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Green Mobility Implementation Strategy: A SWOT Analysis Approach

Ahyani[1,] *, Sri Sarjana[2], Dani Hardianto[3], Guntoro Zain Ma'arif[4], Nomin[5]

[1,3] Road Transportation Management, Indonesian Land Transportation Polytechnic – STTD, Indonesia
[2] Marketing, Innovation and Technology, Indonesian Land Transportation Polytechnic – STTD, Indonesia
[4] Land Transportation, Indonesian Land Transportation Polytechnic – STTD, Indonesia
[5] Railway Transportation Management, Indonesian Land Transportation Polytechnic – STTD, Indonesia

***Correspondence to**: ahyani@ptdisttd.ac.id

Abstract: Green mobility is one of the main solutions to reduce the environmental impact of transportation, as well as to support sustainable urban development. This study aims to identify strategies for implementing green mobility in urban areas using the SWOT (Strengths, Weaknesses, Opportunities, Threats) and STP (Segmentation, Targeting, Positioning) analysis approaches. This study uses a qualitative method based on literature studies that examine various sources related to policies, infrastructure, and green mobility practices in various cities. The results of the SWOT analysis show that the main strength of green mobility implementation lies in green mobility being an environmentally friendly transportation with low operational costs and can reduce congestion, although there are weaknesses in terms of inadequate infrastructure and resistance to behavioral change. Opportunities that can be utilized include support from government policies and global trends towards smart cities and increased investment in the environmentally friendly transportation sector, while threats faced by resistance from the conventional vehicle industry include high dependence on private motor vehicles. In the STP analysis, market segmentation is carried out based on geographic, demographic, and psychographic characteristics, targeting urban workers who are more open to environmentally friendly transportation solutions. Green mobility is positioned as an efficient, cost-effective, and environmentally friendly transportation option. Based on the analysis results, it is suggested that transportation policies that support green mobility focus on developing better infrastructure, educational campaigns, and policy support from the government. Thus, the implementation strategy obtained is green mobility education to the community, development of supporting infrastructure, provision of incentives and subsidies, and government policies that support the implementation of green mobility.

Keywords: Green mobility, SWOT analysis, STP analysis, sustainable transportation

Introduction

The Golden Indonesia Vision 2045 is a long-term vision that aims to make Indonesia a prosperous, fair, and sustainable developed country. One of the important goals of this vision is to significantly reduce the intensity of Greenhouse Gas (GHG) emissions, with the goal of achieving net zero emissions. This is very crucial considering the impact of climate change that is increasingly real and threatens the sustainability of the environment and human life. Indonesia has committed to reducing GHG emissions through various initiatives. Reducing the intensity of GHG emissions towards net zero emissions is not only the responsibility of the government, but also requires the active participation of all stakeholders and society. These efforts include various measures, including improving energy efficiency, by adopting clean and renewable energy technologies to reduce dependence on fossil fuels, and sustainable transportation development, by developing environmentally friendly transportation infrastructure, including efficient public transportation and the use of electric vehicles.

One of the development agendas in the 2025-2045 Medium-Term and Long-Term Development Plan (RPJMP) to support the vision of Golden Indonesia 2045 is to realize quality and environmentally friendly facilities and infrastructure, namely infrastructure development that is not only high-quality, but also supports environmentally friendly principles. The implementation of this agenda aims to ensure that infrastructure development in Indonesia is in line with the commitment to reduce GHG emissions and support environmental sustainability. The rapid development of urbanization and industrialization has driven an increase in the need for transportation which, while essential for economic growth, also has a significant environmental impact. Carbon emissions from the transportation sector are currently one of the main contributors to climate change and the decline in air quality in urban areas. In the face of this problem, green mobility or environmentally friendly mobility is the main concern in many countries as a step to create a more environmentally friendly and low-emission transportation system. Green mobility not only offers emission reduction, but also emphasizes energy efficiency, congestion reduction, and improved quality of life for urban communities (Almatar, 2023). The concept of eco-friendly transportation can

effectively address transportation problems, contributing to the realization of eco-friendly and sustainable cities in Indonesia. This approach is crucial in reducing high carbon emissions resulting from the increased use of private transportation and less environmentally friendly energy sources. The implementation of environmentally friendly transportation is based on the principles of sustainable development, with a focus on various modes of transportation, improving accessibility, and implementing green transportation policies, which are crucial for the success of green city programs (Primastuti & Puspitasari, 2021).

The concept of green mobility includes various initiatives, such as the development of low-emission vehicles, the improvement of public transport infrastructure, the promotion of cycling and walking, as well as the application of smart technologies and environmental policies such as low-emission zones (Vătămănescu et al., 2024). In various major cities around the world, efforts to implement green mobility are growing with the support of smart technology and IoT, which allows for the optimization of travel routes and more efficient traffic management (Wang et al., 2020). However, the implementation of green mobility faces various challenges, especially in developing countries, such as limited infrastructure, low public awareness, and investment cost barriers (Okour & Shaweesh, 2024). On the other hand, the success of developed cities in adopting the concept of green mobility shows that this transition can be achieved with a holistic approach involving policies, community participation, and private sector support (Narváez Vallejo et al., 2024). Urban transportation problems are worsening in Asian cities, despite ongoing efforts to reduce car use and promote green mobility. The average score for green mobility performance in Asia-Pacific cities is slightly lower than the global average, indicating the need for improvements in sustainable transport implementation. The study identified several challenges that hinder the growth of green mobility, including uncoordinated management, lack of clear vision and strategy, and inadequate infrastructure (Sultan et al., 2016). The need to increase awareness among the public about the potential of new technologies and the use of clean vehicles, emphasizing the importance of informing the public to promote the use of clean vehicles (Bekiaris et al., 2017). The research was carried out by identifying and formulating strategies for the implementation of green mobility using a literature study approach and analyzed with SWOT and STP approaches. Literature study is a process of searching, studying, and analyzing various sources of information that are relevant to a particular research topic or problem. The study of literature serves to gain insight and deeper understanding of the topic being researched, as well as to identify trends, findings, theories, methodologies, and knowledge gaps that exist in the field. SWOT analysis is a strategic tool used to evaluate the strengths, weaknesses, opportunities, and threats faced by an organization, project or initiative (Sarjana et al., 2023). This analysis helps in formulating strategies based on internal and external factors that influence decisions. STP analysis is an analysis to determine segmenting, targeting, and positioning which is a process in marketing to help organizations understand and manage the market more effectively. STP is used to identify the most relevant consumer groups, determine which groups to serve (target market), and create a clear product or service position for consumers. STP analysis is important because it helps to design marketing strategies that are more focused, efficient, and relevant to market needs.

