DESIGN STRATEGY TO IMPROVE AUTOMOBILE INDUSTRY TRANSITION TO THE ERA OF ELECTRIC VEHICLE BASED ON QUANTITATIVE STUDY : A STRUCTURAL EQUATION MODELLING

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AUTHENTICITY STATEMENT

In the name of Allah SWT, I hereby claim that all of the research work is done by myself and none of those is work or written by other researcher except for the citation and summaries that is explicit knowledge. I understand that if in the future there is any investigation for misconduct regarding this research may lead to revoke of my undergraduate candidate in Universitas Islam Indonesia

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Yogyakarta, October 25th, 2022

Ade Juliano

POSTGRADUATE THESIS APPROVAL OF EXAMINATION COMMITTEE

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DEDICATION PAGE

This undergraduate thesis is dedicated to all of my beloved family, friends, and my supervisor that give me infinity support, care, and the most importantly, sticking with me even though life goes up and down, through the best and the worst.
Also thankyou for all of my friends and family of TI UII for unforgetable journey during the master pursuit.

MOTIVATION PAGE

"And Allah has sent down rain from the sky and given life thereby to the earth after its lifelessness. Indeed in that is a sign for a people who listen."
- Surah An-Nahl [16:65]

"When something is important enough, you do it even if the odds are not in your favor."
- Elon Musk

"If you go back a few hundred years, what we take for granted today would seem like magic-being able to talk to people over long distances, to transmit images, flying, accessing vast amounts of data like an oracle. These are all things that would have been considered magic a few hundred years ago."
- Elon Musk

"Once you begin to see everything beautiful as only a reflection of God's beauty, you will learn to love in the right way."
- Yasmin Mogahed

PREFACE

Assalamu'alaikum Warrahmatullahi Wabarakatuh,
Alhamdu lillahi rabbil 'alamin, all praise to Allah S.W.T. Because of His blessing, I can finished my undergraduate thesis entitled *"KEY FACTOR OF ELECTRIC VEHICLES AND HOW TO IMPROVE THE COMPETENCE OF ELECTRIC VEHICLE USING STRUCTURAL EQUATION MODELLING".* Also, support and motivation is a major role in finishing my thesis. Author would like to appreciate and thank to whom giving endless support and motivation:

1. Winda Nur Cahyo, S.T., M.T., Ph.D as the supervisor who always supporting, guiding and providing information and knowledge that helpful for the Author in completing this Thesis.
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ABSTRACT

The development of electric vehicles (EVs) has significantly disrupted the world's road transportation industry. EVs are predicted to account for more than 50% of new vehicle sales globally by 2035, however demand will differ greatly from country to country. Automobile is one of Indonesia's key industry that support GDP, it is important for the industry to adapt to the transformation from ICE (Internal Combustion Engine) to EV (Electric Vehicle). Using the SEM (Structural Equation Model) Analysis approach, this research will help the automobile industry in Indonesia by reviewing and analyzing the key factor of Electric Vehicles. From this analysis, the industry can learn and implement the right strategy to penetrate the potential EV demand of Indonesia market.

Keyword: Electric Vehicle, Strategy, Transformation, Automotive, Structural Equation Modelling.

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CHAPTER I
INTRODUCTION

1.1. BACKGROUND

Fossil fuels are mostly used in Indonesia's for transportation, electricity production, and domestic use. High levels of CO_2 emissions, challenges with energy sustainability, and higher funding for fuel subsidies are only a few drawbacks of a high reliance on fossil fuels. Due to the widespread usage of fossil fuel vehicles, the automobile industry is also a significant contributor to the high amounts of CO_2 in the atmosphere (Utami, 2020).

The development of electric vehicles (EVs) has significantly disrupted the world's road transportation industry. EVs are predicted to account for more than 50% of new vehicle sales globally by 2035, however demand will differ greatly from country to country. EVs are now common in many regions of the world. This revolutionary, greener technology is just now beginning to exert a big influence on Indonesia (Hansmann, 2021).

The government of Indonesia has released many regulations for the growth of the automotive industry in response to the country's slow adoption of electric vehicles. The government has set 2025 adoption targets of 2.1 million electric motorcycles and 2,200 electric cars. In addition, the government set a goal for Indonesia to be able to create 2,200 electric or hybrid cars, as stated in the Presidential Regulation No. 22 of 2017 of the Republic of Indonesia about the National Energy General Plan. Many nations have implemented this rule, including France, England, Norway, and India.

Sales of Internal Combustion Engine Vehicles (ICEV) will be outlawed and the public will be urged to utilize electric-powered vehicles starting in 2040, according to an objective set for the Ministry of Energy and Mineral Resources. The Indonesian government published Presidential Regulation No. 55 of 2019 in 2019 on the Acceleration of the Program for Battery-Based Electric Motor Vehicles for Road Transportation. This endeavor is a step toward resolving two issues: the depletion of fuel oil supplies and air pollution.

According to Gaikindo in AHK (2020), only 13,800 cars were sold in the retail market in Indonesia in May 2020 as a result of Covid-19, compared to 72,200 units in May 2019. However, Indonesia continues to see a rise in electric vehicle sales. From January 2020 through October 2020, 685 plug-in hybrid electric vehicles (PHEV) were sold. However, Indonesia's sales of battery electric vehicles (BEV) increased from zero to 250 in 2019 (Rahadiansyah, 2020).

Right now, there are 2 factory that produce EV in Indonesia which is Korean based Hyundai Motor that offer Hyundai Ioniq 5 EV and Kona EV. And the other brand is China based brand which is Wuling that offer cheapest 4 wheel EV in Indonesia which is Wuling Air EV. The Air EV become a hits on Indonesia Electric Motor Show (IEMS) Exhibition due to its being the cheapest EV car in Indonesia and according Gabungan Industri Kendaraan bermotor Indonesia (GAIKINDO), Air EV ranked no.1 in Wholesales from January to September 2022 in a value of 2.708 unit followed by Hyundai Ioniq 5 with 947 unit with total of EV Wholesale (All Brand) 3.801 unit (Data by Gaikindo)

The contribution of the automotive industry to the national economy (GDP) was 1.76 percent or equivalent to Rp 260.9 trillion last year. One of these contributions comes from the car sales tax (Gaikindo). Moreover, as automobile is one of Indonesia’s key industry that support GDP, it is important for the industry to adapt to the transformation from ICE (Internal Combustion Engine) to EV (Electric Vehicle).

Using the SEM (Structural Equation Model) Analysis approach, this research will help the automobile industry in Indonesia by reviewing and analyzing the key factor of Electric Vehicles. From this analysis, the industry can learn and implement the right strategy to penetrate the potential EV demand of Indonesia market.

1.2. Problem Formulation

As the automobile industry in Indonesia is one of the biggest GDP income for the government, it is important to be able transitioning to the EV automobile industry. Inability of reacting on the proper prioritize and strategy can disrupt the automobile industry. It is necessary to respond to two research questions.

First, “What is the key factor that influence an individual to purchase an EV?”

The second question is, “How should companies in the automotive sector prioritize change?” In this study, understanding those factors was done with SEM.

1.3. Research Purpose

The objective is to comprehend key factor of electric vehicles in Indonesia. Understanding key factor of electric vehicles may enable the industry to pinpoint the elements that influence a person's decision to purchase an EV.

Additionally, the suggested methods for industry in the market can be created with the presence of growth potential. The ultimate goal of this research is to recommend strategy and its prioritize in each industry that plan to sell and/or manufacture electric cars in Indonesia. This study will concentrate on Indonesia's automotive industry's adoption of electrical vehicles. Additionally, this research will not analyze any specific companies in the industry, rather, it will concentrate on the Indonesian automobile industry as a whole.

1.4. Research Benefit

As mentioned before, as the automobile industry is one of the vital support for Indonesian GDP, it is important to keep the sustainability of the automobile industry by knowing the key factor and executing the proper strategy to have a seamless transition to the future of automobile.

1.5. Research Limitation

The limitation of this research is:

1. This research only gather data from the user of ICEV, potential user and current user of Electric vehicles in Indonesia.

2. This research focus on establishing strategy and its prioritize for the automobile industry to penetrate EV market in Indonesia.

3. This research limit the EV and ICEV to automobiles.

CHAPTER II
LITERATURE REVIEW

The two categories of literature review studies inductive and deductiveare explained in this chapter. A study that uses credible prior research from the past is said to be inductive. On the other hand, a deductive study explains the underlying theory in light of this research. The gap between earlier research and more recent research must be identified, and plagiarism must be avoided, through inductive and deductive studies. There will be several sub-chapters in this review of the literature.

2.1. Inductive Study

No	Author	Year	Scope of Research				
			Business Model	Market Analysis	Adoption of EV	Government Incentive	Technology Development
1.	Andersen	2016	V				
2.	Bruckman	2021				V	
3.	Kankoum	2017	V	V			
4.	Liu J	2016					V
5.	Mangram	2012		V			
6.	Maoheng	2018	V	V			
7.	Sharma	2020					V
8.	Yang	2019	V		V		
9.	Kresno	2021	V	V	V		
10.	Yuniza	2021			V	V	
11.	Prasetio	2019			V		V
12.	Carley	2019		V	V		
13.	Ade	2023	V	V	V		V

An inductive study is one that draws conclusions from earlier research that has been published in books, journals, or proceedings. This inductive research intended to aid the researcher in learning more about the subject and finding the most appropriate theory to serve as direction for the research. The earlier research on this subject is described below:

Andersen M. et al., 2016 examined the Tesla Disruptive Business Model. Elon Musk wrote on a blog in 2006 about his "secret master plan" for the electric vehicle industry. Although the price of Tesla's first product, the sport car "Tesla Roadster," is high, Musk claimed that sales will outpace those of other sports cars and will enable Tesla to finance the technology and increased production volume required to market its successor, a "Sporty four door family car" that will be more widely available and more affordable.

