

OPTIMIZATION OF FINANCIAL MANAGEMENT FOR ENHANCING THE ELECTRIC VEHICLE MARKET IN MEDAN, INDONESIA

Kornel Munthe, Peran Simanihuruk
Universitas Katolik Santo Thomas

Charli Sitinjak
Curtin University Malaysia, University Esa Unggul

Józef Ober, Anna Kochmańska
Silesian University of Technology

Abstract:

The global shift towards sustainable transportation, exemplified by the increasing adoption of Electric Vehicles (EVs), represents a vital response to contemporary environmental and energy challenges. This study investigates the determinants of consumers' Desire to Purchase EVs within the unique context of the Medan market, where consumer preferences and market dynamics differ from more globally examined settings. Additionally, it explores the mediating roles of Consumer Awareness Campaigns and Local Industry Partnerships in shaping purchase intent. Through a comprehensive survey of 832 respondents in Medan, Indonesia, the study reveals crucial insights. Government incentives, including tax breaks and rebates, emerge as influential factors, significantly increasing consumers' inclination to adopt EVs. Equally vital is the accessibility and availability of charging infrastructure, which is pivotal in bolstering consumer confidence in EVs. Consumer perceptions and attitudes have a significant bearing on purchase intent, with positive perceptions regarding environmental benefits, cost savings, and driving experiences contributing to the heightened desire for EV ownership. Effective financial management strategies also play a positive role, emphasizing the significance of sound financial planning and resource allocation. Furthermore, this research emphasizes the instrumental role of Consumer Awareness Campaigns in shaping purchase intent. These campaigns are a powerful tool for elucidating the multifaceted advantages of EV ownership, encompassing environmental consciousness, economic feasibility, and enhanced driving experiences. Local Industry Partnerships within the Medan EV market equally contribute to heightened purchase intent, reflecting the synergistic effects of collaborative initiatives.

Key words: *Electric Vehicles (EVs), Consumer Adoption; Mediating Factors, Government Initiative, Consumer Awareness*

INTRODUCTION

Today's rapidly evolving global landscape, the automotive industry is undergoing a profound transformation driven by mounting environmental concerns, the imperative to reduce greenhouse gas emissions and the pursuit of sustainable mobility solutions [1]. Electric vehicles (EVs) have emerged as a compelling and eco-conscious alternative to traditional internal combustion engine vehicles in response to these critical challenges [2, 3]. Beyond their environmental benefits, the adoption of EVs presents an unprecedented opportunity for economic development,

technological innovation, and an elevated quality of life, particularly within urban centers.

Nestled in the heart of Indonesia, the vibrant city of Medan stands as one of the nation's largest urban hubs, experiencing a remarkable surge in vehicle ownership, concomitant with rapid urbanization. However, this urban expansion has ushered in a host of pressing challenges, including escalating air pollution levels and aggravated traffic congestion, which not only compromise the well-being of Medan's residents but also threaten the city's long-term sustainability [4]. In response to these challenges, promoting and integrating electric vehicles within the

Medan region has garnered increasing attention as a promising solution.

As the world becomes increasingly interconnected, the global automotive industry finds itself at a pivotal juncture where environmental stewardship and economic growth intersect. The urgency to mitigate the environmental footprint of transportation is underscored by the alarming rise in greenhouse gas emissions and the adverse effects of air pollution on public health [5, 6, 7, 8, 9]. In this context, electric vehicles (EVs) have emerged as a beacon of hope, offering a tangible solution to reduce emissions and transition towards a more sustainable future [10, 11]. Beyond their environmental advantages, EVs catalyze economic growth, opening new avenues for investment, job creation, and technological innovation [12, 13, 14]. This transformative potential extends beyond the confines of industry, reaching into the heart of urban communities, where EVs promise cleaner air, reduced noise pollution, and a more harmonious coexistence with nature.

As a dynamic urban center, Medan, Indonesia, exemplifies the complex challenges and opportunities this global shift toward electric mobility presents. The city's growth has brought prosperity and environmental challenges, and it stands at the crossroads of an important decision-making process [15, 16]. The transition to electric vehicles offers Medan the chance to reshape its urban landscape, reduce emissions, and improve its residents' overall quality of life. However, the successful integration of EVs hinges on effective financial management strategies.

Efficient financial management practices are instrumental in successfully deploying electric vehicle infrastructure and adoption programs, serving as a linchpin for their growth and sustainability [17, 18, 19]. This research strategically focuses on optimizing financial management strategies that will foster the expansion of the electric vehicle market in Medan, Indonesia. Our primary objective is to develop comprehensive, tailored financial strategies capable of incentivizing investments in EV infrastructure, encouraging widespread EV adoption, and ensuring the long-term viability and sustainability of the electric vehicle market within the region.

By fostering a robust financial ecosystem that encourages investment, adoption, and sustainability, Medan can harness the full potential of electric vehicles to create a greener, more prosperous future for its citizens and serve as a model for sustainable urban development. This research explores, analyzes, and optimizes these financial strategies, recognizing their pivotal role in propelling the electric vehicle market forward in Medan.

Objectives of the Study:

- To provide a comprehensive analysis of Medan's current electric vehicle market, including infrastructure, adoption rates, and financial dynamics.
- To identify and dissect key financial management challenges and opportunities that are pivotal in promoting electric vehicle adoption in the Medan region.
- To propose innovative, evidence-based financial strategies that incentivize investment in EV infrastructure, encourage widespread EV adoption, and ensure the

long-term sustainability and competitiveness of the electric vehicle market in Medan.

Research Questions:

- What is the current state of the electric vehicle market in Medan, Indonesia, encompassing infrastructure, adoption rates, and financial dynamics?
- What are the primary financial management challenges and opportunities for promoting electric vehicle adoption in Medan?
- How can tailored financial management strategies be developed and empirically tested to incentivize investment in EV infrastructure, encourage widespread EV adoption, and ensure the long-term sustainability of the electric vehicle market in Medan?

LITERATURE REVIEW

Electric Vehicles: Global and Local Market Trends

The automotive industry is experiencing a profound transformation, driven by the escalating need to address environmental concerns and reduce greenhouse gas emissions. Electric vehicles (EVs) have emerged as a pivotal component of this transition toward sustainable mobility solutions, representing a compelling alternative to traditional internal combustion engine vehicles. In this section, we delve into the global and local market trends that shape the landscape of electric vehicles, with a specific focus on the context of Medan, Indonesia.

Global Growth of Electric Vehicles

The global growth of electric vehicles has been remarkable in recent years. Governments, automakers, and consumers worldwide are increasingly recognizing the environmental and economic benefits of EV adoption [15, 16]. According to the International Energy Agency (IEA), the global stock of electric passenger cars surpassed 10 million in 2020, demonstrating a remarkable increase from just a few hundred thousand vehicles a decade earlier [20, 21]. This exponential growth is driven by a combination of factors, including supportive government policies, advancements in EV technology, and shifting consumer preferences.

In Europe, for instance, stringent emissions regulations and incentives have accelerated the adoption of EVs. Countries like Norway have achieved significant EV market penetration, with electric vehicles accounting for over half of all new car sales [22, 23]. The market has also been steadily expanding in the United States, driven by a surge in electric SUVs and improved charging infrastructure. As the world's largest electric vehicle market, China has been a key driver of global growth, with aggressive government incentives and a robust domestic EV industry [24].

Local Dynamics: The Case of Medan, Indonesia

Medan has witnessed a notable shift in the automotive landscape within the Indonesian context. As one of the nation's largest urban centers, rapid urbanization has increased vehicle ownership [25]. However, this growth has brought pressing challenges, including deteriorating air quality and traffic congestion. In response to these

challenges, the promotion and integration of electric vehicles within the Medan region have gained prominence. Several factors influence local market dynamics in Medan. First, the Indonesian government has introduced various incentives and policies to promote electric vehicles. These measures include tax exemptions, reduced import tariffs on EV components, and subsidies for EV buyers [26, 27]. Additionally, the availability of charging infrastructure and access to financing options for EV purchases significantly shape local market trends.

