Customer Satisfaction Index On The Electrical Buses (Electrical Vehicle) In Malaysia: Case Study On The Affordability, Safety and Accessibility

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Abstract- Public transportation is an important facility that developing countries must incorporate. At the same time, public transport is often related to gas emissions and pollution. All parties, including Malaysia, play an active role in reducing energy consumption and carbon dioxide emission. One of the national efforts is to equip the urban transit system with sustainable development vehicles such as electric buses. In increasing public transportation usage, electric bus services should be designed to accommodate the service required by customers. This research aims to identify the service quality based on a few elements needed to develop customer satisfaction among electrical bus users in Bandar Pengerang by adopting the Customer Satisfaction Index analysis. The main elements to measure are affordability, safety, comfort, and accessibility of the customers to the electric buses. In addition, this research also provides a descriptive analysis of the service quality elements to improve customer satisfaction in public transportation operations.

Keywords Public transportation, service quality, customer satisfaction.

1. Introduction

According to the National Energy Balance, in 2015, the transportation sector consumed the highest amount of energy at approximately 45.2% compared to 1993, with only 37.0% of the energy consumed (Sylwester et al., 2016; Brioschi et al., 2022). The drastic increase in energy consumption has led to a significant increase in carbon dioxide emission (CO_2), amounting to 189.4% over the last 40 years (Sylwester et al., 2016). Malaysia emits 254.6 million metric tons of CO_2 annually, placing it the 25th on the list of countries that emit the most CO_2 in the world while placing 3rd among the ASEAN countries. Fossil fuel combustion produces Greenhouse gas (GHG) that is stored heat in the atmosphere and re-emits it back to earth. By 2040, there is expected to be 41 gigatons of CO_2 trapped in the atmosphere, which is four times the amount that will potentially cause the world to overheat (Lay et al., 2018).

Electric vehicles (EVs) are now on the verge of experiencing rapid growth in both industrial and consumer markets. It provides various features that can help tackle the issues that many local governors/governments face. EVs have become a popular mode of transportation since they operate

by using electricity, a renewable energy that can be easily replenished. EV owners enjoy the privileges of a much lower running cost by substituting petroleum for electric power since the cost to charge an EV is three times lower compared to buying petrol (Jennifer et al., 2013). EV have a high demand because of the energy consumption that is renewable (Di Martino et al., 2022).

Electric buses (E-buses) have been seen to hold the potential to be the most viable alternative to replace diesel-powered buses in the upcoming years eventually. E-buses have gained popularity in major countries such as China, the USA, and several other developed countries (Ataur et al., 2018). Big cities require a mass transit system to function. A mass transit system helps citizens travel to their destinations while effectively reducing their carbon foot-print using public transportation. E-buses provide various opportunities for local governors to reduce traffic congestion cost-effectively while simultaneously helping preserve the surrounding environment. For instance, the largest bus fleet is in Shenzhen, China. The fleet consists of 16,359 buses, with most of them manufactured by BYD Company and 100% electrified (Sylwester et al, 2016). According to Bloomberg New Energy Finance (BNEF), China's e-bus fleet is projected to rise by more than 600,000 in six years. At that point, the demand for 6.4 million barrels of oil per day will be depleted by 2040.

As a developing country, Malaysia wants to reduce energy consumption and CO_2 emission while improving environmental conditions. Low Carbon Cities (LCC) is an agenda stipulated in the Green Technology Master Plan (GTMP), 2017-2030. LCCs consist of societies that consume renewable green technology, green practices and emit relatively low CO_2 or GHG compared to present-day practices to avoid the horror of climate change (Lamiaa et al., 2012). Wide-scale adoption of e-buses could significantly change society by improving air quality, subsequently reducing GHG emissions emitted through the combustion of fossil fuels (petroleum, diesel, kerosene etc.). E-buses generate power solely using electricity compared to conventional buses. Therefore, the whole mass transit system can be conducted more wholly and economically to remove the demand for fossil fuels that will harm the environment.

The Customer Satisfaction Index (CSI) is a versatile analytical tool for measuring customer satisfaction with a product, service, or company. It offers help in finding a reason for customer satisfaction or, rather, dissatisfaction. CSI is a handy tool that can indicate a customer's satisfaction level since customer satisfaction is very important to decision-making. The raw data can be further analyzed using this tool to understand better customers' most preferred features about a certain product or service. The information outcomes provided by using this tool can be used to provide a better insight into how the company can improve their sales number by proposing quality and value improvement, and conducting the business more cost-effectively, that will surely keep the customers satisfied and keep using the product or service based on past positive experiences (Factum Group, 2014). The usage of CSI can bring a lot of benefits; some of them are it can identify the most important elements which significantly satisfy the customers, able to determine the opportunities that will greatly improve the customers' satisfaction, and it also offers crucial information about specific customers' group to easily distinguish the differences between the loyal and unreliable type of customers (Carolina, 2014). In the long run, appropriate utilization of CSI can develop proper facilitation for monitoring the customers' satisfaction with the possibility of analyzing events effects and assisting in notifying feedback during changes of an existing product or launching a new product (Factum Group, 2014).