Method

This research was conducted using a descriptive qualitative method that focuses on secondary data analysis through literature studies. This approach was chosen to dig deeper into the implementation of green mobility, the factors that affect it, and strategies that can be applied in urban areas. This study does not collect field data, but rather analyzes various relevant literature sources to formulate an appropriate approach. The research was conducted by collecting secondary data from various sources, including scientific journals, books, and articles from sources that discuss the topic of green mobility. The literature study covers theories and cases of green mobility implementation in several cities in the world that have successfully implemented green mobility strategies. This qualitative approach provides in-depth insights into the perceptions, needs and challenges faced by various stakeholders (Kusumastuti et al., 2023). The results of the analysis can be used to develop implementation strategies that are relevant to the local context, such as integrating green transportation technology with the needs of the local community or increasing public participation through education programs. By understanding internal and external factors more holistically, this research not only contributes to the development of green mobility theory but also provides practical guidance for policy makers and industry players to create sustainable and inclusive mobility solutions.

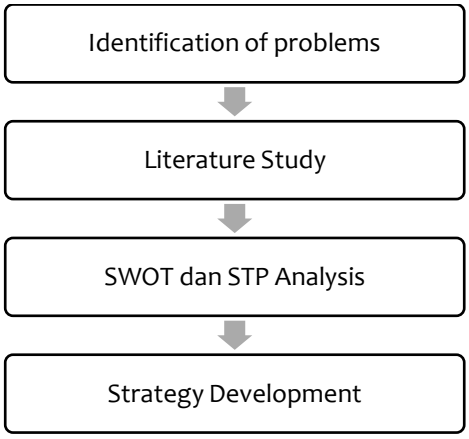

Figure 1. Research stages

The data obtained from literature studies were analyzed qualitatively to identify internal and external factors that affect the implementation of green mobility. This method is used to compile a SWOT analysis that includes strengths, weaknesses, opportunities, and threats. Identifying internal strengths and weaknesses, as well as external opportunities and threats can be done with a SWOT analysis to obtain comprehensive conclusions (Sarjana et al., 2024). Based on the qualitative data obtained, then an analysis was carried out with an STP approach to formulate a strategy and implementation of green mobility. Segmentation by grouping urban communities based on age, environmental awareness and transportation preferences. Targeting by selecting the segments that are most responsive to green mobility. Meanwhile, Positioning by placing green mobility as a transportation solution that is environmentally friendly, energy-efficient, and can reduce pollution and congestion.

Result and Discussion

Climate change and rising air pollution are major challenges for the world's major cities, driving the need for eco-friendly mobility solutions. Green mobility includes various strategies and technologies that aim to reduce the carbon footprint of the transportation sector while improving the quality of life in urban areas (Abdelkareem et al., 2024). In the context of rapid urbanization, the need for a sustainable transportation system is increasingly urgent to reduce congestion, greenhouse gas emissions, and pollution caused by fossil fuel vehicles. Green mobility is one of the approaches that is increasingly recognized in various countries as a solution to reduce the negative impact of conventional transportation on the environment, especially in urban areas. As urbanization and population growth in major cities increases, Indonesia faces a variety of challenges, including air pollution, traffic congestion, and reliance on fossil fuels. Green mobility initiatives involve the use of environmentally friendly modes of transportation, such as electric vehicles, bicycles and renewable energy-based public transportation, which are expected to contribute to the achievement of the Sustainable Development Goals and improve the quality of life of people in urban areas. Several cities in the world have been pioneers in the implementation of green mobility by developing innovative approaches to address urban environmental challenges. For example, Copenhagen in Denmark is known as one of the cities with the most advanced bicycle infrastructure in the world. With policies that support cycling as the main mode of transportation, almost 62% of the population uses bicycles for daily activities, thus reducing dependence on motor vehicles (Pucher & Buehler, 2017). In addition, the city has also installed a network of charging stations to support the use of electric vehicles among residents and tourists.

Tokyo, Japan, is taking a different approach by prioritizing rail-based public transportation. The train system in Tokyo is known as one of the most efficient and integrated in the world, allowing people to travel without using a private vehicle. The combination of fast, punctual, and affordable public transportation makes the use of private transportation in Tokyo much lower than in other major cities (Olayode et al., 2024). Tokyo has also begun integrating electric buses and hydrogen-based technology as part of its efforts to reduce carbon emissions. In addition, Amsterdam in the Netherlands is also known for its green mobility policy, which focuses on building a bicycle network and providing adequate bicycle parking facilities throughout the city. Almost 48% of trips in Amsterdam are by bicycle, and the city government continues to work to expand bicycle lanes and other supporting infrastructure, including the car free days initiative to minimize motor vehicles in the city center (Mekonnen, 2024). This policy has made Amsterdam one of the most environmentally friendly and comfortable cities for cyclists. In the United States, San Francisco implements a green mobility policy through the promotion of public transportation and ridesharing, including providing an electric bus transportation network that covers most of the city. San Francisco also supports

bike sharing systems and electric scooters, which makes it easier for residents to switch to more environmentally friendly modes of transportation. In addition, the city enacted low-emission zones and incentives for electric vehicles, which successfully reduced the number of fossil fuel cars (Bai et al., 2023).