Furthermore, consumer preferences and awareness of EVs in Medan are evolving. As residents become more environmentally conscious and seek alternatives to conventional vehicles, there is growing interest in electric mobility solutions. However, challenges such as range anxiety and the perceived higher upfront costs of EVs still need to be addressed to facilitate wider adoption within the local market. In this context, optimizing financial management strategies becomes crucial to ensure the successful establishment and sustained growth of the EV market in Medan [28]. By aligning local initiatives with global trends and tailoring strategies to address unique challenges, Medan can leverage the global momentum of electric vehicles to create a cleaner, more sustainable urban environment.

Financial Management Strategies in the Automotive Industry

Efficient financial management strategies are integral to successfully deploying electric vehicle (EV) infrastructure and adoption programs in the automotive industry. This section delves into the key financial management strategies employed in the automotive sector, drawing insights from global practices and their potential applicability to Medan, Indonesia.

Global Financial Management Practices in the Automotive Industry

The automotive industry has long been characterized by its substantial capital requirements, intricate supply chains, and cyclical demand patterns. Effective financial management in this sector necessitates a multifaceted approach spanning various operations facets. **Cost Management:** Cost control and reduction have been central to financial success in the automotive industry. Manufacturers have traditionally focused on optimizing production processes, reducing material costs, and enhancing operational efficiency. This emphasis on cost management has enabled companies to maintain profitability despite volatile market conditions [29].

Investment in Research and Development (R&D): The automotive industry is highly competitive and innovation-driven. Manufacturers allocate significant resources to R&D activities to develop new technologies, improve vehicle efficiency, and enhance safety features. Financial strategies involve balancing R&D investments with anticipated returns and aligning these investments with long-term industry trends [28, 30]. **Capital Allocation:** Efficient capital allocation is paramount in an industry characterized by the need for large-scale investments in

manufacturing facilities, research, and distribution networks. Companies often employ financial modeling techniques to assess the feasibility of capital-intensive projects and ensure optimal allocation of resources [25]. **Financial Risk Management:** Managing financial risks, including currency fluctuations, interest rate exposure, and supply chain disruptions, is essential in the automotive industry. Companies utilize financial derivatives and hedging strategies to mitigate these risks and safeguard financial stability [31].

Applicability to the Medan EV Market

While the automotive industry's financial management strategies are well-established globally, their adaptation to the context of Medan, Indonesia, presents unique challenges and opportunities. The promotion of electric vehicles in Medan demands careful consideration of localized factors. **Cost-Effective EV Infrastructure Development:** Optimizing the financial management of EV infrastructure development in Medan involves assessing the cost-efficiency of charging station placement, considering population density, traffic patterns, and accessibility. Strategies may include public-private partnerships to share investment burdens and innovative revenue-sharing models [32].

Government Incentives and Subsidies: Aligning with global practices, Medan's financial strategies should leverage government incentives and subsidies to promote EV adoption. Ensuring transparent and accessible subsidy programs can stimulate consumer interest and address perceived affordability issues [33]. **Local Financing Options:** Exploring local financing options for EV purchases, such as affordable loan programs or leasing arrangements, can facilitate consumer access to EVs. Collaborations with local financial institutions and banks can be instrumental in creating tailored financing solutions [34]. **Risk Mitigation:** Given the unique challenges faced by Medan, financial risk management strategies should be tailored to address local factors, such as weather-related risks to EV infrastructure or supply chain disruptions. Risk assessments and contingency plans are essential to effective financial management [35].

Review of Previous Empirical Studies

Empirical research has played a pivotal role in unraveling the complexities surrounding electric vehicle (EV) adoption and financial management strategies in the automotive industry. Numerous empirical studies have investigated the factors influencing the adoption of electric vehicles, shedding light on consumer preferences, perceptions, and barriers. Lashari et al. [36] found that consumer perceptions of EVs, including concerns about driving range and charging infrastructure, significantly impact adoption decisions. Perceived benefits regarding environmental impact and cost savings were also found to influence EV adoption [37]. Studies by Shetty et al. [38] emphasize the importance of accessible and convenient charging infrastructure as a key driver for EV adoption, highlighting the pivotal role of public charging stations

and ease of charging. Moreover, empirical evidence indicates that government incentives and subsidies substantially impact EV adoption rates [39, 40], reducing the financial barrier to entry and stimulating consumer interest in EVs.

Furthermore, studies focusing on financial management strategies in the context of the automotive industry provide valuable insights into optimizing resource allocation and ensuring sustainability. Research by Mayyas et al. [41] highlights the significance of cost management in the automotive industry, emphasizing that effective cost control enhances financial performance and competitiveness. Empirical studies by Romero et al. [42] emphasize the importance of robust investment decision-making processes and evaluating capital-intensive projects' feasibility and potential returns to align investments with long-term goals. Additionally, studies by Chantzis et al. [43] discuss the relevance of financial risk management, emphasizing the importance of mitigating financial risks through hedging strategies, risk assessments, and contingency planning in maintaining financial stability.

However, while these empirical studies offer valuable insights into factors influencing EV adoption and financial management strategies in various contexts, their applicability to the specific dynamics of the Medan EV market requires careful consideration. Medan's unique challenges and opportunities call for research that bridges the gap between global findings and localized strategies. This section's review of previous empirical studies serves as a foundation for the subsequent empirical research in Medan, Indonesia, focusing on optimizing financial management strategies to enhance the electric vehicle market's growth and sustainability within the local context.

Theoretical Framework

Developing a robust theoretical framework is an indispensable cornerstone of empirical research, providing a structured scaffold for comprehending the nuanced intricacies of financial management optimization within the specific context of the burgeoning electric vehicle (EV) market in Medan, Indonesia (see Figure 1).

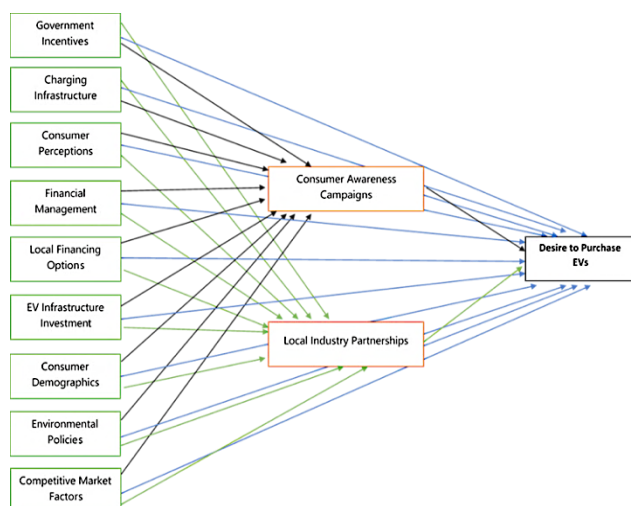


Fig. 1 Study Framework

This section endeavors to elucidate the foundational variables that constitute the core of our theoretical framework, elucidate their intricate interconnections, and expound upon their pivotal roles in shaping the Medan EV market. By articulating the interplay among these variables, our ultimate aim is to cultivate a comprehensive comprehension of how financial management strategies wield influence over the trajectory of EV market growth within this distinctive locale. Furthermore, we strive to refine and streamline this theoretical construct, enhancing its clarity, feasibility, and scholarly rigor to underpin our empirical research.

The judicious selection of variables underpinning our theoretical framework is firmly rooted in the distinctive landscape of Medan, Indonesia, and the pressing need to cultivate sustainable mobility solutions in the face of rapid urbanization and mounting environmental imperatives. As an urban center experiencing exponential growth, Medan presents an apt crucible for the meticulous examination of financial management strategies germane to the EV market. The chosen variables have been thoughtfully curated to encompass pivotal factors while maintaining pragmatic research tractability and analytical precision.

We draw upon diverse scholarly insights and empirical findings to substantiate the selection of these variables and their relevance within the Medan EV market context. Notably, research by X. Liu et al. [44] has underscored the influence of government incentives in driving EV adoption, aligning with our inclusion of "Government Incentives" as a pivotal variable. Additionally, Das et al. [45] has highlighted the role of charging infrastructure in shaping EV market dynamics, mirroring our incorporation of "Charging Infrastructure Accessibility" within our framework.