A few novel study have been run to analysis the EV charging behaviour (Akil, Dokur & Bayindir, 2022). This is by applying Monte Carlo simulation. Meanwhile, Jin et al. (2021) analysis the power management of EV especially in residential area. At the same time, Issi and Kaplan in 2022 tried to simulate a wireless charging for EV.

This study aims to develop a satisfaction index analysis based on local respective local individuals to enable the decision-making on the adoption of electric mobility in the Pengerang district. Several potential measures were demonstrated to improve the viability and feasibility of e-buses. The goals are to find if there is any relationship between independent variables (customer satisfaction) and dependent variables (accessibility, comfort, safety, affordability). In this investigation, the evaluation was conducted on BYD's e-buses and consisted of three phases for the satisfaction index: Pre-study, Peri-study and Post-study. The data were analyzed to generate insight into the implementation of e-buses in the Pengerang district.

1.1. Problem Statement

Reaching public transportation is still a struggle for most citizens. The problem with public transit is not always related to the quality of the service provided by the transportation provider. Still, it also can relate to getting people to locations where citizens can use public transport (The Edge, 2019). According to a town planner, Nia Chun Wei, "connectivity between certain areas remains a major hassle, and the scattered placement of Malaysian cities makes it difficult for public transport to cover all areas." Accessible and reliable public transportation is vital to ensure that the urban poor has greater access to socio-economic opportunities (Kenneth et al, 2018). Better routing planning and bus stop development are crucial for the transportation provider to maximize the connectivity between housing areas and public transport.

Other than that, while most citizens struggle with accessibility to public transportation, people with disabilities have it the worst regarding mobility constraints. Mobility is essential to daily life activities, especially when dealing with the internal and external environment. Despite that, the current state of most public transportation in Malaysia is still lacking in terms of good design and facilities to accommodate minorities, including senior citizens and persons with disabilities (Sayed et al, 2012). The National Transport Policy (NTP 2019-2030) has included the disabled community's interests, which align with the world trend of having the disabled in mind (Haidah et al, 2019). In

accordance with the policy, it emphasized the inclusiveness of all segments of society to ensure that everyone can receive equal opportunities and enjoy the convenience of mobility through public transportation. Thus, public transport providers and operators need to understand these people's necessities to improve and transform their service, enhancing friendliness towards minorities.

Another issue closely related to public transportation is the comfort and safety of existing facilities, e.g., bus stops and bus terminals. According to one of the Environmental Sustainability Design (ESD) Consultants, Japheth Lim, he stated that "bus stops can be landmarks, and a resemblance of community integration, it's a common space, and it is meant to be respected and shared. It is to be safe, convenient, user-friendly, and a healthy place to be." Bus stops and terminals are supposed to be an area where customers can spend their time patiently while waiting for the buses. Since bus stops and terminals act as a simple shelter before customers board the transports, it is expected that the infrastructures can ensure the passengers' safety and comfort regardless of the weather condition and capacity during peak hours. But in reality, these facilities provided are in deplorable condition. Some of the problems listed are very vulnerable to heavy rains, not being comfortable and unnecessary heat gain, dirty benches, poor lighting, and proximity of bus stops which expose users to potential rape victims etc. (Japheth, 2011).

Public transportation is an essential contributing factor to urban sustainability. Effective public transportation networks can significantly improve the socio-economic opportunities for every segment of society while simultaneously helping to lower the city's per capita carbon foot-print and make cities more livable by easing the commute of citizens and increasing the accessibility of public transportation. Besides, public transportation also helps both consumers and operators to reduce road congestion, travel times, energy and oil consumption, and air pollution. Thus, it is crucial to understand the satisfaction level of consumers during the Pre, Peri, and Post stage of implementation of e-buses in Pengerang. This is likely to have an impact on the issues which are stated above and change a city's profile and urban quality.

Based on previous research studies, consumers' satisfaction levels with the implementation of e-buses are still very lacking compared to other research. There are still no studies of e-buses in Malaysia which are customer-oriented. (Ziaul et al., 2020) only discussed the perceived quality of electric buses among young people in the USA aged 34 and below. Hence, given the problems and gaps of previous research, an effort is made to study the customer satisfaction level on implementing e-buses in Pengerang.

1.2. Research Question

- What are the customers' satisfaction levels with the implementation of e-buses?
- What are the most important service quality elements to satisfy the customers?
- What is the condition of the current mode of public transportation?

