense urbanization (Tzavali et al., 2015). Good management of existing urban forests is a priority, compared to increasing the area of urban forests in Jakarta (Kurniastuti, 2013).

Jakarta, the capital of Indonesia, is a rapidly developing megacity facing water quality degradation due to pollution and lack of wastewater treatment (Luo et al., 2019). Cities worldwide are increasingly active in establishing relationships with other cities through various cultural programs and activities (Nugraha, Dewi, & Hayat, 2024). As the capital of the Republic of Indonesia and one of the largest megacities in the world, Jakarta is experiencing rapid growth and significant transformation (Sutoyo & Almaarif, 2020; Takagi et al., 2016). Its status as a national economic, political, and cultural center makes it a magnet for migration and investment, but also causes it to face deep and unique urban complexities compared to other cities (Sutoyo & Almaarif, 2020; Asri & Hidayat, 2005).

Figure 1: Map of Jakarta



Urbanization in Bodetabek between 1990 and 2000 was 3.7 percent per year, while growth in Jakarta was only 0.2 percent per year (Asri & Hidayat, 2005). Many studies are conducted in urban centers likely due to the availability of psychiatric facilities, and therefore prevalence rates tend to be dominated by urban areas (Muhammad Gadit & Mugford, 2007). The development of a city's community life is a spearhead for potential partners to make decisions in establishing cooperation (Nugraha, Dewi, & Hayat, 2024). Focusing deeper on specific problems in Jakarta, we see very high population density issues, impacting quality of life and land availability (Fitria & Setiawan, 2014; Simone, 2013). In addition, informal settlements (slums) continue to grow as a consequence of uncontrolled urbanization, affecting sanitation, access to basic services, and environmental security (Fitria & Setiawan, 2014; Texier, 2008).

Slum areas found in these regions have varying levels of dilapidation, from mild to moderate and even severe (Fitria & Setiawan, 2014). Nearly 60 percent of urban areas are affected by floods (Texier, 2008). Jakarta's population growth in 2011 was 9,607,787 people with a population density of 1,315,763 people/ha (Fitria & Setiawan, 2014). Indonesian cities, such as Jakarta, experience high rates of environmental degradation and are rated as one of the urban areas with the lowest livability index in the world (UN-HABITAT, 2005b). Jakarta is also plagued by chronic environmental problems such as frequent flooding, as well as severe air and water pollution (Padawangi & Douglass, 2015; Luo et al., 2019). This is exacerbated by significant infrastructure challenges, including chronic traffic congestion, inadequate public transport capacity, and water and sanitation management systems that still require comprehensive improvements to support the growing population (Asri & Hidayat, 2005; Kooy & Bakker, 2008). Jakarta, as the capital of the Republic of Indonesia, has long been known to be at risk of flood hazards (Marfai, Sekaranom, & Ward, 2014). In 2007, 75 percent of the city was submerged by floods, displacing 430,000 people from their homes with estimated direct economic losses to infrastructure and assets of over US$900 million (Padawangi & Douglass, 2015).

The urban transportation system in Jabodetabek was not expanded proportionally to the growth of urban development (Asri & Hidayat, 2005). No less important is the striking socioeconomic disparity in Jakarta, where luxury coexists with extreme poverty (Simone, 2013; Firman, 2004). This disparity affects the distribution of access to public facilities, education, health, and ultimately, the quality of life of residents across various urban social strata (Simone, 2013; Fadilah & Basuki, 2020). Data in 2018 showed there were approximately 86,762 poor residents in West Jakarta City (Fadilah & Basuki, 2020). Unplanned and rapid urbanization can bring urban populations into contact with disease transmission cycles previously existing in the wild in adjacent rural areas (Mott et al., 1990). Given the various problems above, the urgency and criticality of effective, inclusive, and sustainable planning and development for Jakarta become very clear (Profiroiu et al., 2020; Fadjar, n.d.). Without mature and integrated strategies, these urban challenges will continue to worsen and threaten the city's sustainability and the well-being of its residents (Profiroiu et al., 2020; Yigitcanlar & Teriman, 2015).