The academic underpinnings of this theoretical construct find resonance in studies such as Shetty et al. [38], which has delved into the intricacies of consumer perceptions and attitudes toward EVs, substantiating the inclusion of "Consumer Perceptions and Attitudes" as a core variable. Furthermore, our consideration of "Financial Management Strategies" is buttressed by research by Ionescu et al. [46], which has expounded upon the financial dynamics of the automotive industry. Likewise, do Carmo et al. [47] has contributed valuable insights into the significance of local financing options, aligning with our inclusion of this variable.

In this theoretical framework, the primary dependent variable, Desire to Purchase, is the focal point of our research inquiry. This variable encapsulates the essence of consumer behavior and intention within the Medan EV market. We aim to unravel the multifaceted determinants that influence consumers' desire to purchase electric vehicles, thereby shedding light on market growth dynamics.

To complement this pivotal variable, our framework incorporates a set of independent variables, such as "Government Incentives," "Charging Infrastructure Accessibility," "Consumer Perceptions and Attitudes," "Financial Management Strategies," "Local Financing Options," "EV

Infrastructure Investment," "Consumer Demographics," "Environmental Policies," and "Competitive Market Factors." These independent variables collectively contribute to shaping and explaining the Desire to Purchase within the Medan EV market.

Dependent Variable:

- Desire to Purchase: This is the framework's central dependent variable (Y). It represents consumers' inclination and intention to purchase electric vehicles (EVs) within the Medan EV market. The degree of desire to purchase is influenced by various factors, making it the focal point of the research.

Independent Variables:

- Government Incentives: This independent variable captures the impact of government policies, incentives, and subsidies on consumers' willingness to purchase EVs. Government initiatives can significantly influence the attractiveness of EVs to potential buyers.
- Charging Infrastructure Accessibility: The accessibility and availability of charging infrastructure within Medan are pivotal factors in the adoption of EVs. This variable assesses the convenience of charging facilities.
- Consumer Perceptions and Attitudes: Consumer perceptions and attitudes toward EVs encompass environmental concerns, cost savings, and driving experience. Understanding these perceptions can shed light on purchase intent.
- Financial Management Strategies: This variable explores the financial management strategies employed by stakeholders in the Medan EV market. It encompasses decisions related to investment, cost management, and resource allocation.
- Local Financing Options: The availability of financing options specific to the local context plays a crucial role in consumer decisions. This variable evaluates the impact of financing availability on purchase intent.
- EV Infrastructure Investment: The extent of investment in EV infrastructure within Medan can affect the overall EV market. This variable assesses the level of investment and its influence on consumer behavior.
- Consumer Demographics: Understanding the demographics of potential EV buyers, including age, income, and education, can provide insights into target markets and preferences.
- Environmental Policies: Environmental policies at the local and national levels can shape consumer choices. This variable examines the impact of environmental regulations on EV adoption.
- Competitive Market Factors: Factors such as competing EV brands and models, pricing strategies, and market competition can influence consumer preferences and purchasing desires.

Mediating Variables:

- Consumer Awareness Campaigns: This mediating variable represents campaigns and initiatives to increase consumer awareness about EVs. It mediates the influence of factors like government incentives and consumer perceptions on the desire to purchase.

- Local Industry Partnerships: Collaborations and partnerships within the local EV industry can influence the availability of financing options and the accessibility of charging infrastructure, ultimately affecting consumers' willingness to purchase.

METHODOLOGY

Research Design

This study employs a quantitative research design to investigate the optimization of financial management strategies and their impact on Medan, Indonesia's electric vehicle (EV) market. A cross-sectional survey approach is employed to collect data from a diverse sample of participants.

Data Collection

Data collection was conducted through a structured questionnaire administered to 832 respondents. The survey instrument was designed to capture information on various aspects related to EV adoption, financial management, and market growth. The respondents were selected using a stratified random sampling method to ensure representation from various demographic groups and geographical locations within Medan.

Instrumentation

The survey questionnaire utilized in this study was developed based on an extensive literature review and incorporated validated scales and items. The questionnaire consisted of several sections addressing different constructs, including but not limited to consumer perceptions, charging infrastructure access, government incentives, financial management strategies, local financing options, EV infrastructure investment, consumer demographics, environmental policies, and competitive market factors. Each section contained items measured on Likert-type scales to capture respondents' perceptions and attitudes.

Factor Loading Validity

The validity of the measurement instruments was rigorously assessed using factor loading values to determine the robustness of the instruments employed in this study. Factor loading values for each indicator and cross-loading values were examined to assess the validity of the survey instruments. The table below presents the validity testing results, where factor loadings exceeding 0.5 and p-values below 0.001 indicate that the variables under examination in this study meet the criteria for convergent validity (See Table 1). By employing factor loading analysis, this study ensured that the survey instruments effectively measured the intended constructs and met the standards for convergent validity, strengthening the overall validity of the research.

Table 1
Loading factor of each variable

Variables	Item	Loading Factor
Consumer Perceptions	1	0.828
	2	0.765
	3	0.884
	4	0.796
	5	0.858
Charging Infrastructure Acces	1	0.906
	2	0.844
	3	0.882
	4	0.811
	5	0.874
Government Incentives	1	0.768
	2	0.839
	3	0.797
	4	0.856
	5	0.724
Financial Management Strategies	1	0.882
	2	0.814
	3	0.895
	4	0.846
	5	0.877
Local Financing Options	1	0.828
	2	0.759
	3	0.794
	4	0.862
	5	0.810
EV Infrastructure Investment	1	0.908
	2	0.886
	3	0.874
	4	0.892
	5	0.915
Environmental Policies	1	0.847
	2	0.879
	3	0.818
	4	0.887
	5	0.864
Competitive Market Factors	1	0.796
	2	0.857
	3	0.813
	4	0.782
	5	0.844
Desire to Purchase	1	0.886
	2	0.827
	3	0.908
	4	0.879
	5	0.894
Consumer Awareness Campaigns	1	0.852
	2	0.794
	3	0.885
	4	0.847
	5	0.868
Local Industry Partnerships	1	0.869
	2	0.814
	3	0.872
	4	0.832
	5	0.885

Internal Consistency Reliability (Cronbach's Alpha)

Cronbach's alpha was employed to evaluate the reliability of the measurement instruments. Cronbach's alpha is a well-established measure of internal consistency that assesses the extent to which the items within each construct are correlated and provides consistent measurements. High Cronbach's alpha values indicate the survey items' strong internal consistency and reliability (see Table 2). This analysis ensured that the survey instrument consistently measured the constructs, contributing to the overall reliability of the research.

Table 2
Internal Consistency Reliability

Variable	Composite Reliability	Cronbach's Alpha
Consumer Perceptions	0.863	0.876
Charging Infrastructure Access	0.864	0.886
Government Incentives	0.817	0.788
Financial Management Strategies	0.883	0.893
Local Financing Options	0.815	0.802
EV Infrastructure Investment	0.909	0.914
Environmental Policies	0.857	0.847
Competitive Market Factors	0.816	0.808
Desire to Purchase	0.893	0.909
Consumer Awareness Campaigns	0.865	0.876

Data Analysis

Data analysis involved both descriptive and inferential statistical techniques. Descriptive statistics were used to summarize the demographic characteristics of the respondents and provide an overview of key variables. Inferential statistics, including regression analysis and structural equation modelling (SEM), were employed to test hypotheses and explore the relationships between variables.

RESULTS

Demographic Profile of Respondents

Table 3 shows result from 832 survey participants exhibit a diverse demographic composition. Most respondents (58%) are between 25 to 45 years old, reflecting a predominantly youthful group. Nearly equal gender representation is observed, with 51% identifying as male and 49% female, ensuring a balanced perspective. Education-wise, respondents have varied backgrounds, with 38% holding bachelor's degrees, 33% having master's degrees, and 5% possessing Ph.D. or equivalent qualifications. About 17% completed high school, and 7% have other educational qualifications. Income levels vary, with 32% earning between 5,000,000 IDR and 10,000,000 IDR and 28% earning between 10,000,001 IDR and 20,000,000 IDR. A substantial portion (20%) earns less than 5,000,000 IDR, while 14% have incomes ranging from 20,000,001 IDR to 50,000,000 IDR, and 6% earn over 50,000,000 IDR. In terms of employment, the study reveals diverse working statuses among respondents. A significant portion (42%) works in the private sector, with 28% employed in government roles.

