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Research paper

Enhancing Customer Satisfaction Index for Electric Bus service in Aligarh smart city: A case study on critical attributes and improvement strategies

Rahman Ali Khan [1] *, Mushfiq Humam [2], Dr. Mohammad Farhan Fazli [3]

[1] *Master of Planning (Urban and Regional), Department of Architecture, Zakir Husain College of Engineering and Technology, Aligarh Muslim University, Aligarh*
[2] *Guest Faculty, Department of Architecture, Zakir Husain College of Engineering and Technology, Aligarh Muslim University, Aligarh*
[3] *Professor, Department of Architecture, Zakir Husain College of Engineering and Technology Aligarh Muslim University, Aligarh*
**Corresponding author E-mail: rahman.zhcet@gmail.com*

Abstract

Public transportation serves as a critical infrastructure in developing countries, essential for promoting mobility and sustainability. However, traditional transit systems often contribute to environmental degradation through emissions. Recognising this challenge, nations such as India are actively pursuing strategies to reduce energy consumption and carbon emissions. An important initiative involves integrating electric buses into urban transit systems. To optimise the effectiveness of these electric bus services and encourage greater public transportation usage, it is essential to align service offerings with customer needs and expectations. This research aims to assess customer satisfaction among electric bus users in Aligarh using the Customer Satisfaction Index (CSI) analysis. Critical attributes such as affordability, safety, comfort, and accessibility will be examined to identify areas for improvement. An analysis will be conducted to gain insights into service quality attributes crucial for enhancing customer satisfaction in public transportation operations and the strategies for improving customer satisfaction to be defined.

Keywords: *Customer Satisfaction; Electric Mobility; Public Transportation; Service Quality.*

1. Introduction

Globally, the transportation sector contributed approximately 24% of all Carbon dioxide emissions resulting from fuel combustion in 2020 with road transport responsible for three-quarters of this figure (International Energy Agency (IEA), 2022). Such high emissions levels not only pose environmental threats but also jeopardize human health (Lott & Daly, 2015). According to estimates from the International Energy Agency (IEA), between 2019 and 2025, there will be a 5.7 million barrels per day (mb/d) increase in global fuel consumption. India is expected to drive a significant portion of this demand, having consumed 164.87 million metric tons (MMT) of petroleum products during 2022-23 with a growth rate of 10.53% in consumption of petroleum products (Ministry of Petroleum and Natural Gas, 2022). The nation heavily depends on imports to supply approximately 81.7% of its crude oil needs and ranks as the third-largest energy consumer worldwide, after the USA and China. Projections indicate that this dependence on imported oil will increase, leading to a probable rise in oil and natural gas prices (Central Statistics Office, 2017). The current share of India in global primary energy consumption is 6.1% and is likely to increase to about 9.8% under the stated policies scenario by 2050 (International Energy Agency (IEA), 2021). This surge in energy usage has correspondingly led to a substantial increase in carbon dioxide (CO2) emissions. In 2022, India ranked third globally in terms of CO2 emissions, contributing to 8% of the worldwide total. However, India's per capita emissions are less than half the global average, at 2 tonnes per person in 2022. India's per capita emissions are also the lowest in the G20, at about one-eighth of what the average American emits annually (Tiseo, 2023). In response to environmental concerns and to curb oil consumption and CO2 levels, EVs have been proposed by scientists and numerous governments as a viable alternative to traditional petrol and diesel vehicles (Shabarien et al., 2023).

Electric vehicles (EVs) are poised for rapid growth in both industrial and consumer markets, offering solutions to challenges faced by many local governments. Operating on electricity, a renewable energy source, EVs have emerged as a popular mode of transportation. EV owners benefit from significantly lower running costs, as charging an EV is approximately three times cheaper than purchasing petrol. With their reliance on renewable energy, EVs are in high demand (Di Martino et al., 2022).

Electric buses are emerging as a promising alternative to diesel-powered buses in the near future. They have gained traction in major countries like the USA, China and other developed nations (Shabarien et al., 2023). Urban centres heavily rely on mass transit systems to facilitate citizen travel while minimizing carbon emissions through public transportation. E-buses offer local governments opportunities to efficiently alleviate traffic congestion and contribute to environmental preservation. For example, Shenzhen, China, boasts the largest

electric bus fleet globally, comprising 16,359 buses, predominantly manufactured by BYD Company and fully electrified (Lu et al., 2018). Bloomberg New Energy Finance (BNEF) forecasts a significant expansion of China's e-bus fleet by over 600,000 units within six years, which could lead to a reduction in oil demand by 6.4 million barrels per day by 2040 (Henze, 2018).

As a developing nation, India aims to decrease energy consumption and CO2 emissions while enhancing environmental conditions. In alignment with this goal, India has set a target for electric vehicles (EVs) to constitute 30% of all vehicle sales by 2030. To encourage the adoption of electric vehicles (EVs) and facilitate their growth, the Indian government has implemented several policies and initiatives. These efforts aim to address challenges such as high initial costs, inadequate charging infrastructure, and limited consumer awareness. The National Electric Mobility Mission Plan (NEMMP), initiated in 2013, is a key program focused on promoting hybrid and electric vehicles, emphasizing indigenous manufacturing, research, development, and infrastructure creation for EVs. Its objectives include enhancing national fuel security, reducing vehicular emissions, and fostering sustainable growth in the automotive sector (National Electric Mobility Mission Plan (NEMMP), 2020). The Faster Adoption and Manufacturing of Electric Vehicles (FAME) India Scheme, launched in 2015, offers financial incentives to purchasers of electric and hybrid vehicles to expedite their adoption and promote indigenous manufacturing. The scheme provides subsidies on EV purchases, supports charging infrastructure development, and offers incentives to EV manufacturers. The government has also introduced favourable GST rates for EVs, making them more affordable compared to conventional vehicles. Additionally, various states in India offer additional incentives such as tax exemptions and fee waivers to promote EV adoption, complementing national efforts (Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India, 2015). The widespread adoption of e-buses has the potential to bring about substantial societal changes by enhancing air quality and consequently lowering greenhouse gas (GHG) emissions resulting from the burning of fossil fuels such as diesel, petroleum and kerosene. E-buses operate exclusively on electricity, unlike conventional buses, thereby enabling the entire mass transit system to operate more efficiently and economically while reducing the reliance on fossil fuels detrimental to the environment.