1.3. Research Objective

- To analyze customer satisfaction (pre, peri, post) on implementation of e-buses.
- To conduct a descriptive analysis of the e-buses' users.
- To analyze the accessibility, reliability, and connectivity of current public transportation.

1.4. Significance of the Research

One of the initiatives the local governor of Pengerang district has taken to reduce carbon emissions significantly is the implementation of e-buses. E-buses are lauded not just for their lower emissions but also for being quieter and having lower operating costs than diesel and natural gas buses (Katie, 2018).

This research can provide helpful information for many parties involved, especially for future research and development. This study also can raise the level of awareness of people about the importance of environmental preservation. Based on the analysis, the researcher can understand the customers' satisfaction level with implementing e-buses in the Pengerang district. Finally, this study can provide a clear understanding to the local government about the most important measures required to satisfy the customers in terms of public transportation. As a result of this study, the regional governor can provide a high-quality transportation service by using e-buses, making customers' preference change from conventional buses to e-buses.

1.5. Research Scope and Methodology

This research only focused on public transport users in Bandar Pengerang in Johor and was conducted following the guideline provided in Johor Public Transport Master Plan (2015-2045). The researcher used two methods which are quantitative and qualitative method. The methodologies included are an observation checklist, publication research and survey questionnaire. The study consisted of three stages: pre, peri and post-study.

During the pre-study, an observation study was done to gain some background information on the research areas. Four components were observed: affordability, safety, comfort, and accessibility of the current public transportation.

After that, during the peri-study, a questionnaire was used as a research instrument to gather data from customers to measure the affordability, safety, comfort, and accessibility of customers throughout the journey inside the e-bus. Some background data of the respondents was collected. Next, during the third stage, the post-study, the questionnaire was used to gather data about customers' satisfaction level with implementing e-buses as public transportation. An evaluation was conducted to ensure that all the objectives had been

achieved. The final stage is related to the writing of reports and their submission. If there is irrelevant data, the experiment needs to start back from the setup of the instrument.

2. Literature Review

2.1. Customer Satisfaction

According to Karolina (2013), consumers are the market entity that consumes products or services to satisfy all their needs. The consumers' behaviour depends on whether, what, when, where, and how to purchase goods and services. Therefore, companies must execute their business activities according to the consumers' behaviour and interests. According to (Zeithaml et al, 2001), satisfaction can be defined as the customer's fulfilment responses. It is a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfilment.

Meanwhile, customer satisfaction can be defined as the level of pleasure the customers feel after comparing the service quality with perceived quality (what they hoped for). The customer is unsatisfied if the service quality is lower than the perceived quality. If the service quality exceeds the perceived quality, the customers are delighted (Kotler, 2000). In the context of customer satisfaction, generally, the perceived quality is the customers' hopes and trust that the product will serve its purposes well. Customers' perceived quality is constantly evolving after the customers' purchasing experience. These perceived qualities from customers are usually developed through the past purchase experience, friends' recommendations, as well as the self-claim from the producer's company. Therefore, customer satisfaction is based on customers' perception of the product quality compared to what the producer's company claimed the product could be (Iva, 2015). In conceptual, Tjiptono (2000) has outlined the customers' satisfaction as follows:

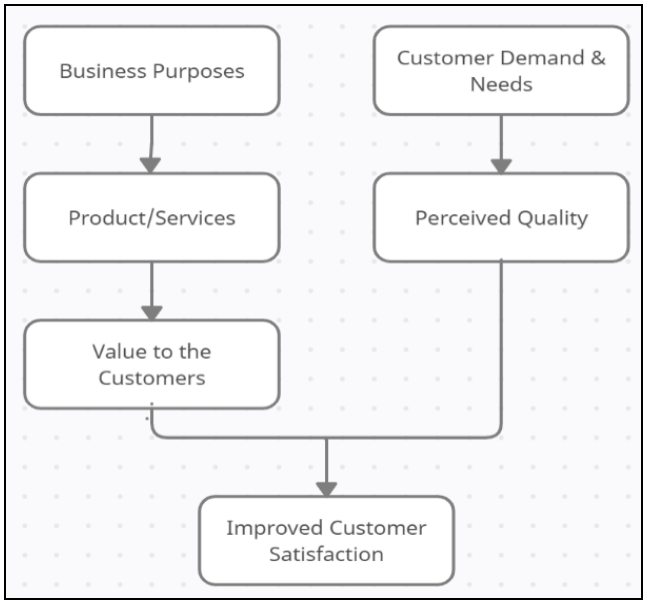

Figure 1. Customer satisfaction concept.