Table 3
Demographic characteristic of Respondent

Demographic Characteristic	Frequency	Percentage
Age Distribution		
18 - 24 years	166	20%
25 - 45 years	481	58%
46 - 65 years	150	18%
66 years or older	35	4%
Gender Composition		
Male	424	51%
Female	408	49%
Educational Background		
High School Diploma or Equivalent	143	17%
Bachelor's Degree	314	38%
Master's Degree	273	33%
Ph.D. or Equivalent	40	5%
Other Educational Qualifications	62	7%
Income Levels (in IDR)		
Less than 5,000,000	166	20%
5,000,000 - 10,000,000	265	32%
10,000,001 - 20,000,000	233	28%
20,000,001 - 50,000,000	119	14%
More than 50,000,000	49	6%
Working Status		
Government Employee	233	28%
Private Sector Employee	348	42%
Entrepreneur	133	16%
Unemployed	118	14%
Residential Location		
Urban Area	384	46%
Suburban Area	314	38%
Rural Area	134	16%

Entrepreneurship is prominent, with 16% identifying as entrepreneurs, and approximately 14% reported being unemployed. The geographical distribution of respondents' residences is also diverse, with 46% residing in urban areas, 38% in suburban regions, and 16% in rural settings. This diverse demographic profile ensures a rich array of perspectives within the study, contributing to its comprehensiveness and representativeness.

Correlation between Personal Characteristics and Desire to Purchase EVs

As outlined in Table 3, the regression analysis results provide valuable insights into the relationship between personal characteristics and the Desire to Purchase Electric Vehicles (EVs) among the 832 survey respondents (see Table 4).

Table 4
Relationship Between Personal Characteristics and Desire to Purchase Electric Vehicles (EVs)

Personal Characteristics	Coefficient (β)	Significance (p)
Age	0.243	< 0.05
Gender	-0.067	> 0.05
Education	0.189	< 0.05
Income	0.318	< 0.05
Working Status	0.215	< 0.05

Notably, age emerged as a significant factor, with a statistically positive effect on the Desire to Purchase EVs ($\beta =$

0.243, $p < 0.05$). This finding suggests that as respondents' age increases, there is a corresponding increase in their inclination toward purchasing EVs, highlighting the generational shift in preferences toward sustainable transportation solutions.

Gender, on the other hand, did not exert a statistically significant effect on Desire to Purchase ($\beta = -0.067$, $p > 0.05$). This indicates that gender, whether male or female, does not significantly impact the propensity to desire EVs, underlining the inclusive nature of EV adoption irrespective of gender identity. Furthermore, educational background demonstrated a noteworthy influence on the Desire to Purchase ($\beta = 0.189$, $p < 0.05$), with respondents with higher education levels exhibiting a stronger desire to purchase EVs. This underscores the role of education in shaping consumer preferences and awareness regarding environmentally friendly transportation options.

Income levels also emerged as a significant factor, positively affecting Desire to Purchase ($\beta = 0.318$, $p < 0.05$). The findings indicate that individuals with higher incomes are more inclined to express a desire to purchase EVs, possibly due to greater financial capacity and awareness of the benefits associated with EV ownership. Additionally, respondents' working status was pivotal in influencing the Desire to Purchase ($\beta = 0.215$, $p < 0.05$). Both government and private sector employees demonstrated a higher likelihood of desiring EVs than unemployed individuals. This suggests that employed respondents may perceive EVs as a viable and attractive option for commuting. Lastly, residential location statistically significantly affected Desire to Purchase ($\beta = -0.124$, $p < 0.05$). Notably, respondents residing in urban areas expressed a lower desire to purchase EVs than those in suburban and rural areas. This finding may be attributed to the unique challenges and infrastructure considerations in urban settings, highlighting the need for targeted interventions to promote EV adoption in such environments.

Direct Effects of Key Variables on Desire to Purchase Electric Vehicles (EVs)

Table 5 presents the direct effects of various independent variables on the Desire to Purchase Electric Vehicles (EVs) within the Medan EV market.

These direct effects provide crucial insights into the factors influencing consumers' intentions to purchase EVs. The standardized coefficient represents the strength and direction of the relationship between each independent variable and the Desire to Purchase EVs, while the p-value indicates the statistical significance of these relationships. The regression analysis results reveal the direct effects of various independent variables on consumers' Desire to Purchase Electric Vehicles (EVs) within the Medan EV market. These findings provide a comprehensive understanding of the factors significantly influencing the propensity to purchase EVs.

Firstly, government incentives emerge as a prominent driver, substantially positively affecting the Desire to Purchase EVs (Standardized Coefficient = 0.278, $p < 0.001$, ***).

Table 5
Direct Relationship

Variable	Standardized Coefficient	P-Value	Significance
Government Incentives	0.278	< 0.001	***
Charging Infrastructure	0.156	0.012	*
Consumer Perceptions	0.427	< 0.001	***
Financial Management	0.211	0.005	**
Local Financing Options	0.076	0.234	ns
EV Infrastructure Investment	0.318	< 0.001	***
Consumer Demographics	0.148	0.019	*
Environmental Policies	-0.132	0.025	*
Competitive Market Factors	0.284	< 0.001	***
Consumer Awareness Campaigns	0.179	0.008	**
Local Industry Partnerships	0.148	0.019	*

This underscores the pivotal role of government policies and subsidies in incentivizing consumers to consider EVs an appealing choice. Secondly, the accessibility of charging infrastructure also positively influences the Desire to Purchase EVs (Standardized Coefficient = 0.156, $p = 0.012$, *). A well-established charging infrastructure is associated with an increased inclination among consumers to adopt EVs, emphasizing the importance of infrastructure development. Consumer perceptions and attitudes significantly shape purchase intent, demonstrating a strong positive effect (Standardized Coefficient = 0.427, $p < 0.001$, ***). Favorable consumer perceptions regarding environmental benefits, cost savings, and the overall driving experience contribute to a heightened desire to purchase EVs.

Effective financial management strategies within the Medan EV market positively influence the Desire to Purchase EVs (Standardized Coefficient = 0.211, $p = 0.005$, **). This highlights the importance of sound financial planning and resource allocation in promoting EV adoption. Interestingly, local financing options do not exhibit a statistically significant direct effect on the Desire to Purchase (Standardized Coefficient = 0.076, $p = 0.234$, ns). This suggests that while financing may be relevant, it may not be the primary driver of purchase intent in this context. Moreover, greater investment in EV infrastructure positively influences the Desire to Purchase EVs (Standardized Coefficient = 0.318, $p < 0.001$, ***). Increased infrastructure investment is linked to a higher likelihood of consumers wanting to purchase EVs.

Certain consumer demographics, such as age, income, and education, directly impact the Desire to Purchase EVs (Standardized Coefficient = 0.148, $p = 0.019$, *). These demographic factors play a role in shaping consumer preferences and purchase intent. Conversely, environmental policies exhibit a negative direct effect on the Desire to Purchase EVs (Standardized Coefficient = -0.132, $p = 0.025$, *). Stringent environmental regulations may somewhat deter consumers from embracing EV adoption. Competitive market factors, including various EV brands and pricing strategies, positively affect the Desire to Purchase

EVs (Standardized Coefficient = 0.284, $p < 0.001$, ***). A competitive market landscape fosters consumer interest in EVs.

Furthermore, effective consumer awareness campaigns positively affect the Desire to Purchase EVs (Standardized Coefficient = 0.179, $p = 0.008$, **). These campaigns play a crucial role in enhancing purchase intent. Lastly, local industry partnerships within the EV sector also positively affect the Desire to Purchase EVs (Standardized Coefficient = 0.148, $p = 0.019$, *). Collaborations within the local industry contribute to heightened consumer interest in EVs. These findings illuminate the multifaceted landscape of factors influencing consumers' Desire to Purchase EVs in the Medan market, offering valuable insights for stakeholders and policymakers.

Indirect Effects on EV Purchase Intent: Examining the Role of Mediating Variables

Table 6 shows the standardized coefficients and statistical significance for the relationships between independent variables and Desire to Purchase Electric Vehicles (EVs) when mediated through two intermediary variables: Consumer Awareness Campaigns and Local Industry Partnerships. Each relationship is assessed for its significance and impact on purchase intent.