The Customer Satisfaction Index (CSI) serves as a versatile analytical instrument for evaluating customer satisfaction with a service, product or company. It aids in identifying the factors contributing to customer satisfaction or dissatisfaction, thereby offering valuable insights crucial for decision-making. By analysing raw data through CSI, companies can gain a deeper understanding of customers' preferences regarding specific features of a product or service. The insights gleaned from CSI enable companies to propose quality and value enhancements, enhance cost-effectiveness, and ultimately retain satisfied customers based on positive past experiences. The utilization of CSI brings numerous benefits, including the identification of key elements that significantly influence customer satisfaction, recognition of opportunities for enhancing satisfaction levels, and the provision of essential insights into customer segments, distinguishing between loyal and unreliable customers (Factum Group , 2014).

The quality of transit services significantly influences the choices of travel users. A positive experience with transit is likely to encourage repeat usage, whereas negative experiences may deter future use. Therefore, enhancing service quality is crucial for retaining regular travellers and attracting new users. Additionally, the need to provide high-quality services ensures competition among transit agencies, ultimately benefiting users with improved services and facilities. To achieve these objectives, transit agencies must evaluate their performance. (Eboli & Mazzulla, 2009)

Customer satisfaction serves as a key measure of company performance based on meeting customer needs (Hill & Brierley, 2003). Thus, measuring customer satisfaction serves as an indicator of service quality. Customers express their opinions on service aspects through specialized surveys known as "customer satisfaction surveys."

Transit service aspects can generally be categorized into characteristics that directly describe the service (For example: service frequency) and less quantifiable characteristics influenced by customer preferences (For example: comfort). Numerous studies discussed transit service quality, as indicated in Table 1. These studies explore various attributes that determine transit service quality, including service coverage, service scheduling and reliability, information provision, cleanliness, comfort, safety and security. Service scheduling involves parameters such as service frequency and service time. Service reliability relates to adherence to schedules, ensuring optimal travel times for users. Service coverage encompasses aspects such as route characteristics, stop frequency, and accessibility. Information provision includes details on departure and arrival times, ticket costs, and stop locations. Comfort considerations encompass factors like climate control, seating comfort, ride smoothness, odours, and noise levels. Cleanliness pertains to both vehicle and terminal cleanliness. Safety addresses the risk of accidents, while security concerns personal safety against crimes. Other service quality aspects include fare structures, staff appearance and assistance, environmental initiatives, and customer services like ticket purchasing convenience and complaint management (Eboli & Mazzulla, 2009).

Table 1: Literature on the Attributes Determining Transit Service Quality

Author and Date	Name of the Publication	Objectives of the Study	Attributes Determining Transit Service Quality
(Transportation Research Board, 2003a)	A Guidebook for Developing a Transit Performance Measurement System	To develop a system that can measure the performance of the implemented transit System.	• Availability of Transit Service • Travel Time • Safety & security • Maintenance & Construction, • Economic Measures • Capacity • Reliability • Comfort.
(Transportation Research Board, 2003b)	Transit Capacity and Quality of Service Manual, TCRP Report 88	To provide guidance on transit performance measurement	• Reliability • Service Scheduling • Service Coverage • Comfort • Cleanliness • Information Provision, • Safety • Security
(Eboli & Mazzulla, 2007)	Service Quality Attributes Affecting Customer Satisfaction for Bus Transit	To identify the main Service Quality Attributes Responsible for Customer Satisfaction and Dissatisfaction for Bus transit.	• Bus Stop Availability • Service Frequency • Route Characteristics • Reliability • Cleanliness

			• Bus stop furniture • Cost • Information • Complaints • Safety & Personal Security • Bus Stop Maintenance
(Iseki & Taylor, 2008)	Style versus service? An analysis of user perceptions of transit stops and stations in Los Angeles.	To analyse user observations of transit stops and stations.	• Comfort • Cleanliness • Safety • Security • Reliable Service
(Joewono & Kubota, 2007)	User Perceptions of Private Paratransit Operation in Indonesia	To explore the relationship between user loyalty and various variables in the context of paratransit in Bandung, Indonesia.	• Accessibility • Availability • Information • Fare • Customer service • Negative Experience with Crew Attitude
(Tyrinopoulos & Antoniou, 2018)	Public transit user satisfaction: Variability and policy implications	This research seeks to understand how passengers perceive transit performance across different operators and its policy implications.	• Service Frequency • Accessibility • Waiting Time • Vehicle cleanliness • Safety

This study aims to create a satisfaction index analysis customized for the local population of Aligarh Smart City to facilitate decision-making regarding the adoption of electric bus services. Various potential measures have been identified to enhance the feasibility and practicality of E-buses. The primary objectives include conducting a comprehensive analysis of the critical attributes (affordability, accessibility, safety, comfort, etc.) that are essential for overall customer satisfaction. The evaluation focuses on the currently operational E-bus routes within the city, with data analysis aimed at providing insights into the implementation of E-buses and aiding in the development of a sustainable, attractive, reliable, efficient, and safe bus network. Ultimately, these efforts aim to enhance bus connectivity, expand catchment areas, and improve customer satisfaction, thereby increasing bus ridership.

