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Safety And Sustainable Public Transportation in The 21st Century

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Abstract

This study examines the current prospects of sustainable and safe public transportation in Indonesia in the 21st century. Through a comprehensive literature review, this study analyzes the challenges and opportunities in implementing an effective public transportation system that prioritizes safety and sustainability. The main findings highlight the suboptimal condition of public transportation, the low willingness of the public to use public transportation as the primary mode of transportation, and the implementation of inconsistent policies. The study proposes strategies to improve public transportation's quality, safety and sustainability, including infrastructure improvements, public awareness campaigns, and policies to prevent the use of private vehicles. Stakeholder coordination, community involvement, and innovation development in the transportation sector are emphasized. This study concludes that realizing safe and sustainable public transportation in Indonesia requires a multifaceted and long-term approach involving governments at all levels, the private sector, and society. Continuous evaluation and adaptive policy-making are essential to develop context-appropriate solutions appropriate to Indonesia's diverse regions.

Keywords: *Indonesia, public transportation, sustainability, safety, urban mobility*

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1. Introduction

Road transportation is an important part of the transportation system in Indonesia, playing a crucial role in supporting community mobility (Rarasati & Iskandar, 2017) (Abdullah & M., 2017). Individuals require transportation modes that facilitate their movement from one place to another, whether for work, education, or leisure purposes (Maulinasari, 2022). However, the increasing popularity of private vehicles, particularly motorcycles, has led to various challenges, including traffic congestion, air pollution, and safety concerns (Valenzuela et al., 2022) (Farida, 2018).(Rithoma & Rahmatullah, 2013).However, as the number of private vehicles increases, the problem of public transportation is becoming more complex, especially related to safety and sustainability.(Huu & Ngoc, 2021) The growth of private transportation has reached 10% per year in Indonesia, contributing to a significant increase in air pollution, which is a major concern (Putra et al., 2020). According to the World Health Organization (WHO), traffic accidents cause about 1.3 million deaths yearly worldwide (Bloombserg, 2023). Meanwhile, the transportation sector accounts for about 14% of global greenhouse gas emissions (Regional enviroment center & Exergia, 2004). Developing sustainable and safe public transportation is certainly an important solution to address this problem (Joewono & Kubota, 2006) (Mahardhika et al., 2021). The provision and use of safe, safe, comfortable, orderly, and sustainable public transportation in Indonesia is an important thing to pay attention to in the 21st century (Pearce et al., 2000). The current focus of public transportation development in Indonesia is on how to encourage the Indonesian public to be more inclined and interested in utilizing public transportation as their primary mode of transport for their everyday activities (Insani et al., 2023) (Estetiono et al., 2017). Kondisi Angkutan Umum di

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Indonesia saat ini. The Indonesian government has taken various actions to address these challenges, including implementing the "Back to Public Transportation" national movement (Irmawandari et al., 2022). The national movement aims to encourage the public to choose public transportation as their primary mode of transportation to reduce the use of private vehicles and improve overall transportation efficiency (Insani et al., 2023)(Ratnawati, 2021). However, this program has not been fully successful, therefore it is necessary (Hipogrosso & Nesmachnow, 2020) to evaluate the challenges and opportunities in implementing sustainable and safe public transportation in Indonesia (Rarasati & Iskandar, 2017).

Some of the research studies that have been conducted and related to this include (Farida, 2018), These studies examine research on public transportation services, focusing on safety aspects such as the provision of services by government and private entities, as well as the public's utilization of these services (Joewono & Kubota, 2006). From these studies, it can be seen that the presence of public transportation modes does not automatically solve transportation problems, especially safety issues for users (Hipogrosso & Nesmachnow, 2020). Research studies underscore the imperative to improve the quality, comfort, and dependability of public transportation services in Indonesia, as a significant number of vehicles are in a state of disrepair and poor condition (Gundersen et al., 2022).