Table 1. Green Mobility Implementation in Several Cities in the World

City	Key Strategies	Superiority	Challenge	Impact
Amsterdam	Wide bike lanes, eco-friendly public transport.	Complete and safe bicycle infrastructure.	Bad weather can reduce the use of bicycles.	Low air pollution, 60% of trips are done by bicycle.
Copenhagen	Cycle Superhighways system and electric buses.	Strong cycling culture, government policy support.	High initial investment in infrastructure.	CO_2 emissions drop significantly, recognized as the greenest city.
Paris	Reduction of private vehicles, increase of car-free zones.	Implementation of low-emission zones, efficient public transportation.	Resistance from motorists and local businesses.	Less congestion, improved air quality.
Singapore	Integrated transportation system, Electronic Road Pricing (ERP).	Integrated policies, adoption of advanced technologies.	High costs for technology deployment.	Reduction of congestion, energy efficiency of transportation.
Bogota	Ciclovia (weekly bike lane), Bus Rapid Transit (BRT).	Improving transportation accessibility for the community.	Traffic density outside Ciclovia hours.	High community participation, increased physical activity.
Tokyo	Highly efficient and spacious public transportation.	World's best rail system, intermodal integration.	High population density.	Low use of private vehicles, small per capita emissions.
Berlin	Promotion of electric vehicles, bike lanes, and green zones.	Government and community support for green mobility.	Challenges in changing old habits.	Reduced air pollution, increased environmental awareness.
San Francisco	Transportation electrification, bicycle lanes, car-free zones.	Local community support, electric vehicle incentives.	The hilly topography makes it difficult to use bicycles.	Reduction of greenhouse gas emissions, increase in the use of public transportation.

The use of electric vehicles is considered one of the main options to reduce carbon emissions from the transportation sector. According to research by the International Energy Agency (IEA) (2021), electric vehicles produce lower carbon emissions than fossil fuel vehicles, even when accounting for emissions from electricity production. However, EV adoption requires the development of extensive charging infrastructure to address range anxiety or concerns about limited mileage. The development of EV charging stations spread across strategic locations, such as city centers, shopping malls, and residential areas, can increase public interest in electric vehicles (Sovacool et al., 2019). Some countries, such as Norway and the Netherlands, have shown that increasing charging stations can significantly increase EV usage (IEA, 2021). In developing countries, the challenge faced is the cost of building this infrastructure, so a public-private partnership-based approach is often required for financing (Shakya & Shrestha, 2011). Efficient and low-emission public transportation is a key element in green mobility because it reduces dependence on private vehicles. Major cities such as Singapore and Tokyo have successfully developed well-integrated public transportation systems, allowing people to travel effectively without using a private car (Macea et al., 2023). The use of public transportation modes also significantly reduces the per capita carbon footprint (Dawkins et al., 2024). The modernization of public transportation with hydrogen-fueled vehicles, electrics, or hybrid systems in various countries has reduced greenhouse gas emissions substantially (Tozluoğlu et al., 2024). This strategy also needs to involve the development of transit-oriented development (TOD), which connects residential, office, and commercial areas with public transportation to minimize travel distances.

Cycling and walking are completely emission-free green mobility options, and research shows that increased bike-only lanes and safe sidewalks can encourage people to switch away from private vehicles (Pucher & Buehler, 2017). Countries like the Netherlands have become a prime model in creating safe and comfortable cycling infrastructure. Some cities in Asia, such as Tokyo and Seoul, are also continuing to upgrade bike lanes as part of their eco-friendly programs. Cycling and walking initiatives can be combined with bike-sharing programs that have been widely implemented in major cities around the world, such as New York and Paris (Fishman, 2015). The program has

proven effective in reducing the use of cars for short trips and increasing people's physical activity. However, safety factors and road design must be considered to ensure the comfort of bicycle users and pedestrians, especially in urban areas with heavy traffic (Aldred et al., 2016).

Comparative Analysis

Green mobility options include a range of transportation solutions designed to reduce environmental impact and promote sustainability (Li et al., 2025). This option aims to reduce dependence on fossil fuels, lower greenhouse gas emissions, and improve public health. The transition to green mobility involves technological innovation and changes in consumer behavior. Consumer attitudes and perceived behavioral controls significantly influence the adoption of green mobility options. Factors such as safety, cost, and convenience play a role in shaping the attitude of choosing green mobility options. A comparison of some green mobility options such as electric cars, public transportation, cycling, and walking with conventional options such as private cars, motorbikes, and online transportation is used to assess aspects that are generally used to determine which mobility will be used by travelers.