1.1. Problem Statement

Accessing public transportation remains challenging for many citizens, with the issue not solely attributed to the quality of service provided by transportation companies but also to the difficulty in reaching locations where public transport is available. According to renowned town planner Nia Chun Wei, the lack of proper connectivity between some areas poses a significant challenge, exacerbated by the dispersed layout of Indian cities (Chauhan, 2023). Ensuring accessible and reliable public transportation is crucial for providing urban poor populations with greater access to socio-economic opportunities. Improved route planning and bus stop development are essential for maximizing connectivity between residential areas and public transport. Additionally, while accessibility to public transportation is challenging for many citizens, individuals with disabilities face even greater mobility constraints (Soltani et al., 2012). Mobility is vital for daily activities, yet the existing state of public transportation in India lacks adequate facilities and design to accommodate minorities, including senior citizens and persons with disabilities. The Rights of Persons with Disabilities Act (RPWD) mandates that public transportation must be made accessible for individuals with disabilities. This entails the provision of ramps, lifts, and designated areas for wheelchair users (Department of Empowerment of Persons with Disabilities, 2016). In line with this policy, public transport providers and operators must understand the needs of these individuals to enhance service quality and foster inclusivity.

Another issue closely tied to public transportation service is the safety and comfort of existing facilities, such as bus stops and terminals. Japheth Lim, an Environmental Sustainability Design (ESD) Consultant, emphasizes the significance of bus stops as communal spaces that should be safe, convenient, user-friendly, and conducive to community integration. However, in reality, many of these facilities are in poor condition, vulnerable to heavy rains, uncomfortable, poorly lit, and may pose safety risks to users (Lim, 2012). Public transportation plays a crucial role in urban sustainability by enhancing socio-economic opportunities and reducing the city's carbon footprint. Effective public transportation networks improve accessibility and reduce travel times, road congestion, energy consumption and air pollution. Therefore, assessing consumer satisfaction levels during the various stages of the implementation of Electric buses in Aligarh is essential. This evaluation is likely to address the aforementioned issues and contribute to enhancing the urban quality and profile of the city. Preceding research indicates that consumer satisfaction levels regarding the application of e-buses remain notably deficient compared to other areas of study in India. While some studies have examined the implementation of electric bus services, they have not specifically focused on consumer satisfaction. Therefore, recognizing these deficiencies and gaps in prior research, there is a concerted effort to investigate customer satisfaction levels regarding the implementation of Electric buses in Aligarh. The objectives of the research are as follows:

1) To analyse the quality of the implemented e-bus service in Aligarh city using the customer satisfaction index.
2) To understand the critical attributes responsible for customer satisfaction or dissatisfaction.
3) To suggest improvement strategies aimed at increasing bus ridership in the city.

1.2. Significance of the research

One of India's significant initiatives to significantly reduce carbon emissions involves the introduction of e-buses in urban areas. The deployment of electric buses across the country is guided by government policies and initiatives such as the National Electric Mobility Mission Plan (NEMMP), launched in 2013, and the Faster Adoption and Manufacturing of Electric Vehicles (FAME) India Scheme, initiated in 2015. These schemes offer financial incentives to encourage the adoption of electric and hybrid vehicles and promote local manufacturing. Electric buses are praised not just for their minimal emissions, but also for their silent functioning and lower operational expenses in comparison to their diesel and natural gas counterparts (Ministry of Heavy Industry & Public Enterprises, 2015). This research holds valuable insights for various stakeholders, particularly for future research and development efforts. It serves to increase

public awareness about the importance of environmental conservation. Through analysis, the study aims to gauge customer satisfaction levels regarding the implementation of Electric bus service in Aligarh City. Furthermore, it aims to provide local governments with essential insights into the key attributes necessary to enhance customer satisfaction in public transportation. Consequently, regional authorities can deliver high-quality transportation services through the use of e-buses, potentially shifting customer preferences from conventional buses to e-buses.

2. Literature review

2.1. Customer Satisfaction

According to Ilieska (2013), consumers are individuals who utilize products or services to fulfil their various needs. Consumer behaviour is influenced by factors such as what, when, where, and how to make purchases, prompting companies to align their business activities accordingly. Zeithaml & Bitner (2000) define satisfaction as the customer's response to fulfilment, indicating the level of enjoyment derived from a product or service feature. It is an evaluation of whether a product/service meets expectations and provides a satisfactory level of consumption-related fulfilment. Customer satisfaction, as per Kotler (2001) is the degree of pleasure experienced by customers upon comparing service quality with perceived quality. Unsatisfaction arises when service quality falls below perceived quality, while delight occurs when service quality exceeds perceived quality. In the context of customer satisfaction, perceived quality represents the customer's expectations and faith in a product's potential to fulfil its intended purposes. This perception evolves over time based on past purchase experiences, recommendations from friends, and assertions from the producing company. Thus, customer satisfaction hinges on the customer's perception of product quality compared to the claims made by the producing company.

Customer satisfaction serves as a vital indicator of company performance, reflecting its ability to meet customer needs and ensure service quality (Hill & Brierley, 2003). Businesses' proactive efforts to enhance their services play a pivotal role in addressing customer complaints stemming from poor service quality, ultimately fostering customer loyalty. Research by (Fornell et al., (2005) revealed a significant increase in shareholder numbers (+52%) for businesses that improved customer satisfaction over five years (1999-2004), contrasting sharply with those experiencing a decline (-28%) due to poor customer satisfaction. During the 2008 economic crisis further emphasized the importance of customer satisfaction, indicating that businesses with high American Customer Satisfaction Index (ACSI) scores suffered less market stock reduction (-33%) compared to those with lower ACSI scores (-55%). Achieving top-tier customer satisfaction necessitates studying consumer behaviour and creating business marketing strategies to align with the needs of the consumer market (Ilieska , 2013).