Additionally, the studies highlight the need to increase public awareness and willingness to use public transportation as the primary mode of transport, as this is crucial for the success of the "Back to Public Transportation"(Yildizhan & BİLGİÇ, 2023). Further evaluation is needed to examine the role of public transportation services in facilitating the desired shift towards increased public transportation usage (Abou-Zeid & Ben-Akiva, 2012) (Borhan et al., 2017). Realizing safe and sustainable transportation in Indonesia faces significant challenges, as evidenced by the follow-up evaluation (Priyadi et al., 2022). The government grapples with obstacles such as the continued lack of public interest in utilizing public transportation for day-to-day activities, as well as the relative ease of acquiring private vehicles in the country (Agaton et al., 2020)(Guno et al., 2021) (Ernawati & Lutfi, 2022) (Gundersen et al., 2022). The government's policy initiatives have occasionally created new challenges in the implementation of its program to encourage the public to return to using public transportation (Menghwar, 2021). Inconsistent policies and actions may potentially hinder the Indonesian government's efforts to establish safe and sustainable public transportation systems. Implementing sustainable and safe public transportation is a crucial goal, as it can mitigate negative impacts on congestion, environmental pollution, and the social and economic well-being of the community (Valenzuela et al., 2022). To address these challenges and move towards sustainable and safe public transportation in Indonesia, several key strategies can be considered (Sari & Hidayat, 2020). First, it is crucial to enhance the quality, comfort, and reliability of public transportation services (Jannah et al., 2020). This objective can be realized through strategic capital expenditures in infrastructure enhancements, including the establishment of dedicated bus lanes, the development of transportation hubs, and the improvement of accessibility measures (Hipogrosso & Nesmachnow, 2020) (Christopher et al., 1999).

The government should make it a priority to modernize and replace aging public vehicles to ensure they meet safety standards and provide a comfortable experience for passengers (Cheranchery et al., 2019). Second, a deliberate and coordinated strategy is necessary to heighten public consciousness and promote increased utilization of public transportation services (Min, 2014). Evolve targeted public campaigns, educational initiatives, and the provision of integrated ticketing systems that make public transportation more user-friendly and accThis can inessible (Currie & Rose, 2008). Third, the government should examine policies that would discourage private vehicle ownership and usage, such as increasing parking fees, implementing congestion pricing, or restricting private vehicle access to specific areas (Guno et al., 2021) (Handy, 2020) (Gu & Liang, 2021) (Erhardt et al., 2022). The purpose of this study is to analyze the current condition of public transportation in Indonesia and

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strategies that can be applied to realize safe, comfortable, and sustainable public transportation in the 21st century.

2. Methods

The method used is a literature review from various sources related to public transportation services, especially those related to safety and sustainability. The data and information gathered come from journals, books, reports, and the results of previous research on topics related to public transportation. The method used in this study is a literature study that utilises various sources to gain an in-depth understanding of public transport services, particularly in terms of safety and sustainability. The process began with the collection of data from relevant academic journals, books, reports and previous research. Academic journals provided up-to-date information and in-depth analyses, while textbooks offered theoretical and practical context. Reports from government agencies and non-governmental organisations provide data and policy evaluation, while previous research provides additional insights and support for the arguments. Once the data is collected, the next stage is the analysis and synthesis of the information, which involves identifying key themes, comparing findings, and integrating information from multiple sources to build a comprehensive understanding. The process concludes with the writing of a report or paper that presents the results of the analysis systematically, complete with appropriate citations and references to support academic validity. This method aims to provide a comprehensive overview of safety and sustainability in public transport services by utilising existing knowledge.

Academic journals provide current data and in-depth research on safety and sustainability aspects of public transport. Books provide theoretical background and comprehensive information on the topic. Reports published by government agencies or other organisations provide data and practical evaluations of policy and implementation. In addition, previous research adds insight by providing historical context or relevant case studies. Once the information has been collected, the next step is to analyse and synthesise the data from the various sources. This involves identifying key themes, such as safety strategies and sustainability practices, and comparing findings from different studies to understand trends and differences. This process aims to bring together information from multiple perspectives and generate a thorough understanding. Finally, the results of the analysis are outlined in a report or paper that presents the findings in a systematic and clear manner. This writing is accompanied by appropriate references to ensure the accuracy and reliability of the information presented. In this way, the desk study helps build a complete picture of the challenges and solutions in public transport services related to safety and sustainability.