Table 2. Comparison of Mobility Options

Aspects	Electric Vehicles	Public Transportation	Cycling	Walk	Private Car	Motor	Online Transportation
Travel speed	Fast	Medium - fast	Medium	Slow	Fast	Fast	Fast
Time flexibility	Flexible	Less flexible	Flexible	Flexible	Flexible	Flexible	Flexible
Route flexibility	Flexible	Less flexible	Flexible	Flexible	Flexible	Flexible	Flexible
Congestion contribution	Causes congestion	Not	Not	Not	Causes congestion	Enough to cause congestion	Causes congestion
Comfort	Comfortable	No - Comfortable Enough	No – Quite Convenient	Uncomfortable	Comfortable	Quite Comfortable	Comfortable
Security	Safe	Quite Safe	No – Quite Convenient	No – Quite Convenient	Safe	Quite Safe	Safe
Initial costs	High	-	Low	-	High	Medium	-
Fees operational	Low	Low	-	-	High	Low	High
Treatment costs	Low	-	Low	-	High	Low	-
Environmental perception	High	High	High	High	Low	Low	Low
Carbon emissions	Low	Low	-	-	High	High	High
Energy efficiency	High	Very high	Very high	Very high	Low	Medium	Low

Based on the table 2, the green mobility option provides a better perception of the environment. This is because green mobility contributes to relatively less environmental damage compared to current mobility, such as air pollution, noise, carbon emissions and energy efficiency. On the other hand, conventional mobility provides aspects needed by travelers, such as comfort, safety, travel speed, time flexibility, and route flexibility (Yan et al., 2021). So that conventional mobility options are very difficult to replace with existing green mobility options, except for electric vehicle options. However, this is also constrained by the relatively high initial cost required to buy an electric vehicle.

Green mobility in transportation includes several key aspects that support sustainability and public health, as well as reduce negative environmental impacts that have an important role including:

- Reducing environmental impact
  Green mobility focuses on reducing dependence on fossil fuels, which can reduce greenhouse gas emissions, air pollution, and noise. This helps maintain air quality and lower the level of environmental damage caused by conventional vehicles.
- Improving public health
  With the decrease in air pollution and noise, the quality of life and public health are improving. Cycling and walking as part of green mobility also encourage a healthy lifestyle.
- Driving technological innovation
  The transition to green mobility requires the development of new technologies, such as electric vehicles, renewable energy systems, and supporting infrastructure, such as electric vehicle charging stations. This technology helps reduce carbon emissions and improve energy efficiency.

- Influencing consumer behavior
  For the adoption of green mobility, changing consumer behavior is essential. People's attitudes towards safety, cost, and convenience influence their decisions in choosing more environmentally friendly mobility options. Education and campaigns about the benefits of green mobility play a big role in driving this adoption.
- Providing a sustainable alternative to conventional mobility
  While it is difficult to replace the comfort, safety, flexibility, and speed offered by conventional vehicles, green mobility provides a more environmentally friendly alternative option, particularly through electric vehicles, low-emission public transportation, and infrastructure that supports the use of bicycles or pedestrians.
- Minimizing long-term costs
  Although green mobility, like electric vehicles, requires a large initial investment, in the long run, this option could be more economical due to lower operating costs and reduced public health costs associated with pollution.
- Building a better perception of the environment
  Green mobility contributes positively to public perception of environmental sustainability, which can increase support for environmental policies and encourage the adoption of green technologies.

However, green mobility faces challenges in replacing conventional mobility, especially related to the high cost of early technology and the limitations of the comfort and flexibility it offers. The important role of green mobility is an encouragement to continue to develop technology that can compete with conventional modes of transportation, so that sustainability goals can be achieved. In addition to the consideration of aspects contained, the selection of green mobility and conventional mobility options can be influenced by the size of the city. Generally, the size of the city will give a different assessment depending on the facilities provided and the characteristics of each city size. Table 2 provides a comparative overview of the selection of mobility options based on city size.

Table 3. Preferences Based on City Size

Aspects	Electric Vehicles	Public Transportation	Cycling	Walk	Private Car	Motor	Online Transportation
Big City	It began to be chosen as an alternative to mobility.	There is a great demand for adequate mass transportation.	Selected for short trips and bike lanes available.	It is chosen for short-distance trips and sidewalks are available.	The top choice for women and above.	Most chosen for flexibility.	Preferred alternative for flexibility.
Medium City	Medium to high (limited charging).	General, although routes may be limited.	Preferred (accessible without a dedicated lane).	Common for short distances.	General (smooth traffic).	Popular, especially among workers or students.	It's popular, but demand tends to be lower than in big cities.
Small Town	Medium (less charging).	Limited (public transportation is usually inadequate).	Preferred for short trips.	Preferred for local purposes.	General (less congestion).	Preferred (fast and flexible access in a wider area).	General (accessible even if the travel frequency is low).
Rural	Low (very limited charging infrastructure).	Limited (public transportation is rarely available).	Preferred, especially in rural areas with safe lanes.	Common for short distances within the village.	It is very popular, especially for long-distance mobility.	Very popular, flexible for narrow streets.	Limited (limited access due to low demand and long distance).

Based on the table above, in big cities, the option of green mobility of public transportation is an option to travel on the condition that it is supported by an adequate public transportation network and routes. Electric vehicles are becoming an increasingly popular choice in big cities. But the use of motorcycles is also an option because of its flexibility. In the middle to upper class, private cars remain the top choice even though traffic generally starts to get stuck because it takes more comfort into the road. Online transportation is also widely used as a more flexible travel alternative than using public transportation (Kelana et al., 2024). In medium cities, the most preferred mode is motorcycles both among workers and students. For travel, using a private car is also an option because traffic tends to be smooth. Meanwhile, green mobility options in medium cities are not a priority for travelers. Public transportation is still used although it is not the main choice especially because of the limited routes (Sarjana, 2021). Meanwhile, for mobility options in small towns and rural areas, motorcycles are the main choice for traveling.

Motorcycles are more flexible and can be used on narrow roads. In addition, due to the absence of public transportation, motorcycles and private cars are an option in traveling. Meanwhile, the use of electric vehicles in small cities and rural areas is still limited. To a lesser extent, the use of bicycles and walking became options for close trips for daily purposes around the local area.