Bruckmann G. et al., 2021 research on the specific consumer traits and home-location-based geographic traits of current owners of battery electric vehicles (BEVs) and internal combustion engines in an area without many EV policies. In order to comply with international agreements, emissions from individual motorized transportation must be reduced. Alternatives to internal combustion engines are currently available on the market, but the adoption of electric vehicles (EVs) is still low because of a lack of widespread political support.

Kankoum C., 2017. Do a study on how Tesla used its strategy in foreign markets, examining the factor that contributed to its success, identifying issues it should address, and outlining the key management implications.

Liu J. et al., 2017 analyzed new energy vehicle innovations from Toyota, Tesla, and BYD as examples. This study examines and contrasts the primary innovations in the business model, ecological environment, market positioning, and innovation path and comes to the following conclusions: Toyota created a vehicle with a global configuration using an inventive symbiosis strategy that complemented the global relevant enterprise.

While Tesla is ranked first globally for the environment that fosters technological innovation. BYD, meanwhile, has created a platform for product innovation in Shenzhen by working with both domestic and international partners in a favorable ecological environment. The BYD product is built from a variety of core technologies and is intended to connect with extensive remodeling expansion, continuous low cost, high strength, integration, and open innovation.

M.E. Mangram (2012) The strategic marketing plan for Tesla Motors' line of electric vehicles is examined in this research. It has important marketing management implications because it examines this topic from the unique viewpoint of Tesla's "new technology"-based approach to automotive marketing and compares it with Apple Computer's productive marketing model.

This marketing strategy is in stark contrast to the normal marketing management approach used by the automotive sector, which supports mass marketing and mass production. This investigation was conducted using a qualitative, exploratory research methodology. The bulk of the case studies used in the study were about Apple Computer, and the research used secondary literature, data analysis, and case studies extensively.

The main findings are as follows: (1) The battery electric vehicle market is anticipated to grow quickly; (2) Tesla Motors is well positioned to benefit from this growth potential; and (3) Tesla's present and future success depend on a "new technology"-based approach to marketing management.

Maoheng W., 2018. This research examines the concept, components, and importance of brand marketing. Then discuss electric cars and Tesla, making Tesla brand marketing the study's main focus. resulting in the drawback and recommendation of pulling brand marketing that offer insightful information about profit models and marketing strategies for the electric vehicle industry.

This study demonstrates how EV companies have very appealing development prospects due to the variety of EVs' product positioning, profitability models, and business models, which range from the production of batteries to automobiles. Tesla is the main focus because it has a distinctive brand marketing business model that is more innovative than that of traditional automakers.

Sharma S. et al., 2020. This review article outlines the fundamental ideas behind electric vehicles (EVs) as well as the technological developments made from ancient to the present that have enhanced their performance. A thorough analysis of the primary parts and energy storage systems (ESS) used in electric vehicles is also included.

The primary focus of the paper is on batteries, which are essential to making electric vehicles more cost-effective, practical, and environmentally friendly. There are many different ESS topologies that have been taken into consideration, including hybrid combination technologies like hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), and many others.

The fundamental ideas behind electric vehicles (EVs) are described in this review article, along with the technological developments that have improved their performance over time. The main elements and energy storage systems (ESS) used in electric vehicles are also covered in detail.

The paper primarily focuses on batteries because they are a vital part of making electric vehicles more cost-effective, practical, and environmentally friendly. There are a number of ESS topologies that have been taken into consideration, including hybrid combination technologies like hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), and many others.

Yang Et al., 2019. This study on the status of electric vehicles in China is crucial and valuable as a benchmark for other countries developing electric vehicles because China boasts a sizable market for EVs. It is essential to create low-carbon, energy-saving, and intelligent electric vehicles in order to reduce our impact on the climate.

This study first offers a theoretical framework based on the theory of planned behavior (TPB), the technology acceptance model (TAM), and innovation diffusion theory in order to examine the significant factors affecting consumers' purchases of electric cars. (IDT). The findings demonstrate that: It is acceptable to apply the key factor model developed in this research to consumers' behavioral intentions regarding the purchase of electric vehicles.

Kresno B.W. Et al., 2021. This study was carried out to determine the market potential for electric vehicles in Indonesia and to offer advice to businesses operating in the sector. Therefore, it is important for businesses to understand what influences customers' decisions to buy electric cars.

This study used the Theory of Planned Behavior to comprehend those elements (TPB). Additionally, it was discovered that attitude has a significant impact on the purchase intention (PI) of electric cars (AT). While environmental value has a significant impact on one's attitude toward buying an electric automobile (AT). In conclusion, this analysis demonstrated that Indonesia has significant development potential for electric cars. Additionally, it displays the variables that affect Indonesian consumers' intentions to buy electric cars.

Yuniza et al., 2021. Research focuses on incentive strategies with related theories in an effort to address Indonesia's issues with the development of electric vehicles. Electric vehicles have become a global trend for states to create as part of an endeavor to actualize an environmentally friendly economy, including in Indonesia.

The government must provide electric automobiles in Indonesia significant support. Indonesia plans to start producing indigenous electric automobiles in 2022. The goal in Indonesia is for electric automobiles to account for 20% of the market by 2025. Through President Regulation Number 55 of 2019 about the Acceleration of the Battery Electric Vehicle Program for Road Transportation, the Indonesian government aimed to offer incentives for hastening the development of electric vehicles in this circumstance.

The public has not yet started switching to electric vehicles as a result of this legislation, nevertheless. The absence of government-sponsored incentives that customers can take advantage of would be the determining factor for this challenge. The government's incentive program, according to the author, is still in doubt because it hasn't been able to convince people to switch to electric cars.

Prasetio et al., 2019. This study tries to understand why public electric vehicles, as opposed to shuttle buses, public buses, private motorcycles, and private cars, are preferred for long-distance (about more than 20 km) daily commuting. Statement assessments, sociodemographic characteristics, and stated preferences are the three elements of a questionnaire-based survey used for data gathering (SE). Multinomial logit (MNL) modeling approaches, which are frequently utilized in transportation research, are applied in this study. The findings suggest that while choosing a mode of transportation, Indonesian commuters are primarily attentive to travel and congestion times. It appears that commuters who use public transportation are more concerned about pollution, vibration, and noise levels than commuters who use private transportation. Additionally, it appears that commuters do not place much importance on emissions. However, public electric bus is more preferred to public bus with the same parameters.

2019; Carley S. et al. The author of this research examines whether shifts in consumer interest in PEVs have coincided with market and technological advancements. The author looks at how intent to purchase or lease a battery electric vehicle or a plug-in hybrid electric vehicle has changed between 2011 and 2017 in order to address this question, as well as how the factors that affect intent variation have changed over time. The information for our analysis came from two nationwide surveys of potential car buyers in the 21 largest American cities.

One of the key findings from the analysis is that between 2011 and 2017, survey respondents' intentions to purchase a PEV increased, and that over time, perceptions of trial-ability, observability, network effects, and policies have contributed to an increasing amount of the variation in purchaser intentions.

No.	Author Name	Year	Title	Output
1.	Andersen M. et al.	2016	What Automaker can learn from Tesla Phenomenon	Provide Tesla business model
2	Bruckmann G et al.	2021	Battery Electric Vehicle adoption in regions without strong policies	Insight on factor that effect the EV adoption.
3.	Cedric Kamkoum	2017	Tesla, Inc. International Business Strategies	Provide Tesla foreign market strategies, the barrier, and success strategy
4.	Liu J. et al.	2016	Innovation model analysis of new energy vehicles: taking Toyota,	Provide business model comparison between Toyota, Tesla, and BYD

			Tesla and BYD as an example	
5.	Mangram M.E.	2012	The globalization of Tesla Motors: A strategic marketing plan analysis	Conclude that EV is poised for explosive growth, Tesla Motor is positioned for growth opportunity, and "new technology" is Tesla current and future marketing management
6.	Maoheng W.	2018	Research On The Brand Marketing Of Tesla Electric Vehicle	Provide Tesla Brand marketing, its drawback, and suggestion for Tesla
7	Sharma S. et al.	2020	Storage technologies for Electric Vehicles	Provide an insight of energy storage for various Electric Vehicle and its technological development
8	Yang C. Et al.	2019	Key Factors Influencing Consumers' Purchase of Electric Vehicles	Provide a key factor model regarding the intention of EV purchase.
9	Kresno B.W. Et al.	2021	Electric Car Penetration Potential in Indonesia	Factor that influence in buying an EV which is Environment Value and Attitude
10	Yuniza E. M. Et al.	2021	Indonesia's Incentive Policies on Electric Vehicles: The Questionable Effort from the Government	Determinant factor that influnce public to switch to an EV, which is goverment subsidies & Incentive
11	Prasetio et al.	2019	Acceptance of Electric Vehicle in Indonesia: Case Study in Bandung	Concerning factor that influence public to prefer choosing conventional public transport vs EV public transport

12	Carley S. Et al.	2019	Evolution of plug-in electric vehicle demand: Assessing consumer perceptions and intent to purchase over time	Finding that proves an increase of EV Demand between 2011 to 2017 and its factor that variate the intention of transporting

Table 1. Inductive Review

2.2. Deductive Study

2.2.1 Structural Equation Modelling

Structural Equation Modeling (SEM) is a method for research that analyzes a collection of regression equations simultaneously. In other words, the purpose of SEM analysis is to analyze the relationship between 1 or more independent variables and 1 or more dependent variables.

SEM analysis can test simple models, but it can also test complex relationships, such as factoral analysis and time series analysis. The output of SEM structural relations can be modeled as a graph that provides clear insight into the results of the existing analysis. In general, SEM analysis is used to analyze a relationship or relationship between independent and dependent variables (Cheung, 2008).