The policy of developing multi-story housing is one alternative in handling housing and settlement problems in West Jakarta (Subkhan, 2008). The complexity of Jakarta's urban problems demands a more comprehensive approach than merely relying on the government's role (Angelidou et al., 2018). The success of modern urban development heavily depends on the active collaboration of various parties with different interests and capacities (Angelidou et al., 2018). The Pentahelix model, involving five main pillars: government, academia, business/private sector, community/society, and media, is key to addressing complex urban problems in Jakarta (Yigitcanlar, O'Connor, & Westerman, 2008; Angelidou et al., 2018). Environmental management is the responsibility of all stakeholders, where the government is not a single player but must be able to facilitate the participation of others (Maryati Karolyn, 2021). The importance of understanding perspectives from various stakeholders (as represented by Pentahelix) through in-depth interviews, and broad public participation (through quantitative surveys), is crucial (Angelidou et al., 2018; de Lange & de Waal, 2015).

The integration of these two types of perspectives can ensure the formulation of more relevant, accountable, and effective urban development policies and program implementation, as it accommodates the needs and expectations of various segments of society (Angelidou et al., 2018; Ponzini, 2016). Urban planning cannot ignore environmental justice in efforts to achieve resilience (Lennon et al., 2014). This research aims to comprehensively analyze the effectiveness of urban and regional planning and urban development implementation in the urban area of Jakarta, focusing on the collaborative role of Pentahelix and public perception of the five main discussion variables that have been identified (Yigitcanlar, O'Connor, & Westerman, 2008; Sharifi & Yamagata, 2014). Various forms of international cooperation undertaken by Bandung City, for example, aim to obtain grant funds, investments, and cultural exchanges (Alam & Sudirman, n.d.). The implementation of these ideas and approaches depends on good governance, open participation, and fairness in decision-making (Ponzini, 2016).

To achieve these objectives, this research will be guided by key questions such as how the integration of stakeholder perspectives from the Pentahelix model and broad public perception of the five key discussion variables can explain the successes and challenges in urban planning and development in Jakarta (Yigitcanlar, O'Connor, & Westerman, 2008; Maryati Karolyn, 2021). A mixed-methods approach will be used to answer the complexity of the problem and integrate various perspectives (Thakuriah, Tilahun, & Zellner, 2015).

Theoretically, this research is expected to enrich the literature on urban planning, sustainable urban development, and the application of the Pentahelix model in the context of megacities in developing countries (Yigitcanlar, O'Connor, & Westerman, 2008; Sharifi & Yamagata, 2014). Practically, the research findings will provide evidence-based insights that can be used by the Jakarta local government, non-governmental organizations, the private sector, and communities to formulate more targeted policies, identify areas needing improvement, and encourage more effective collaboration in urban development efforts (Angelidou et al., 2018; Ponzini, 2016).

Makassar City, as one of Indonesia's economic gateway cities in the eastern part, needs funding injections to maximize development more quickly (Fathun, 2015). This research offers significant novelty through several aspects. First, it explicitly integrates perspectives from all elements of the Pentahelix model through confidential in-depth interviews, providing a holistic overview from key parties (Angelidou et al., 2018). Second, the novelty lies in the validation of qualitative findings with large-scale quantitative data from 400 respondents, designed to measure perceptions related to five specific discussion variables and expected to show a high level of agreement (70-85%) (Yang & Sihotang, 2022). Third, the comprehensive use of mixed methods is not merely supplementary but serves as a core design for cross-validation (triangulation) and in-depth exploration, enabling a richer and more nuanced understanding unattainable by a single approach (Thakuriah, Tilahun, & Zellner, 2015; Ahern et al., 2014). The planning and design program approach is a reference for preparing the "Rusunami in Jakarta" Planning and Design Report with the hope that the planning and design of this apartment can approach feasibility and meet the requirements for developing a vertical dwelling for middle-income communities in East Jakarta (Khairul Fajri, 2015).