In the short, sustaining high levels of customer satisfaction can yield significant returns on investment and boost sales revenue. Profitability serves as the primary driver for ensuring business stability, allowing for enhancements in service quality, product diversification, and expansion into new markets (Shabarien et al., 2023). Moreover, over the long term, prioritizing customer satisfaction fosters increased customer loyalty, leading to a greater willingness to pay premium prices and advocate for the brand among potential new customers. Ultimately, this approach contributes to the overall profitability and success of the company (Martin, 1995). Reichheld & Sasser (1990) emphasize the positive correlation between customer loyalty and business performance, while Barroso & Martin (1999) highlight the role of customer loyalty in both enhancing business value and attracting new clientele.

2.2. Customer Satisfaction Indexes

Ilieska (2013) defines customer satisfaction as the emotional response, whether positive or negative, experienced by customers upon consuming a product or service, which is then compared to their anticipated level of service. Over time, various methodologies have emerged to accurately gauge customer satisfaction, with the ServQual method introduced by Parasuraman et al. (1985) being among the most renowned. This model focuses on bridging the disparity between customer expectations and the actual service received, comprising three distinct sections: drivers of satisfaction (customer expectation, perceived value and perceived quality) on the left, satisfaction levels at the centre, and satisfaction outcomes (customer complaints and loyalty) on the right (Ilieska , 2013). The ServQual framework offers a structured approach to assessing service quality, emphasizing five key dimensions: tangibles, reliability, responsiveness, assurance, and empathy (Laura, 2016). These dimensions, as outlined by Parasuraman et al. (1985), are defined as follows:

1) **Tangibles:** Refers to the appearance and state of physical facilities, equipment, staff, and informational materials.
2) **Reliability:** Pertains to the ability to consistently and accurately deliver services with credibility.
3) **Responsiveness:** Involves effectively addressing customer complaints and resolving issues in a timely manner.
4) **Assurance:** Encompasses possessing the necessary skills and knowledge, transparent communication, and instilling confidence and trust in customers.
5) **Empathy:** Involves being approachable, accessible in communication, and understanding of customers' needs.

The approach utilizes a questionnaire format employing a Likert scale, which measures seven levels of agreement or disagreement ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). These indexes are pre-established to discern between customers' expectations and perceptions of service across the five dimensions of service quality incorporated within each index (Laura, 2016). Following the introduction of the ServQual method in research, numerous adaptations and iterations of this model have emerged. Cronin & Taylor (1994) presented the ServPerf methodology, while Teas (1993) proposed the Normed Quality (NQ) model. Despite the ServQual method being the most commonly utilized approach for evaluating service quality, its chosen measurement scale for capturing customer evaluations possesses certain drawbacks in generating an overall quantitative calculation of service quality. Specifically, to compute an index, analysts must assign a numerical value to each level of judgment. Consequently, equal intervals are allotted to each qualitative point on the scale, assuming uniform distances between successive levels of customer judgment.

Over the past decade, several national and international indexes, based on customer perceptions and expectations, have emerged. Primarily, these indexes of satisfaction are typically incorporated into extensive frameworks of cause-and-effect relationships, also known as satisfaction models. These models include latent or unobservable variables and produce reliable satisfaction indexes (Johnson et al., 2001). The Swedish Customer Satisfaction Barometer (SCSB), established in 1989, is the first national customer satisfaction index for goods and services acquired domestically (Fornell, 1992). In contrast, the American Customer Satisfaction Index (ACSI) was introduced in 1994 (Fornell et al., 1996), followed by the Norwegian Customer Satisfaction Barometer (NCSB) in 1996 (Andreassen & Lindestad, 1998; Andreassen & Lervik, 1999). The European Customer Satisfaction Index (ECSI) is a more recent addition to these indexes (Eklof, 2000). The original SCSB model is based on customer perceptions and expectations of products or services. While the subsequent mod-

els share foundational concepts, they diverge from the original in terms of the considered variables and introduce cause-and-effect relationships. The models underpinning these indexes exhibit considerable complexity. Moreover, estimating model coefficients requires substantial amounts of experimental data and entails a calibration process that is challenging to execute. Consequently, transit agencies find this method impractical, especially for monitoring service quality (Eboli & Mazzulla, 2009).

Recently, a new index created on discrete choice models and random utility theory has emerged. This index, known as the Service Quality Index (SQI), is derived from the utility function of a selected service alternative (Hensher & Prioni, 2002). Users select between their regular service and hypothetical alternatives, delineated through Stated Preferences (SP) techniques by altering the quality levels of service attributes. The user defines their regular service by assigning values to each attribute. The design of SP experiments of this nature is typically intricate (Eboli & Mazzulla, An SP Experiment for Measuring Service Quality in Public Transport., 2008a). Initially computed using a Multinomial Logit model to assess transit service quality, SQI saw the introduction of Hierarchical Logit models by Marcucci & Gatta (2007) and Hensher et al. (2003). The mixed Logit model was proposed by Eboli & Mazzulla (2008b) and Hensher (2001), SQI includes the concept of satisfaction through customer expectations and perceptions. Unlike approaches relying on customer ratings, SQI is rooted in choice data, wherein users indirectly express importance judgments on service attributes by selecting a service. Furthermore, when describing their habitual service, users implicitly evaluate satisfaction with its attributes. However, SQI's complexity lies in its intricate calculation procedure. While choice data can yield more reliable outcomes due to users making simultaneous attribute comparisons, the reliance on such data poses challenges as they are not customary in customer satisfaction surveys and necessitate well-designed SP experiments for collection. Hill et al. (2003) characterize CSI as a straightforward and precise approach to evaluating service quality through an overall index. CSI reflects the elements of service quality that are derived from a customer's perceptions of service attributes. It is expressed through the importance ratings, which are compared with the customer's expectations, articulated in terms of satisfaction rates. CSI addresses the limitations of the ServQual method by evaluating the model using a numerical scale of the expressed dimension. This approach allows for a more precise and quantifiable assessment of service quality. Among the various indexes outlined, CSI stands out as a straightforward process, facilitating easy calculation by market researchers.