3. Result and Discussion

This literature review reveals several key insights regarding public transportation in Indonesia in the 21st century. The prevailing state of public transportation services in Indonesia remains suboptimal, with a substantial number of public vehicles in a state of disrepair, inadequate maintenance, and failure to meet safety standards. Substandard public transportation conditions and the deterioration of public vehicles have become important factors that encourage low levels of public satisfaction and the use of public transportation services in Indonesia (Nurlukman et al., 2020)(Menghwar, 2021).

Why is this the case? The primary causes are the insufficient allocation of resources for upgrading and upkeeping the public transportation fleet, combined with the difficulties in consistently enforcing safety standards across the system. The limited willingness of the Indonesian populace to adopt public transportation as their primary mode of commute represents a key obstacle to achieving sustainable public transportation systems. As highlighted in the research, the lack of public awareness and an ingrained cultural preference for private vehicle usage significantly impede efforts to shift commuter behavior toward public transportation (Insani et al., 2023)(Munawar, 2007). The Indonesian government has

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endeavored to bolster the quality of public transportation through the implementation of the "Return to National Public Transportation" initiative, yet its execution has not been fully optimal.

Figure 1. Road Traffic Constraints in Indonesia
Source: Data Processing

The limited willingness of the Indonesian populace to adopt public transportation as their primary mode of commute represents a key obstacle to achieving sustainable public transportation systems (Munawar, 2007) (Pelangi et al., 2021). As highlighted in the research, the lack of public awareness and an ingrained cultural preference for private vehicle usage significantly impede efforts to shift commuter behavior toward public transportation. The Indonesian government has endeavored to bolster the quality of public transportation through the implementation of the "Return to National Public Transportation" initiative, yet its execution has not been fully optimal (Insani et al., 2023) (Munawar, 2007).

Table 1. Data on the Number of Vehicles of Each Police in Indonesia in 2024

NO	POLDA	MP	BUS	MB	MOTORCYCLE	RANSUS	ENTIRE	%
1	JAWA TIMUR	5.456.587	42.681	779.436	19.154.472	3.868	25.438.263	15,61
2	METRO JAYA	4.322.642	48.275	875.249	19.092.738	67.067	24.405.990	14,98
3	JAWA TENGAH	1.527.806	35.473	662.691	18.603.484	8.664	20.841.865	12,79
4	JAWA BARAT	1.946.556	24.743	577.127	16.893.126	7.840	19.450.603	11,94
5	SUMATERA UTARA	823.437	9.341	320.253	6.797.602	3.921	7.954.970	4,88
6	SULAWESI SELATAN	609.827	5.297	232.656	4.382.340	15.440	5.246.221	3,22
7	BALI	510.946	15.301	182.690	4.380.025	1.354	5.090.708	3,12
8	RIAU	430.522	5.743	239.007	3.950.514	2.628	4.628.414	2,84
9	SUMATERA SELATAN	435.395	7.040	343.417	3.502.548	12.598	4.301.043	2,64
10	LAMPUNG	323.105	3.397	194.656	3.634.985	2.508	4.158.651	2,55
11	KALIMANTAN TIMUR	334.597	7.114	218.037	2.943.202	2.992	3.506.262	2,15
12	BANTEN	300.386	4.075	97.555	3.052.874	1.522	3.457.768	2,12
13	DIY	370.569	4.339	71.963	2.811.035	1.264	3.259.501	2,00
14	KALIMANTAN BARAT	183.544	1.771	120.369	2.884.391	1.310	3.191.401	1,96
15	KALIMANTAN SELATAN	262.181	3.744	159.209	2.695.979	1.913	3.123.218	1,92
16	SUMATERA BARAT	362.748	4.494	128.807	2.506.593	1.538	3.005.418	1,84
17	JAMBI	200.836	33.655	147.519	2.384.951	1.735	2.768.941	1,70
18	ACEH	201.180	2.601	77.675	2.389.319	4.752	2.675.841	1,64
19	NUSA TENGGARA BARAT	117.044	2.889	89.793	2.028.450	1.052	2.239.419	1,37
20	KALIMANTAN TENGAH	124.061	1.764	87.463	1.507.208	1.601	1.724.820	1,06
21	KEPRI	220.456	2.415	38.548	1.260.762	516	1.523.387	0,94
22	SULAWESI TENGAH	113.419	1.038	61.542	1.308.541	760	1.485.772	0,91
23	KEP. BABEL	92.922	1.239	51.156	1.079.524	521	1.225.620	0,75
24	BENGKULU	120.936	930	55.132	1.037.155	502	1.214.674	0,75
25	SULAWESI TENGGARA	193.461	366	51.849	954.082	362	1.200.274	0,74
26	SULAWESI UTARA	160.769	1.616	76.941	913.685	575	1.153.754	0,71
27	NUSA TENGGARA TIMUR	70.962	3.443	66.189	971.761	6.250	1.119.429	0,69
28	PAPUA	104.531	1.697	54.023	800.835	685	961.783	0,59
29	GORONTALO	41.933	373	31.987	473.176	703	548.184	0,34