In this research, SEM Analysis is used on the variables of key factor of buying intention in behalf of Electric Vehicle, to know the relationship between variables so that the strategy can be analyzed for its effectiveness and adjusted to the needs of the Indonesian market. Research on penetration strategies using SEM with the PLS program will make this research a renewable one.

2.2.2 Marketing Mix 7P's

The seven components of a marketing mix—product, price, promotion, venue, people, process, and tangible evidence—are known as the "7Ps of marketing" (Tjiptono. 2015). To study and develop marketing strategies, these elements are used. Here is a quick description of each element:

Product: This is used to describe the items or services that a company provides to its clients.

Price: The price of a product is the sum of money that a consumer must spend to purchase it.

Advertising, sales promotions, public relations, and personal selling are just a few of the many strategies that a company may employ to reach and influence its target market.

Place: This refers to the channels—such as retail storefronts, e-commerce websites, and distributors—through which a product is distributed and made accessible to consumers.

People: The business's internal people resources as well as its clients and other stakeholders are included in this element.

Process: This component describes the systems and practices that a company use to manufacture and deliver its goods to clients.

Physical evidence: This refers to the visible components of a company, such as its logo, packaging, and the exterior of its buildings, which might affect customers' perceptions.

Businesses can create efficient marketing strategies that will help them achieve their goals by taking into account these factors in their marketing planning and decision-making.

2.2.3 Electric Vehicle

An electric vehicle (EV) is a type of vehicle that uses electric power to move. It is powered by one or more electric motors, which use electricity from a battery or fuel cell to drive the vehicle. Some examples of EVs include electric cars, electric buses, electric bikes, and electric scooters. One of the main advantages of EVs is that they do not produce any emissions, making them a cleaner and more environmentally-friendly transportation option. They also tend to be more energy-efficient than vehicles with internal combustion engines, as they do not waste energy through the process of burning fuel (Kamal, M. S., et al., 2020).

There are a few different types of EVs, including:

Electric cars (EVs) that only use an electric motor and a battery are known as battery electric vehicles (BEVs). The vehicle's motor is powered by energy that is stored in the battery.

Electric vehicles (EVs) that use fuel cells to produce energy for the motor are referred to as FCEVs. Water and heat are the only byproducts of the fuel cell's process, which converts hydrogen into energy by combining it with oxygen from the air.

Hybrid electric vehicles (HEVs) are automobiles with an electric generator and an internal combustion engine. The vehicle can switch between using the internal combustion engine and an electric motor as required. The electric motor is powered by a battery. (Kamal, M. S., et al., 2020).

2.2.3.1 Key Components of an Electric Car

In accordance with Ahmad (2019). Below is a diagram of the electric car's parts:

Battery: In electric drive cars, the batteries supply electricity to run the accessories.

Charge Port: To charge the battery cell, the vehicles are connected to an external power source via the charge port.

Using a DC/DC converter, the traction battery pack's higher-voltage DC power is transformed into the lower-voltage DC power required to operate the vehicle's accessories and replenish the auxiliary battery.

Electric Traction Motor: Powered by the traction battery cell, it propels the vehicle's wheels. When braking, the engine occasionally functions as a generator.

On-Board Charger: This device uses the charge connection to accept AC power and transform it into DC power to charge the traction battery. While the pack is charging, the battery's characteristics including voltage, current, temperature, and status of charge are tracked.

Power Electronics Controller: This device regulates the passage of electrical energy and regulates the electric motor's speed and torque.

The thermal system ensures that the engine, electric motor, power electronics, and other parts operate within the correct temperature range.

Transmission: In electric vehicles, the transmission converts electrical energy into mechanical force that drives the wheels.

2.2.3.2 Batteries Energy storage

Batteries are a crucial component of the technologies used in plug-in hybrid, all-electric, and hybrid electric vehicle (HEV) and hybrid electric vehicle (PHEV) vehicles. (EVs). Due to their high energy density per mass, high power-to-weight ratio, high energy efficiency, high temperature performance, and low self-discharge traits, lithium-ion batteries are the most frequently used batteries in portable consumer electronics like mobile phones and laptops.

Although this battery can be recycled, doing so would be very expensive and would present a problem for the sector. Other choices include lead-acid and nickel-metal hydride batteries, but their effectiveness is inferior to that of lithium-ion and is steadily declining. (Gaines, 2014).

2.2.3.3 Charging Station and Charging Time

Electric vehicle charging stations that supply electricity are necessary for the battery recharge of electric vehicles, such as electric cars. To charge their cars, consumers use charging stations, also known as electric vehicle supply equipment. Vehicles can be charged at home, at the office, or in public locations.

The primary determinants of charging time are battery capacity and charging power. The voltage handling capabilities of the batteries and charger electronics in the vehicle determine the charging level, which in turn determines the time rate of the charge. One of the biggest issues with electric vehicles is the fact that recharging an EV takes at least a couple of hours while refueling a traditional car only takes a few minutes. (Liu J, 2020).

The charging method that uses the power found in a standard outlet is presently the slowest option available. Hungary has 230 volts and 10 amps, or 2.3 kW, of power accessible. A 12-hour charge for an electronic car can be completed in as little as 30 minutes. The capacity of the battery and the rate of the charging station will determine this. An average electric car's (60kWh battery) battery can be fully charged in just under 8 hours using a 7 kW charging point. The available charging options currently vary from 2.3 kW to 145 kW.

2.3 Variable Factor

2.3.1 Socio demographic

The socio demographic factor is a set of personal variables that affects how people behave and make decisions. Age, gender, marital status, education, income, employment, and vehicle ownership are significant factors influencing the adoption of electric vehicles, according to (Eccarius et al., 2020).

2.3.2 Financial Factor

The purchase price represents the Electric Vehicle initial cost, excluding any incentives. According to Sierzchulaet al.,(2014) the biggest battery capacity is what leads to the high buying price of electric vehicles. Battery cost is the price associated with replacing a battery after its original life has expired.

According to study by Krause et al.,(2013) the cost of the batteries is one of the financial obstacles to purchasing an electric car. Compared to the cost of gasoline, the charging cost is the price of electricity used to operate an Electric Vehicle (CaulfieldB., 2012). Maintenance expenses are regular maintenance expenses for Electric Vehicles, not accident-related repairs that have an influence on the adoption of Electric Vehicles (Long S., 2012)

2.3.3 Technological Development

The electric motorcycle battery can travel the greatest distance once it has been completely charged. According to Zhang et al. (2016), vehicle performance refers to how customers rate electric vehicle features like range, power, charging speed, safety, and battery life. The top speed of an electric motorbike is power. An electric motorcycle must be completely charged over the course of time.

2.3.4 Ecosystem

The infrastructure of available charging stations is something that adopters of electric vehicles cannot escape. Public charging stations are thought to be crucial for promoting the uptake of electric vehicles. (Jensen, 2013). Customers also required charging availability at home and at work (Kurani, 2012) to maintain the battery of their car. According to Krupa et al. (2014), the accessibility of repair facilities for regular maintenance and damage has an impact on the uptake of electric vehicles.

CHAPTER III
RESEARCH METHOD

This chapter will demonstrate the research's flow by first identifying the problem at hand, acquiring information from potential EV users, EV user, and ICEV user then analyzing it using Structural Equation Modeling.

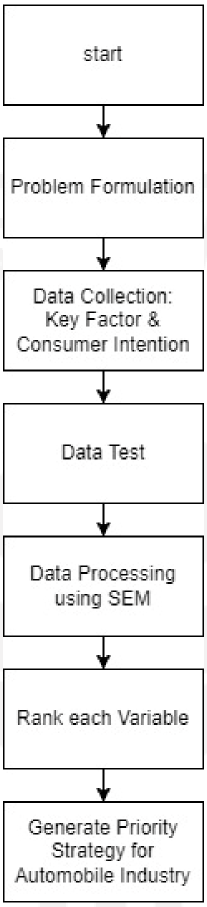

Figure 2. Research Flow

3.1 Data Collection

The gathering of the study's necessary data is the first stage in conducting the research. Demand data and journey time data are the two data that need to be collected. Each section will include an explanation of the data collection process in depth. The methodology of this study will be covered in this part. The study topic and object, data types, data processing, and research flow will all be explained. The research methods will be described in general below.

3.2 Research Subject

The subject of the research will be divided into two main group, which is consist of user of Internal Combustion Engine Vehicle (ICEV), user of Electric Vehicle (EV), and potential user of EV.

3.3 Research Object

A Model of strategy for automobile industry in Indonesia is the main object of this research. This research is conducted to develop strategy of automobile industry that transform their focus from ICEV to EV based on Structural Equation Modeling.

3.4 Data Types

In this research, the author uses primary and secondary data. The primary data is gathered using online questionnaire that gather data about the basic knowledge of EV in the perspective of potential user and current user of EV & ICEV. While in the other hand, source for secondary data must be dependable and trustworthy in order to be used as research input. Data was gathered by the researcher on Indonesia's ecosystem growth and the country's present EV sales situation.

3.5 Questionnaire

To do the SEM Analysis, the researcher needs data from automotive observer on how is the current state of EV in Indonesia, how is the specification and gimmick feature, the price, and even their opinion on ecosystem and Total Cost of Ownership that EV faces. The form of the instrument used to collect data is in the form of a questionnaire.

To obtain questions related to this research problem, a list of several references that are relevant to the research problem and discussion is compiled. On this research, the questionnaire is shared to several automotive forums, combined from ICEV automobiles forum and EV automobile forums.

3.6 Data Processing

In this research, the gathered data will be processed using SEM Analysis. The data processing will be using Microsoft Excel software to test the fitness and using PLS to analyse using SEM Method. The result will shows the relation between each variable to the individual's interest in buying an electric vehicle and its ranked value.

3.7 Variable Identification

There are four variable that being used in this research, which is: Social Demographic, Finansial Factor, Technological Development, and Ecosystem. All of those variable is discovered through deductive study.