Customer satisfaction represents a measure of company performance according to customers' needs; therefore, customer satisfaction provides a service quality measure (Hill, Brierly, & MacDougall, 2003). Businesses' decisions to improve their services systematically are the main contributors in deciding the follow-ups complaint received from consumers caused by bad service quality until it can seal customers' loyalty later in the future (Elu, 2005). Customer satisfaction has become the most crucial parameter in ensuring business continuity. In 2004, JD Power stated that a business that specialized in measuring customers' satisfaction levels in the automotive industry has proved that a business that can improve their customers' satisfaction in five years (1999-2004) has experienced a significant increment in their number of shareholders by +52%. Otherwise, businesses with poor customer satisfaction have received a reduced number of shareholders by as much as -28%. Claes Fornell also showed that during the time of crisis in 2008, businesses that have a considerable value of the American Customer Satisfaction Index (ACSI) only received a -33% reduction in the number of market stocks, while businesses that have a poor ACSI, the amount increase to -55%. Thus, customer satisfaction provides advantages to businesses when the economy is in good condition and is helpful in times of economic crisis (Lestari, 2009). The only way to achieve high-grade customer satisfaction is by researching customers' behaviour and adapting the business marketing strategies aligned to consumers' market needs (Karolina, 2013).

In the short term, maintaining good customer satisfaction can bring a huge investment return and sales profit. Profit is the main key driver in ensuring business consistency because, with a huge profit return, the business can improve the quality of services provided, increase the variety of products, as well as expanding its target market and market reach (Soeling, 2007). On top of that, in the long term, a good effort in maintaining customer satisfaction will make the customers more loyal to the product, willing to pay more for the product or service and improve readiness to recommend the product to other new customers. Generally, it makes the company more profitable ("Managing Customer", 1995). According to Reichheld and Sasser (1990), customer loyalty positively correlates with business performance. Castro and Armario (1999) stated that customer loyalty not only helps in improving the business value but also helps in attracting new customers.

2.1.1. Customer Satisfaction Index (ServQual)

According to Karolina (2013), customer satisfaction is the pleasure or disappointment customers feel after consuming the product and comparing it with their perceived (expected services) of the product to its actual performance or outcomes.

Ever since the concept of customer satisfaction as a measure of perceived service quality was introduced in market research, many techniques have been developed to measure the customer satisfaction level properly. The most widely known technique is the ServQual method, which Parasuraman, Zeithaml, and Berry (1985) proposed. The

ServQual model addresses the gap between service expectations and the actual service received by the customers. The model is a cause-and-effect model that are used to measure customer satisfaction. The model is divided into three parts (left, centre and right). Each part is equipped with indices for drives of satisfaction on the left side (customer expectation, perceived quality, and perceived value), the level of satisfaction at the centre, and the outcomes of satisfaction on the right side (customer complaints and customer loyalty) (Karolina, 2013).

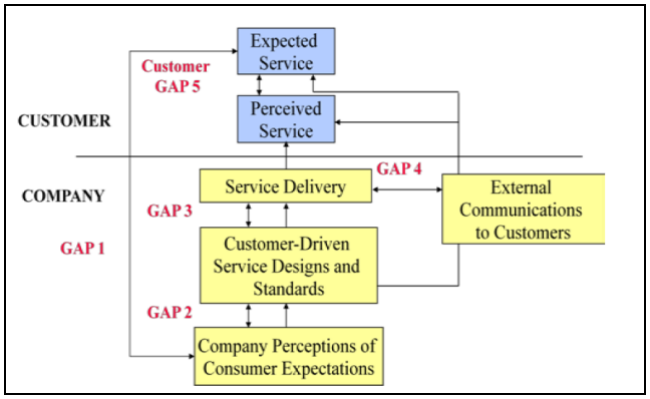

Figure 2. Gap model of service delivery.

The ServQual method has a framework that is used for measuring service quality based on the contextual definition of the five dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy (Laura,2009). According to Parasuraman *et al* (1985), the five dimensions of service quality are defined as follows:

- **Tangibles**: appearances of physical facilities, equipment, machines, staff, and information leaflets.
- **Reliability**: ability to provide service accurately and dependably with credibility.
- **Responsiveness**: ability to handle customers' complaints effectively and solve problems in a timely manner.
- **Assurance**: competent possess the requisite skill and knowledge, transparent and believable when delivering information, ensuring freedom from danger, risk and doubt, which creates credibility and trust for customers.
- **Empathy**: approachable, easily accessible in terms of communication and ability to understand customers' need

This method is in the form of a questionnaire that uses a Likert scale that ranks the seven levels of agreement or disagreement from 1 (Strongly Disagree) to 7 (Strongly Agree). This method provides indices that are predetermined to differentiate between customers' expectations and perception of the service provided under the five service quality dimensions embedded in each index (Laura, 2009).

Since the ServQual method was introduced in the market research, many variations of this model have been established. The Swedish Customer Satisfaction Barometer (SCSB) was introduced in 1989 as a tool to assist the company in achieving customer satisfaction (Fornell, 1992). The good feedback received from using SCSB has inspired the development of ACSI. The two well-established theories – the quality, satisfaction, and performance (QSP) paradigm and Hirschman's (1970) exit-voice theory; have become the theories that influenced the development of the ACSI model. The ACSI model helps the company measure the relationship between the cause and the effects, which directly links the customer satisfaction level to its consequences (Hsu, 2007).