Transportation plays a vital role in facilitating the socio-economic development of any nation, particularly in densely populated urban areas. With capital cities experiencing rapid urbanization and population growth, the provision of reliable transportation has become increasingly essential for maintaining urban functionality. Over recent decades, transportation service providers have progressively enhanced their service quality to improve customer satisfaction, a strategy that has demonstrated significant benefits for both providers and passengers (Shabarien et al., 2023). Therefore, ensuring the sustainable growth of public transportation in major cities necessitates continual improvement in the quality and reliability of services offered. Despite the significance of service quality in public transportation, insufficient research has been dedicated to addressing this issue (Friman et al., 2001). The anticipated service quality for public transportation may vary among users, considering the diverse demographics and social classes within the population. categorizes expected service quality based on mobility and travel constraints. Olio et al. (2011) categorize anticipated service quality based on mobility and travel constraints. These expectations encompass four main key attributes: accessibility, affordability, safety, and comfort. These attributes are consistently highlighted in various articles by researchers (See Table 1) such as establishing them as fundamental aspects of service quality expected by transportation users.

3. Research Methodology

To accomplish the research objectives of assessing the state of the existing public transportation system in Aligarh, Uttar Pradesh, both document review and observational studies were conducted, employing a checklist. The document review involved analysing existing journals and related documents to identify the service quality attributes deemed important by public transportation users in Aligarh. This process aimed to delineate potential improvements in customer satisfaction for users of public transportation in the city. Conversely, the observational study, or visual survey, entailed non-experimental research wherein ongoing activities and phenomena were directly observed and analysed in their natural setting. This qualitative approach sought to visually assess the current condition of the public transportation system in Aligarh. During the observational study, a checklist was utilized and developed based on the service quality elements identified through the document review process.

A survey was conducted to enhance the public transportation system in Aligarh, Uttar Pradesh, utilizing a structured questionnaire as the research instrument. The questionnaire comprised various series of inquiries aimed at gathering information from respondents. Face-to-face interviews were conducted onboard during service hours by surveyors with public transportation users on three routes: AL-01 (from Khereshwar to Panethi), AL-02 (from Harduaganj to Mehrawal), and AL-04 (from Harduaganj to Hastpur) of the E-Bus operation in Aligarh. The aim was to gain insight into the perceived quality of the public transportation system. This method aimed to gain insights into user's perceived quality compared to the actual service received, assessing their satisfaction levels and whether the service met their expectations.

Sampling, defined as the process of selecting units from the population of interest, was employed to ensure the reliability and consistency of the results while minimizing sampling error. Given the impracticality of surveying all transportation service users, sampling was essential to obtain a representative percentage of the population. Simple random sampling was utilized in this study to ensure equal inclusion likelihood for each potential respondent within the target population. A total of 465 respondents were meticulously surveyed on three operational E-Bus routes (See Table 2). They were asked to provide socio-economic data, including age, education, gender and occupation, to ensure a comprehensive representation of the entire population.

Table 2: Number of Passengers Surveyed on Different Routes of Electric Bus Service in Aligarh

Route Code and Name	Number of Passengers Surveyed
AL-01: Khereshwar to Panethi	150
AL-02: Harduaganj-Mehrawal	140
AL-04: Harduaganj to Hastpur	175

The questionnaire was constructed based on previous research and critical attributes pertinent to the city's public transportation system effectiveness. The questionnaire utilized a five-point Likert scale to gauge respondent's perceptions, with "1: Very Dissatisfied" to "5: Very Satisfied" representing rating of satisfaction levels. Similarly, for rating the importance of various attributes, the scale ranged from "1: Do not bother" to "5: Extremely Important" (See Table 3) The questionnaire encompassed ten significant attributes, including the CSI introduced by Hill et al. (2003). The questionnaire consisted of two parts:

- Part 1: Demographic information to study respondent's backgrounds.

- Part 2: Studying the important and preferred service quality attributes by customers, including Service Frequency, Punctuality/Reliability, Seat Availability, Bus Travel Time, Access to Bus Stop, Availability of Proper Bus Stops, Bus Route Information, Fare, Security, and Overall Service Quality.

Table 3: Customer Satisfaction Survey Satisfaction and Importance Levels on the Likert Scale

Satisfaction Level	Importance Level
1 - Very Bad	1 - Do not bother
2 - Bad	2 - Not Important
3 - OK	3 - Important
4 - Good	4 - Very Important
5 - Very Good	5 - Extremely Important

As outlined previously, this study is based on the Customer Satisfaction Index (CSI) proposed by Hill et al. (2003), determined through user satisfaction ratings, weighted by the importance ratings they assign. This calculation is based on the following formula:
Equation 1: Customer Satisfaction Index

$$CSI = \sum_{k=1}^{N} [\bar{S}_k \cdot W_k]$$

Where:
$\bar{S}_k$ represents the mean of the satisfaction rates expressed by users for attribute k of service quality.
W_k (importance weight) denotes the weight assigned to attribute k, calculated using the importance rates provided by service users. Specifically, it is the ratio between the mean of the importance rates $\bar{I}_k$ expressed by users for attribute k and the sum of the average importance rates for all service quality attributes.
Equation 2: Importance weight

$$W_k = \frac{\bar{I}_k}{\sum_{k=1}^{N} \bar{I}_k} \qquad OR \qquad W_k = \frac{\text{Mean of Importance Rate } (\bar{I}_k)}{\text{Sum of Importance rates of k Attributes}}$$