Social Demographic variable will cover age, gender, income, and current vehicle ownership. Finansial Factor will cover on price of EV, the maintenance, Total Cost of Ownership, and subsidiary from government.

Technological Developement will cover on current state of battery range provided, battery cost, technical specification, and EV features. And lastly, the ecosystem that will wrap about charging station avaibility, the portability of a charger, and service place for routine maintenance.

Variable	**Item**	**Code**
Demographic	Age	D1
	Gender	D2
	Net Income	D3
	Vehicle Ownership	D4
Financial	EV Price	F1
	Maintenance Cost	F2
	TCO	F3
	Incentive / Subsidiary	F4
Technological Development	Battery / Range Capacity	T1
	Feature	T2
	Technical Specification	T3
Ecosystem	Charging Station avaibility	E1

	Portability of charger	E2
	Aftersales guarantee	E3

Table 2. Factor Variable

3.8 Hypothesis

According to the literature chapter 2, this research will be built with these hypothesis, later on this hypothesis will be tested and analyzed using Structural Equation Modelling (SEM).

Demographic	H1	Age has a positive significant effect on the intention of buying an Electric Vehicle.
	H2	Gender has a positive significant effect on the intention of buying an Electric Vehicle.
	H3	Income has a positive significant effect on the intention of buying an Electric Vehicle.
	H4	Vehicle Ownership has a positive significant effect on the intention of buying an Electric Vehicle.
Financial	H5	EV Price has a positive significant effect on the intention of buying an Electric Vehicle.
	H6	EV Maintenance has a positive significant effect on the intention of buying an Electric Vehicle.
	H7	EV TCO has a positive significant effect on the intention of buying an Electric Vehicle.
	H8	EV Incentive/subsidiary has a positive significant effect on the intention of buying an Electric Vehicle.
Technological Development	H9	EV Range Capacity has a positive significant effect on the intention of buying an Electric Vehicle.
	H10	EV ADAS Feature has a positive significant effect on the intention of buying an Electric Vehicle.
	H11	EV Technical Specification has a positive significant effect on the intention of buying an Electric Vehicle.
Ecosystem	H12	EV Charging Station Spreadness has a positive significant effect on the intention of buying an Electric Vehicle.

	H13	EV Charging Portability has a positive significant effect on the intention of buying an Electric Vehicle.
	H14	EV Aftersales Guarantee has a positive significant effect on the intention of buying an Electric Vehicle.

Table 3. Hypothesis

3.8.1 Likert Scale

Measurement scale The variables used in this study are quantitative, so to measure these variables using a Likert scale. The answer scale in the questionnaire is made using a scale of 1 – 5 to represent the opinions of the respondents. The criteria and values for the scale are:

Strongly willing : 5
Agree : 4
Disagree : 3
Moderately agree : 2
Strongly disagree : 1

3.8.2 Data Quality Test

Data Normality
Normality testing aims to determine whether the data is normally distributed or not. There are two stages of data normality testing. First, testing the normality for each variable, while the second stage is testing the normality of all variables together which is caled multivariate normality (Santoso, 2011). The processes involved in the data normality test are as follows: the test is carried out by calculating the critical ratio (cr) of the skewness level of a variable, with the following process: 33 Calculating the standard error of skewness. $.e$ = 6 where N is the number of samples.

3.8.3 Confirmatory Analysis Test

Confirmatory testing aims to see if there is a fit of the hypothesized model. The hypothesized model consists of one or more latent variables, which are measured by one or more indicator variables. To measure latent construct indicators, Confirmatory Factor Analysis (CFA) was used. At this stage, Confirmatory Factor Analysis (CFA) is used to confirm the consistency of a theory and exogenous and endogenous constructs. At another stage, goodness of fitness evaluation, validity and reliability tests are also carried out.

3.9 Goodness of fit

Structural Equation Model Equation Model is a statistical technique that allows simultaneous analysis of one or more independent variables. Evaluation of the fitness of the model through several measurements that are important in evaluating various goodness of fit criteria are as follows (Ghozali, 2014):

a. Chi Square Statistics

   The chi square test is used to see if there are any variations between the sample covariance matrix and the (trained) covariance matrix model. (Latan, 2013). The smaller the value of chi square produced, the better the model used in the study. This is because a small value of chi square can produce a probability value (p) that is greater than the level of significance (), which explains why the input data of the covariance matrix between predictions and the actual observations do not differ significantly.

b. GFI (Goodness Of Fit Index)

   The estimated population covariance matrix is used to determine the weighted proportion of the variance in the sample covariance matrix. Non-statistical measures have values between 0 (poor fit) and 1 (perfect match). (perfect fit). The model will be able to describe the data more effectively the closer the GFI value is to 1.

c. AGFI (Adjusted Goodness Fit of Index)

The degree of freedom for the suggested model compared to the degree of freedom for the null model is adjusted to create the adjusted goodness fit of index (AGFI), which is a development of the GFI. The ideal number is greater than 0.90.

d. TLI (Tucker Lewis Index)
A model with a TLI value > 0.95 and a value close to 1 suggests a very excellent fit. The Tucker Lewis Index compares a tested model to a baseline model.

e. RMSEA (The Root Mean Square Error of Appoximation)
An index that can be used to account for the chi square statistic in a big sample is the root mean square approximation error. The RMSEA number of 0.08 is a measure of the model's acceptability and illustrates how well the model fits the data based on the degrees of freedom. When the model is estimated in the population, the RMSEA value shows the anticipated goodness of fit.

f. CFI (Comparative Fit Index)
As the results approach 1, the level of fit in the data is said to be strong or a very good fit. The magnitude of an excellent CFI index has a range of values from 0-1. The CFI value of 0.90 was used in the research to denote a good fit of the data. Because it is so effective at gauging the degree of model acceptance, this indicator has the benefit of being unaffected by sample size.

3.9.1 Hypothesis Test

To be able to answer the hypotheses that have been put forward in this study, the next step after testing the structural equation model is to conduct causality analysis and hypothesis testing on several variables arranged in the research model.

Hypothesis testing is done by comparing the significance value of the research results. In this study, the significance level of the test used was (α) 0.05. The result of hypothesis testing is a determinant of whether the influence of a variable is significant or not.

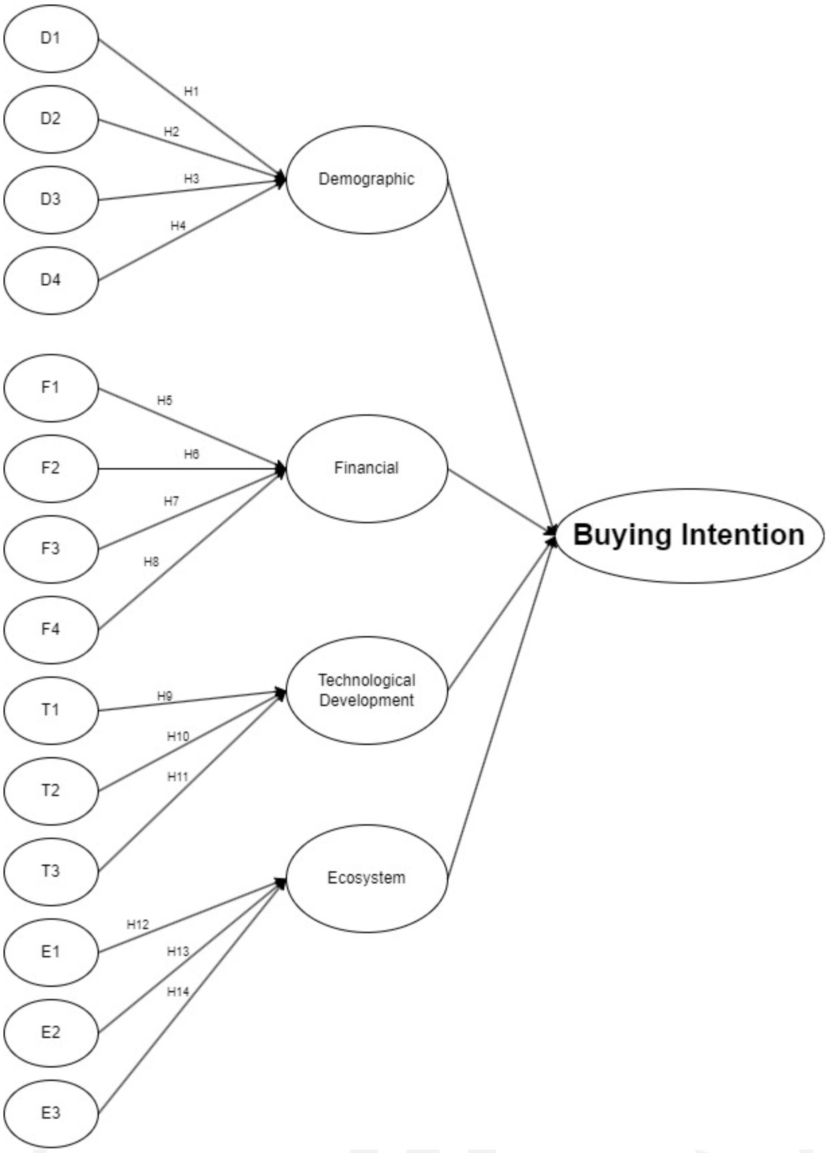

Figure 2. Hypothesis of the Model

CHAPTER IV
DATA ANALYSIS

By analyzing the relationships between the four latent variables outlined in the model, the study's main goal was to test a theoretical model of the impact of demographic, financial, technological development, and ecosystem factors on the purchasing intention of electric vehicles.

This part provides descriptive statistics of the sample and the variables used in the study using SEM AMOS as well as inferential statistics that address the research hypothesis. It also reflects on the response rate for the survey and structured record review. A total of 158 questionnaire responses were obtained; the respondent's personal information is shown below.