Hill et al (2003) describe CSI as a more direct and accurate measure for service quality evaluation by using an overall index. CSI represents the dimensions of service quality based on customers' perceptions of service aspects and are expressed in terms of importance rates, compared with customers' expectations expressed in terms of satisfaction rates. CSI fills in the gap of the ServQual method because the model is measured by the numerical scale of the dimension expressed. Among all the described indexes, CSI is a simple process that allows the index to be easily calculated by the market researcher (Laura, 2009).

2.1.2. Empirical Study for Customer Satisfaction

According to Aryani (2009), customer satisfaction is an independent construct that is heavily influenced by service quality. Service quality can also directly influence customer loyalty (Zeithaml, Berry & Parasuraman, 1996), while customer loyalty is indirectly influenced by customer satisfaction (Caruana, 2002). Customer satisfaction is the key factor in developing customer loyalty. Businesses can enjoy many advantages with their achievement in maintaining high customer satisfaction. Other than improving customer loyalty, businesses also can prevent customer turnover, reduce customers' tolerance to pricing, reduce the cost involved in failures of marketing, reduce operation costs that are heavily involved in the sudden increase of the customer number, improve marketing effectivity and improve businesses reputation (Fornell, 1992).

The service quality is the major factor responsible for encouraging customers to commit to a certain product and service, which heavily contributes to increasing the product's market share. Service quality is also crucial to maintain customer loyalty in the long run. Businesses with superior service quality can maximize their business economic performance (Gilbert *et al*, 2004). As competitiveness increases within the market, customers will face many other alternatives that consist of many variations of quality and pricing. This condition will force the customers to choose the product that provides the highest value to them (Kotler, 2005).

Other than that, as Karolina (2013) stated, customer satisfaction significantly impacts the profitability of every business organization. A customer who is satisfied with the service quality provided will eventually recommend the business to other nine to ten people. It is estimated that around half of American companies have found success through this informal, "word-of-mouth" communication (Reck, 1991). On the other hand, poor service quality will cause the customer to have lower satisfaction. This situation

will badly impact the company to lose a significant number of customers, not only the existing customers but also the new potential customers. Because a dissatisfied customer will have a higher tendency to spread bad "word-of-mouth" for the service provided to at least another 15 potential customers. This will make customers substitute their preference for other business competitors (Lupiyoadi & Hamdani, 2006).

Moreover, the research done by Laura (2009) also emphasized that the usage of CSI summarized the dimensions of service quality on various attributes, providing a proper measurement for the overall satisfaction level felt by customers. Thus, the results of CSI are beneficial on a fundamental level since its outcomes provide descriptive analysis, which assists in identifying certain strengths and weaknesses of the service quality dimensions. The information outcomes can help businesses identify the most important requirements to satisfy their customers and subsequently encourage them to focus more on the most critical areas that customers value the most (Karolina, 2013).

2.1.3. Empirical Study for Service Quality of Public Transportation

According to Rose (2020), that transportation is crucial in assisting the socio-economic development of any country, especially in large cities. As capital cities are experiencing urbanization, with a rapidly increasing population growth rate, providing a reliable mode of transportation has become ever more crucial in maintaining the city's functioning. Over the last few decades, transportation providers have gradually improved their service quality to ameliorate customer satisfaction. The strategy has been proven to notably impact transportation providers, their customers, and passengers (Laura, 2007). Thus, improving the quality and service provided is vital to ensure the sustainable development of public transportation in major cities. Although service quality is an important factor in public transportation, inadequate research is still done to address this issue (Friman, Edvardsson, & Garling, 2001).

The customers expected service quality for public transportation might be varied for every public transportation user, as the population contain many groups of people consisting of different kind of social class. Thus, their service expectation for public transportation might differ from each other. According to Luigi (2011), he classified the expected service quality or also can be derived from mobility and travels constraints. The four service quality elements include affordability, safety, comfort, and accessibility. These four elements have been mentioned several times in many different articles, including Kokku et al (2011), Luis (2018), and Salvatore (2013). They have become the four most important service qualities customers expect from the transportation provider.

2.1.4. Affordability

The definition of affordability, as stated in the Oxford dictionary, is that something is cheap enough that people can afford to buy or pay for; how affordable it is. Affordability also can refer to the financial costs that households are burdened by to travel from one point to another to accomplish basic daily activities such as school, work, healthcare, shopping, and other social activities. The concept of transportation affordability is the ability to make financial sacrifices for undertaking necessary transport movements without having to be financially burdened with accomplishing other essential activities.