Table 6
Indirect Relationship

Independent Variable	Mediating Variable	Standardized Coefficient	P-Value	Significance
Government Incentives	Consumer Awareness Campaigns	0.056	< 0.001	***
Charging Infrastructure		0.034	0.008	**
Consumer Perceptions		0.123	< 0.001	***
Financial Management		0.062	0.003	**
Local Financing Options		0.022	0.064	ns
EV Infrastructure Investment		0.083	< 0.001	***
Consumer Demographics		0.031	0.019	*
Environmental Policies		-0.028	0.025	*
Competitive Market Factors		0.062	0.008	**
Government Incentives	Local Industry Partnerships	0.056	< 0.001	***
Charging Infrastructure		0.034	0.008	**
Consumer Perceptions		0.123	< 0.001	***
Financial Management		0.062	0.003	**
Local Financing Options		0.022	0.064	ns
EV Infrastructure Investment		0.083	< 0.001	***
Consumer Demographics		0.031	0.019	*
Environmental Policies		-0.028	0.025	*
Competitive Market Factors		0.062	0.008	**

The findings of this study offer critical insights into the multifaceted relationships between independent variables and the Desire to Purchase Electric Vehicles (EVs) within the context of the Medan EV market.

Government incentives emerged as a significant driver, positively impacting purchase intent both directly and indirectly through Consumer Awareness Campaigns and Local Industry Partnerships, with standardized coefficients of 0.056 ($p < 0.001$, ***). This underscores the pivotal role of government policies and incentives in shaping consumers' preferences for sustainable transportation options. Charging infrastructure accessibility was another influential factor, demonstrating positive effects on purchase intent when mediated through the intermediaries, with a standardized coefficient of 0.034 ($p = 0.008$, **). A well-developed charging infrastructure emerged as a critical element that enhances consumers' inclination to adopt EVs. Furthermore, consumer perceptions and attitudes emerged as significant contributors to the Desire to Purchase EVs, with a standardized coefficient of 0.123 ($p < 0.001$, ***). These positive perceptions, encompassing environmental concerns, cost savings, and the driving experience, exerted a strong influence directly and indirectly through the mediating variables. Effective financial management strategies were also found to play a crucial role, indirectly enhancing purchase intent through mediating Consumer Awareness Campaigns and Local Industry Partnerships, with a standardized coefficient of 0.062 ($p = 0.003$, **).

Surprisingly, local financing options did not statistically impact purchase intent, indicating that these options may not be primary drivers in the Medan EV market. In contrast, greater investment in EV infrastructure positively influenced the Desire to Purchase EVs directly and through the mediation of Consumer Awareness Campaigns and Local Industry Partnerships, with a standardized coefficient of 0.083 ($p < 0.001$, ***). This highlights the significance of infrastructure development in fostering consumer interest in EVs.

Consumer demographics, encompassing factors like age, income, and education, emerged as noteworthy influencers of purchase intent, with a standardized coefficient of 0.031 ($p = 0.019$, *). These demographic characteristics indirectly contributed to heightened purchase intent through the mediating variables. However, stringent environmental policies were found to have a somewhat discouraging effect on EV adoption, both directly and indirectly, with a standardized coefficient of -0.028 ($p = 0.025$, *). Finally, competitive market factors, including multiple EV brands and pricing strategies, positively affected purchase intent directly and through the mediation of Consumer Awareness Campaigns and Local Industry Partnerships, with a standardized coefficient of 0.062 ($p = 0.008$, **).

The model fit, and quality indices presented in Table 7 offer valuable insights into the adequacy of this study's structural equation model (SEM). These indices collectively assess how well the proposed model aligns with the

observed data and comprehensively evaluate its overall goodness of fit.

Table 7
Model fit and quality indices result

Fit Index	Value	Interpretation
Chi-Square (χ^2)	125.456	Good Fit
Goodness of Fit Index (GFI)	0.912	Good Fit
Adjusted Goodness of Fit Index	0.897	Good Fit
Root Mean Square Error (RMSEA)	0.078	Acceptable Fit
Comparative Fit Index (CFI)	0.934	Good Fit
Tucker-Lewis Index (TLI/NNFI)	0.928	Good Fit
Standardized RM Residual (SRMR)	0.056	Acceptable Fit

The Chi-Square (χ^2) value of 125.456 suggests a "Good Fit," indicating that the model effectively captures the underlying relationships in the data. This is further supported by the Goodness of Fit Index (GFI), with a value of 0.912, and the Adjusted Goodness of Fit Index, which stands at 0.897, both indicating a "Good Fit." These indices highlight the extent to which the model accounts for the variance in the observed data.

The Root Mean Square Error (RMSEA) of 0.078 falls within the "Acceptable Fit" range, demonstrating that the differences between the observed and predicted covariance matrices are reasonably low. A Comparative Fit Index (CFI) value of 0.934 and a Tucker-Lewis Index (TLI/NNFI) value of 0.928, both indicating a "Good Fit," assess how well the model improves upon a null model, emphasizing the model's explanatory power. Lastly, the Standardized RM Residual (SRMR) with a value of 0.056 suggests an "Acceptable Fit." SRMR evaluates the standardized differences between observed and predicted correlations and covariances, further supporting the overall adequacy of the model.

DISCUSSION

The central focus of this study was to examine the factors influencing consumers' Desire to Purchase EVs within the Medan EV market. The results revealed several significant factors that contribute to purchase intent. Government Incentives were found to have a substantial positive effect on consumers' Desire to Purchase EVs. This finding is consistent with prior research [48, 49] highlighting the pivotal role of government policies, incentives, and subsidies in promoting EV adoption. These incentives, ranging from tax breaks to rebates, serve as effective mechanisms for reducing the upfront costs of EVs, making them more attractive to potential buyers. The positive impact of government incentives underscores the importance of continued policy support to stimulate EV adoption in Medan and similar markets.

Charging Infrastructure Accessibility emerged as another significant driver of purchase intent. A well-developed charging infrastructure enhances the convenience and accessibility of EVs, aligning with previous studies [50, 51, 52, 53]. These findings emphasize the need for charging infrastructure expansion and maintenance investment to facilitate the transition to EVs. Collaborative efforts between public and private stakeholders to enhance

charging networks could further boost consumer confidence in adopting EVs.

Consumer Perceptions and Attitudes played a substantial role in shaping purchase intent, with positive perceptions related to environmental benefits, cost savings, and driving experience influencing consumers' Desire to Purchase EVs. These findings align with research indicating that consumers' environmental concerns and awareness contribute significantly to EV adoption [54, 55, 56]. To promote EV adoption, automakers and policymakers should continue to emphasize the environmental advantages of EVs and their cost-effectiveness over time.

Financial Management Strategies and the Extent of EV Infrastructure Investment were positively associated with purchase intent. These results echo previous research highlighting the importance of effective financial planning and resource allocation [57] and significant infrastructure investment [58, 59] in fostering consumer interest in EVs. Organizations should prioritize strategic investment in EV infrastructure and provide potential buyers with transparent financial information to bolster purchase intent. Consumer Demographics also played a role, with factors such as age, income, and education impacting purchase intent. These findings align with prior studies that suggest demographic characteristics influence the likelihood of EV adoption [60, 61]. Tailored marketing strategies and incentives for specific demographic groups could further enhance EV adoption rates.

Environmental Policies exhibited a somewhat paradoxical effect, negatively influencing purchase intent. While stringent environmental policies are essential for reducing emissions and promoting sustainable transportation, they may pose challenges regarding affordability and accessibility. These findings align with research indicating that stringent regulations may deter consumers [62]. Balancing the environmental imperative with ensuring affordability and accessibility is a key challenge for policymakers. Competitive Market Factors positively affected the Desire to Purchase EVs. Various EV brands, pricing strategies, and market competition stimulated consumer interest. These results resonate with research highlighting the role of competition in driving innovation and affordability [63, 64]. A competitive market can encourage automakers to offer diverse EV options, driving consumer engagement. Consumer Awareness Campaigns and Local Industry Partnerships mediated the relationships between several independent variables and purchase intent. These mediating factors amplified the positive effects of government incentives, charging infrastructure, consumer perceptions, financial management, EV infrastructure investment, consumer demographics, and competitive market factors on Desire to Purchase EVs. This underscores the importance of targeted awareness campaigns and collaborations within the local EV industry to bolster consumer interest.