To measure the quality of Electric bus service, users provided feedback on 10 service attributes, assigning ratings of importance and satisfaction on a scale from 1 to 5. Additionally, they rated the overall service quality. These attributes encompass various aspects of bus services, such as route characteristics, reliability, comfort, coverage, fare, information provision, safety, and security. An initial evaluation of E-Bus service quality involved analysing the satisfaction and importance ratings, calculated through average scores. Attributes with an average satisfaction score below 3.25 (65%) are considered critical service aspects. Furthermore, examining the importance ratings helps identify the most crucial attributes for passengers. It is noteworthy that all service attributes received high importance ratings from passengers, with those scoring above 4.5 (90%) deemed exceptionally important. The Customer Satisfaction Index for each of the three routes is computed independently. Subsequently, the average CSI of all the routes is determined, which defines the overall CSI of the E-Bus operation in Aligarh city. CSI serves as an effective measure of overall satisfaction by consolidating users' evaluations of several service attributes into a single score. The accuracy of the overall satisfaction measure depends on the meticulous selection of attributes, ensuring a comprehensive description of service aspects. Therefore, the chosen attributes should thoroughly cover all aspects of the service.

4. Study area

The research study area is Aligarh, situated in the northern Indian state of Uttar Pradesh. Aligarh is a city with a total population of 0.87 million, as per the 2011 census, and a projected population of 1.32 million in the year 2021. It comprises 80 wards and 5 tehsils: Koil, Atrauli, Khair, Iglas, and Gabhana. The city covers a total area of 63.81 square kilometres (See Figure 1), with a population density of 44,481 individuals per square kilometre. Aligarh is home to approximately 264,000 households, with an average household size of 5.9 individuals (District Administration Aligarh, 2023).

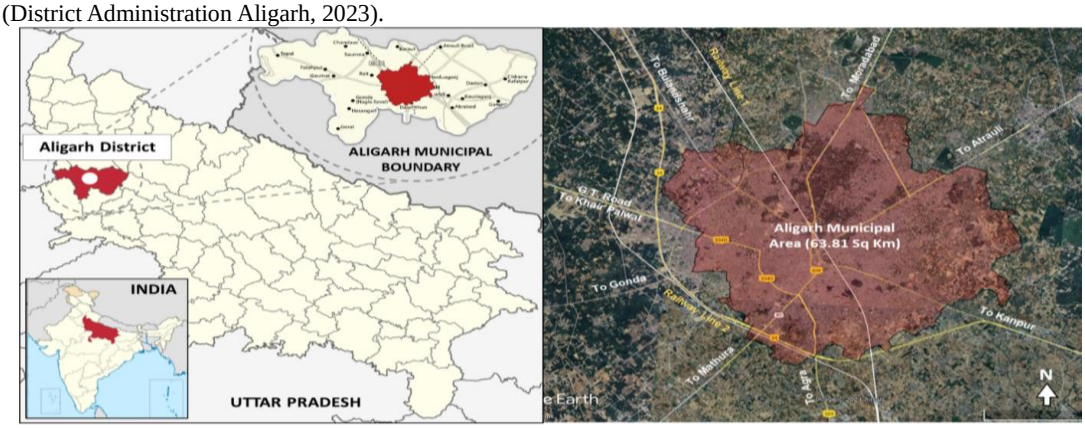

Fig. 1: Aligarh City Municipal Boundary.

Aligarh is renowned for its rich cultural heritage and educational institutions and is currently undergoing a transition towards a more sustainable and efficient public transport system. The city is part of the Smart Cities Mission, initiated on June 25, 2015, by the Government of India. This mission is focused on promoting cities that are sustainable and inclusive, offering essential infrastructure and a re-

spectable standard of living to its residents, all within a clean and sustainable environment (Ministry of Housing and Urban Affairs, 2015).

In 2021, the Mahanagar Bus Service operated on five routes in Aligarh to improve public transportation services. However, due to insufficient ridership, operations ceased in 2022. A significant development occurred in 2022 with the introduction of 25 electric buses on five different routes under the FAME- II scheme. This initiative not only contributes to reducing air pollution but also offers modern transportation options. Presently, three routes are operational, covering a total catchment area of 24.98 square kilometres (See Figure 2), with a population coverage of 511,876 and a daily passenger count of 5,764. These routes serve to connect nearby small towns and villages with urban centres. The information regarding the routes is provided in Table 4 and the route map is in Figure 2.

Table 4: Operational Electric Bus Service Routes Details

Service Characteristics	**Route 1**	**Route 2**	**Route 3**
Route code	AL-01	AL-02	AL-04
Name of the Route	Khereshwar to Panethi	Harduaganj to Mehrawal	Harduaganj to Hastpur
Route Length (Km)	18	20	28
Number of Designated Bus Stops	16	11	20
Bus Fleet	9	8	7
Bus Headway (Mins)	10 Minutes	15 Minutes	10 Minutes
Round Trip Duration (Mins)	135 Minutes	135 Minutes	160 Minutes
Daily Travel demand (Pass/day)	1667 pass/day	2900 pass/day	1197 pass/day
Per Bus Kilometres	216.4	224.0	248.0
Number of per Bus trips	14	12	10
Daily Planned Kilometres	1947.6	1792.0	1736.0
Scheduled Bus Trips	126	96	70
Average Load Factor (%)	16.32	14.70	18.20
Bus Service Operating Hours	14 hours (6:00 a.m. to 10:10 p.m.)	16 hours (6:10 a.m. to 10:10 p.m.)	15 hours (5:45 a.m. to 8:45 p.m.)
Service frequency (Run/hr)	6 run/hr	4 run/hr	6 run/hr
Ticket cost (INR)	Rs. 12 to Rs. 35 (depending on covered distance)	Rs. 12 to Rs. 35 (depending on covered distance)	Rs. 12 to Rs. 45 (depending on covered distance)
Bus Route Catchment Area (Sq. Km)	8.08	9.12	7.78
Population Coverage of the Route (Inhabitants)	2,06,451	1,08,636	1,96,792

