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THE INFLUENCE OF INFRASTRUCTURE AND INCENTIVES ON ELECTRIC VEHICLE ADOPTION INTENTION IN PEKANBARU CITY: IMPLICATIONS FOR SUSTAINABLE TRANSPORT PLANNING

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ABSTRACT
The transition to electric vehicles (EVs) represents a key pillar of Green Urbanism in reducing urban transport emissions. This study aims to analyze the influence of infrastructure and incentive policies on the intention to use electric vehicles in Pekanbaru City, Riau Province, as well as to examine their implications for sustainable transport planning. A quantitative approach was employed using Structural Equation Modeling based on Partial Least Squares (SEM-PLS). Data were collected from 51 respondents using purposive sampling through structured questionnaires administered to residents of Pekanbaru City, covering infrastructure variables, specifically Electric Vehicle Charging Stations (EVCS/SPKLU), and both fiscal and non-fiscal incentive policies. The results indicate that infrastructure does not have a significant effect on EV adoption intention ($p = 0.355$), whereas incentives have a significant and more dominant influence ($p = 0.031$). These findings suggest that, in the early stage of transition, users are more responsive to economic and operational incentives than to physical infrastructure availability. The study implies that the development of an EV ecosystem requires the integration of incentive-based policies with spatial planning approaches, including prioritizing EVCS deployment and aligning it with the urban transport system.

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1. INDTRODUCTION

In the context of urban planning, the availability of charging infrastructure constitutes a critical spatial component in supporting sustainable mobility. In Indonesia, this infrastructure is known as Electric Vehicle Charging Stations (EVCS/SPKLU). As of 2024, the number of electric vehicles in Pekanbaru City has reached 1,329 units, while only 18 charging stations are available. This condition indicates a gap between EV growth and supporting infrastructure provision.

According to the Global EV Outlook (2019), the recommended ratio is approximately 1:10, meaning one public charging point for every ten electric vehicles to ensure reliable mobility. In this context, limited infrastructure is often perceived as a major barrier. Despite ongoing efforts to expand charging infrastructure, public interest in adopting electric vehicles remains relatively low compared to the growth of conventional vehicles in Pekanbaru City. This raises a critical question: whether current infrastructure policies are sufficient to address

economic barriers, or whether a policy shift toward stronger economic incentives is required.

This study is important in the context of sustainable development in Indonesia, particularly in supporting regional development plans, climate mitigation, and spatial management. The Indonesian government has set a Net Zero Emission target by 2060 (IEA, 2022). From a regional planning perspective, this issue is increasingly urgent given the rapid growth of population and motor vehicles, which affects air quality, energy consumption, and urban spatial structure.

Therefore, this study contributes not only to the academic discussion on infrastructure and incentive factors influencing EV adoption intention but also to the formulation of regional planning strategies supporting sustainable transport development.

Recent studies have increasingly examined electric vehicle adoption in developing countries, highlighting challenges related to technological conditions, charging infrastructure, economic factors, and government policies (Ghani et al., 2025). However, further empirical evidence at the city level is needed, particularly for developing urban contexts where EV adoption and charging infrastructure are still at an early stage of development. In particular, the roles of infrastructure and incentive factors in shaping EV adoption intention, as well as their implications for urban and regional transport planning, remain important issues to be examined at the city level. This study addresses this gap by examining the influence of infrastructure and incentive factors on EV adoption intention in Pekanbaru City from a sustainable transport and regional planning perspective.

This study offers the following contributions:

1. Examining the influence of infrastructure and incentive factors on EV adoption intention in a developing city context.
2. Applying SEM-PLS to identify relationships between variables as a basis for transport policy intervention.
3. Providing a spatial planning perspective through the analysis of EV infrastructure development implications in Pekanbaru City.