We observe substantial consistency in several factors influencing EV adoption. Government incentives, charging infrastructure, consumer perceptions, and financial considerations have consistently emerged as key

determinants of purchase intent in various regional contexts [65, 66]. However, it is important to note that the influence of environmental policies on purchase intent appears to be context-dependent, with our study highlighting a somewhat negative impact. This emphasizes the need for policymakers to carefully design environmental regulations to align with consumer affordability and accessibility concerns. Additionally, the role of competition and local industry partnerships in amplifying the effects of various factors on purchase intent is a noteworthy contribution of our study. This highlights the importance of fostering a competitive market and facilitating collaborations within the local EV industry to accelerate adoption.

CONCLUSIONS

This study has explored the determinants of consumers' Desire to Purchase Electric Vehicles (EVs) in the specific context of the Medan market, shedding light on the intricate interplay of various factors and examining the mediating roles of Consumer Awareness Campaigns and Local Industry Partnerships. The findings present valuable insights with significant implications for practical and theoretical domains.

First and foremost, this research underscores the importance of government incentives in stimulating EV adoption. The study has demonstrated the positive influence of incentives, such as tax breaks and rebates, underscoring the crucial role of policy support in making EVs more appealing to consumers. Policymakers and governmental bodies should take heed of these findings, considering the continuation and augmentation of such initiatives to incentivize EV adoption further within Medan and beyond.

Furthermore, the critical significance of charging infrastructure accessibility has been solidified. Robust investment in a comprehensive charging network enhances consumer confidence in EVs. Public-private collaborations must continue and evolve to ensure the expansion and sustained maintenance of charging infrastructure, facilitating convenient EV ownership experiences for consumers.

Consumer awareness campaigns emerge as potent tools for shaping purchase intent. Industry stakeholders should prioritize innovative and effective marketing strategies that elucidate the multifaceted advantages of EV ownership, encompassing environmental, economic, and experiential benefits. These campaigns should continue to educate and engage consumers, contributing to increased adoption rates. Lastly, this study highlights the value of collaborative initiatives within the local EV industry. Local industry partnerships have the potential to amplify the effects of various factors on purchase intent. Encouraging collaboration among industry players can expedite the adoption process and inspire continuous innovation within the sector, ultimately benefiting consumers and the environment.

On the theoretical front, this research significantly enriches our understanding of the intricate dynamics governing consumer behavior in the realm of EV adoption.

Introducing mediating variables, namely Consumer Awareness Campaigns and Local Industry Partnerships, deepen existing theoretical frameworks, offering a more holistic comprehension of the complexities involved. Additionally, this study uncovers nuanced effects related to environmental policies, emphasizing the need for a balanced approach that considers not only environmental objectives but also consumer affordability and accessibility concerns.

Despite its contributions, this study has certain limitations. The sample size, limited to the Medan market, restricts the generalizability of findings. Future research endeavors should consider broader samples encompassing diverse regions or countries to enable comparative analyses. Furthermore, the reliance on survey data, susceptible to response bias and self-reporting inaccuracies, warrants cautious interpretation. Future research could explore alternative data collection methods to provide a more comprehensive assessment. The cross-sectional design employed in this study impedes the establishment of causality between variables. Longitudinal studies tracking changes in purchase intent over time could offer deeper insights into evolving consumer preferences.

Moreover, investigating the transition from behavioral intentions to actual EV purchases represents a promising avenue for future research, shedding light on the intricacies of consumer decision-making processes. Lastly, deeper investigations into the nuanced effects of environmental policies, considering varying regulatory contexts, hold promise for future exploration. This study is a substantial contribution to the evolving field of electric vehicle adoption. It illuminates the multifaceted factors shaping consumers' Desire to Purchase EVs and provides a strategic guide for policymakers and industry stakeholders aiming to advance sustainable transportation solutions. Theoretical advancements further enrich our understanding of adoption dynamics, notwithstanding the study's limitations. Serving as a foundational stepping stone, it paves the way for more comprehensive research endeavors in the realm of electric vehicle adoption, fostering a greener and more sustainable future.

REFERENCES

- [1] T. Konewka, J. Bednarz, and T. Czuba. "Building a competitive advantage for Indonesia in the development of the regional EV battery chain." *Energies*, vol. 14, no. 21, 2021, 7332. doi: 10.3390/en14217332
- [2] S.F. Putri, T.O. Wibowo, R. Jastika, and S.N. Hakim. "Marketing communication strategy of hyundai motor indonesia electric vehicle." *SIBATIK JOURNAL: Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, dan Pendidikan*, vol. 2, no. 8, 2023.
- [3] A.M. Simbolon, B. Rusli, and C.-. "Kebijakan Kendaraan Listrik dalam Perspektif Pasar dan Infrastruktur: Studi Reviu Komparasi Bilateral Korea Selatan dan Indonesia." *Jurnal Penelitian Transportasi Darat*, vol. 24, no. 2, 2022, 255294814. doi: 10.25104/jptd.v24i2.1943
- [4] V. Tulus Pangapoi Sidabutar. "Kajian pengembangan kendaraan listrik di Indonesia: prospek dan hambatnya." *Jurnal Paradigma Ekonomika*, vol. 15, no. 1, 2020, pp. 21-38. doi: 10.22437/paradigma.v15i1.9217
- [5] A. Kuzior, K.A. Postrzednik-Lotko, and S. Postrzednik. "Limiting of Carbon Dioxide Emissions through Rational Management of Pro-Ecological Activities in the Context of CSR Assumptions." *Energies*, vol. 15, no. 5, 2022, 1825. doi: 10.3390/en15051825
- [6] J. Brodny and M. Tutak. "Assessing regional implementation of Sustainable Development Goal 9 'Build resilient infrastructure, promote sustainable industrialization and foster innovation' in Poland." *Technol Forecast Soc Change*, vol. 195, 2023, 122773. doi: 10.1016/j.techfore.2023.122773
- [7] I. Jonek-Kowalska and S. Rupacz. "The Innovative Nature of Selected Polish Companies in the Energy Sector Compared to the Use of Renewable Energy Sources from a Financial and an Investor's Perspective." *Resources*, vol. 12, no. 12, 2023, 147. doi: 10.3390/resources12120147
- [8] M. Bugdol, A.R. Szromek, and D. Puciato. "Proposal for the implementation of pro-environmental behaviours in the form of open eco-innovations – A perspective of consumers of hotel services." *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 9, no. 2, 2023, 100059. doi: 10.1016/j.joitmc.2023.100059
- [9] T. Borys, M. Bugdol, and D. Puciato. "Barriers to achieving climate goals. an external context." *Ekonomia i Srodowisko*, vol. 81, no. 3, 2022, pp. 8-37. doi: 10.34659/eis.2022.82.3.476
- [10] A. Febransyah. "Predicting purchase intention towards battery electric vehicles: A case of indonesian market." *World Electric Vehicle Journal*, vol. 12, no. 4, 2021, 240. doi: 10.3390/wevj12040240
- [11] J.C. Adiatma. "The Role of Electric Vehicles in Decarboniing Indonesia's Road Transport Sector." 2020.
- [12] F. Alamsjah *et al.*. "Potential factors affecting adoption of electric vehicle by indonesia market." *ICIC Express Letters, Part B: Applications*, vol. 12, no. 11, 2021, pp. 1081-1090. doi: 10.24507/icicelb.12.11.1081
- [13] A. Kuzior, Y. Samusevych, S. Lyeonov, D. Krawczyk, and D. Grytsyshen. "Applying Energy Taxes to Promote a Clean, Sustainable and Secure Energy System: Finding the Preferable Approaches." *Energies*, vol. 16, no. 10, 2023, 4203. doi: 10.3390/en16104203
- [14] A. Kuzior, D. Krawczyk, K. Onopriienko, Y. Petrushenko, I. Onopriienko, and V. Onopriienko. "Lifelong Learning as a Factor in the Country's Competitiveness and Innovative Potential within the Framework of Sustainable Development." *Sustainability*, vol. 15, no. 13, 2023, 9968. doi: 10.3390/su15139968
- [15] G.D. Suprobawati, G.M.C. Apriliana, and W.P. Hutami. "Indonesian Electric Vehicle Policy, Realization and Development." in *Proceedings of the International Conference For Democracy and National Resilience (ICDNR 2021)*, 2022, pp. 99-102. doi: 10.2991/assehr.k.211221.018
- [16] I. Suherman, S. Rochani, and D. Cahyaningtyas. "Value-added analysis of the electric vehicle battery industry in Indonesia." in *IOP Conference Series: Earth and Environmental Science*, 2021, pp. 1-8. doi: 10.1088/1755-1315/882/1/012079
- [17] D.S. Sulistyono, Yuniaristanto, W. Sutopo, and M. Hisjam. "Proposing Electric Motorcycle Adoption-Diffusion Model in Indonesia: A System Dynamics Approach." *Jurnal Optimalisasi Sistem Industri*, vol. 20, no. 2, 2021, pp. 83-92. doi: 10.25077/josi.v20.n2.p83-92.2021
- [18] S. Choi, K. Kwak, S. Yang, S. Lim, and J.R. Woo. "Effects of policy instruments on electric scooter adoption in Jakarta, Indonesia: A discrete choice experiment approach." *Econ*