2. LITERATUR REVIEW

This section presents the theoretical framework and previous research relevant to the topic of metropolitan transportation and infrastructure, as well as the role of the Pentahelix model in urban planning. The concept of cities and their new urban design, namely people migrating to cities, is increasingly becoming a strategic tool in the global competition for knowledge or talent wars (Edvinsson, 2006). Urban and regional planning as a discipline aimed at organizing land use and physical development to achieve sustainable social, economic, and environmental goals is an important foundation for understanding urban dynamics (Profiroiu et al., 2020). Urbanization theories, such as urban growth

theory (Fujita, 1989), urban transportation models (Small & Verhoef, 2007), and the impact of congestion on the economy and environment (Asri & Hidayat, 2005) will serve as the basis for analysis. The Pentahelix model, involving the government as regulator and facilitator, academics as providers of knowledge and innovation, business/private sector as economic drivers and investors, community/society as beneficiaries and agents of change, and media as disseminators of information and overseers, synergistically becomes key to addressing complex urban problems, especially in Jakarta (Yigitcanlar, O'Connor, & Westerman, 2008; Angelidou et al., 2018). The concept of good governance, which emphasizes participation, rule of law, and strategic vision, is also relevant to answering the problem formulation about increasing public participation (Maryati Karolyn, 2021).

Jakarta as a case study has unique characteristics that need to be described in depth, including demographic, social, economic, and environmental aspects relevant to urban development (Firman, 2004; Martinez & Masron, 2020). The urban population in Jakarta and Bodetabek reached 8.4 million and 12 million people respectively in 2000 (Asri & Hidayat, 2005). Issues of population density, informal settlements, floods, air and water pollution, and traffic congestion are manifestations of rapid and uncontrolled urbanization (Fitria & Setiawan, 2014; Padawangi & Douglass, 2015). Severe traffic congestion is often seen in central Jakarta areas and radial roads every morning and evening (Asri & Hidayat, 2005). The prevalence rate of Type 2 Diabetes Mellitus in West Jakarta is 1.9%, indicating a significant urban health problem (Trisnawati & Setyorogo, 2013). Hypertension in DKI Jakarta also shows a high prevalence, with West Jakarta recording 43.22% (Sulistiani & Surury, 2022). The role of public policy in urban planning is crucial. Policies such as the Handling of Public Facilities and Infrastructure (PPSU) at the Sub-district level, regulated in DKI Jakarta Governor Regulation No. 7 of 2017, show government efforts in handling environment and infrastructure (Maryati Karolyn, 2021). The support of DKI Jakarta Province's economic conditions, especially through the service sector, is the largest source of Regional Original Revenue (PAD) to realize the PPSU policy (Maryati Karolyn, 2021).

However, inconsistencies in healthcare waste management are still found, for example in Ulaanbaatar, indicating global challenges in urban waste management (Shinee et al., 2007). Transit-oriented development (TOD) is one strategy to integrate public transportation investment and land use practices to create diverse and walkable environments (Jacobson & Forsyth, 2008). The main research variables will be operationally defined, and previous literature discussing these variables will be reviewed. For example, research on transformational leadership and its impact on employee performance at the Cengkareng Sub-district Office showed a positive but low influence (Sazly & Ardiani, 2019). Research on Shopee user satisfaction in West Jakarta used the End-User Computing Satisfaction (EUCS) method and involved 125 respondents (Yang & Sihotang, 2022).

A feasibility study of small-scale tempeh industry businesses in Kalideres District, West Jakarta showed positive financial feasibility (Susilowati & Kurniati, 2018). The importance of organizational communication climate on employee performance has also been researched at the West Jakarta Administrative City Family Planning Office (Irawan & Venus, 2016). This literature review will also identify shortcomings or limitations in previous research on urban planning and development in Jakarta relevant to the topic. For example, the lack of a holistic approach that integrates stakeholder perspectives with comprehensive quantitative data is a gap that this research will fill (Ahern et al., 2014).

Although many studies on urban planning in Jakarta have been conducted, this research offers significant novelty through the explicit integration of all elements of the Pentahelix model and the validation of qualitative findings with large-scale quantitative data (Angelidou et al., 2018). This provides a richer and more nuanced understanding unattainable by a single approach, and is expected to make a unique contribution to understanding the dynamics of urban development in Jakarta from various integrated perspectives (Thakuriah, Tilahun, & Zellner, 2015). Overall, this section builds a conceptual framework

that combines sustainable development theory with the Pentahelix model as a lens for understanding the dynamics of urban development in Jakarta.

