




Electric vehicles and smart traffic systems as urban emission solutions: an analysis of jakarta within the SDG framework

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i></p> <p>Received Dec 13, 2025 Revised Dec 24, 2025 Accepted Jan 13, 2026</p> <p><i>Keywords:</i></p> <p>Company X; Learning Organization; Organization Commitment; Turnover Intention.</p>	<p>Jakarta, as one of the largest metropolitan cities, faces significant environmental pressures due to urbanization and high vehicle volumes. This paper examines technological innovations in sustainable transportation in Jakarta, aiming to fundamentally reduce carbon emissions and improve energy efficiency. Technologies such as electric vehicles (EVs), alternative fuels, and intelligent traffic management systems (ITS) offer potential solutions to address the city's chronic air pollution and congestion issues. However, the implementation of these technologies faces significant challenges such as limited charging infrastructure, high initial implementation costs, and the complexity of integrating with existing public transportation systems. An in-depth analysis was conducted to compare the existing situation with the targets of Sustainable Development Goals (SDGs) 7 (Clean Energy) and 11 (Sustainable Cities), identifying significant gaps in achieving these targets, particularly in the use of renewable energy and improving air quality. The study concludes that while these technologies offer a promising pathway, successful adoption relies heavily on strong policy commitments, strategic investments, and collaboration among transportation institutions to achieve truly sustainable urban mobility.</p> <p><i>This is an open access article under the CC BY-NC license.</i></p> 

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1. INTRODUCTION

In recent decades, the negative impact of conventional transportation systems on the environment has become a growing global concern (Agni, 2021). Carbon emissions from motor vehicles contribute significantly to climate change and air pollution. Therefore, technological innovation in sustainable transportation is becoming increasingly important to reduce carbon footprints and improve quality of life (Aulia, 2020). Technologies such as electric vehicles, autonomous transportation, and intelligent traffic management systems offer potential solutions to these issues (Nugroho, 2021). While these technological solutions have been widely discussed, in-depth studies of the specific

implementation challenges and gaps with SDG targets in dense urban contexts like Jakarta are limited (Wibowo, 2022).

In its 2025 Regional Long-Term Development Plan (RPJPD) and Regional Government Work Plan (RKPD), Jakarta affirms its ambition to become a global city that is advanced, competitive, and sustainable. This is achieved through six benchmark indicators, including a clean, comfortable, and sustainable environment. In the Global Cities Report 2024 released by international consultancy Kearney, Jakarta ranks only 74th out of 156 cities. Other data from the Oxford Economics Global Cities Index 2025 places Jakarta at 159th. Its ranking is below several Southeast Asian cities, such as Singapore (21st) and Kuala Lumpur (79th).

Data from the ITSC will help the Environmental Agency identify road sections and emissions violations, enabling law enforcement. The cameras equipped with Automatic Number Plate Recognition (ANPR) technology used in the ITCS will transmit data to the Environmental Agency. This will allow for easy identification of road sections with the highest number of vehicles and emissions violations. According to him, Jakarta still faces significant challenges in providing adequate green space. Currently, only about 5% of the city's total area is green open space, far below global city standards, which require cities to have 20% to 30% green space. Jakarta needs to optimize abandoned land into small parks or pocket gardens, as has been done in Bangkok and New York.

This study illustrates that effective integration between innovative technologies and progressive policies is key to creating environmentally friendly and sustainable transportation networks. With rapid population growth and urbanization, mobility-related challenges are becoming increasingly pressing, including congestion, air pollution, and increased energy consumption. This study aims to analyze the role of technology and policy in realizing sustainable transportation networks. The strategy used in this study is a literature review strategy with a systematic approach to collect, review, and analyze literature relevant to the topic of the role of technology and policy in realizing sustainable transportation networks. Technology and policy in realizing sustainable transportation networks are very important. The implication of this finding is that technology is very influential on sustainable transportation by providing innovative solutions that can increase efficiency, reduce emissions, and improve comfort in transportation. This study also provides a better understanding of technology and policies that influence sustainable transportation.

This paper begins with an explanation of the case study methodology, followed by an analysis of the innovations, challenges, and comparisons with the SDGs, before concluding with conclusions and recommendations.