Respondent Demographic		
Age	17 - 25	32%
	26 - 35	39%
	36 - 45	20%
	46 - 60	10%
Gender	Male	79%
	Woman	21%
Net Income	< Rp. 2.000.000	24%
	< Rp. 10.000.000	28%
	< Rp. 20.000.000	23%
	< Rp. 50.000.000	17%
	> Rp. 50.000.000	8%
Current Vehicle	ICEV / Conventional Combusti	70%
	EV / Electric Vehicle	11%
	Hybrid Vehicle	18%

Table 4. Respondent Demographic

For the data collection, questionnaire spread have the answer of likert scale from 1 to 5, where 1 shows Strong unwilling, 2 for Unwilling, 3 for Biased, 4 for Willing, and 5 for Strong Willing. Below is the statistical data gathered from the data collected.

Buying Intention Statistics	Strong Unwilling	3%
	Unwilling	6%
	Biased	18%
	Willing	27%
	Strong Willing	46%

Table 5. Likert Scale

Data Normality Test Results

Normality test aims to see the level of normality of the data used in this study. This test is done by observing the skewness value of the data used. The data can be said to be normally distributed if the critical ratio value of the skewness value is below the range of ± 2.58 (Ghozali, 2005).

Variable	min	max	skew	c.r.	kurtosis	c.r.
E1	1.000	5.000	-.900	-4.616	.177	.455
E2	1.000	5.000	-1.046	-5.366	.424	1.087
E3	1.000	5.000	-1.231	-6.317	1.054	2.704
T1	2.000	5.000	-.802	-4.116	-.533	-1.367
T2	1.000	5.000	-.742	-3.807	-.188	-.482
T3	1.000	5.000	-.792	-4.062	-.342	-.877
F1	1.000	5.000	-1.010	-5.183	.078	.199
F2	1.000	5.000	-1.040	-5.338	.468	1.201
F3	1.000	5.000	-1.046	-5.367	.512	1.314
F4	1.000	5.000	-.909	-4.666	-.042	-.109
D1	1.000	4.000	.417	2.139	-1.130	-2.899
D2	1.000	2.000	.334	1.712	-1.889	-4.846
D3	1.000	5.000	.364	1.867	-.975	-2.501
D4	1.000	5.000	-.418	-2.147	-1.240	-3.182
Multivariate					79.253	23.533

Table 6. Data Normality

Based on the results of the normality test of the data in Table 6, it can be seen that the majority are normally distributed because there is no critical ratio value of the skewness value which is below the range of ± 2.58. Thus, it can be concluded that the data in the study have met the requirements for data normality, or it can be said that the data in the study have been normally distributed.

1. Confirmatory Factor Analysis (CFA)

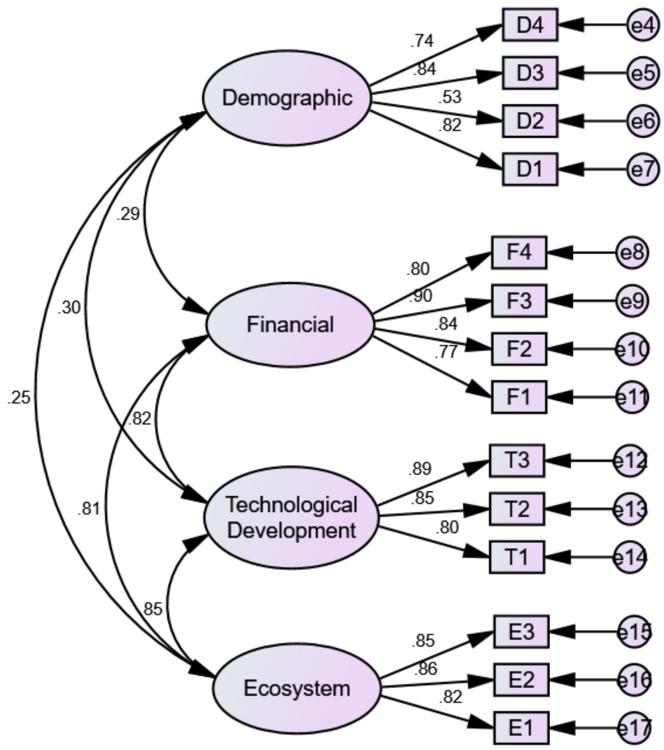

Figure 3. CFA Test

Variabel	Item	Standar Loading (λ)	Error (ε)	Σ (λ)	Σ (ε)	Construct Reliability (CR)	AVE	Keterangan
Demographic				2.940	1.885	0.821	0.541	Reliabel
	D4	0.742	0.880					Valid
	D3	0.840	0.460					Valid
	D2	0.535	0.174					Valid
	D1	0.823	0.371					Valid
Financial				3.312	1.424	0.885	0.659	Reliabel
	F4	0.804	0.317					Valid
	F3	0.900	0.184					Valid
	F2	0.840	0.291					Valid
	F1	0.768	0.632					Valid
Technological _Development				2.535	0.775	0.892	0.735	Reliabel
	T3	0.889	0.198					Valid
	T2	0.851	0.271					Valid
	T1	0.795	0.306					Valid
Ecosystem				2.537	0.796	0.890	0.729	Reliabel
	E3	0.854	0.255					Valid
	E2	0.860	0.244					Valid
	E1	0.823	0.297					Valid

Table 7. CFA Result

To estimate the measurement and structural model, this study used the two-step structural equation modeling (SEM) procedure suggested by Anderson (1988). Confirmatory Factor

Analysis (CFA) was used in the first step to evaluate the measurement model's construct reliability and validity, and in the second step, it was used to check the path effects and their importance in the structural model. Maximum likelihood estimation (MLE) was used to evaluate the measurement model in terms of factor loadings, measurement accuracy, convergent validity, and discriminant validity.

Table 7. provides a summary of the extracted average variance (AVE), standard errors, square multiple correlations, significance tests, and unstandardized and standardized factor loadings. The item reliability of each measure or square multiple correlation, the composite reliability of each construct, and the average variance extracted are three indicators for evaluating the convergent validity of the measuring items presented by Fornell and Larcker (1981). The internal consistency of dependability across all indicators in a construct is referred to as composite reliability.

Each normalized factor loading falls within a respectable range, between 0.821 and 0.892, as indicated in Table 7. This proves the convergent validity of each and every question. All of the constructs show internal consistency, as evidenced by the composite reliabilities of the constructs, which vary from 0.934 to 0.969 and are higher than the value of 0.7 suggested by Bernstein (1994).

			Estimate
D4	<---	Demographic	.742
D3	<---	Demographic	.840
D2	<---	Demographic	.535
D1	<---	Demographic	.823
F4	<---	Financial	.804
F3	<---	Financial	.900
F2	<---	Financial	.840
F1	<---	Financial	.768
T3	<---	Technological_Development	.889
T2	<---	Technological_Development	.851
T1	<---	Technological_Development	.795
E3	<---	Ecosystem	.854
E2	<---	Ecosystem	.860
E1	<---	Ecosystem	.823

Table 8. Exogenous Variable

Meanwhile, seen from the results of testing the exogenous construct model in Table 8, all indicators of exogenous variable questions have a value of more than 0.5. So that it can be said that all indicators of exogenous variable questions are declared valid.

GOODNESS OF FIT

This analysis aims to test whether the model developed is fit for use. Testing through the steps, namely the first is the Model FIT Test:

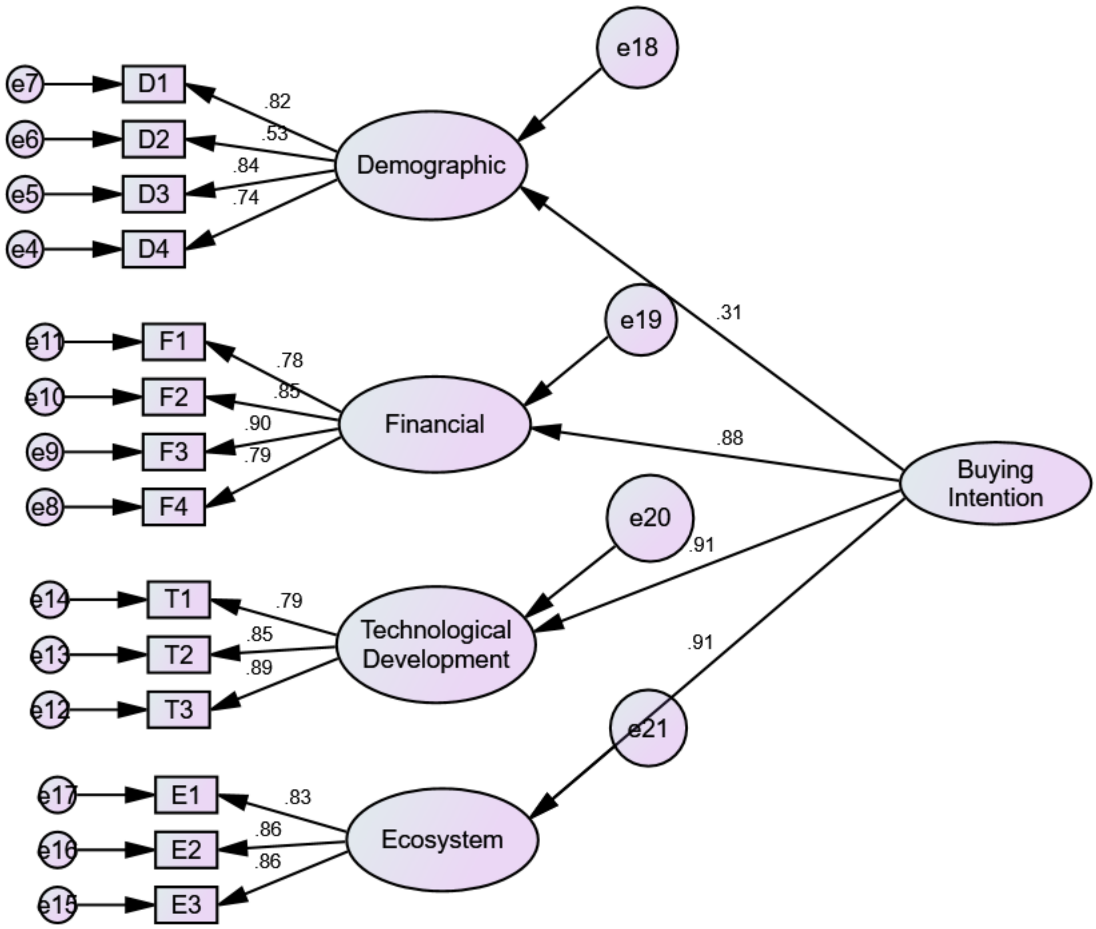

Figure 4. Goodness of Fit

Goodness of fit	Cut – off Value	Hasil Model	Keterangan
X2 – Chi Square	Diharapkan nilainya kecil	117.199	
Probability	> 0,05	0,000	Tidak Baik
CMIN/DF	<2	1.651	Baik
GFI	> 0,90	0,909	Baik
RMSEA	< 0,08	0,064	Baik
AGFI	> 0,90	0,866	Marginal
CFI	>0,90	0.969	Baik
TLI	>0,90	0.960	Baik

Table 9. Goodness of Fit Result

The table above shows that the Chi-square value is 117,199 <143.24 (X2 table) and the probability value is 0.000 less than 0.05. The probability value does not meet the recommended value standard so that the model does not fit. However, the Chi Square test with probability is not enough, because it can be measured from another Chi Square parameter, namely Cmin/DF.

The test results for the CMIN/DF value of 1.651 are smaller than 2 so that they have met the goodness of fit requirements. Furthermore, the RMSEA value of 0.064 is smaller than 0.08, so it is said to be good. Furthermore, the AGFI value is 0.909 above 0.9, the TLI value is 0.960 above the recommended value, namely 0.90, the last CFI value is 0.969 above the recommended value is 0.90. Based on these results, the model can be said to be marginally feasible.

Hypothesis Analysis Result

After the model is obtained, the author will summarize the results of the influence variables studied in the following table:

Indicator and Variable			Standard coefisien	t-value	p-value
D1	<---	Demographic	0.824	9.537	0.000
D2	<---	Demographic	0.535	6.273	0.000
D3	<---	Demographic	0.839	9.621	0.000
D4	<---	Demographic	0.742		0.000
F1	<---	Financial	0.776	10.563	0.000

F2	<---	Financial	0.848	11.832	0.000
F3	<---	Financial	0.897	12.668	0.000
F4	<---	Financial	0.791		0.000
T1	<---	Technological_Development	0.792	12.478	0.000
T2	<---	Technological_Development	0.853	14.167	0.000
T3	<---	Technological_Development	0.885		0.000
E1	<---	Ecosystem	0.834	12.825	0.000
E2	<---	Ecosystem	0.856	13.323	0.000
E3	<---	Ecosystem	0.856		0.000

Description: t-value is empty ( ) is an indicator as a variable preference so that it is automatically very significant

Table 10. Hypothesis Analysis Reesult

a) Influence of age on buying intention

According to the table 10, It is discovered that D1 (Age) obtained a standard estimate coefficient of 0.824 with a probability value of 0.000 <0.05, it can be stated that D1 has a significant effect on buying intention. Thus Hypothesis H1 Age has a positive significant effect on the intention of buying an Electric Vehicle. Supported by data and ranked no. 9 for the correlation to the buying intention.

b) Influence of gender on buying intention

According to the table 10, It is discovered that D2 (Gender) obtained a standard estimate coefficient of 0.535 with a probability value of 0.000 <0.05, it can be stated that D2 has a significant effect on buying intention. Thus Hypothesis H2 Gender has a positive significant effect on the intention of buying an Electric Vehicle. Supported by data and ranked no. 14 for the correlation to the buying intention.

c) Influence of net income on buying intention

According to the table 10, It is discovered that variable D3 (Net Income) obtained a standard estimate coefficient of 0.839 with a probability value of 0.000 <0.05, it can be stated that D3 has a significant effect on buying intention. Thus Hypothesis H3 Net Income has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 7 for the correlation to the buying intention.

d) Influence of vehicle ownership on buying intention

According to the table 10, It is discovered that variable D4 (Vehicle Ownership) obtained a standard estimate coefficient of 0.742 with a probability value of 0.000 <0.05, it can be stated that D4 has a significant effect on buying intention. Thus Hypothesis H4 Vehicle Ownership has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 13 for the correlation to the buying intention.

e) Influence of EV price on buying intention

According to the table 10, It is discovered that F1 (EV Price) variable obtained a standard estimate coefficient of 0.776 with a probability value of 0.000 <0.05, it can be stated that F1 has a significant effect on buying intention. Thus the H5 EV Price hypothesis has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 12 for the correlation to the buying intention.

f) Influence of maintenance cost on buying intention

According to the table 1010, It is discovered that Variable F2 (Maintenance Cost) obtained a standard estimate coefficient of 0.848 with a probability value of 0.000 <0.05, it can be stated that F2 has a significant effect on buying intention. Thus Hypothesis H6 EV Maintenance has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 6 for the correlation to the buying intention.

g) Influence of total cost of ownership on buying intention

According to the table 10, It is discovered that Variable F3 (Total Cost of Ownership) obtained a standard estimate coefficient of 0.897 with a probability value of 0.000 <0.05, it can be stated that F3 has a significant effect on buying intention. Thus the H7 EV TCO hypothesis has a positive significant effect on the intention of buying an Electric Vehicle. It is supported by data and ranked no. 1 for the correlation to the buying intention.

h) Influence of incentive on buying intention

According to the table 10, It is discovered that Variable F4 (Incentive) obtained a standard estimate coefficient of 0.791 with a probability value of 0.000 <0.05, it can be stated that F4 has a significant effect on buying intention. Thus the H8 EV Incentive/subsidiary hypothesis has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 11 for the correlation to the buying intention.

i) Influence of range capacity on buying intention

According to the table 10, It is discovered that Variable T1 (Range Capacity) obtained a standard estimate coefficient of 0.792 with a probability value of 0.000 <0.05, it can be stated that T1 has a significant effect on buying intention. Thus the hypothesis H9 EV Range Capacity has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 10 for the correlation to the buying intention.3

j) Influence of feature on buying intention

According to the table 10, It is discovered that Variable T2 (Feature) obtained a standard estimate coefficient of 0.853 with a probability value of 0.000 <0.05, it can be stated that T2 has a significant effect on buying intention. Thus the hypothesis H10 EV ADAS Feature has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 5 for the correlation to the buying intention.

k) Influence of technical specification on buying intention

According to the table 10, It is discovered that Variable T3 (Technical Specification) obtained a standard estimate coefficient of 0.885 with a probability value of 0.000 <0.05, it can be stated that T3 has a significant effect on buying intention. Thus Hypothesis H11 EV Technical Specification has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no. 2 for the correlation to the buying intention.

l) Influence of charging station vaibility on buying intention

According to the table 10, It is discovered that Variable E1(Charging Station Avaibility) obtained a standard estimate coefficient of 0.834 with a probability value of 0.000 <0.05, it can be stated that E1 has a significant effect on buying intention. Thus the hypothesis H12 EV Charging Station Spreadness has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no.8 for the correlation to the buying intention.

m) Influence of portability of charger avaibility on buying intention

According to the table 10, It is discovered that Variable E2 (Portability of Charger) obtained a standard estimate coefficient of 0.856 with a probability value of 0.000 <0.05, it can be stated that E2 has a significant effect on buying intention. Thus Hypothesis H13 EV Charging Portability has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no.3 for the correlation to the buying intention.

n) Influence of aftersales guarantee avaibility on buying intention

According to the table 10, It is discovered that Variable E3 (Aftersales Guarantee) obtained a standard estimate coefficient of 0.856 with a probability value of 0.000 <0.05, it can be stated that E3 has a significant effect on buying intention. Thus Hypothesis H14 EV Aftersales Guarantee has a positive significant effect on the intention of buying an Electric Vehicle. supported by data and ranked no.4 for the correlation to the buying intention.

CHAPTER V
DISCUSSION

5.1 VARIABLE FACTOR

5.1.1 Demographic

Based on the Hypothesis test that has been done, can be concluded that demography does have effect on buying intention of Electric Vehicle, This is in accordance with previous research conducted by (Eccarius et al., 2020) which is "Age, gender, marital status, education, income, employment, and vehicle ownership are significant factors influencing the adoption of electric vehicles".

5.1.2. Financial Factor

Secondly, based on the hypothesis test that has been done, can be concluded that financial does have effect on buying intention of Electric Vehicle, This is in accordance with previous research conducted by Krause et al.,(2013) the cost of the batteries is one of the financial obstacles to purchasing an electric car.

Compared to the cost of gasoline, the charging cost is the price of electricity used to operate an Electric Vehicle (CaulfieldB., 2012). Maintenance expenses are regular maintenance expenses for Electric Vehicles, not accident-related repairs that have an influence on the adoption of Electric Vehicles (Long S., 2012)

5.1.3. Technological Development

Thirdly, on the hypothesis test that has been done, concluded that technological development does have effect on buying intention of Electric Vehicle, This is in accordance with previous research conducted by Zhang et al., (2016) said that vehicle performance refers to consumers evaluation on electric vehicle including mileage capacity, power, charging time, safety, and battery life.

5.1.4. Ecosystem

According to earlier research by Jensen et al. (2013), the availability of public charging stations is essential to support the adoption of electric vehicles. Ecosystem also has an impact on purchasing intentions for electric vehicles.