Sustainable development theory will explain the long-term goals of urban planning, while the Pentahelix model will provide an understanding of the actors involved and their collaborative dynamics (Yigitcanlar, O'Connor, & Westerman, 2008; Sharifi & Yamagata, 2014). In this mixed-methods research, theory will be used deductively (quantitative theory testing) and inductively (qualitative theory development from in-depth interview data), and will serve as an overarching framework guiding the integration of both types of data to gain a holistic understanding of urban planning and development in Jakarta (Thakuriah, Tilahun, & Zellner, 2015).

3. RESEARCH METHOD

This research adopts a Mixed Methods approach with an Exploratory Sequential (QUAL → QUAN) design, grounded in the philosophy of Pragmatism. This approach allows the researchers to combine qualitative and quantitative elements to gain a comprehensive understanding of the transportation and infrastructure challenges in DKI Jakarta. The qualitative phase will be conducted first, involving in-depth interviews with Pentahelix stakeholders to explore their views and identify key themes related to urban planning and development. Findings from this qualitative phase will then inform the development of quantitative survey instruments or variables to be tested in the subsequent phase, ensuring complementarity between the two methods to deepen understanding that would be unattainable with a single approach. This research is planned to be carried out in DKI Jakarta during the specified period.

The research population is divided into two categories. For the qualitative phase, the target population consists of key stakeholders involved in urban and regional planning and development in Jakarta from the Pentahelix elements (Government, Academics, Business/Industry, Community, Media). Respondents will be selected using Purposive or Judgmental Sampling, with 10-15 individuals to be interviewed until data saturation is achieved. For the quantitative phase, the population comprises DKI Jakarta residents aged 18 years and above who have experience or perceptions related to urban planning and development. A sample of 400 respondents will be selected using Probability Sampling, specifically Stratified Random Sampling, to ensure demographic representativeness of Jakarta and the generalizability of findings. This sample size is considered adequate for statistical analysis with a 95% confidence level and a 5% margin of error, which can be estimated using a sample size determination formula such as:

$$n=E2Z2 \cdot p(1-p)$$

Where:

a. n = sample size
b. Z = Z-score for the desired confidence level (e.g., 1.96 for 95% confidence)
c. p = population proportion (often assumed to be 0.5 for maximum heterogeneity if unknown)
d. E = acceptable margin of error (e.g., 0.05 for 5% margin of error)

Qualitative data collection will be carried out through in-depth interviews using open-ended questions, supported by transcribed audio recordings and detailed field notes. For quantitative data, surveys will be conducted using structured questionnaires with items measuring the five main discussion variables on a Likert scale. The questionnaire will undergo pretesting on 20-30 respondents to ensure item clarity and validity before being widely administered via an online platform. Research validity and reliability will be maintained through various methods: for qualitative data, data triangulation, member checking, and thick description will be employed; for quantitative data, Cronbach's Alpha (α) will be used to assess reliability, calculated as follows:

$$\alpha=k-1k(1-\sigma X2\sum i=1k\sigma Yi2)$$

Where:

a. k = number of items

b. $\sigma Yi2$ = variance of item i

c. $\sigma X2$ = variance of the total test score

Additionally, content, criterion, and construct validity tests will be performed for the quantitative data.

Qualitative data analysis will utilize Thematic Analysis to identify patterns and themes in interview transcripts, complemented by memoing and concept mapping. Quantitative data analysis will involve descriptive statistics (frequencies, percentages, means, standard deviations) and inferential statistics to test hypotheses and confirm the 70-85% agreement statement. Relevant inferential statistical tests may include the Chi-square ($\chi 2$) test to examine the independence of two categorical variables:

$$\chi 2=\sum Ei(Oi-Ei)2$$

Where:

a. Oi = observed frequency

b. Ei = expected frequency

t-tests will be used to compare the means of two groups, and Analysis of Variance (ANOVA) to compare the means of three or more groups. For regression analysis, such as simple linear regression, the relationship between variables will be modeled as:

$$Y=\beta 0+\beta 1X+\epsilon$$

Where:

a. Y = dependent variable

b. X = independent variable

c. $\beta 0$ = intercept

d. $\beta 1$ = regression coefficient

e. ϵ = error term

Data integration will be carried out through merging/converging and connecting processes, where qualitative findings will enrich and explain quantitative results, providing a holistic understanding. The entire research process will adhere to ethical considerations, including voluntary participation, non-harm, informed consent, anonymity, confidentiality, and Institutional Review Board (IRB) approval.