Transportation is one of the most necessary facilities in a developing country since the developed countries can be measured by the advancement of the public transportation system (Syafiq & Zurinah, 2020). Affordability is one of the service quality elements most users are looking for in a public transportation service (Luigi, 2011). Based on Robin et al. (2005) on major cities in other developing countries such as India, the United Kingdom, and Mexico, the results have shown that affordability is an extremely important element that needs to be critically addressed.

The study declared that most public transportation users are heavily affected, especially the low-income earner that must travel to work, by the various pricing provided by the transportation provider. The study's results also stated that people who are unemployed and have a low income would likely use public transportation more frequently, only if the pricing rate is affordable and much better deals are provided (Robin et al., 2005).

2.1.5. Safety

The Oxford dictionary definition of safety is the condition and state of being safe and protected from any danger or harm. Many people have agreed that the operation of public transportation is closely aligned with handling human lives on a larger scale since most public transport must accommodate many passengers at once, riding inside one collective vehicle (Tri & Hisashi, 2005). Tri and Hisashi (2005) also announced that there are approximately one million fatalities involving road transportation. The number amounted to ten million people who have experienced injuries, some with long-term disabilities, with each year passing by. 70% of the cases reported involved developing and emerging countries that incorporated mass public transportation transit systems (Tri et al., 2005).

According to Mat Yazid et al. (2017), public transportation is actively involved in preserving lives in a healthy, high-quality, clean environment. Nowadays, public transportation in Malaysia has always given a wrong impression to most users, with many issues, including road congestion, accidents and incompetency of the bus drivers. Furthermore, various modes of public transportation, mainly buses, are closely related to excessive carbon emission to the atmosphere, eventually resulting in environmental pollution and affecting the quality of life. Public transportation users have established that safety is crucial for every public transportation.

2.1.6. Comfort

The definition of comfort, as defined by the Oxford dictionary, is the state of being physically relaxed and free from any pain and providing a feeling of safety without must worry so much, thus feeling less unhappy. Ride comfort, as defined by Sukru et al. (2017), can be divided into several parts such as the friendliness of facilities (i.e., bus stop and bus terminal), during transit comfort, ambient conditions, supporting facilities, and ergonomic (Sükrü & Dilay, 2017). Rozmi Ismail (2013) has studied the comfort elements such as facilities provided, service provided, comfort level, and vehicle design, significantly contributing to customer satisfaction.

Sukru et al. (2017) stated that the comfort element is commonly neglected in public transportation system design, despite it being one of the most important service quality elements that most users demand. Harifah Mohd Noor et al. (2016) described that the comfort element in public transportation is at the lowest level compared to other service qualities that are required in public transportation. Nizamuddin Zainuddin et al. (2017) showed that most public transportation users demand comfort from the transportation provider and that the transportation they use is more eco-friendly, subsequently providing a better environmental impact.

2.1.7. Accessibility

Accessibility can be defined as how easily something can reach, enter, use, or see (Oxford Learner's Dictionaries, 2020). Cullen (2006) declared that accessibility has always been recognized as one of the service quality elements of an efficient, sustainable, and high-quality public transportation system since it complied with the inclusiveness concept, which is providing access to everyone consisting of a different group of people from every level of social classes. Accessibility is an important element in the public transportation system because it provides mobility to every citizen within the country. It has become a crucial element in designing and evaluating the public transportation system to achieve better mobility and sustainability (Muhammad Atiullah Saif, Mohammad Maghrour Zefreh, and Adam Torok., 2017). Sayed (2012) also stated that accessibility is about equal access to everyone, especially those with limited access to facilities and services, including persons with disabilities and elderly citizens.

The main goals of accessibility are to provide better connectivity between people and places. At the same time, it significantly reduces traffic congestion and simultaneously provides a better alternative for the personal vehicle that gives out a devastating impact towards environmental conditions and healthfulness (Yatskiv et al., 2017). Accessibility is a public transportation service quality element that is closely aligned with affordability. Low-income earners in the country have the most pressing need for an accessible and affordable public transportation system since this group relies heavily on public transportation. Furthermore, low-income earners have minimal journeys they can afford for public transportation, giving them a lower possibility of becoming less poor (Luis, 2008). According to Robin (2005), an adverse placement of public transportation facilities provides poor accessibility to low-income citizens. This condition is heavily affecting this group of people since they must walk or spend their money on taxis to reach the nearest public transportation facilities.