Customers also required charging availability at home and at work (Kurani, 2012) to maintain the battery of their car. According to Krupa et al. (2014), the adoption of electric vehicles is impacted by the availability of service facilities for regular maintenance and damage.

5.2. MAJOR RELATED VARIABLE

5.2.1. Total Cost of Ownership (TCO)

As written above on chapter 4, every variable has its rank to the intention of buying, lead by variable F3 which is Total Cost of Ownership. This variable state that the TCO's is the major reason an individual think and decide on their option to adopt an Electric Vehicle. TCO's cover all cost that comes from owning the electric vehicle, from initial purchase, daily recharge cost, maintenance, untill depreciation loss when the vehicle is being sold.

This variable need to be the focus for the industry to prioritize lowering cost for customer owning an EV from the production cost to the daily cost. The industry should developed teams specialized on decreasing the price of EV car, specifically the battery unit as the battery is considered as the most valuable thing in an EV.

5.2.2. Technical Specification

While for the 2nd rank, which is Technical Specification, means that consumer of vehicles prefer to prioritize a great technical specification of the EV such as top speed, acceleration, range capacity, battery age, charging time. These are the thing that automobile should focus on, creating a higher range capacity, higher top speed and better acceleration, faster charging and developing a battery that deteriorate less.

In the development of EV, the industry should consider the technical specification of conventional car within the same range of the developed EV. The conventional car should be the base minimum for the EV technical specification so that the consumer will be interested in adopting an EV.

5.2.3. Portability of Charger

For the 3rd rank, which is portability of charger, means that consumer prefer to have a charger that is portable so that the user of electric vehicle can charger wherever they are as there is a electronical socket to plugged in. The flexibility of the charger become one of the dominant reason a person will bought an EV. There are a few different aspects to consider when it comes to the portability of charger development for electric vehicles (EVs) (Finn, 2020). Here are some of the key factors to consider:

Charger compatibility: In order for a charger to be portable, it needs to be compatible with a wide range of EVs. This means that it should be able to work with different types of connectors, voltages, and current ratings.

Physical size and weight: A portable charger should be compact and lightweight, making it easy to transport and store.

Power source: A portable charger will need a power source in order to function. This could be a wall outlet, a generator, or a battery pack.

This should be taken into account when the car industry decides whether to make portable chargers standard equipment for every electric vehicle. Battery shifting is an alternative to this that functions by switching out the exhausted battery for a new one that is fully charged. Driving into a battery switch bay is the first step in the procedure. An automated system will then position the car, disconnect the old battery, and install a completely charged one in its place.

Depleted batteries are charged in the station for later use. The system operates under the business model that the EV user owns the vehicle, not the battery. The battery swapping remains the fastest method (equivalent to refueling time). In Indonesia, this business model is applied on the business of LPG Gas for household needs, where the consumer bring in empty tube of LPG and paying for a replacement that has been fulfilled with LPG.

5.3 PROPOSED STRATEGY – BASED ON STRUCTURAL EQUATION MODELLING

5.3.1. Total Cost of Ownership (TCO's) Adjustment

From the result above, it is stated that the Total Cost of Ownership (TCO's) is the primary reason for a person deciding to buy an Electric Vehicle. There is various way to lower the TCO's of EV. From the energy side, a development of charger so that an EV user can recharge their battery using a solar panel or hydroelectric power plant so that the recharging cost is lower. In the other hand, the major TCO's is the initial cost which is the buying cost. It is important for the automobile industry to lead the R&D division to prioritize on finding a way to lower the research cost and manufacturing cost as both of those is the main reason the TCO's become high for an EV.

Another way is that the manufacturer can establishing a join company so that the R&D cost can be split for both company, while the result of the R&D can be use for both company also, besides R&D, join company also able to produce the same base electric vehicle so that the production plan development cost can be split up. This has been practised by Chevrolet and Wuling under the main company which is General Motor's.

Other way to reduce the TCO's is reducing the upfront cost, or can be called as initial cost by buying the Electric Vehicles. This can reduced by petitioning to the government to give specialized incentive for the Electric Vehicles, the incentive can be various, started from the tax incentive to charger installment incentive.

No.	**Things to consider to lowering the TCO's**
1.	Establish a joint company
2.	Producing a major part with universal capability of installation
3.	Prompting a Government Incentive

5.3.1.1. Joint Company, Common Part, and Government Incentive Fundamental

There are some instances of collaborations between automobiles industry that have acknowledged gains in productivity by having a joint company:

Toyota and Mazda made plans to spend $1.6 billion to construct a new assembly plant in the US public in 2017. The joint venture, according to the companies, would lead to reduced costs and greater manufacturing efficiency because the factory would be set up to build cars on a common platform. (Shepardson D., 2017)

Ford and Volkswagen in 2019 announce joint industry for commercial and electric vehicles (Klayman B., 2019). The businesses claimed that their cooperation would lead to substantial cost savings and increased productivity in the development and manufacture of vehicles.

One case in point is Norway, which has one of the greatest rates of EV adoption worldwide. In order to promote EV ownership, the government of Norway has put in place a number of incentives, such as tax exemptions, decreased toll and ferry costs, and cost-free public parking. Resulting in a significant increase in EV sales, which will make up more than half of all new car sales by 2020.

5.3.2. Technical Specification Development

Ranked 2nd on prioritize, the industry should point their R&D to research on technical specification so that the developed EV should at least overtake the specification of conventional vehicle, as the foundation of EV motor that have the instant torque, this should be an easy thing to do. As the instant torque goes, the e-vehicle should be able translating the power efficiently to the wheels so that more power is translated to more travelled range which in return, higher efficiency.

Another character that consumer didn’t want in the EV is the character of battery capacity when the EV is used on high speed constantly, which in case such as highway intercity trip and when the EV is use for towing a trailer that brough a weighty load. These both two scenario shorten the range capacity in a significant way. The R&D should be able to find a way to computate this problem, one of the option is by using a reduction gear or a transmission so that when rolling speed is high, the rotation on the electric motor is much slower than before.

5.3.2.1. Transmission Development Fundamental

Compared to gasoline-powered cars, electric vehicles (EVs) have a much simpler drivetrain, so they typically do not use conventional transmissions. Unlike gasoline-powered cars, which need a complicated gearbox to convert the engine's high-speed rotation to the right wheel speed, EVs depend on an electric motor that produces torque directly to the wheels.

However, to maximize the motor's effectiveness and performance, some EVs do feature a single-speed gearbox, also referred to as a "reducer." The motor can run at its most effective speed while still supplying the wheels with enough torque to accelerate and ascend hills with a single-speed transmission.

EVs with multiple motors occasionally employ a two-speed transmission to enhance efficiency at both low and high speeds, such as the Tesla Model S and Model X. The extra gear increases the engines' efficiency and can increase the vehicle's range (Voelcker, 2019). In EVs, a transmission is generally used much less frequently than in gasoline-powered cars, but it can be useful for maximizing the speed and efficiency of the vehicle.

5.3.3. Portability of Charger Development

Overall, the portability of charger development for EVs is an important consideration, as it allows drivers to charge their vehicles wherever they go. The development of chargers for electric vehicles (EVs) can be made quite portable in a number of ways:

Standardization: The absence of a global standard for EV charging connectors is one of the biggest obstacles to charger compatibility. It would be simpler to design chargers that are compatible with a variety of EVs by creating a standardized connector.

Miniaturization: As technology advances, it might be possible to produce lighter, more portable chargers that are also smaller and easier to store.

Some portable chargers are dependent on a single power source, such as a wall outlet or a generator. It would be simpler to charge EVs in different locations by creating chargers that can use a range of power sources.

Overall, there are a variety of ways that portable charger development for EVs could be improved, and it is probable that in the upcoming years, we will see a variety of new and inventive products in this area.

5.3.3.1. Charger Development Fundamental

There is evidence to indicate that the expansion of EV sales has been aided by the development of EV charging infrastructure. Norway has made significant investments in EV charging facilities, with over 11,000 public charging stations spread out across the nation. As a consequence, Norway has seen a significant increase in EV sales, which will make up more than half of all new car sales by 2020.

Similarly, it has been demonstrated that building out a charging infrastructure boosts EV purchases in the US. The National Renewable Energy Laboratory (NREL) reported that the availability of charging infrastructure is a critical factor in EV adoption, with greater EV sales in areas with more charging stations. The study also discovered that the availability of rapid charging stations, which can supply a sizeable charge in a brief amount of time, can raise the likelihood that an individual will own an electric vehicle.

5.4 PROPOSED STRATEGY – BASED ON 7P

Here are some potential of the seven Ps for the electric vehicle (EV) market:

5.4.1 Product: The EV itself as well as any related goods or services, such charging stations, upkeep services, and financing alternatives, might all be considered products (Gillespie, 2019). The product in the context of the electric vehicle (EV) sector could consist of a variety of services, such as:

- Automobiles that run on electricity rather than gasoline include sedans, SUVs, sports cars, and other types of vehicles.

- Bicycles, scooters, and other electric vehicles geared at short-distance travel might all be considered electric bikes.

- Public transit buses, delivery trucks, and other types of electric-powered vehicles may fall under the category of electric buses and trucks.

- Charging stations: These could include those in homes, those in public locations, as well as other pieces of technology needed to charge EVs.

- Maintenance services: These could include tasks like tire rotations, oil changes, and other maintenance procedures required to keep EVs in good working order.

- Financing options: These can include loans, leases, and other financial solutions aimed at making EVs more affordable for customers.

Companies in the EV sector can cater to the various needs and preferences of their clients by providing a broad range of products and related services. Based on the SEM research, it is important that the industry focus on the specification technical and the provided portable charger as that become the main reason a person considering to transform to the EV.