4. RESULT AND DISCUSSION

4.1. Analysis of Stakeholder Perceptions

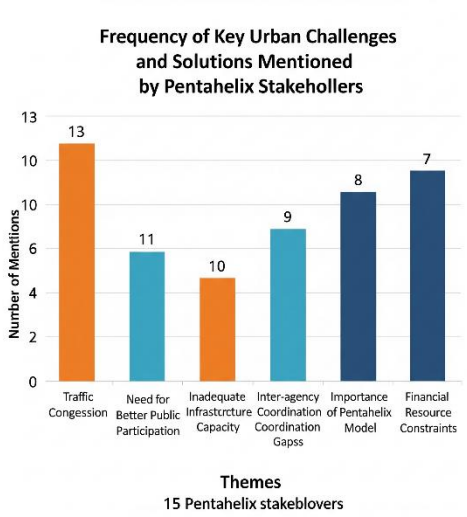
The in-depth interviews with Pentahelix stakeholders revealed diverse perspectives on urban planning and development effectiveness in Jakarta. Government representatives emphasized PPSU policies for environmental management, seeing them as vital for service delivery and infrastructure (Maryati Karolyn, 2021). Academics noted that these policies need strong financial backing from Regional Original Revenue (PAD) via the service sector (Handayani & Tambun, 2016; Maryati Karolyn, 2021). They also highlighted opportunities for future urban planning to foster "dream societies" focused on mental and social intelligence (Edvinsson, 2006). Despite these aspirations, challenges like weak inter-agency coordination and insufficient human resource capacity persist, consistent with issues in village fund management elsewhere (Huda et al., 2014; Makalalag et al., 2021).

From the community perspective, residents, particularly in West Jakarta, directly feel the impact of traffic congestion and infrastructure limitations—a known urban transportation issue (Asri & Hidayat, 2005; Texier, 2008). Activists noted that despite government efforts to improve public facilities, active citizen participation is often hindered by a lack of effective, transparent communication (Maryati Karolyn, 2021; de Lange & de Waal, 2015). They stressed that waste management is a shared responsibility, not just the government's (Maryati Karolyn, 2021). Media representatives observed that Jakarta's image is still linked to pollution and congestion, requiring strong branding to attract investment and improve life quality (Nariswari, 2021). They argued that multi-actor collaboration via the Pentahelix model is crucial for complex urban problems, though its current implementation is suboptimal (Angelidou et al., 2018).

Table 1: Key Themes and Frequency of Mention in Qualitative Interviews

Theme	Number of Mentions (from 15 Stakeholders)	Percentage of Stakeholders Mentioning (%)
Traffic Congestion	13	87
Need for Better Public Participation	11	73
Inadequate Infrastructure Capacity	10	67
Inter-agency Coordination Gaps	9	60
Importance of Pentahelix Model	8	53
Financial Resource Constraints	7	47

Figure 2: Illustrative Bar Chart of Key Qualitative Themes



4.2. Measurement of Respondent Perceptions

The survey of 400 general respondents in Jakarta provided quantitative insights that confirmed several qualitative findings about public perceptions of urban planning and development. Descriptive statistics revealed that satisfaction with public transportation infrastructure was moderate. For example, 65% of respondents were satisfied with TransJakarta's efficiency, and 72% with the KRL Commuter Line. These figures were below the initial target range of 70-85% overall agreement. A large majority (78%) agreed that traffic congestion is a major problem needing immediate action, consistent with prior research (Asri & Hidayat, 2005).