2. RESEARCH METHOD

Secondary data-driven research is an efficient and effective approach to answering various scientific questions, especially when time, cost, and resources are major constraints. By utilizing readily available data, researchers can explore various social, economic, educational, and environmental phenomena without having to go directly into the field. However, like any other approach, this research also has limitations that must be carefully anticipated. Selecting credible data sources, understanding the data context, and using appropriate analytical methods are key to the success of this type of research.

Case study research is a type of research that focuses in-depth on a single case or specific unit, such as an individual, group, organization, or event, to understand its characteristics, complexities, and dynamics (Siregar, 2022). In the context of sustainable transportation research in Jakarta, case studies serve to examine how technological innovations, such as electric vehicles and smart traffic management systems, are implemented and addressed by the city (Prasetyo, 2021). This method was chosen because of its ability to unravel the complexity of the urban transportation system that

involves many stakeholders and variables (Gunawan, 2022). This case study analyzes secondary data sourced from the Greater Jakarta Transportation Master Plan (RITJ) report, BPS data, the Jakarta Regional Energy General Plan (RUED), and air quality data (Hardjoso, 2023). Through case studies, this research can provide an in-depth overview of transportation conditions in Jakarta, the challenges that arise, and how close the city is to achieving Sustainable Development Goals (SDG) standards in the transportation and energy sectors (Mulyono, 2021).

3. RESULTS AND DISCUSSIONS

3.1 Technological innovation in transportation

Technological innovations in transportation, such as electric vehicles and alternative fuels, play a crucial role in reducing carbon emissions. Electric vehicles reduce emissions because they use electricity instead of fossil fuels and are more energy efficient. Furthermore, the use of biofuels, hydrogen, and synthetic fuels also helps reduce dependence on fossil fuels.

Our study shows that the use of electric vehicles can significantly reduce fuel consumption. However, EVs do not automatically reduce emissions. Without a parallel transition to sustainable renewable energy sources, the use of electric vehicles will only eliminate emissions from tailpipes to power plant chimneys. Furthermore, the effectiveness of these new vehicle models depends heavily on supporting infrastructure and transportation policies that support comprehensive energy efficiency.

The energy transition, particularly in the transportation sector, is not simply a matter of replacing fossil-fueled engines with batteries. This step requires a major transformation that requires a new paradigm in building an efficient, affordable, and low-carbon transportation system. Electric vehicles must be seen as one part of a broader strategy to achieve energy balance.

Other technologies, such as hybrid vehicles, sustainable public transportation, and aerodynamic designs with lightweight materials, improve energy efficiency. Autonomous driving and connectivity systems can optimize routes and traffic management, reducing energy consumption. All of these innovations contribute to reducing carbon emissions and increasing efficiency in the transportation sector.

a. Electric Vehicles (EV)

Emission Reduction: Using electricity as a power source reduces greenhouse gas emissions compared to fossil-fueled vehicles.

Energy Efficiency: Electric motors are more efficient than internal combustion engines, resulting in less wasted energy. This innovation is seen as a key effort to improve environmental sustainability and promote a green economy in Indonesia.



Figure 1. Electric vehicles charging

(Source: <https://atonergi.com>)

b. Alternative Fuels

Biofuels and Hydrogen: Using biofuels and hydrogen can reduce dependence on fossil fuels and reduce carbon emissions.

Development of Synthetic Fuels: These fuels can be produced with lower carbon emissions.



Figure 2. Use of biofuel
(Source: <https://depositphotos.com>)

Illustrates the concept of biofuel, a fuel derived from biomass (organic matter), as an alternative to fossil fuels. In the context of Jakarta, the development of biofuels such as biodiesel (e.g., B30 or B40 blended with diesel) is crucial for reducing particulate and greenhouse gas emissions from the transportation sector, particularly from the bus and heavy truck fleets that still dominate the roads.

c. Hybrid Technology

Combination of Engine and Electric Motor: Hybrid vehicles use both a combustion engine and an electric motor, which can reduce fuel consumption and emissions.