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30	SULAWESI BARAT	26.574	92	17.511	395.010	86	440.535	0,27
31	PAPUA BARAT	39.285	431	20.173	350.351	1.959	412.259	0,25
32	KALIMANTAN UTARA	26.443	307	19.516	352.332	473	399.071	0,24
33	MALUKU	30.047	509	16.216	350.136	237	397.145	0,24
34	MALUKU UTARA	25.005	181	15.536	337.845	233	378.937	0,23
TOTAL		**20.110.712**	**278.374**	**6.181.891**	**136.181.031**	**159.429**	**162.930.141**	

Source: Korlantas Polri Last update : 2024-06-24 22:27:55

Table 2. Data on the Number of Vehicles on Each Island in Indonesia in 2024

No.	ISLAND NAME	MP	BUS	MB	MOTORCYCLE	RANSUS	ENTIRE	%
1	JAWA	13.924.546	159.586	3.064.021	79.607.729	90.225	96.853.990	59,45
2	SUMATERA	3.211.537	70.855	1.596.170	28.543.953	31.219	33.456.959	20,53
3	KALIMANTAN	930.826	14.700	604.594	10.383.112	8.289	11.944.772	7,33
4	SULAWESI	1.145.983	8.782	472.486	8.426.834	17.926	10.074.740	6,18
5	BALI	510.946	15.301	182.690	4.380.025	1.354	5.090.708	3,12
6	NUSA TENGGARA	188.006	6.332	155.982	3.000.211	7.302	3.358.848	2,06
7	PAPUA	143.816	2.128	74.196	1.151.186	2.644	1.374.042	0,84
8	MALUKU & MALUKU UTARA	55.052	690	31.752	687.981	470	776.082	0,48
TOTAL		**20.110.712**	**278.374**	**6.181.891**	**136.181.031**	**159.429**	**162.930.141**	

Source: Korlantas Polri Last update : 2024-06-24 22:27:55

Findings from the literature review suggest that a comprehensive strategy is required to enhance the quality, safety, and sustainability of public transportation in Indonesia. This includes the improvement of modern transportation infrastructure, such as the development of integrated public transport networks, the provision of dedicated bus lanes, and the enhancement of intermodal connectivity (Farida, 2018). Strengthening public campaigns and incentives to encourage people to switch to public transportation are also important factors.