5.4.2 Price: This would consist of the price of the EV as well as any additional costs or fees, like taxes, license fees, and financing expenses (Lefebvre, 2020). Industry in the electric vehicle (EV) sector can employ a number of techniques to price their goods in a way that maximizes sales, including:

- Pricing that is competitive with those of other EV firms can help to draw in clients who are price conscious.

- Price skimming: Pricing a new EV high initially then dropping it progressively over time can assist attract early adopters and increase revenues in the short term.

- Bundle pricing: By offering customers with value, packages that come with several goods or services such as powerfull charger or free charging for years can help industry grow their sales.

Companies in the EV industry can create pricing plans that are well-suited to their target market and business objectives by taking into account these and other pricing techniques.

5.4.3 Promotion: This could involve several forms of marketing and advertising to spread knowledge about the EV and urge people to buy it, like online advertising, social media campaigns, and events. According to Robinson (2019), The marketing mix's promotion component refers to the many strategies a company employs to interact with and influence its target market. Companies in the electric vehicle (EV) market can promote their products and raise brand awareness through a variety of tactics. Here are a few methods that can be done:

- Advertising: To reach a large audience and advertise EVs, Company can use a variety of media, including print and internet ads, radio and TV commercials, and social media campaigns.

- Sales promotions: Company can employ sales promotions to boost sales and draw in new clients. These include discounts, vouchers, and free trials.

- Public relations: Company can employ public relations strategies to improve their reputation and create favorable associations with their brand. These strategies include media relations, sponsorships, and CSR initiatives.

- Personal selling: Company can speak with customers directly and convince them to buy their EVs by using personal selling strategies including face-to-face selling and telemarketing.

Companies in the EV sector can effectively interact with and persuade their target audience to consider buying their products by using these and other promotion tactics.

5.4.4 Place: The channels that an organization uses to make its products available to customers are referred to as the place aspect of the marketing mix (Robinson L., 2017). Companies in the electric vehicle (EV) sector can employ a variety of tactics to maximize the place component of the marketing mix. Here are a few methods:

- Using channel optimization, companies can assess which of their outlets and distribution routes are most successful in reaching their target market and satisfying client needs. They can then concentrate on improving these channels and discontinuing others that are not producing satisfactory results.

- Online sales: Companies can contact clients that prefer to shop online by investing in e-commerce skills and utilizing online retailers and marketplaces.

- Partnerships and collaborations: Companies can look to collaborate and form partnerships with other businesses to broaden their consumer base and distribution networks.

- Convenience for customers: Companies can make it as easy as possible for customers to access and buy their items, for example, by enabling home delivery or offering practical payment alternatives.

Companies in the EV sector can optimize the place component of the marketing mix and make it simpler for customers to access and buy their products by putting these and other tactics into practice.

5.4.5 People in the EV sector, such as salespeople, technicians, and customer support agents, would be included in this category. The consumers and other market participants for EVs would also be included. Companies in the electric vehicle (EV) sector can employ a variety of techniques to handle the people element of the marketing mix. Here are a few illustrations:

- Employers can hire and educate workers who are informed about EVs and capable of offering top-notch customer care. This could contribute to improving customer satisfaction and establishing a great customer experience.

- Customer segmentation: Businesses can divide their customers into several groups based on characteristics like interests, behaviors, and demographics, and then target each group with different marketing strategies. For instance, companies can concentrate on environmentally sensitive consumers with advertising about the advantages of EVs, or they might target younger consumers with social media ads.

- Engagement of stakeholders: Businesses can interact with other stakeholders, including customers, suppliers, and members of the community, to forge lasting bonds and handle any issues or concerns that may emerge. By doing this, the business and its products may gain more credibility and support.

Companies in the EV sector can effectively address the people component of the marketing mix and develop strong relationships with their employees, clients, and other stakeholders by putting these and other ideas into practice.

5.4.6 Processes like those utilized in manufacturing, shipping, and customer service are included in this section since they are used to make and deliver electric vehicles to customers (Garbett, 2021). Companies in the electric vehicle (EV) sector can employ a variety of tactics to promote customer satisfaction and process efficiency. Here are a few technique that can be done:

- Lean manufacturing: Businesses can cut costs and boost productivity by putting lean manufacturing ideas into practice, such as getting rid of waste and optimizing production procedures.

- Just-in-time production: By employing just-in-time manufacturing methods, businesses may cut back on waste and inventory, which can lower costs and increase productivity.

- Customer relationship management (CRM): Businesses can monitor and manage customer interactions and deliver individualized service that is catered to each client's needs and preferences by using CRM software and other resources.

- Supply chain management: By streamlining their supply chain operations, businesses can cut costs, boost dependability, and cut lead times, which can boost productivity and competitiveness.

- Companies in the EV sector can optimize customer experiences and processes by putting these and other tactics into practice, which can boost sales and foster customer loyalty.

5.4.7 Physical evidence of the EV industry, such as the branding and packaging of the EV, the appearance of EV dealerships and other outlets, and the appearance of the EV itself, would be considered physical evidence (Melewar, 2015). Companies in the electric vehicle (EV) sector can employ a variety of tactics to maximize the physical evidence element of the marketing mix. Here are a few:

- Style and design: To appeal to customers and set themselves apart from rivals, businesses might spend in the styling and appearance of their electric vehicles.

- High-quality materials and attention to craftsmanship are two ways that businesses may give their electric vehicles (EVs) a sense of worth and longevity.

- Packaging and branding: Businesses may build a unified and expert image by developing a strong and consistent brand identity and applying it to all of their marketing materials, including packaging.

- Design and look of outlets: Businesses might spend money on the layout and decor of their stores and other points of sale to attract and reassure customers.

- Website design and content: Businesses can spend money on their website's design and content to help customers discover the information they need and make purchases.

Companies in the EV sector can maximize the physical evidence component of the marketing mix and build a strong and recognizable brand image by putting these and other ideas into practice.

5.4 B.U.M.N. OPPORTUNITY

As electric car technology develops and the world's need for more environmentally friendly transportation, the transition to the era of electric vehicles (EV) is becoming more and more obvious. As state-owned enterprises, State-Owned Enterprises (BUMN) can take advantage of opportunities in this transition.

The following are several opportunities that can be utilized by SOEs in the transition to the EV era:

Production of electric vehicles: SOEs engaged in the automotive sector, such as PT Industri Kereta Api (INKA) or PT Garuda Mataram Motor, can produce electric vehicles according to the needs of the domestic and foreign markets.

Battery charging infrastructure: SOEs engaged in the energy sector, such as PT Pertamina or PT PLN, can build battery charging infrastructure for electric vehicles. This will help accelerate the adoption of electric vehicles in Indonesia.

Battery production: SOEs engaged in mining, such as PT Aneka Tambang Tbk (Antam), can produce batteries for electric vehicles. This will help reduce Indonesia's dependence on battery imports.

Development of electric vehicle technology: SOEs engaged in research and development, such as PT Dirgantara Indonesia (DI) or PT Pindad, can develop electric vehicle technology and produce electric vehicle components.

Partnership with the electric vehicle industry: SOEs can establish partnerships with the electric vehicle industry, both domestically and abroad, to develop better electric vehicles.

In conclusion, the transition to the era of electric vehicles offers many opportunities for SOEs to develop and increase their contribution to the national economy and the environment. By taking advantage of this opportunity, SOEs can play an important role in driving the adoption of electric vehicles in Indonesia.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The study is discussing the factors that are important in Indonesia's adoption of electric vehicles (EVs). This research used a statistical technique called structural equation modeling (SEM) to analyze data and identify which factors had a significant impact on consumers' intention to buy EVs. The results showed that the Total Cost of Ownership (TCO), Technical specification, and charging portability were significant factors.

The TCO refers to the overall cost of owning and operating an EV, including the purchase price, maintenance costs, fuel costs, and other expenses. The study found that there is a demand for EVs with a lower TCO, as this would make them more affordable for a larger volume of consumers.

The Technical specification refers to the performance and features of the EV. Consumers are interested in comparing the performance of EVs to that of traditional internal combustion engine vehicles, and they prefer EVs that have an advantage in terms of performance. This is because EVs have instant torque, or power, due to their electric drivetrain, which allows them to accelerate quickly.

Charging portability refers to the ability to charge an EV using different types of charging stations or outlets. Consumers may prefer EVs that are more portable in terms of charging, as this would give them more flexibility and convenience when it comes to refueling their vehicles.

The 7Ps of the marketing mix (product, price, promotion, place, people, process, and physical evidence) are a set of tools that businesses can use to develop and implement marketing strategies. In the electric vehicle (EV) industry, these elements might include:

- Product: The EV itself, as well as related products and services such as charging stations and maintenance services.
- Price: The cost of the EV, as well as associated taxes, fees, and financing costs.
- Promotion: Marketing and advertising efforts to raise awareness of the EV and persuade consumers to purchase it.
- Place: Distribution channels and outlets through which the EV is made available to consumers.
- People: The human resources within the EV industry, as well as the customers and other stakeholders.
- Process: The systems and procedures used to produce and deliver the EV to customers.
- Physical evidence: The tangible aspects of the EV industry, such as the branding and deisgn of the EV, the appearance of dealerships and other outlets.

By considering these elements in their marketing planning and decision-making, companies in the EV industry can develop effective marketing strategies that will help them meet their goals. Overall, the study suggests that the automotive industry should focus on these factors in order to successfully transition to EVs and be more competitive in the market. By prioritizing the TCO, Technical specification, and charging portability, the industry can lead the way towards the new era of EVs in a more efficient and powerful manner compared to their competitors

6.2. Recommendation

The recommendations for the future research are:

1.Doing more research to explore the automobile industry capability of EV development and its progress on Indonesia industry.

2. Conduct further research by focusing on the current user of Electric Vehicle, so that the research will be more focused toward the true experience of EV user.

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