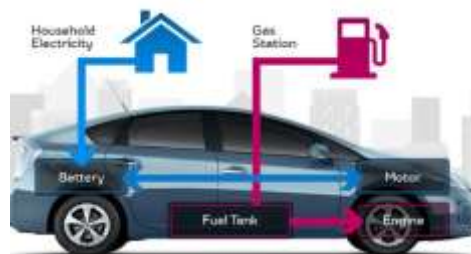


Figure 3. Examples of hybrid vehicles
(Source: <https://kompasiana.com>)

Demonstrates the basic working principle of a hybrid electric vehicle (HEV). This technology serves as a transitional bridge to full electrification, combining an internal combustion engine (gasoline) and an electric motor. In dense stop-and-go traffic conditions like those in Jakarta, the electric motor can take over when the vehicle is slowing down or stopped, significantly saving fuel consumption and reducing emissions at congestion points.

d. Sustainable Public Transport

Electric Trains and Electric Buses: Replacing older modes of transportation with electric trains and buses can significantly reduce emissions, although the transition of large fleets such as TransJakarta faces complex infrastructure and operational challenges.

Smart Management System: Optimizing routes and schedules to reduce energy consumption and increase efficiency. The implementation of smart mobility, as evaluated

in Jakarta, is crucial for integrating various modes and improving overall system efficiency. Integration efforts through an Intelligent Transportation System (ITS) are essential for improving overall system efficiency.

3.2 Challenges of Implementing Sustainable Transportation Technologies

The implementation of sustainable transportation technologies faces several key challenges, including limited infrastructure, high implementation costs, and difficulties integrating with existing transportation systems. Studies of policy structures in Indonesia also highlight that vehicle costs, infrastructure, and perceived social factors play a significant role in electric vehicle adoption. Furthermore, vehicle cost, infrastructure availability, and social factors are also perceived as significant barriers to and opportunities for adoption. All of these factors need to be addressed through investment in research and development (R&D) and decentralized infrastructure. These can be categorized as follows:

a. Limited Infrastructure

Challenge: Existing infrastructure may not be ready for new technologies, such as electric vehicles (EVs) or hydrogen-based transportation. EV charging requires widespread stations and a more robust electricity grid.

b. Implementation and Maintenance Costs

Challenge: Implementing sustainable transportation technologies requires significant upfront investment. Furthermore, maintaining sustainable infrastructure can be a financial challenge for local governments or the private sector.

c. Integration with Existing Transportation Systems

Challenge: Integrating new technologies with conventional transportation systems can be complex, especially for cities with aging infrastructure. New technologies such as autonomous vehicles or EVs require different support systems than conventional transportation.

3.3 Comparison of Jakarta's transportation conditions with Sustainable Development Goals (SDG) standards.

Currently, the transportation and energy conditions in Jakarta show several gaps when compared to the Sustainable Development Goals (SDG) targets, especially in the indicators of sustainable transportation and energy.

a. SDG 7 (Clean and Affordable Energy)

SDG 7 targets access to affordable, reliable, sustainable, and modern energy. Jakarta still faces challenges when it comes to renewable energy sources, as the majority of its energy still comes from fossil-based sources. Renewable energy use in Jakarta remains low and limited, despite initiatives such as the installation of solar panels on public and private buildings. This highlights the need for increased adoption of renewable energy and broader energy efficiency efforts.

Primary Energy Mix Targets for DKI Jakarta Province, consist of Petroleum, Natural Gas, Coal and EBT.



Figure 4. Energy Mix Targets Based on DKI Jakarta's RUED Jakarta 2023-2050

b. SDG 11 (Sustainable Cities and Human Settlements)

SDG 11 aims to make cities and human settlements inclusive, safe, resilient, and sustainable by ensuring access to affordable housing, improving sustainable transport, and strengthening public participation in urban planning. This goal also emphasizes reducing negative environmental impacts, providing access to safe and inclusive public spaces, and enhancing disaster resilience. Furthermore, it is crucial to protect cultural and natural heritage, ensure cities can accommodate population growth, and improve the quality of life for all residents.

This SDG prioritizes safe, accessible, and sustainable public transport. Jakarta has shown progress with the TransJakarta, MRT, and LRT programs, which support accessibility and reduce private vehicle use. However, the penetration and integration of public transport is not evenly distributed across the region, and challenges remain related to traffic congestion and high levels of air pollution. With air quality still at alarming levels, Jakarta faces significant challenges to fully achieve this indicator.