Table 4. Advantages and Disadvantages of Mobility Options

Mode	Excess	Deficiency
Electric Vehicles	Environmentally friendly with low emissions and lower operating costs than conventional cars.	High initial costs for purchase and limited charging infrastructure.
Public Transportation	The cost is usually quite economical.	Comfort and safety factors are still lacking as well as route and schedule limitations.
Cycling	It is very environmentally friendly, cheap, and good for health.	Only suitable for short distances and safe lanes
Walk	Very environmentally friendly, cheap, and good for health	Only suitable for short distances and safe lanes
Private Car	Very flexible and convenient.	It has a significant negative impact on the environment and congestion, as well as high operational costs.
Motor	Very flexible, convenient and low cost.	It has a significant negative impact on the environment and congestion.
Online Transportation	Provides high comfort and flexibility.	It has the potential to increase congestion and emissions and is relatively expensive.

Overall, green mobility modes such as electric vehicles, public transportation, cycling, and walking have strong preferences especially among users who care about the environment and the costs incurred (Wu et al., 2024). However, the convenience and flexibility offered by conventional modes such as private cars, motorcycles, and online transportation are still attractive to users who prioritize time flexibility, convenience, and quick accessibility.

SWOT Analysis

In Indonesia, efforts to implement green mobility have received support from the government through various policies. However, the implementation of this concept is inseparable from significant challenges, including limited infrastructure, high initial costs, and low public awareness. Therefore, a SWOT analysis is needed to understand the potential and obstacles in the implementation of green mobility in Indonesia, especially in urban areas. By conducting a SWOT analysis, it is hoped that a more comprehensive picture of the strengths, weaknesses, opportunities, and threats related to the implementation of green mobility in Indonesia can be obtained. This is important as a foundation for developing more effective strategies in promoting sustainable transportation in the future. Based on the study carried out, the results of the SWOT analysis as shown in Table 5 show the Strengths, Weaknesses, Opportunities, and Threats for the implementation of green mobility.

Table 5. SWOT Green Mobility Analysis

Strengths	**Weaknesses**
Environmentally friendly	High initial costs
Energy efficiency	Infrastructure limitations
Low operating costs	Limited range
Reducing dependence on fuel	Lack of comfort, safety, and security
Congestion reduction	Low level of public awareness
Opportunities	**Threats**
Government & private policy support	Resistance from the conventional vehicle industry
Electric vehicle trends	Policy changes
Smart city development	Community resistance
	Tropical weather conditions

Green mobility has the strengths of being environmentally friendly, energy efficient, low operating costs, reducing dependence on fuel, and reducing congestion. Green mobility produces no exhaust emissions, helps reduce air pollution and supports climate change mitigation efforts. Although the option of public transportation still generally produces emissions, it is still lower than the emissions produced from private vehicles. Green mobility is also included in mobility that is efficient in energy use and reduces dependence on fuel. The use of electric vehicles, public transportation, bicycles, and walking uses less fuel or even does not use fuel to travel. Another strength is low operating costs. The use of electric vehicles and public transportation is clearly more economical compared to the

use of private vehicles or online transportation in terms of operational costs. In addition, green mobility, especially the use of public transportation, can reduce congestion, especially in urban areas.

In addition to having the above strengths, green mobility also has several weaknesses, high initial costs, limited infrastructure, limited coverage, lack of security, safety and security, and a low level of awareness to support green mobility. The high initial cost of green mobility is related to the purchase of electric vehicles, which are generally higher in price than conventional vehicles, so not all people are willing to buy in addition to other aspects such as technical problems and public trust to buy electric vehicles. In addition, green mobility still has limitations in its supporting infrastructure. For example, SPKL infrastructure is still rare even in urban areas. Other examples are bicycle lanes and sidewalks. The number of bicycle lanes is still limited, and the sidewalks are often uncomfortable for pedestrians, so the use of bicycles and pedestrians is still limited, in addition to the range of bicycle and pedestrian use only to reach a limited area within the local scope and short distance. Another drawback is the lack of comfort, safety, and security of some green mobility options. In some cases, public transportation has a low level of comfort, safety, and security so that it is not attractive to travelers. Another thing is the low level of public awareness to support green mobility efforts and contribute to sustainable transportation.

Table 6. SWOT Green Mobility in Indonesia

Strengths	Environmentally friendly: *green mobility* produces no exhaust emissions, which helps reduce air pollution and supports climate change mitigation.
	Energy efficiency: green mobility utilizes alternative energy sources such as electricity and renewable energy, making it more efficient than fossil fuel vehicles.
	Low operating costs: the use of electric vehicles and public transportation reduces operational costs compared to private vehicles or online transportation.
	Reducing dependence on fuel: reducing the use of non-renewable fossil fuels, helping to maintain national energy security.
	Congestion reduction: the use of public transportation, bicycles, and walking in urban areas can reduce the volume of private vehicles, thereby reducing congestion on the road.
Weaknesses	High initial costs: electric vehicles and other *green mobility* technologies have high purchase prices that are unaffordable for most people.
	Infrastructure limitations: supporting infrastructure such as electric vehicle charging stations (SPKL), bicycle lanes, and comfortable sidewalks are still minimal, especially in urban areas.
	Limited range: modes of transportation such as bicycles and walking can only be used for short distances and are not suitable for long-distance travel.
	Lack of comfort, safety, and security: some public transportation has a poor quality of service in terms of comfort and safety, which reduces public interest in switching to *green mobility*.
	Low public awareness: there are still many people who have not fully supported and adopted the concept of *green mobility* and have not realized the importance of contributing to sustainable transportation.
Opportunities	Government support: the government has implemented various policies to encourage the use of *green mobility*, such as electric vehicle incentives and the development of environmentally friendly infrastructure.
	Technological developments: technological advancements allow for a decrease in the cost of electric vehicles and an increase in vehicle efficiency and range.
	The need for sustainable mobility: with increasing awareness of environmental issues, there is an opportunity for *green mobility* as a more sustainable alternative to transportation.
	Potential urbanization market: large cities with high urbanization rates offer a large market for *green mobility*, especially for practical and efficient modes of transportation.
	Infrastructure development support: the government and the private sector can collaborate in the development of environmentally friendly infrastructure, such as SPKL, bicycle lanes, and sidewalks.
Threats	Competition with conventional mobility: the comfort, speed, and flexibility offered by conventional vehicles are difficult to match by *green mobility*, especially in big cities.
	High implementation costs: the cost of building *green mobility* infrastructure such as SPKL and bicycle lanes is still expensive, especially in developing countries.
	Social and cultural constraints: the habits and culture of people who still rely on private vehicles make the transition to *green mobility* difficult.
	Fluctuations in government policies: changes or uncertainties in government policies can affect the implementation and sustainability of *green mobility programs*.