Figure 2. Transportation Infrastructure Development
Source: Data Processing

However, policies that discourage the use of private vehicles may face significant public resistance and could be politically challenging to implement. While such policies may support the development of sustainable public transportation, they must be carefully balanced with the need to accommodate the preferences and needs of the public, who may be reluctant to give up the convenience and flexibility of private vehicle usage (Timilsina & Dulal, 2010)(Wei et al., 2020). Effective coordination among the central government, local authorities, and other relevant stakeholders is imperative for realizing safe and sustainable public transportation

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systems (Buehler, 2018) Conducting regular and systematic evaluations of the efficacy of public transportation programs and policies is also a pressing imperative to ensure their continued relevance and effectiveness (Singh et al., 2020).

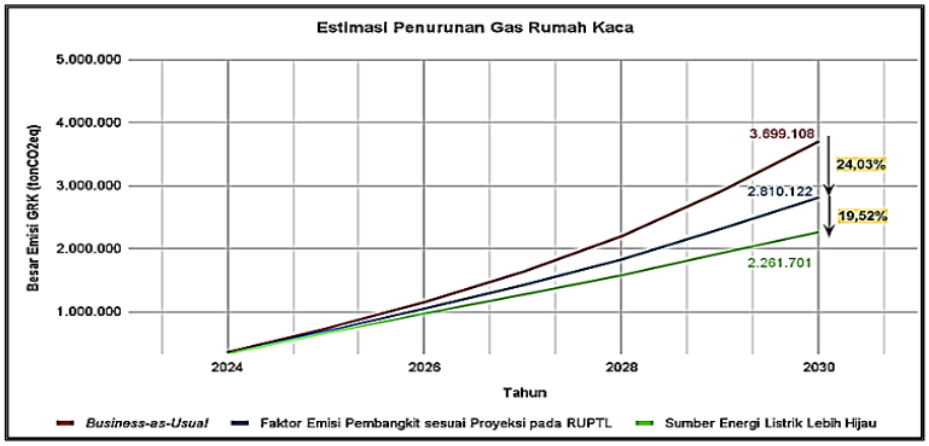

Figure 3. Estimated Greenhouse Gas Reduction
Source: Data Processing

The Indonesian government has attempted to enhance the quality of public transportation through the implementation of the "Return to National Public Transportation" initiative, yet the execution of this program has not been fully effective (Rahman & Nurzaman, 2023). While ensuring the provision of safe, comfortable, and sustainable public transportation is important, it may not be the most critical element in establishing a more environmentally responsible urban transportation system and enhancing community well-being (Yildizhan & BİLGİÇ, 2023). Other factors, such as urban planning, infrastructure development, and public awareness campaigns, may play an equally vital role in driving the shift toward a more sustainable transportation paradigm (Valenzuela et al., 2022).

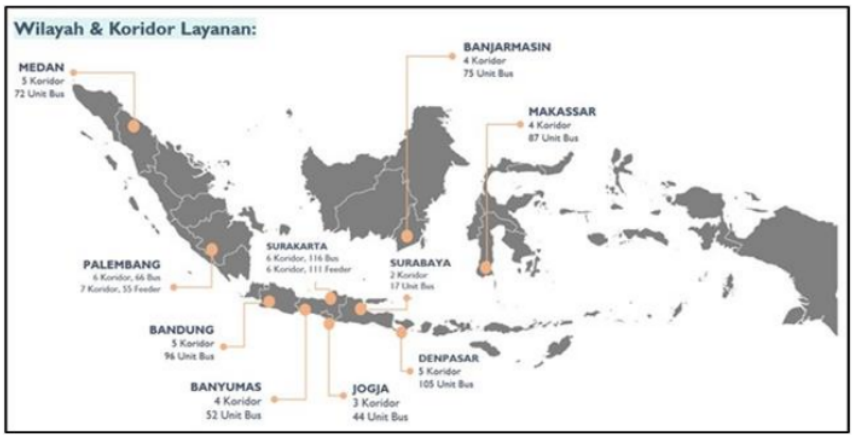

Figure 4. Map of Bus Friends Crossing until 2023
Source: Data Processing

While a comprehensive strategy to enhance the quality, safety, and sustainability of public transportation in Indonesia is undoubtedly important, it may not be sufficient on its own

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(Putra et al., 2020). Opponents argue that a balanced approach encompassing urban planning, infrastructure development, and public awareness campaigns may be equally, if not more, vital in driving the shift toward a more sustainable transportation paradigm (Pojani & Stead, 2015). Coordinating the efforts of various stakeholders, including the central government, local authorities, and the public, is crucial for the successful implementation of this comprehensive strategy (Sustainable Mobility Policy – 2030, 2023)(McPhearson et al., 2021).