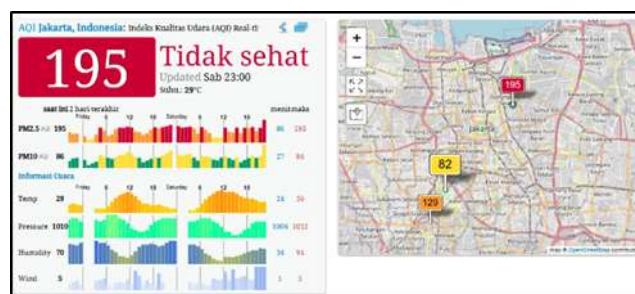


Figure 5. Jakarta air data from
(Source: <https://aqicn.org/city/jakarta/id/>)

According to the 2020 population census, the Greater Jakarta (Jabodetabek) population represents 11% of Indonesia's population. Compared to the population of Java, 21% of the population is concentrated in the Greater Jakarta area. The total population of Jakarta Province and the regencies/cities within the Greater Jakarta area in 2023 is approximately 32 million. Jakarta Province has the largest population, with 10,672,000 people, or 33% of the Greater Jakarta population. Bogor Regency has the second largest population, with 5,682,300 people.

Wilayah	Jumlah Penduduk				
	2019	2020	2021	2022	2023
Provinsi DKI Jakarta	10.557.810	10.562.088	10.609.681	10.679.951	10.672.100
Kabupaten Bogor	5.965.410	5.427.070	5.489.540	5.556.310	5.662.300
Kabupaten Bekasi	3.763.890	3.113.020	3.157.960	3.193.840	3.237.420
Kabupaten Tangerang	3.800.787	3.245.619	3.293.533	3.352.472	3.362.605
Kota Bogor	1.112.080	1.043.070	1.052.360	1.060.940	1.070.720
Kota Bekasi	3.003.920	2.543.680	2.564.940	2.598.070	2.627.210
Kota Depok	2.406.830	2.056.340	2.065.940	2.113.620	2.145.400
Kota Tangerang	2.229.901	1.895.486	1.911.914	1.930.556	1.963.966
Kota Tangerang Selatan	1.747.906	1.354.350	1.365.688	1.378.466	1.399.496
Jabodetabek	34.588.534	31.240.723	31.531.556	31.864.225	32.161.217

Figure 6. Jabodetabek population data 2019-2023

Based on data processing from the Central Statistics Agency (BPS), the total number of vehicles in Greater Jakarta (Jabodetabek) reached 33,106,097 units. This comprises 5,548,131 cars, 52,209 buses, 1,130,562 trucks, and 26,375,195 motorcycles. Motorcycles, as the major contributor to pollution, dominate the number of vehicles in Greater Jakarta, accounting for 80% of the total number. The number of motorcycles in 2023 increased by 6% compared to the previous year. The following table presents data on the number of motorized vehicles by region in Greater Jakarta.

Wilayah	Mobil	Bus	Truk	Motor
Provinsi DKI Jakarta	5.548.131	52.209	1.130.562	26.375.195
Kabupaten Bogor	184.107	973	48.429	1.433.350
Kabupaten Bekasi	222.775	3.315	59.726	1.227.730
Kabupaten Tangerang	217.751	1.736	57.595	1.306.093
Kota Bogor	93.048	621	11.772	362.278
Kota Bekasi	306.651	2.331	51.445	1.147.706
Kota Depok	192.021	698	19.245	928.839
Kota Tangerang	238.480	2.275	48.534	1.029.881
Kota Tangerang Selatan	261.807	1.548	31.215	712.142
Jabodetabek	5.548.131	52.209	1.130.562	26.375.195

Figure 7. Motorcyclist Data in the Jakarta Area, source: RITJ Ministry of Transportation 2024

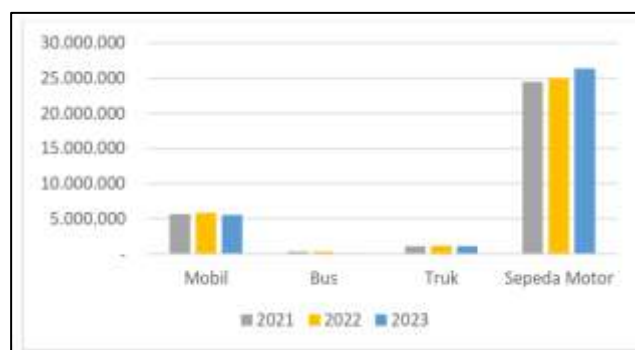


Figure 8. Motorbike Data for the last 3 years in the Jakarta area Source: Ministry of Transportation's 2024 RITJ