2. RESEARCH METHOD

This study employs a quantitative approach using Structural Equation Modeling based on Partial Least Squares (SEM-PLS) to analyze the relationships between variables. Data Collection Techniques consists of questionnaire survey administered to respondents and field observation to support contextual interpretation. Data analysis was conducted using SEM-PLS, including evaluation of the outer model (validity and reliability) and the inner model (structural relationships). Independent variables consist of Infrastructure (availability, distance, accessibility, facilities) and Incentives (tax, subsidies, non-fiscal incentives such as free parking, priority parking, and dedicated lanes). How these variables would influence the EV adoption intention.

STUDY AREA OVERVIEW

Pekanbaru City is administratively the capital of Riau Province and plays a strategic role as a center of economic activities, services, and government administration. Along with its rapid urban growth, the city has experienced dynamic spatial development, particularly in the transport sector.

Based on the latest administrative expansion regulation (Disdukcapil, 2022), Pekanbaru City consists of 15 districts covering an area of approximately 632.27 km². This administrative division serves as the primary basis for analysing the distribution of infrastructure, particularly electric vehicle charging infrastructure (EVCS/SPKLU).

The provision of charging infrastructure is a fundamental prerequisite for supporting electric vehicle mobility in urban areas. In Pekanbaru City, the development of EVCS is still at an early stage and exhibits a highly concentrated spatial distribution pattern, with noticeable service gaps (blank spots) in several administrative areas. According to the most recent data, there are currently 18 operational charging station locations within the administrative area of Pekanbaru City. The charging ecosystem has also begun to involve private sector actors and automotive manufacturers.



Figure 1. Spatial Distribution of EVCS in Pekanbaru City
(Source: Author's analysis using Google My Maps, 2026)

The level of infrastructure service across the 15 districts is further analyzed using a blank spot analysis matrix, which classifies areas into served, under-served, and unserved zones based on infrastructure availability and service coverage.

Table 1. Spatial Disparity Status of Service Coverage

No.	District	Number of EVCS	Service Intensity	Service Status	Description
1	Marpoyan Damai	6	Very High	Served Zone	Economic and automotive

					activity center
2	Payung Sekaki	2	High	Served Zone	Concentrated along commercial corridor
3	Lima Puluh	2	High	Served Zone	Central Business District (CBD)
4	Binawidya	2	Moderate	Borderline	High-density residential area
5	Sukajadi	2	Moderate	Served Zone	Government administrative center
6	Tuah Madani	1	Low	Under-Served	High-density residential area
7	Bukit Raya	1	Low	Under-Served	Coverage limited to main road corridors
8	Tenayan Raya	1	Very Low	Under-Served	Large area with minimal service coverage
9	Rumbai Timur	2	Low	Under-Served	Large area, High-density residential area
10	Rumbai	0	No Service	Blank Spot	No infrastructure available
11	Rumbai Barat	0	No Service	Blank Spot	No infrastructure available
12	Senapelan	0	No Service	Blank Spot	No infrastructure available
13	Pekanbaru Kota	0	No Service	Blank Spot	Dependent on neighboring districts
14	Sail	0	No Service	Blank Spot	No infrastructure available
15	Kulim	0	No Service	Blank Spot	No infrastructure available

The development of electric vehicles in Indonesia, including in Pekanbaru City, is driven by a comprehensive regulatory framework established at the national level. These policies are designed to address both economic barriers, such as high purchase costs, and operational barriers, including infrastructure availability.

a) Regulatory Framework

The Indonesian Government has established an energy transition roadmap through Presidential Regulation No. 55 of 2019 concerning the acceleration of electric vehicle programs for road transportation. This regulation serves as the primary legal framework mandating inter-agency coordination to provide both fiscal and non-fiscal incentives for EV users and manufacturers.

b) Fiscal Incentive Schemes

The government has introduced several tax incentive policies, including:

i. Value-Added Tax (VAT) Subsidy

Under Ministry of Finance Regulation No. 8 of 2024 (Articles 3 and 4), further reinforced by Regulation No. 12 of 2025, the government provides a 10% VAT subsidy for electric vehicles that meet a minimum domestic content requirement (TKDN) of 40%. As a result, consumers are only required to pay 1% VAT. This policy significantly reduces the retail price of EVs in authorized dealerships, including those in Pekanbaru.