While strengthening public campaigns and incentives to encourage people to switch to public transportation may be important factors, opponents argue that such efforts alone are unlikely to be sufficient in driving a meaningful shift toward sustainable transportation(Proc. et al., 2013). A more comprehensive approach that also addresses urban planning, infrastructure development, and public awareness may be equally, if not more, vital in catalyzing the transition to a sustainable transportation paradigm(McPhearson et al., 2021).

However, policies that discourage the use of private vehicles may face significant public resistance and could be politically challenging to implement (Transitions to Alternative Transportation Technologies—Plug-in Hybrid Electric Vehicles, 2009). While such policies may support the development of sustainable public transportation, they must be carefully balanced with the need to accommodate the preferences and needs of the public, who may be reluctant to give up the convenience and flexibility of private vehicle usage (Guno et al., 2021) (Timilsina & Dulal, 2010) (Wei et al., 2020)(Singh et al., 2020). Effective coordination among the central government, local authorities, and other relevant stakeholders is imperative for realizing safe and sustainable public transportation systems (Irmawandari et al., 2022).

However, effective coordination among the central government, local authorities, and other relevant stakeholders may not be sufficient to realize safe and sustainable public transportation systems (Zhang, 2021). Critics argue that a more decentralized and community-driven approach, allowing for greater local autonomy and citizen participation, could be equally if not more effective in addressing the unique needs and preferences of different communities across the diverse and geographically dispersed Indonesian archipelago (Friedman et al., 2020). Empowering local stakeholders and incorporating community input can enable the development of transportation solutions tailored to the specific challenges and cultural contexts of each region, rather than relying solely on a top-down, one-size-fits-all strategy imposed by the central government (Talpur et al., 2014)(Duleba & Moslem, 2018). This bottom-up approach may foster a greater sense of ownership and investment among the public, thereby increasing the likelihood of successful and long-lasting adoption of sustainable transportation practices (Ling et al., 2021) (Reynante et al., 2021) (Cong & Thomsen, 2021).

While conducting regular and systematic evaluations of the efficacy of public transportation programs and policies is a pressing imperative, opponents argue that such evaluations alone may not be sufficient (Buenk et al., 2019) (Valenzuela et al., 2022)(Wang et al., 2021). They contend that a more holistic approach, which also considers urban planning, infrastructure development, and public awareness campaigns, may be equally, if not more, vital in ensuring the long-term sustainability and effectiveness of public transportation systems(Chen & Zhu, 2020). Such a comprehensive strategy would enable policymakers to better understand the diverse needs and preferences of local communities and develop tailored solutions that resonate with the public(Lieberman et al., 2001) (Johnson et al., 2022)(Singh et al., 2020)(Watkins et al., 2021). This could involve empowering local stakeholders, fostering community engagement, and integrating bottom-up feedback into the decision-making process (Innovative Citizen Participation and New Democratic Institutions, 2020)(Fernandes et al., 2019). By adopting a more decentralized and community-driven approach, the development of sustainable public transportation can be more effectively aligned with the unique circumstances and cultural contexts across the Indonesian archipelago (Solihati & Indriyani, 2021) (Hasibuan & Permana, 2022) (Chen & Zhu, 2020).