The population growth of Greater Jakarta (Jabodetabek) for 2020-2023, based on calculations using data from the Central Statistics Agency (BPS), was 0.97%. The highest population growth was in Bekasi City at 1.88%. Bekasi City's population growth increased from 0.83% between 2010 and 2020. Other areas experiencing population growth include South Tangerang City, Bogor Regency, and Tangerang City. Along with the increase in population growth on the Jakarta side, population growth in DKI Jakarta

decreased. From 2010 to 2020, the population growth rate in DKI Jakarta was 0.92%, decreasing to 0.38% between 2020 and 2023.



Figure 9. Jabodetabek population growth rate 2010-2020 and 2020-2023

In addition to population growth data, Jakarta has a map of movement from surrounding cities, such as Bodetabek (Jabodetabek), to the city center as the final destination. This demonstrates Jakarta's role as a transportation magnet for people to travel and a hub for interconnected regional activities. This complex network illustrates the importance of adequate infrastructure to support population mobility in the Greater Jakarta area. It highlights the need for sound transportation flow management to reduce congestion and support economic growth and a better quality of life for residents in this metropolitan area.

This regional interconnectedness has direct implications for decarbonization efforts. This massive daily commuter flow, much of which still relies on fossil-fueled private vehicles, contributes significantly to total emissions in the metropolitan area. Therefore, the implementation of sustainable transportation technologies such as electric vehicles or smart traffic management systems cannot be successful if implemented only in isolation within the administrative boundaries of DKI Jakarta.

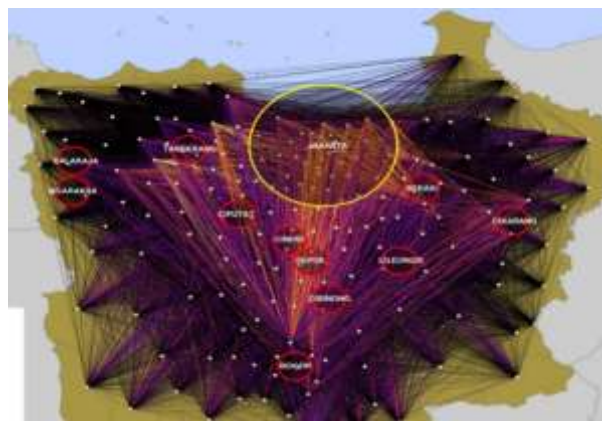


Figure 10. Map of movement in the Jabodetabek area

Figure 10 visually maps the intensity of commuter movement in the Greater Jakarta area. The map highlights Jakarta (circled in yellow) as the main destination hub, attracting massive traffic flows from surrounding satellite cities such as Bogor, Depok, Tangerang, and Bekasi (marked in red). The intersecting lines indicate a dense and complex connectivity network. This visualization emphasizes the high interdependence

between Jakarta and its surrounding areas, which directly impacts daily traffic volumes and the urgency for integrated regional transportation solutions.

In practice, transportation mode integration in Jakarta involves the development of transportation hubs that enable easy and fast transfers between modes. Examples include major stations like Dukuh Atas Station, which connects the MRT, KRL, LRT, and TransJakarta buses within a single area. Furthermore, efforts are being made to integrate the payment system through electronic tickets or an app, allowing users to use only one ticket for various modes. This effort involves coordination between local governments, transportation companies, and private operators, with the hope of creating a more user-friendly, efficient, and sustainable public transportation system for Jakarta residents.

Transport mode integration in Jakarta also plays a crucial role in supporting environmental sustainability. By encouraging people to shift from private vehicles to integrated public transportation, it is hoped that this will reduce carbon emissions and air pollution, major urban problems. Furthermore, an integrated transportation system allows for more efficient use of urban land, reducing the need for extensive parking spaces and additional road infrastructure. Ultimately, transportation mode integration in Jakarta not only improves mobility but also supports the creation of a greener and more livable urban environment.