ii. Regional Tax Exemption

Based on Ministry of Home Affairs Regulation No. 8 of 2024, electric vehicles are subject to a 0% Motor Vehicle Tax (PKB) and a 0% Vehicle Ownership Transfer Fee (BBNKB). In Pekanbaru City, this policy serves as a strong incentive, as significantly lower annual tax costs reduce the long-term financial burden compared to conventional internal combustion engine vehicles.

iii. Infrastructure and Operational Support Policies

In relation to the infrastructure variable in this study, Ministry of Energy and Mineral Resources Regulation No. 1 of 2023 governs the provision of EV charging infrastructure. This regulation enables the participation of non-state actors in developing EVCS and supports the expansion of the EV ecosystem through more competitive tariffs and business schemes.

iv. Regional Policy: Riau Governor Regulation No. 70 of 2022

At the local level, the commitment of the Riau Provincial Government is reflected in Governor Regulation No. 70 of 2022 on the acceleration of battery electric vehicle programs. This regulation includes several strategic policies such as fiscal incentives in the form of exemptions from PKB and BBNKB, which play a key role in reducing vehicle ownership costs, infrastructure support that encourages the provision of EV charging facilities by both government and private entities, directly related to the infrastructure variable in this study and non-fiscal incentives, including administrative support and the provision of specific facilities within the province, as long as they comply with existing regulations.

v. Additional Policies: Home Charging

In addition to financial incentives, the government has introduced various non-fiscal schemes aimed at providing convenience and priority for EV users in public and private spaces. One key initiative is the provision of home charging facilities, regulated under Ministry of Energy and Mineral Resources Regulation No. 13 of 2020, which governs the provision of electricity charging infrastructure, including residential charging installations.

3. RESULT AND DISCUSSION

Results

Hypothesis testing was conducted using the bootstrapping technique to assess the strength and significance of relationships among variables in the structural model. The results are presented in Table 2.

Tabel 2. Hypothesis Testing Results

Variable Relationship	Original Sample (O)	T-Statistics	P-Values	Conclution
Infrastructure –> Adoption Intention	0,198	0,925	0,355	Not Significant
Incentives –> Adoption Intention	0,327	2,158	0,031	Significant

Following the evaluation of the measurement model (outer model), which confirmed the validity and reliability of all indicators, the infrastructure variable yielded a p-value of 0.355 (> 0.05), indicating a statistically non-significant effect. This finding is supported by the effect size ($f^2 = 0.044$), which falls within the small effect category. These results suggest that the current availability of Electric Vehicle Charging Stations (EVCS/SPKLU) has not yet become a primary driver of public interest in adopting electric vehicles.

The lack of significance and the small effect size reflect a gap between the provision of physical infrastructure and the functional expectations of Pekanbaru residents. The existing infrastructure has not yet reached a critical mass sufficient to ensure reliable urban mobility, thereby limiting its ability to induce large-scale behavioral shifts from conventional vehicles to electric vehicles. More specifically, the mean scores for availability and distance indicators are relatively lower compared to other indicators. This indicates that the spatial distribution and density of EVCS networks are key factors shaping public perception of infrastructure readiness. From a planning perspective, these findings suggest that infrastructure development should focus not only on quantity but also on spatial distribution aligned with urban mobility patterns.

In contrast to infrastructure, incentive policies demonstrate a significant influence on EV adoption intention. The structural model results indicate that economic incentives and operational privileges exert a stronger appeal for residents when considering the transition to electric vehicles.