While ensuring the provision of safe, comfortable, and sustainable public transportation is an important component for establishing more environmentally responsible urban transportation systems, opponents contend that it is not the sole or most critical element (Diani,

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2021) (Ratnawati, 2021) (Pelangi et al., 2021). They argue that other factors, such as comprehensive urban planning, strategic infrastructure development, and impactful public awareness campaigns, may play equally vital roles in driving a shift toward a more sustainable transportation paradigm (Ling et al., 2021). A more comprehensive approach that addresses these broader factors, in addition to enhancing public transportation, may be necessary to catalyze a meaningful and lasting transition to a sustainable transportation system (Gallo & Marinelli, 2020). Effective coordination and collaboration among diverse stakeholders, including government agencies, local authorities, and the public, will be crucial in developing and implementing such a holistic strategy that can effectively address the multifaceted challenges of sustainable urban mobility (Kanuri et al., 2019) (Makarova et al., 2019) (Lyons, 2018) (McPhearson et al., 2021).

Fostering research and innovation in the field of public transportation is also a critical imperative to support the government's policy objectives (Irmawandari et al., 2022) (Kanuri et al., 2019). Investing in R&D can drive the development of new technologies, designs, and operational models that enhance the efficiency, safety, and sustainability of public transportation systems (Kaewunruen et al., 2016) (Insani et al., 2023). Innovations in areas such as alternative fuel sources, intelligent traffic management, and user-friendly interfaces can help make public transportation more attractive and accessible to the public, ultimately contributing to the adoption of more sustainable urban mobility practices (Sarkar & Ward, 2016) (Menezes et al., 2017) (Alsaleh & Farooq, 2023). Additionally, supporting pilot projects and experimental initiatives that test novel transportation solutions can provide valuable insights to inform the creation of effective, context-specific policies and strategies(Lyons, 2018)(Menezes et al., 2017)(Wimbadi et al., 2021). Encouraging collaboration between public agencies, academic institutions, and private sector partners can further catalyze innovation and drive the implementation of cutting-edge public transportation technologies and services(Legaspi et al., 2020).

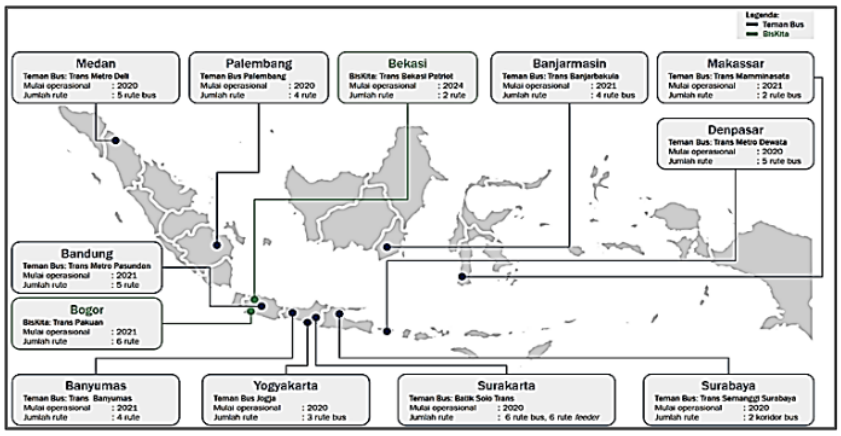

Figure 5. City of Implementation of Teman Bus and BisKita
Source: Data Processing

4. Conclusion

The development of safe and sustainable public transportation in Indonesia faces significant challenges, as evidenced by the continued reliance on private vehicles, lack of public interest, and inconsistent policy implementation. Effective coordination among stakeholders, the incorporation of community input, and a more comprehensive approach that addresses broader urban planning and public awareness factors will be critical in driving a meaningful and lasting transition to a sustainable transportation system. Fostering innovation and research in the field of public transportation can also play a pivotal role in enhancing the

efficiency, safety, and attractiveness of these services, ultimately contributing to their widespread adoption and the realization of more environmentally responsible urban mobility practices. However, overcoming these challenges will require a sustained and multifaceted effort involving all levels of government, the private sector, and the public. Continuous monitoring and evaluation of public transportation programs, coupled with adaptable and responsive policy-making, will be necessary to ensure the long-term viability and effectiveness of sustainable transportation solutions tailored to the unique needs and contexts of Indonesia's diverse regions.

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