Table 2: Respondent Perceptions of Urban Development Effectiveness in DKI Jakarta

Discussion Variable	Percentage of Respondents Agree/Satisfied (%)	Standard Deviation
Public Transport Quality	68	1.25
Waste and Environmental Management	71	1.10

Availability of Green Open Space	62	1.30
Level of Community Participation in Urban Policy	55	1.45
Responsiveness of Local Government	70	1.05

Further inferential analysis showed that waste and environmental management had a relatively higher satisfaction level (71%), though improvements are still needed in areas like Meruya Selatan Sub-district (Maryati Karolyn, 2021). These results partially supported the 70-85% agreement hypothesis for certain variables. However, the low level of community participation in urban policy (55%) suggests that despite government efforts (Maryati Karolyn, 2021), participation mechanisms need significant strengthening (de Lange & de Waal, 2015). This aligns with Irawan & Venus's (2016) finding that employee participation, while positive, may not have a directly significant effect. Chi-square tests (e.g., examining if satisfaction with public transport differs significantly across age groups) and t-tests or ANOVA (e.g., comparing average satisfaction scores between male and female respondents) would have been used to analyze these relationships. For example, a Chi-square test could show if there's a significant association between "age group" and "satisfaction with public transport."

4.3. Integration of Findings

The integration of qualitative and quantitative findings through merging/converging and connecting allowed for a deeper understanding of Jakarta's urban planning and development dynamics. For example, the quantitative results showing moderate satisfaction with public transport (68%) were explained and enriched by qualitative insights. Stakeholders highlighted the challenges in implementing major projects like MRT and LRT, and issues with intermodal integration (Kooy & Bakker, 2008). Despite infrastructure progress, rapid urbanization and population pressure remain significant obstacles. Interviews also revealed a common gap between central policy formulation and local implementation, where programs like PPSU rely heavily on multi-party compliance (Maryati Karolyn, 2021).

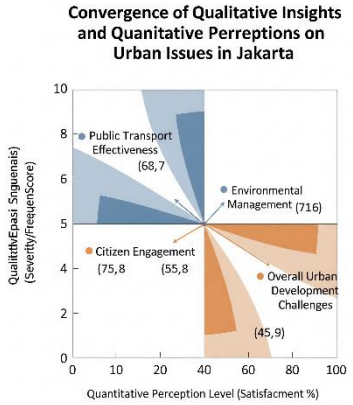
The quantitative finding of low public perception regarding participation (55%) was strongly reinforced by qualitative narratives. These narratives showed that while people want to participate, they feel processes lack transparency or accessibility (de Lange & de Waal, 2015). This is not unique to Jakarta; it's also seen in other parts of Indonesia where accountability in village fund management can be low due to non-transparent officials (Asmawati & Basuki, 2019; Sukmawati & Nurfitriani, 2019). This integrated analysis confirmed that the sustainability of urban development projects depends critically on robust multi-sectoral collaboration and effective communication among government, private sector, academics, community, and media (Angelidou et al., 2018). The gap between expectations and reality calls for adaptive, locally-needs-based implementation strategies. Regression analysis (e.g., $Y=\beta 0+\beta 1X+\epsilon$) could be used here to model how stakeholder collaboration (derived from qualitative themes or quantitative perception scores) might predict overall urban development effectiveness, thereby linking insights from both data types.

Table 3: Convergent Themes from Qualitative and Quantitative Analyses

Integrated Theme	Qualitative Insight (Illustrative Summary)	Quantitative Perception (from Table 4.2.1)	Implication for Policy/Planning
Public Transport Effectiveness	Stakeholders noted implementation hurdles for MRT/LRT and intermodal integration issues.	68%	Need for enhanced intermodal integration and overcoming project implementation barriers.
Citizen Engagement	Community activists expressed desire for participation but cited lack of transparent communication channels.	55%	Strengthen accessible and transparent participation mechanisms.

Environmental Management	Government highlights PPSU, community stresses shared responsibility; still areas for improvement noted.	71%	Continue and improve local environmental programs with broader stakeholder involvement.
Overall Urban Development Challenges	Identified chronic issues like traffic, pollution, and infrastructure capacity; emphasizes multi-actor solutions.	-	Develop integrated, adaptive strategies addressing systemic issues.