The main challenges in developing integrated transportation in Jakarta include limited land at transportation hubs and a lack of integrated facilities outside Jakarta, such as park-and-ride and connecting modes. Congestion at railway intersections and inner-city roads requires solutions such as the construction of flyovers.

Furthermore, differences in management institutions and separate transportation regulations make it difficult to implement consistent fares. Regional government budget constraints also pose a barrier. The imbalance in integration between Jakarta and Greater Jakarta (Bodetabek) needs to be addressed by developing feeder connectors in residential areas and improving the safety and comfort of transportation facilities. Areas south of Greater Jakarta, such as Bogor and Tangerang, are not yet served by direct transportation modes, and a legal framework for integrated fares is needed to make transportation more affordable for the public.

4. CONCLUSION

This study confirms that technological innovation, particularly the adoption of electric vehicles (EVs) and the implementation of intelligent traffic management systems (ITS), is a crucial component in efforts to reduce carbon emissions and improve energy efficiency in Jakarta. While these technologies offer significant potential solutions, the study identifies that their effectiveness is currently hampered by fundamental challenges: limited supporting infrastructure (such as charging stations), high adoption costs, and the complexity of integration with existing transportation systems. A comparative analysis also shows that Jakarta still has substantial gaps in achieving Sustainable Development Goals (SDGs) 7 and 11, as clearly reflected in the alarming levels of air quality and the slow transition to renewable energy (NRE). Therefore, the main conclusion of this study is that technological innovation cannot stand alone. Without cohesive regional policy integration—capable of uniting DKI Jakarta with the surrounding areas of Bodetabek—and a commitment to massively accelerating renewable energy infrastructure, these advanced technologies will only serve as partial solutions and fail to fundamentally address the root causes of regional emissions and congestion.

The general government should focus on developing transportation infrastructure integrated with urban spatial planning through the TOD approach to reduce people's dependence on private vehicles. The application of IoT technology and artificial intelligence (AI) in traffic management must unify and control traffic flow more effectively, especially in large cities. There needs to be a firmer and more consistent policy, such as ERP, to reduce the volume of private vehicles in dense urban areas. Flyovers built in the

area must be accompanied by good transportation management so that they can function optimally and truly reduce congestion, Participation in planning and related transportation needs to be increased to ensure that the solutions implemented are in accordance with the needs of road users.