	Data security and privacy issues: with the increasing use of technology in *green mobility*, there are risks related to user data security, especially in application- and technology-based modes of transportation.

STP Analysis

Segmenting, Targeting & Positioning (STP) analysis is a strategy for creating marketing segmentation, targeting, and positioning that helps identify and achieve the desired customer base effectively. This approach involves dividing the market into different segments, choosing the most viable target market, and positioning the product to attract that market. STP implementation can significantly affect the success of policy implementation by aligning its marketing efforts with user needs and preferences.

Table 7. STP Analysis of Electric Vehicles

Aspects	Description
	Segmenting
Geographic	Urban areas, such as Jakarta, Bandung, Surabaya, and Bali, with better access to infrastructure, including charging stations and policy support.
Demographic	- Age: 25-50 years old, technology and environment-oriented professionals. - Income: Medium to upper because the price of electric vehicles is still relatively high. - Lifestyle: Individuals with environmental awareness and interest in new technologies.
Psychographics	People who care about environmental issues and are looking for eco-friendly transportation solutions, as well as users who want efficiency with low operating costs.
	Targeting
Main Target	Professionals with upper-middle-income income in cities, technology-oriented, and caring about the environment.
Secondary Target	Local governments, transportation companies that want to reduce carbon emissions and operational costs, and families who want to switch to eco-friendly vehicles.
	Positioning
Market Position	Electric vehicles are positioned as a modern, efficient, and environmentally friendly mobility solution for urban communities in Indonesia.
Value Proposition	It offers energy-saving and cost-effective, environmentally friendly, and advanced solutions with technological features that meet the needs of modern users.
Differentiation	Advantages on lower operating costs, positive contribution to the environment, and technological innovation compared to fossil fuel vehicles.

Table 8. Public Transportation STP Analysis

Aspects	Description
	Segmenting
Geographic	Focus on urban areas, especially big cities such as Jakarta, Surabaya, Bandung, and Medan, as well as cities with high density levels that require public transportation to reduce congestion and air pollution.
Demographic	- Age: 15-65 years old, which includes students, workers, and the elderly. - Income: All income levels, as public transportation is designed to be affordable for a wide range of people. - Occupation: Students, workers, and traders.
Psychographics	People who are looking for cost-effective transportation solutions as well as individuals who care about the environment and want to reduce their carbon footprint.
	Targeting
Main Target	Urban communities who use public transportation as the main mode, especially students, office workers, and informal workers who need affordable access to daily transportation.
Secondary Target	Local and private governments who want to improve public mobility, as well as tourists who want easy and cheap access to explore the city.
	Positioning
Market Position	Public transportation is positioned as the main transportation option that is affordable, efficient, and environmentally friendly for people in urban areas.
Value Proposition	It offers safe, comfortable, and accessible transportation for all walks of life at an affordable cost, while reducing congestion and pollution.

Aspects	Description
Differentiation	Emphasis on better accessibility, affordability, and contribution to reducing emissions compared to private vehicles, with routes that cover strategic and congested areas.

Table 9. Bicycle STP Analysis

Aspects	Description
	Segmenting
Geographic	Big cities, tourist areas, and educational areas such as campuses that have potential for bicycle path infrastructure, such as Jakarta, Bandung, Yogyakarta, Surabaya, and areas that have tourist areas and campus areas.
Demographic	- Age: 15-50 years old, especially students, students, workers, and tourists. - Revenue: All levels, with a focus on the upper-middle class segment for tourism. - Lifestyle: An individual who is active, cares about the environment, and seeks efficient transportation alternatives.
Psychographics	People who care about health, active lifestyle, and the environment; interested in using bicycles as alternative transportation and recreation.
	Targeting
Main Target	People who carry out their daily activities in big cities and educational areas, including workers and students/students who need fast and efficient transportation alternatives.
Secondary Target	Tourists who are interested in cycling in tourist areas as part of green tourism.
	Positioning
Market Position	Bicycles are positioned as a healthy, economical, and environmentally friendly alternative transportation, suitable for big cities, tourist areas, and educational areas in Indonesia.
Value Proposition	Offering pollution-free and healthy transportation solutions that are compatible with an active lifestyle and support environmental sustainability and transportation efficiency.
Differentiation	Focus on health benefits, cost efficiency, and positive contribution to the environment compared to motor vehicles, as well as improving the quality of nature-based tourism.

Table 10. Walking STP Analysis

Aspects	Description
	Segmenting
Geographic	High-density urban areas such as Jakarta, Bandung, Surabaya, and Yogyakarta that have pedestrian access and the potential to develop supporting infrastructure, tourist areas and educational areas.
Demographic	- Age: All age ranges, especially 7-60 years old who are active in daily activities. - Income: All income groups. - Lifestyle: healthy, active.
Psychographics	People who care about physical health, want to save money, and care about environmental issues. This group also prefers an active lifestyle and engages in daily physical activities.
	Targeting
Main Target	Urban communities who want to be active in their daily routines, such as workers, students, and people who support a healthy and environmentally friendly lifestyle.
Secondary Target	Local governments that want to create pedestrian-friendly environments and health-focused communities, such as sports groups or environmental communities.
	Positioning
Market Position	Walking is positioned as a healthy, economical, and environmentally friendly mobility solution in urban areas, as well as as part of active and sustainable urban living.
Value Proposition	Offer cost-effective, healthy, and wellness and environmental support solutions by reducing pollution and traffic density.
Differentiation	The advantages in physical health and wellness offered, at no cost, as well as a positive contribution to the reduction of carbon emissions and traffic density compared to other modes.