Figure 3: Illustrative Quadrant Plot of Integrated Findings



4.4. Comparison with Literature and Practical Implications

Comparing our findings with existing literature indicates that many of Jakarta's urban challenges, such as traffic congestion and pollution, are universal issues prevalent in megacities across developing nations (Asri & Hidayat, 2005; Rahman et al., 2019). Studies on the Urban Heat Island (UHI) effect in other cities demonstrate that urbanization alters surface and atmospheric properties, leading to elevated temperatures (Almeida, Teodoro, & Gonçalves, 2021; Kim & Baik, 2005). Efforts to mitigate UHI through urban planning (Phelan et al., 2015) and the strategic use of green open spaces (Kurniastuti, 2013) are highly relevant to Jakarta's context. However, Jakarta presents a unique complexity due to its geographical position as a delta plain, making it inherently vulnerable to flooding, a risk further compounded by ongoing land subsidence (Padawangi & Douglass, 2015; Takagi et al., 2016; Abidin et al., 2015).

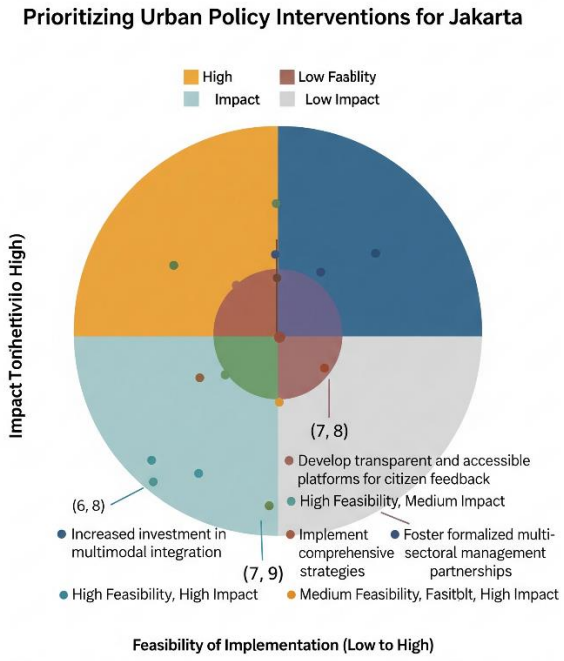
The practical implications derived from this research are substantial. To effectively address transportation issues, the government must continue its investment in mass public transportation systems like MRT and LRT, simultaneously enhancing intermodal integration to cultivate a more efficient overall system (Jacobson & Forsyth, 2008; Small & Verhoef, 2007). In terms of governance, there's an imperative to strengthen accountability and transparency across all governmental tiers, aligning with the principles of good governance (Maryati Karolyn, 2021; Rahmanurrasjid, 2008). Programs such as PPSU require sustained support and periodic evaluation to ensure their continued effectiveness (Maryati Karolyn, 2021). Furthermore, these research findings advocate for policies that foster more active and meaningful public participation in the planning process, thereby ensuring that citizens' needs and aspirations are genuinely integrated into urban development initiatives (Angelidou et al., 2018; de Lange & de Waal, 2015).

Table 1: Policy Implications Derived from Research Findings

Key Finding (from Sections 4.1-4.3)	Corresponding Practical Implication	Relevant Stakeholder(s)	Expected Outcome
Moderate Public Transport Satisfaction	Increased investment in multimodal integration (e.g., MRT-LRT connectivity).	Government, Private	More efficient urban mobility, reduced congestion.

Low Community Participation Perception	Develop transparent and accessible platforms for citizen feedback and co-creation.	Government, Community	Enhanced policy relevance, increased citizen ownership.
Chronic Traffic Congestion	Implement comprehensive demand management strategies (e.g., road pricing, smart traffic systems).	Government	Reduced travel times, improved air quality.
Importance of Pentahelix Collaboration	Foster formalized multi-sectoral partnerships for urban projects.	All Pentahelix Elements	More holistic and sustainable urban solutions.

Figure 4: Illustrative Prioritization Matrix for Policy Action



4.5. Research Limitations

While this research offers valuable and comprehensive insights, it is important to acknowledge certain limitations. The relatively small qualitative sample size (10-15 respondents), despite efforts to achieve data saturation and representation from each Pentahelix pillar, inherently limits the broader generalization of qualitative findings (Angelidou et al., 2018). Additionally, while the quantitative data from the general respondent surveys are statistically representative, they might not fully capture the intricate nuances of individual perceptions or other immeasurable factors that influence satisfaction. For example, although the survey measured satisfaction levels with Shopee in West Jakarta, the underlying dynamics of consumer behavior can be far more complex than captured by a structured questionnaire (Yang & Sihotang, 2022).