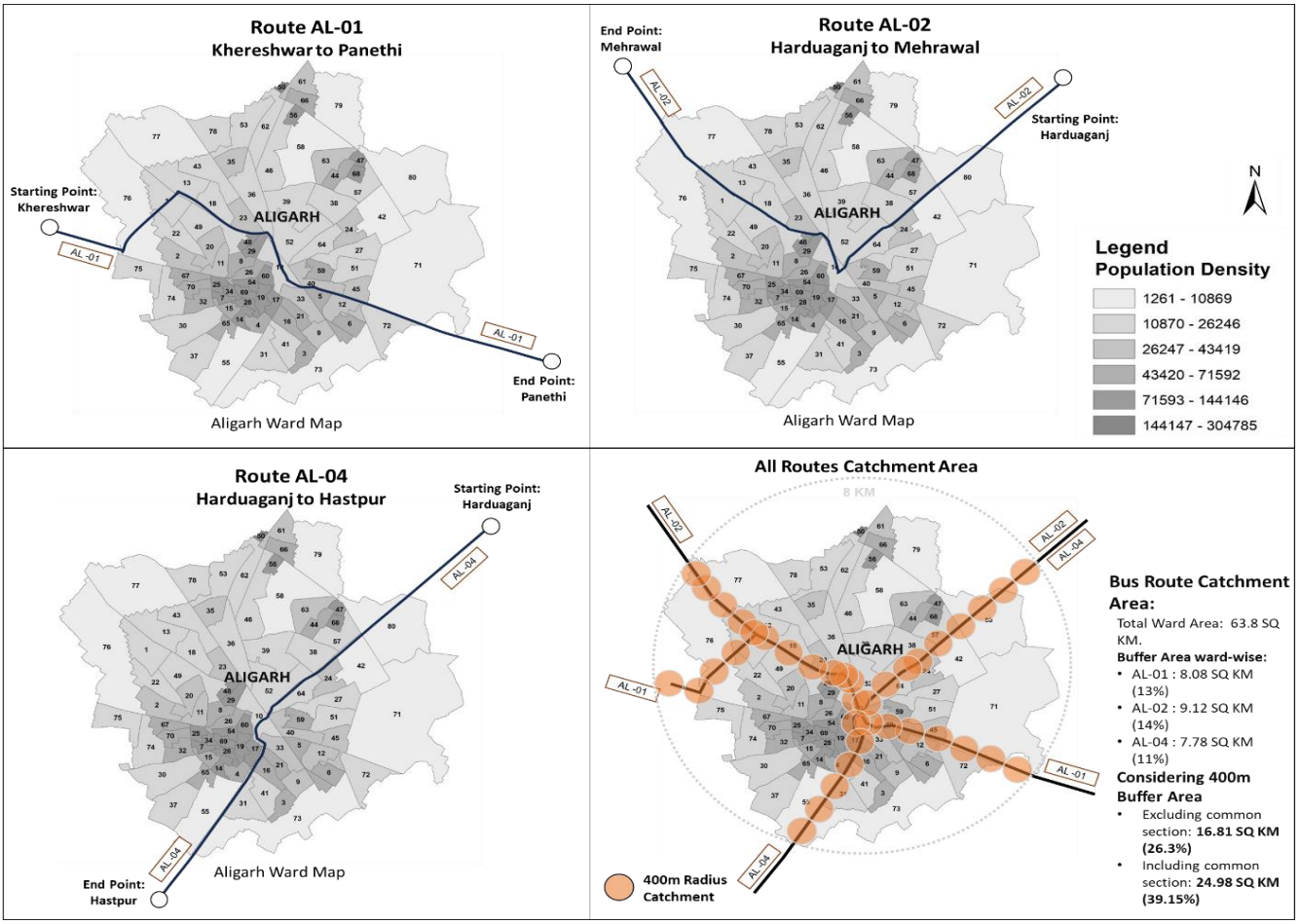

Fig. 2: Electric Bus Route Maps and Catchment Area in Aligarh City.

To support the operation of electric buses, an electric bus depot has been established and is operated by Green Cell under Aligarh Smart City Limited. The depot features four charging points with fast charging options. The original equipment manufacturer (OEM) of the electric buses is PMI Electro Mobility Solutions Private Limited (PMI Regio). These buses are 9 meters in length, with a seating capacity

of 30 and a range of 150 kilometres on a single charge. The detailed specification of E-buses is given in Table 5. Looking ahead, future plans aim to expand the electric bus service to 11 routes by 2031 and 17 routes by 2041. These expansions will entail extending route lengths and stops to enhance the city's public transport infrastructure, in accordance with the plans outlined by the Urban Mass Transit Company in 2022 (Urban Mass Transit Company Limited, 2022).

Table 5: Detailed Specifications of Electric Buses

Electric Bus Specifications	**Description/Values**
Original Equipment Manufacturer (OEM)	PMI Electro Mobility Solutions Private Limited
Manufacturing plant	Haryana
Bus Name	PMI Regio
Bus Suitability	Medium-sized and small cities
Seating Capacity	30 +D
Dimensions (L x W x H)	8540 x 2450 x 3120 mm
Floor Height	900 mm
Battery Capacity	151 kWh
Battery Type	Advanced Li-ion
Battery Range	150 kms
Motor Type	PMSM Motor
Engine Type	Electric motor
Air conditioner (A/C)	Yes
Driver information display	Yes
Number of tyres	6
Top speed	80 km/h
Price	INR 12.5-15 million (INR 3.5 million Government Incentives)
CCTV Cameras	5 with Voice Recording
Buses operational in the city	25
Charging Time	120 min (One Charging gun) – 45 min (Two Charging guns)
Charging Infrastructure	4 Charging points with 8 Charging Guns (150 kWh each)

5. Analysis

The socio-economic characteristics of the study population provide valuable insights into the demographics and employment status of the samples collected. Among the respondents, 67.1% are male, while 32.9% are female, indicating a higher representation of males in the sample. The age distribution shows a diverse representation, with the majority falling in the age group of 21 to 40 years (40.2%). Approximately a quarter of the respondents fall in the age group of 41 to 65 years (24.5%), followed by those up to 20 years (19.8%), and over 65 years (15.5%). In terms of household size, the distribution varies, with the majority of households having 4 or 5 members. About 22.4% of households have 4 members, and 25.2% have 5 members.