Based on the STP analysis applied to the concept of green mobility, several important things are obtained that are relevant to support the development of green mobility. The segmentation results show that the most responsive consumer segments to green mobility initiatives are people who care about the environment, urban residents who

often use public transportation, and cyclist communities. Factors such as climate change awareness, preferences for healthy lifestyles, and a desire to reduce carbon footprint influence decisions in favor of bike lanes, and electric vehicles. For public transportation, it is driven by the cost saving factor and reducing or avoiding congestion (Satya et al., 2024)(Raharjo & Sarjana, 2022). From the targeting analysis, the priority groups selected are active commuters, students, and tourists who are looking for a green tourism experience. This strategy is based on their need for more environmentally friendly and convenient accessibility, as well as a desire to contribute to environmental conservation (Sarjana, 2024). Meanwhile, based on the results of positioning, green mobility is positioned as a transportation solution that is not only environmentally friendly but also provides economic and social benefits, such as reducing air pollution (Nieuwenhuijsen, 2021), improving the quality of life (Ismagilova et al., 2019) and supporting sustainable tourism (Pranita et al., 2023).

Implementation Strategy

Based on the analysis that has been carried out previously, here are some strategies for implementing green mobility for each option:

Table 11. Green Mobility Implementation Strategy

	A. Electric Vehicles
1	Government incentives and subsidies to accelerate the use of electric vehicles
2	Development of Electric Vehicle Charging Station (SPKL) infrastructure
3	Education of urban communities
	B. Public Transportation
1	Improving the quality of public transportation services
2	Development of public transportation supporting infrastructure
3	Increasing awareness of the use of public transportation
	C. Bicycle
1	Development of infrastructure that supports cycling
2	Public education
3	Bicycle utilization policy
	D. Walking
1	Development of pedestrian-friendly infrastructure
2	Public education
3	Pedestrian policy

Based on the table above, the strategy for implementing electric vehicles to support green mobility can be carried out by providing incentives and subsidies, developing SPKL infrastructure, educating public awareness and restricting fuel-based vehicles. Incentives and subsidies to accelerate the use of electric vehicles can be in the form of providing discounts or tax incentives for the purchase of electric vehicles, providing tax breaks to companies that convert their transportation fleets to electric vehicles, and providing free parking or low toll rates for electric vehicle users. The development of SPKL Infrastructure can be done by accelerating the procurement of SPKL in cities that are projected to have a high number of electric vehicle users so that they can continue to increase the use of electric vehicles in urban areas. Public education is also needed to contribute to protecting the environment by not using fuel-based vehicles that can cause pollution and CO_2 emissions. Meanwhile, the policy of restricting fuel-based vehicles, for example, the Low Emission Zone (LEZ) policy, which limits fossil fuel vehicles in certain areas to support green mobility policies (Peters et al., 2021).

The strategy of implementing green mobility with public transportation options can be carried out by improving the quality of public transportation services, developing supporting infrastructure for public transportation, and increasing public awareness to use public transportation. Improving the quality of public transportation services includes increasing the frequency and timeliness of public transportation services so that people feel more comfortable, facilitating payments that make it easier for passengers to pay for public transportation tickets and can be used for various modes of transportation as well as improving the safety and security of public transportation users. The development of supporting infrastructure for public transportation is also needed, such as holding convenient terminals, stations and bus stops equipped with seating, good lighting, information boards, clean toilets, garbage cans, and green areas as well as easy access. Meanwhile, increasing

awareness of the use of public transportation is to encourage people to use public transportation as the main mode of transportation through social media, advertisements, and community activities (Weng et al., 2024).

The implementation of green mobility with bicycle and walking options has the same implementation strategy approach, the development of supporting infrastructure, community education and policies from the government. The development of infrastructure that supports cyclists and pedestrians can be carried out by building bicycle lanes and sidewalks that are comfortable and safe for users and free from illegal parking obstacles and street vendors. In addition, the need for bicycle parking in public areas such as shopping centers, stations, bus terminals, and government offices to make it easier for bicycle users. Public education can be done by raising awareness about the benefits of cycling and walking for physical health and a positive contribution to reducing carbon emissions through advertising, social media, and community events. It is also necessary to socialize it in schools, campuses and offices to promote a healthy lifestyle by cycling and walking. Policies for cyclists and pedestrians also need to be implemented to provide added value for cyclists and pedestrians, for example by prioritizing cyclists and pedestrians in urban transportation planning, providing incentives to companies that encourage their employees to use bicycles and walking, and policies to limit private vehicles in certain areas (Du et al., 2024).

Furthermore, a table of TOWS Strategies that can be developed to increase the utilization of green mobility in Indonesia is presented, based on the SWOT analysis that has been carried out.

Table 12. TOWS Strategy in Increasing the Use of *Green Mobility* in Indonesia.