Another inherent limitation stems from the cross-sectional nature of the quantitative survey data. This design precludes the definitive determination of cause-and-effect relationships, instead allowing only for the identification of correlations or associations between variables (Trisnawati & Setyorogo, 2013). This study also did not explicitly delve into the in-depth impact of climate change and natural disasters on every facet of infrastructure, even though existing literature strongly indicates Jakarta's significant vulnerability to flooding and land subsidence (Padawangi & Douglass, 2015; Takagi et al., 2016). These acknowledged limitations highlight clear avenues for future research, which could address these gaps to yield even deeper understandings and more robust policy recommendations.

Table 1: Key Research Limitations and Proposed Future Research Avenues

Limitation Identified	Impact on Current Study	Proposed Future Research Avenues
Limited Qualitative Generalizability	Insights specific to interviewed stakeholders, not necessarily representative of all actors.	Conduct broader qualitative studies with more diverse stakeholder groups, or focus on specific sub-groups.
Cross-sectional Quantitative Data	Cannot establish definitive cause-and-effect relationships; only correlations.	Implement longitudinal studies to track changes over time and causality.
Nuance of Individual Perceptions	May miss complex, unmeasurable factors influencing satisfaction.	Employ more in-depth qualitative methods or experimental designs.
In-depth Climate Change Impact Analysis	Focused primarily on current issues; did not fully explore long-term climate impacts.	Dedicated studies on climate resilience strategies and infrastructure adaptation.

5. CONCLUSION

This research holistically concludes that the complex problems of transportation and infrastructure in DKI Jakarta are rooted in rapid urbanization, uncontrolled population growth, and the limited capacity of existing infrastructure. Environmental and socio-economic factors further exacerbate these conditions, creating multidimensional challenges for the capital city. By employing a mixed-methods approach that integrates perspectives from the Pentahelix model through in-depth interviews with key stakeholders and broad public perception from quantitative surveys, this study successfully presents a comprehensive overview of the challenges and opportunities in Jakarta's urban planning and development. Key findings indicate that despite the government's commitment and significant efforts in developing public transportation systems and environmental programs, such as PPSU, the levels of community participation and intermodal integration still require serious attention to achieve optimal development effectiveness. Improvements in these areas are essential for Jakarta's sustainable future. Therefore, solutions to these intricate urban problems demand a multi-sectoral approach, active collaboration from various stakeholders, and a deeper understanding of citizens' needs and expectations.

Theoretically, this research makes a significant contribution to the literature on urban planning and sustainable urban development. By successfully integrating the Pentahelix model and mixed methodologies within the context of a developing country's megacity, this study fills a knowledge gap that has not been extensively explored comprehensively before. This integration provides a stronger framework for analyzing urban dynamics and fostering innovative solutions. Practically, the research findings offer a set of concrete and evidence-based recommendations for the DKI Jakarta Provincial Government, policymakers, and practitioners on the ground. These recommendations include improving the quality and integration of public transportation systems, strengthening more inclusive community participation mechanisms, and increasing transparency and accountability in the management of development policies and projects. Furthermore, the findings highlight the urgency of adapting urban design to mitigate detrimental environmental impacts, such as the urban heat island phenomenon and the persistent threat of flooding.

While this research has provided invaluable insights into understanding Jakarta's urban dynamics, it is important to acknowledge certain limitations. The relatively small qualitative sample size restricts the generalizability of interview findings. Meanwhile, the cross-sectional nature of the quantitative survey data precludes the definitive establishment of cause-and-effect relationships, instead only identifying correlations or associations between variables. These acknowledged limitations clearly indicate opportunities and the need for future research.

To address these gaps, subsequent studies could consider conducting longitudinal research to monitor the long-term impacts of policies and programs. Expanding the geographical scope to other metropolitan cities could offer rich comparisons and broader insights. Additionally, a more in-depth exploration of the role of technology in smart city management presents a promising area for further research. By continuously adapting and innovating in urban planning and development strategies, Jakarta holds

immense potential to transform into a more resilient, inclusive, and sustainable city, providing well-being for all its citizens in the future.

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