The incentive variable shows a path coefficient of 0.327 with a p-value of 0.031 (< 0.05), confirming a positive and statistically significant effect. This indicates that improvements in incentive policies are associated with increased adoption intention. The magnitude of this coefficient suggests that enhancements in both the quality and quantity of incentives will significantly increase public interest. Moreover, the effect size of incentives, which is approximately three times larger than that of infrastructure, highlights its role as a priority intervention instrument.

From a policy perspective, this finding implies that local governments can accelerate EV adoption more effectively by strengthening regulatory support and providing financial advantages for potential users. Public interest is largely driven by expectations of cost efficiency, particularly through policies such as 0% Motor Vehicle Tax (PKB) and 0% Vehicle Ownership Transfer Fee (BBNKB). Respondents also expressed expectations for more accessible and substantial subsidy schemes. This indicates that financial considerations remain the primary determinant in EV adoption decisions.

In addition to fiscal incentives, non-fiscal incentives such as dedicated parking spaces, priority parking privileges, and special traffic lanes are also perceived as important operational benefits that enhance daily usability. Although such facilities are not yet widely implemented in Pekanbaru, the high evaluation of these indicators suggests a strong demand for operational privileges. This reflects the expectation that regulatory support in urban space allocation can increase the attractiveness of EVs as a prioritized transport mode.

Discussion

From a regional planning perspective, the findings suggest that policy interventions in Pekanbaru should prioritize incentive-based strategies. Given that infrastructure is not yet statistically significant, local governments can play a more prominent role through operational measures, such as free or discounted parking schemes for electric vehicle (EV) users. The combination of national fiscal subsidies and local operational incentives may serve as a key catalyst in accelerating the transition toward low-emission transport systems.

The non-significant effect of infrastructure also reflects the presence of range anxiety among users. From a transport geography perspective, the current distribution of EV charging stations (EVCS) remains highly centralized and point-based, lacking adequate spatial connectivity. This condition limits system reliability and reduces user confidence in conducting daily travel using EVs, thereby weakening its role in shaping adoption behavior.

These findings indicate that, at the current stage of transition, financial and operational incentives play a more decisive role than physical infrastructure. This aligns with existing literature emphasizing that early-stage adoption in developing urban contexts is strongly influenced by economic considerations rather than spatial readiness. From a planning perspective, these results imply the need for a more integrated and spatially responsive approach to EV development. EVCS expansion should gradually shift toward a network-based system that considers service coverage, spatial distribution, and alignment with urban mobility patterns.

Furthermore, local governments are encouraged to formulate a comprehensive sustainable transport roadmap that integrates national policies with localized interventions. This may include the implementation of non-fiscal measures such as dedicated EV lanes and preferential parking facilities in public areas. Such strategies are expected to enhance user convenience while simultaneously accelerating EV adoption in urban environments.

4. CONCLUSION

Based on the results of data analysis and the discussion presented, the following conclusions can be drawn:

1. Physical infrastructure, particularly Electric Vehicle Charging Stations (EVCS), does not have a significant effect on EV adoption intention in

Pekanbaru City (p = 0.355). In contrast, incentive policies have a positive and significant effect on EV adoption intention (path coefficient = 0.327; p = 0.031). This indicates that, at the current early stage of EV development, economic and operational considerations may have a more immediate relationship with adoption intention, while the existing level and spatial distribution of EVCS have not yet shown a significant relationship.

2. This study provides empirical evidence from a developing urban context where the EV ecosystem and charging infrastructure are still at an early stage of development. From an urban development perspective, the findings highlight the need to align EV transition policies with sustainable urban transport and spatial planning. While incentive-based measures may support EV adoption at the early stage, the continued growth of EV use requires EVCS development to be planned according to service coverage, spatial distribution, and connectivity with residential, commercial, and major urban activity areas. Thus, EV development can be positioned as part of a broader sustainable urban development strategy.
3. Future research should consider a larger sample and broader geographical coverage to improve the generalizability of the findings. Further studies may also incorporate other factors that can influence EV adoption intention and examine their implications for sustainable transport planning and broader urban development.

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