2.2. Conceptual Framework

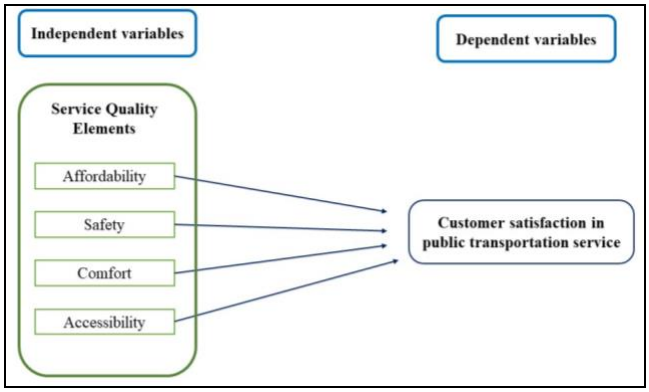

Figure 3. The conceptual framework of the relationship between the service quality elements with customer satisfaction on the public transportation service.

Previous journals and document reviews are essential to gain information related to this study and to understand how previous researchers conducted the study to fulfil the aspects needed. By understanding the important elements, transportation providers can provide service and supporting facilities according to customer's demand to improve customer satisfaction and maintain a sustainable public transportation system.

3. Research Methodology

3.1. Research Design

3.2.1. Qualitative Method

The document review and observation study were conducted using a checklist to achieve the research objectives of investigating the state of the current public transportation system in Bandar Pengerang, Johor. Document review analyses the documents and data gained to determine which service quality elements are important to the public transportation users in Bandar Pengerang. Document review was done by reviewing the existing journal of public transportation or other related documents. The document review process aims to outline the service quality elements that might improve customer satisfaction for public transportation users in Bandar Pengerang. Observational study or field study is a type of non-experimental research where the investigator examines ongoing activity or direct observation of a phenomenon in their natural setting. This qualitative approach aims to observe the current state of the public transportation system in Bandar Pengerang. The

current public transportation system was observed using a checklist developed according to the service quality elements proposed from the results of the document review process.

3.2.2. Quantitative Method

A survey was conducted to improve the public transportation system in Bandar Pengerang, Johor. The research instrument that was incorporated is a questionnaire. The questionnaire consisted of several series of questions to serve the purpose of gathering information from the respondents. The questionnaire was distributed to public transportation users in Bandar Pengerang to understand the perceived quality of the public transportation system provided by the Perbadanan Pengangkutan Awam Pengerang (PPAP). This approach is to better understand the perceived quality of users compared to the actual service they received, whether they are satisfied or dissatisfied, and whether the service provided can satisfy the customers. Some other research were also using questionnaire as part of the method in collecting data (Sheng & Sufahani, 2018; Sufahani et. al, 2018).

3.2.3. Research Area

Bandar Pengerang is a small town located in Kota Tinggi, Johor, Malaysia.

Figure 4. Map of Bandar Pengerang and current route of public buses in Pengerang, Johor.

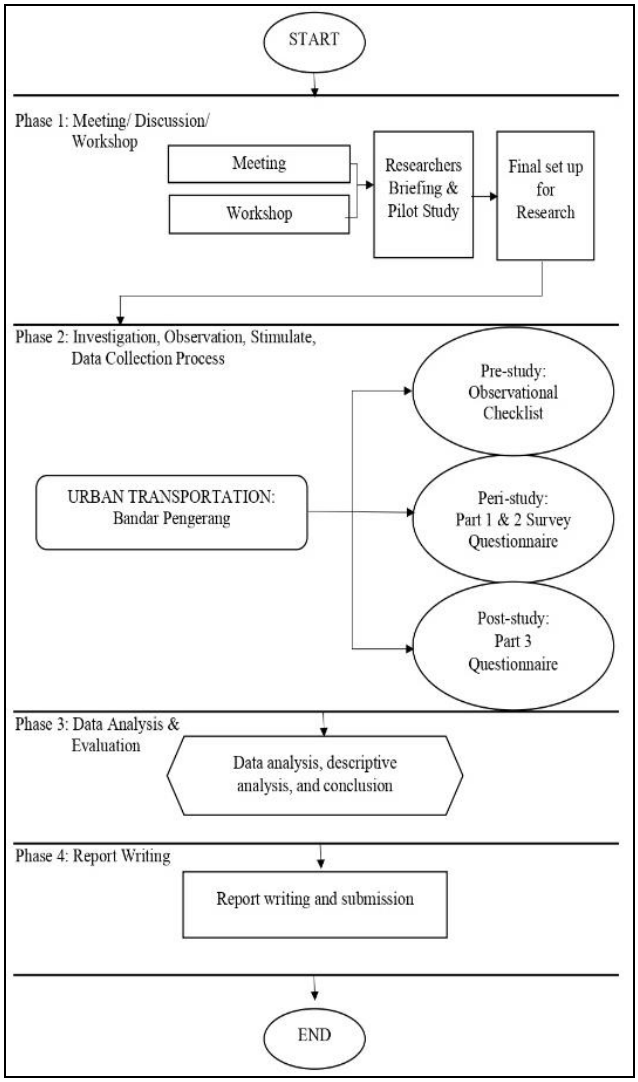

Figure 5. Overall flowchart of the research.