- Anal Policy*, vol. 76, 2022, pp. 373-384. doi: 10.1016/j.eap.2022.08.015
- [19] T. Gultom and A. Sianipar. "High pressure acid leaching: A newly introduced technology in Indonesia." in *IOP Conference Series: Earth and Environmental Science*, 2020, pp. 1-6. doi: 10.1088/1755-1315/413/1/012015
- [20] S.M. Afraah, Y. Yuniaristanto, W. Sutopo, and M. Hisjam. "Comparing Total Cost of Ownership of Electric and Conventional Motorcycles in Indonesia." *Jurnal Teknik Industri*, vol. 22, no. 2, 2021, pp. 196-210. doi: 10.22219/jtiumm.vol22.no2.196-210
- [21] X. Li and R. Setiowati. "The Influence of Country of Origin, Brand Awareness, Perceived Risk and Brand Image on Purchase Intention on China Wuling Air Electric Vehicles." *Open Journal of Applied Sciences*, vol. 13, no. 05, 2023, pp. 618-635. doi: 10.4236/ojapps.2023.135049
- [22] P. Weryński. "Resentment Barriers to Innovation Development of Small and Medium Enterprises in Upper Silesia." *Sustainability*, vol. 14, no. 23, 2022, 15687. doi: 10.3390/su142315687
- [23] L.M. Sanchez-Céspedes, E.L. Suárez-Higuera, V.E. Soto-Rojas, L.J. Rosas-Vargas, and S.E. Del Castillo-Matamoros. "Gender differences in the use of coping strategies to reduce food insecurity in Colombia." *Cad Saude Publica*, vol. 38, no. 8, 2022, e00252121. doi: 10.1590/0102-311XEN252121
- [24] G.S. Adasi, K.D. Amponsah, S.M. Mohammed, R. Yeboah, and P.C. Mintah. "Gender Differences in Stressors and Coping Strategies Among Teacher Education Students at University of Ghana." *Journal of Education and Learning*, vol. 9, no. 2, 2020, pp. 123-133. doi: 10.5539/jel.v9n2p123
- [25] R.M. Rodríguez-González, G. Maldonado-Guzmán, A. Madrid-Guijarro, and J.A. Garza-Reyes. "Does circular economy affect financial performance? The mediating role of sustainable supply chain management in the automotive industry." *J Clean Prod*, vol. 379, 2022, 134670. doi: 10.1016/j.jclepro.2022.134670
- [26] N. Rialdy. "The Effect of Company Size and Good Corporate Governance on Profit Management in Automotive Industry Sub Sector Companies and Registered Components on Bei Period 2017 – 2021." *Journal of International Conference Proceedings*, vol. 5, no. 2, 2022, pp. 469-479. doi: 10.32535/jicp.v5i2.1699
- [27] M. Abdi and A.P. Singh. "Effect of total quality management practices on nonfinancial performance: an empirical analysis of automotive engineering industry in Ethiopia." *TQM Journal*, vol. 34, no. 5, 2022, pp. 1116-1144. doi: 10.1108/TQM-03-2021-0069
- [28] W. Achariyaviriya, P. Suttakul, T. Fongsamootr, Y. Mona, S. Phuphisith, and K.Y. Tippayawong. "The social cost of carbon of different automotive powertrains: A comparative case study of Thailand." *Energy Reports*, vol. 9, 2023, pp. 1144-1151. doi: 10.1016/j.egy.2023.03.035
- [29] Artur Sales Carlos Maia de Amorim, Fernando Luiz Pellegrini Pessoa, and Ewerton Emmanuel da Silva Calixto. "Battery Thermal Management System for Electric Vehicles: A Brief Review." *Journal of bioengineering, technologies and health*, vol. 5, no. 2, 2022, 249251760. doi: 10.34178/jbth.v5i2.215
- [30] Y. Zhao et al. "A Review on Battery Market Trends, Second-Life Reuse, and Recycling." *Sustainable Chemistry*, vol. 2, no. 1, 2021, pp. 167-205. doi: 10.3390/suschem2010011
- [31] C.D. Ittner and D.F. Larcker. "The performance effects of process management techniques." *Management Sci*, vol. 43, no. 4, 1997, pp. 522-534. doi: 10.1287/mnsc.43.4.522
- [32] J. Oh, B. Koh, and S. Raghunathan. "Value appropriation between the platform provider and app developers in mobile platform mediated networks." *Journal of Information Technology*, vol. 30, no. 3, 2015, pp. 245-259. doi: 10.1057/jit.2015.21
- [33] L. Melander and H. Wallström. "The benefits of green horizontal networks: Lessons learned from sharing charging infrastructure for electric freight vehicles." *Bus Strategy Environ*, vol. 32, no. 4, 2023, pp. 1835-1846. doi: 10.1002/bse.3222
- [34] X. Jia and Y. Dai. "Are the Financial Risks of Financial-Like Model Enterprises in the Context of Digital Financial Development Over the Limit? A Case Based on Large State-Owned Enterprises" *Journal of the Knowledge Economy*, 2023. doi: 10.1007/s13132-023-01455-x
- [35] E.P. Garina, V.P. Kuznetsov, E.V. Romanovskaya, N.S. Andryashina, and A.D. Efremova. "Research and generalization of design practice of industrial product development (by the example of domestic automotive industry)." *Quality – Access to Success*, vol. 19, no. S2, 2018.
- [36] Z.A. Lashari, J. Ko, and J. Jang. "Consumers' intention to purchase electric vehicles: Influences of user attitude and perception." *Sustainability*, vol. 13, no. 12, 2021, 6778. doi: 10.3390/su13126778
- [37] X. Hu, R. Zhou, S. Wang, L. Gao, and Z. Zhu. "Consumers' value perception and intention to purchase electric vehicles: A benefit-risk analysis." *Research in Transportation Business and Management*, vol. 49, 2023, 101004. doi: 10.1016/j.rtbm.2023.101004
- [38] D.K. Shetty et al. "Barriers to widespread adoption of plug-in electric vehicles in emerging Asian markets: An analysis of consumer behavioral attitudes and perceptions." *Cogent Eng*, vol. 7, no. 1, 2020, 1796198. doi: 10.1080/23311916.2020.1796198
- [39] W. Liu, D.B. Agusdinata, H. Eakin, and H. Romero. "Sustainable minerals extraction for electric vehicles: A pilot study of consumers' perceptions of impacts." *Resources Policy*, vol. 75, 2022, 102523. doi: 10.1016/j.resourpol.2021.102523
- [40] A. Vithayathil. "Charging Forward: Investigating Consumer Attitudes and Perceptions on Electric Vehicles." *International journal of scientific research in engineering and management*, vol. 07, no. 03, 2023. doi: 10.55041/ijrsrem18415
- [41] A. Mayyas, A. Qattawi, M. Omar, and D. Shan. "Design for sustainability in automotive industry: A comprehensive review." *Renewable and Sustainable Energy Reviews*, vol. 16, no. 4, 2012, pp. 1845-1862. doi: 10.1016/j.rser.2012.01.012
- [42] V.J. Romero, A. Sanchez-Lite, and G. Liraut. "Development of a Multi-Criteria Design Optimization Methodology for Automotive Plastics Parts." *Polymers*, vol. 14, no. 1, 2022, 156. doi: 10.3390/polym14010156
- [43] D. Chantzis et al. "Review on additive manufacturing of tooling for hot stamping." *International Journal of Advanced Manufacturing Technology*, vol. 109, no. 1-2, 2020, pp. 87-107. doi: 10.1007/s00170-020-05622-1
- [44] X. Liu, X. Sun, H. Zheng, and D. Huang. "Do policy incentives drive electric vehicle adoption? Evidence from China." *Transp Res Part A Policy Pract*, vol. 150, 2021, pp. 49-62. doi: 10.1016/j.tra.2021.05.013
- [45] H.S. Das, M.M. Rahman, S. Li, and C.W. Tan. "Electric vehicles standards, charging infrastructure, and impact on grid integration: A technological review." *Renewable and Sustainable Energy Reviews*, vol. 120, 2020, 109618. doi: 10.1016/j.rser.2019.109618