TOWS Strategy	Strengths (S)	Weaknesses (W)
	SO Strategies	WO Strategies
	Strategies to leverage strengths such as environmental friendliness, energy efficiency, and low operating costs by capitalizing on opportunities	Strategies to overcome obstacles such as high initial costs, limited infrastructure, limited reach, and low public awareness by taking advantage of opportunities
Opportunities (O) Government policy support, eco-friendly lifestyle trends, green infrastructure improvements, and technology upgrades	• Promote *green mobility* as part of a sustainability and healthy lifestyle campaign that is increasingly popular with urban communities. • Encourage the use of renewable energy technologies for public vehicles, such as electric buses, to be more efficient in reducing emissions in cities. • Develop an urban planning plan that supports the integration of green mobility with optimal accessibility on bicycle lanes, electric vehicles, and public transportation in big cities.	• Work with the government to provide incentives on the purchase of electric vehicles, such as tax breaks or subsidies to overcome high initial costs. • Build and expand supporting infrastructure such as EV charging stations and bike lanes, involving public-private investment to accelerate implementation. • Conduct public awareness campaigns related to the benefits *of green mobility* in reducing pollution and creating a healthier urban environment.
	ST Strategies	WT Strategies
	Strategies leverage strengths such as environmental friendliness, energy efficiency, and low operational costs to mitigate threats	Strategies to overcome constraints such as high initial costs, limited infrastructure, limited coverage, and low public awareness and address threats
Threats (T) People's dependence on private vehicles, high initial infrastructure costs, and safety factors in public transportation	• Improve the comfort and safety of public transportation, for example by increasing the standard of electric bus fleets and supporting infrastructure to be competitive with private vehicles. • Introduce an incentive system for public transport users and cyclists to attract people to switch from private vehicles. • Design a more integrated *green mobility* system to make it easier for people to access green transportation, such as connecting	• Conduct socialization by showing the long-term cost benefits of *green mobility*, such as operational savings to encourage people to switch from private vehicles. • Develop policies that set aside space for green mobility (e.g., *low emission zones*) to reduce the dominance of private vehicles. • Collaboration with technology developers to create innovations that reduce the initial cost of infrastructure

	bicycle lanes with public transportation.	and provide more affordable options for the community.

To increase the use of green mobility in Indonesia, the TOWS strategy, which is based on the strengths, weaknesses, opportunities, and threats of the green mobility concept, aims to develop integrated and effective measures (Moslem et al., 2024). This strategy is divided into four main areas, namely utilizing strengths to pursue opportunities, overcoming weaknesses by taking advantage of opportunities, using strengths to reduce threats, and improving weaknesses to avoid threats.

- SO Strategies (Strength-Opportunities).
  This strategy directs the harness of the power of green mobility, such as environmentally friendly, energy-efficient, and low operating costs, to take advantage of existing opportunities, including government policy support and healthy lifestyle trends. Green mobility can be promoted as part of a sustainability campaign that is increasingly popular with urban communities. In addition, to attract more users, the government can work with technology developers to apply renewable energy technology to public transportation, such as electric buses, to reduce emissions. The government and city developers also need to integrate green mobility in urban planning, for example by providing optimal accessibility through bicycle lanes and public transportation in the city center and surrounding areas.
- WO Strategies (Weaknesses-Opportunities).
  In this strategy, weaknesses such as high initial costs and limited infrastructure can be overcome by taking advantage of opportunities from government policies and potential public-private investment. For example, the government can provide incentives in the form of subsidies or tax reductions for electric vehicles to reduce initial cost constraints. In addition, the improvement of supporting infrastructure, such as EV charging stations and bicycle lanes, can be accelerated by collaboration between the government and the private sector. Socialization and public education are also an important step to increase public awareness about the positive impact of green mobility, so that they are more interested in supporting and using environmentally friendly transportation.
- ST Strategies (Strengths-Threats).
  This strategy aims to harness the power of green mobility to reduce existing threats, such as people's dependence on private vehicles and potential safety barriers in public transportation. One important step is to improve the comfort and safety standards of public transportation, so that the public sees it as an equal or better alternative to private vehicles. In addition, the government can offer incentives for public transportation users or cyclists, for example through fare discounts or other benefits to entice them to switch to green mobility. In addition, the integration of transportation systems, such as connecting bicycle lanes with public transportation stations, can also make the transition to green mobility smoother and more comfortable for the community.
- WT Strategies (Weaknesses-Threats).
  In this strategy, the focus is on reducing weaknesses and overcoming threats to green mobility. One way is to educate the public about the long-term cost benefits of green mobility, especially in saving operational costs, so that they are increasingly interested in switching from private vehicles. Low emission zones policies can also be applied in urban areas to reduce the dominance of fossil fuel vehicles, providing space for green mobility. Finally, collaboration with technology developers in low-cost innovations can be a solution to reduce high initial infrastructure costs, so that access to green mobility can be more affordable for the wider community.

With the implementation of these strategies, efforts to introduce and expand the use of green mobility in Indonesia can be carried out more effectively, providing significant environmental and social benefits and advancing sustainable transportation.

Conclusions

This study shows that the implementation of green mobility has complex challenges when compared to current mobility. Based on the SWOT analysis, the main strength lies in green mobility as an environmentally friendly transportation with low operational costs and can reduce congestion. However, the challenges faced are the lack of infrastructure that supports green mobility and the habits of people who still rely on private vehicles. The biggest opportunity is the support of government policies and global trends towards smart cities that support green mobility, while the threat comes from resistance from the conventional vehicle industry and society to technological change. The results of the STP analysis show that the most responsive segments to green mobility in cities are office workers and environmentally conscious communities. The main targets are active commuters who use daily transportation and city dwellers who want to switch to cleaner modes of transportation. Positioning green mobility in urban areas

is designed as a practical solution to overcome congestion, reduce carbon emissions, and improve public health by providing adequate public transportation, bicycle lanes, electric vehicle facilities, and comfortable pedestrian facilities. Thus, the implementation strategy obtained is green mobility education to the community, development of supporting infrastructure, provision of incentives and subsidies, and government policies that support the implementation of green mobility.

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