3.2. Data Collection Method

3.2.1. Sampling

Sampling can be defined as the process of selecting units such as organizations and people from the population of interest. The sampling technique is needed to reduce sampling error before executing the data collection process to ensure the reliability and steadiness of the result generated. Since it was impossible to administer surveys to all transportation users, sampling was necessary to obtain a representative proportion of all users of the public transportation system. In this study, simple random sampling was used to ensure that each potential respondent within the target population was equally likely to be included in the sample. The respondents were carefully selected and were asked to provide socio-economic information, including gender, age range, education, and occupation, to ensure the respondents represent the whole population.

3.2.2. Observational Study Checklist and Questionnaire Design

The questions in the checklist and questionnaire were constructed according to previous research and document provided by PPAJ, which are related to the effectiveness of the public transportation system. In this study, a "yes or no" checklist was used for the observational study, and the questionnaire used a five-point Likert scale ranging from (1) Very Dissatisfied and (5) Very Satisfied. The questionnaire was developed by benchmarking the European of Public Transportation survey's tool and the CSI proposed by Hill et al. (2003). The questionnaire consisted of three parts:

- Part 1: Section A: Demographic for studying the background of respondents.
- Part 2: Studying the service quality elements preferred by customers (Section B: Affordability, Section C: Safety, Section D: Comfort, Section E: Accessibility, and Section F: users' preference for using public transportation)
- Part 3: Studying the customer satisfaction level on the implementation of e-buses.

3.3. Data Analysis Technique

The data and information gained from the public transportation journal and document provided by PPAJ were analyzed to outline the crucial elements of this study. Furthermore, the survey questionnaire data were analyzed using IBM Statistical Package for Social Science (SPSS) version 25 to produce significant and reliable data.

3.3.1. Descriptive Statistic Analysis

Generally, two types of statistics are used to analyze and describe the data obtained.

- Measures of central tendency: used to describe the central position of a frequency distribution for a group of data by using the mode, median, and mean settings.
- Measures of spread: used to summarize the data by describing how spread the scores are by using the range, quartile, absolute deviation, variance, and standard deviation settings.

3.3.2. Pilot Test

The pilot test aims to assess the feasibility, cost, and duration to improve the research design before the actual study is initiated. Thirty respondents were involved in this pilot test because, according to Perneger et al. (2015), the amount of 30 respondents was adequate to assess the reliability and validity of the research instrument.

Cronbach's alpha was implemented to determine the scales for reliability for this research questionnaire. Cronbach's alpha is a metric used to assess a series of scales or test the items' accuracy and internal consistency. In other words, any measurement's reliability refers to the extent to which it is a consistent measure of a concept. Cronbach's alpha is a great tool to measure the strength of that consistency.

Table 1. Cronbach alpha.

Cronbach's alpha	Internal consistency
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

3.3.3. Customer Satisfaction Index

CSI is a variation of the ServQual method proposed by Hill et al. (2003) and is a great tool for measuring and identifying the reason for customer satisfaction or dissatisfaction. After finishing gathering data for part 2 of the questionnaire, the CSI was entirely administered to further research customer satisfaction on the pre, peri, and post-stages of the implementation of the e-buses.

Table 2. Manifest variable.

Manifest Variable /Scale	1	5
Overall satisfaction (X1)	Very dissatisfied	Very satisfied
Expectancy disconfirmation (X2)	Falls short of your expectations	Exceeds your expectations
Comparison to an ideal (X3)	Not very close to the ideal	Very close to the ideal

$$CSI = \frac{\left((X_1 \times W_1) + (X_2 \times W_2) + (X_3 \times W_3)\right) - 1)}{4} \times 100 \quad (1)$$

4. Conclusion

The research discussed preparing a CSI analysis on implementing e-buses in Pengerang using qualitative and quantitative approaches. The collected data from the observation checklist and survey will be analyzed by using CSI analysis. The outcomes will be discussed and analyzed to outline the essential elements to satisfy customers in public transportation service. This will reflex the actual atmosphere and acceptance of e-buses in Pengerang.

5. Observational Checklist

1. Accessibility

No	Item	Yes	No	Notes
1	The provision of level and slip-resistance footpath surface			
2	Provision of benches at public transport stations			
3	Provision of safe crossing to public transport waiting area			
4	Provision accessibility for disabilities passengers			
5	Provision of public transport tickets			

2. Reliability

No	Items	Yes	No	Notes
1	Public transport arrives on schedule			
2	Public transport arrives at the bus stop just in time			
3	Consistency of the public transport			
4	Public transport is available in peak time			
5	Public transportation is available late at night			

3. Connectivity

No	Items	Yes	No	Notes
1	The public transport network is comprehensive			
2	Public transport provides a customer service			
3	Passengers can take public transportation at each bus stop			
4	Public transport through each public transport stop is consistency			
5	Route map of the public transport			

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