References

- Kementerian Perhubungan badan pengelola transportasi Jabodetabek. Rencana Induk Transportasi jabodebek. Tahun anggaran 2024
- United Nations ; The sustainable development goals report. 2024
- RUED DKI JAKARTA :Rencana umum energi daerah tahun 2023-2050
- Kementerian PPN/ Bappenas ; Pedoman Teknis penyusunan rencana aksi base on SDG
- Perencanaan tata ruang kota dan transportasi perkotaan by Federal Ministry for Economic Cooperation and Development (BMZ) Germany
- Agni, S. N., & Sarno, R. (2021). Evaluasi Penerapan *Smart Mobility* di Jakarta. *Jurnal Nasional Teknik Elektro dan Teknologi Informasi (JNTETI)*, 10(3)
- Istiqomah, I., et al. (2022). Inovasi kendaraan listrik sebagai upaya meningkatkan kelestarian lingkungan dan mendorong pertumbuhan ekonomi hijau di Indonesia. *Jurnal Sinergitas Pembangunan dan Lingkungan*, 1(1)
- Aulia, R. (2020). Eksplorasi struktur kebijakan pendorong adopsi kendaraan listrik di indonesia dengan pendekatan sistem dinamis. Tesis, Fakultas Teknik, Universitas Indonesia.
- Ernyasih, Ernyasih, et al. "Urban Transportation and Rising CO Emissions: A Case Study of East Jakarta and its Public Health Impacts." *Journal of Public Health and Pharmacy* 5.1 (2025): 150-157.
- Judijanto, Loso, et al. "Analysis of Vehicle Emission Policies and Electric Vehicle Incentives on Air Pollution and Sustainable Transportation Use in Jakarta, Indonesia."
- Junaidi, Wendy. "ANALYSIS OF SMART CITY INITIATIVES TO SUPPORT ENVIRONMENTAL SUSTAINABILITY IN ASIA." *Jurnal Keuangan dan Bisnis* 22.2 (2024): 211-225.
- Lee, Chien-Sing, Natanael Karjanto, and David E. Drew. "Perceptions towards sustainable transportation and recommendations: A survey case study in Jakarta, Indonesia." *International Journal of Computer Information Systems and Industrial Management Applications* 13 (2021): 13-13.
- Irianto, Andis Destrian, and Khana Unsa Wibowo. "PENGEMBANGAN INOVASI TRANSIT ORIENTED DEVELOPMENT DENGAN ELECTRIC VEHICLE SEBAGAI SMART MOBILITY PENGURANGAN EMISI DAN PEMBANGUNAN BERKELANJUTAN DI IBU KOTA NUSANTARA." *Integrative Perspectives of Social and Science Journal* 2.2 Maret (2025): 1495-1508.
- Maudina, Nafrah, and Eko Priyo Purnomo. "Sustainable Transportation in Southeast Asian Countries: Implementation of Green Transport." *Journal of Environmental Science and Sustainable Development* 6.2 (2023): 367-381.
- Nugroho, A., & Puspitasari, D. (2021). Analisis Hambatan dan Peluang Adopsi Kendaraan Listrik (EV) di Wilayah Perkotaan Indonesia. *Jurnal Transportasi Indonesia*, 15(2), 89-102
- Wibowo, T. S., & Santoso, B. (2022). Integrasi Sistem Transportasi Cerdas (ITS) untuk Mendukung Mobilitas Berkelanjutan di Kota Metropolitan: Studi Kasus Jakarta. *Jurnal Pengembangan Kota & Wilayah*, 18(1), 45-58.
- Siregar, M. R., & Haryanto, B. (2022). Analisis Kebijakan Insentif Kendaraan Listrik dan Dampaknya terhadap Minat Beli Konsumen di Jakarta. *Jurnal Ekonomi Pembangunan*, 20(1), 55-70
- Prasetyo, E., & Sutomo, H. (2021). Efektivitas Implementasi *Intelligent Transport System* (ITS) dalam Mengurangi Kemacetan di Koridor Sudirman-Thamrin. *Jurnal Teknik Sipil dan Lingkungan*, 9(2), 123-135.
- Gunawan, A., & Lee, S. (2022). Aligning Urban Transport Policy with Sustainable Development Goals: A Comparative Study of Jakarta and Kuala Lumpur. *Journal of Sustainable Mobility*, 12(3), 201-218.
- Hardjoso, P., & Priyanto, F. (2023). Transisi Armada Bus TransJakarta Menuju Kendaraan Listrik: Tantangan Infrastruktur dan Operasional. *Prosiding Konferensi Nasional Transportasi Perkotaan (KNTP)*, 150-162.

- Mulyono, A. S. (2021). Tantangan Integrasi Tata Ruang dan Kebijakan Transportasi di Kawasan Metropolitan Jabodetabek. *Jurnal Perencanaan Wilayah dan Kota (JPWK)*, 32(2), 105-120.
- Trisnawati, A. Z., Qolbi, N. N., & Purwaningsih, T. (2025, December). Enhancing Sustainable Urban Mobility and Environmental Quality: The Role of JakLingko Integration Program in Advancing Smart City Initiatives in Jakarta. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1566, No. 1, p. 012013). IOP Publishing.
- Wibowo, Arianto, et al. "Leveraging Battery Electric Vehicles (BEV) and Policy Interventions to Mitigate Jakarta's Traffic and Pollution Crisis: A System Dynamic Analysis." *International Journal of Sustainable Development & Planning* 19.12 (2024).
- Wiwid, Wiwid, and Muhammad Eko Atmojo. "Analysis of Sustainable Transport Implementation in Indonesia." *SHS Web of Conferences*. Vol. 204. EDP Sciences, 2024.
- Ying¹, Danielle Kai, et al. "Building a New Future of Transforming Jakarta into Green and Sustainable Model Smart City." *Proceedings of the Business Innovation and Engineering Conference (BIEC 2022)*. Vol. 236. Springer Nature, 2023.
- Young, Cherish, Felicia Evelyn, and Dwi Putra Nugraha. "Implementation of Smart Mobility as a Sustainable Development Model in the Special Capital Region of Jakarta." *ISO Journal: Journal of Social, Political and Humanitarian Sciences* 5.1 (2025): 10-10.