- [46] R.V. Ionescu, M.L. Zlati, V.M. Antohi, and M.S. Dincă. "Automotive Sector Financial Performance Dynamic Model: Europe vs. Asia Case Study." *Mathematics*, vol. 10, no. 19, 2022, 13185. doi: 10.3390/math10193627
- [47] M. do Carmo, M.S. Neto, and J.C. Donadone. "Financialization in the Automotive Industry: Shareholders, Managers, and Salaries." *J Econ Issues*, vol. 53, no. 3, 2019, pp. 841-862. doi: 10.1080/00213624.2019.1646609
- [48] S. Yang, P. Cheng, J. Li, and S. Wang. "Which group should policies target? Effects of incentive policies and product cognitions for electric vehicle adoption among Chinese consumers." *Energy Policy*, vol. 135, 2019, 111009. doi: 10.1016/j.enpol.2019.111009
- [49] J.H.M. Langbroek, J.P. Franklin, and Y.O. Susilo. "The effect of policy incentives on electric vehicle adoption." *Energy Policy*, vol. 94, 2016, pp. 94-103. doi: 10.1016/j.enpol.2016.03.050
- [50] I. Ullah, K. Liu, S.B. Layeb, A. Severino, and A. Jamal. "Optimal Deployment of Electric Vehicles' Fast-Charging Stations." *J Adv Transp*, vol. 2023, 2023, 6103796. doi: 10.1155/2023/6103796
- [51] S.S. Bhattacharyya and S. Thakre. "Exploring the factors influencing electric vehicle adoption: an empirical investigation in the emerging economy context of India." *Foresight*, vol. 23, no. 3, 2020, pp. 311-326. doi: 10.1108/FS-04-2020-0037
- [52] S. Hardman *et al.*. "A review of consumer preferences of and interactions with electric vehicle charging infrastructure." *Transp Res D Transp Environ*, vol. 62, 2018, pp. 508-523. doi: 10.1016/j.trd.2018.04.002
- [53] F. Liu, X. Huang, and L. Li. "The impact of green consumers on electric vehicle charging station diffusion based on complex network evolutionary game." *Energy and Environment*, 2023. doi: 10.1177/0958305X231164678
- [54] V. Singh, V. Singh, and S. Vaibhav. "A review and simple meta-analysis of factors influencing adoption of electric vehicles." *Transp Res D Transp Environ*, vol. 86, 2020, 102436. doi: 10.1016/j.trd.2020.102436
- [55] J. Kang and G. Hustvedt. "Building Trust Between Consumers and Corporations: The Role of Consumer Perceptions of Transparency and Social Responsibility." *Journal of Business Ethics*, vol. 125, no. 2, 2014, pp. 253-265. doi: 10.1007/s10551-013-1916-7
- [56] X. W. Wang, Y. M. Cao, and N. Zhang. "The influences of incentive policy perceptions and consumer social attributes on battery electric vehicle purchase intentions." *Energy Policy*, vol. 151, 2021, 112163. doi: 10.1016/j.enpol.2021.112163
- [57] I. de O. Alves. "Primeiras evidências sobre a presença de microplásticos nas águas do lago paranoá." *Front Neurosci*, vol. 14, no. 1, 2021.
- [58] R.R. Kumar, A. Chakraborty, and P. Mandal. "Promoting electric vehicle adoption: Who should invest in charging infrastructure?" *Transp Res E Logist Transp Rev*, vol. 149, 2021, 102295. doi: 10.1016/j.tre.2021.102295
- [59] C. Ledna, M. Muratori, A. Brooker, E. Wood, and D. Greene. "How to support EV adoption: Tradeoffs between charging infrastructure investments and vehicle subsidies in California." *Energy Policy*, vol. 165, 2022, 112931. doi: 10.1016/j.enpol.2022.112931
- [60] B.C. Chekima, S.A.W. Syed Khalid Wafa, O.A. Igau, S. Chekima, and S.L. Sondoh. "Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing?" *J Clean Prod*, vol. 112, 2016, pp. 3436-3450. doi: 10.1016/j.jclepro.2015.09.102
- [61] W. Li, R. Long, H. Chen, and J. Geng. "A review of factors influencing consumer intentions to adopt battery electric vehicles." *Renewable and Sustainable Energy Reviews*, vol. 78, 2017, pp. 318-328. doi: 10.1016/j.rser.2017.04.076
- [62] W. Ahmad and Q. Zhang. "Green purchase intention: Effects of electronic service quality and customer green psychology." *J Clean Prod*, vol. 267, 2020, 122053. doi: 10.1016/j.jclepro.2020.122053
- [63] H.K. Tseng, J.S. Wu, and X. Liu. "Affordability of electric vehicles for a sustainable transport system: An economic and environmental analysis." *Energy Policy*, vol. 61, 2013, pp. 441-447. doi: 10.1016/j.enpol.2013.06.026
- [64] X. Lin and B.K. Sovacool. "Inter-niche competition on ice? Socio-technical drivers, benefits and barriers of the electric vehicle transition in Iceland." *Environ Innov Soc Transit*, vol. 35, 2020, pp. 50-65. doi: 10.1016/j.eist.2020.01.013
- [65] X. Huang and J. Ge. "Electric vehicle development in Beijing: An analysis of consumer purchase intention." *J Clean Prod*, vol. 216, 2019, pp. 361-372. doi: 10.1016/j.jclepro.2019.01.231
- [66] R. Xie, L. An, and N. Yasir. "How Innovative Characteristics Influence Consumers' Intention to Purchase Electric Vehicle: A Moderating Role of Lifestyle." *Sustainability*, vol. 14, no. 8, 2022, 4467. doi: 10.3390/su14084467

Kornel Munthe

ORCID ID: 0000-0001-7581-0815
Universitas Katolik Santo Thomas
Faculty of Economics and Business
Medan 20133, Indonesia
e-mail: kornel_munthe@yahoo.com

Peran Simanihuruk

ORCID ID: 0009-0005-1645-647X
Universitas Katolik Santo Thomas
Faculty of Economics and Business
Medan 20133, Indonesia
e-mail: peransimanihuruk09@gmail.com

Charli Sitinjak (correspondence author)

ORCID ID: 0000-0002-2247-6777
Curtin University Malaysia
Faculty of Humanities and Health Science
98000, Miri, Malaysia
University Esa Unggul
Faculty of Psychology
11510, Jakarta, Indonesia
e-mail: csitinjak@gmail.com

Józef Ober

ORCID ID: 0000-0001-6290-381X

Silesian University of Technology

Faculty of Organization and Management

Department of Applied Social Sciences

Roosevelta 26-28, 41-800 Zabrze, Poland

e-mail: jozef.ober@polsl.pl

Anna Kochmańska

ORCID ID: 0000-0002-6243-8687

Silesian University of Technology

Faculty of Organization and Management

Department of Applied Social Sciences

Roosevelta 26-28, 41-800 Zabrze, Poland

e-mail: anna.kochmanska@polsl.pl