Regarding employment status, a significant proportion of respondents are employed (63.7%), suggesting that a considerable portion of the population utilizes the service for their daily commute to work. Among the employed respondents, the majority are engaged in the private sector (40.9%), followed by the self-employed (25.7%) and the public sector (19.3%). The data also reveals a varied distribution of family income levels, with the largest proportion of respondents (46.9%) falling into the income bracket of less than Rs. 25,000. This suggests a significant representation of lower-income households using bus service to commute. Overall, the socio-economic characteristics reflect a diverse respondent with varying demographics, employment statuses, household sizes, and income levels. This information is essential for understanding the profile of the study population before analysing satisfaction and importance outcomes for the research objectives (See Table 6).

Table 6: Socio- Economic Characteristics

Socio-Economic Characteristics	Categories	Numbers	Percentage
Gender	Male	312	67.1
	Female	153	32.9
	Total	465	100.0
Age	Up to 20 years	92	19.8
	21 to 40 years	187	40.2
	41 to 65 years	114	24.5
	Over 65 years	72	15.5
	Total	465	100.0
Household Size	1 Person	24	5.2
	2 Persons	58	12.5
	3 Persons	87	18.7
	4 Persons	104	22.4
	5 Persons	117	25.2
	More than 5 Persons	75	16.1
	Total	465	100.0
Employment	Employed	296	63.7
	Unemployed	51	11.0
	Housewife	26	5.6
	Student	47	10.1
	Pensioner	16	3.4
	Others	29	6.2
	Total	465	100.0
Sector of Employment	Public Sector	57	19.3
	Private Sector	121	40.9

	Self Employed	76	25.7
	Others	42	14.2
	Total	296	100.0
Family Income Level (INR)	Less than Rs. 25,000	218	46.9
	Rs. 25,000 – Rs. 49,999	105	22.6
	Rs. 50,000 – Rs. 74,999	62	13.3
	Rs. 75,000 – Rs. 99,999	57	12.3
	Rs. 1,00,000 and above	23	4.9
	Total	465	100.0

An evaluation of E-bus service quality involves analysing satisfaction and importance rates to determine customer satisfaction levels across different routes. The Customer Satisfaction Index (CSI) levels for each route help in the identification of critical attributes specific to those routes, guiding authorities in implementing targeted corrective measures. For example, if the availability of proper bus stops is identified as a critical attribute for certain routes, authorities can address this by constructing designated bus stops. This route-specific analysis is instrumental in discerning the overall customer satisfaction level of the E-bus service within the city.

5.1. Route Al-01: Khereshwar to Panethi

Route AL-01, spanning 18 kilometres, links Panethi to Khereshwar Chauraha, serving as a pivotal link for Aligarh city. This route integrates urban centres and essential landmarks, notably Aligarh Airport. Currently, nine electric buses operate along this corridor, facilitating transportation across urban and suburban areas.

5.1.1. Critical Attributes for Satisfaction and Dissatisfaction (See table 7)

Costumers Dissatisfied (Satisfaction Score Below 3.25 or 65%) with:

- Fare 3.15 (63%).

Costumers Satisfied (Satisfaction Score above or equal to 3.25 or 65%) with:

- Service Frequency: 4.35 (87%)
- Punctuality/ Reliability: 4.97 (99%)
- Seat Availability: 5.00 (100%)
- Bus Travel Time: 4.95 (99%)
- Access to Bus Stop: 4.05 (81%)
- Availability of Proper Bus Stops: 3.97 (79%)
- Bus Route Information: 3.95 (79%)
- Security: 4.15 (83%)
- Overall Service Quality: 4.20 (84%)

5.1.2. Important Attributes for costumers (Importance score above or equal to 4.25 or 85%) (See table 7)

- Service Frequency: 4.25 (85%)
- Punctuality/Reliability: 4.33 (87%)
- Seat Availability: 4.36 (87%)
- Bus Travel Time: 4.53 (91%)
- Access to Bus Stop: 4.49 (90%)
- Availability of Proper Bus Stops: 4.52 (90%)
- Fare: 4.90 (98%)

Customers seem highly satisfied with the frequency of bus services, as indicated by the minimal difference between the importance and satisfaction scores in this aspect (See Figure 3). This suggests that buses are available at frequent intervals, meeting customer expectations for timely transportation. On the other hand, the fare section exhibits the maximum difference between importance and satisfaction scores. This suggests that customers place significant importance on fare affordability. The substantial increase in minimum fare in September 2022, from Rs. 5 to Rs. 12 has led to decreased bus usage, highlighting the impact of fare pricing on customer satisfaction and usage patterns. The overall customer satisfaction percentage on route AL-01 is 85.34%.

5.1.3. Corrective measures

To address the identified critical attributes, targeted corrective measures must be implemented. This involves enhancing fare affordability, ensuring the provision of adequate bus stops, providing comprehensive bus route information, and improving access to bus stops and travel times. These actions include revising ticket prices, establishing well-equipped bus stops with clear route information, improving travel time by avoiding delays and introducing feeder services to facilitate passenger access to designated bus stops. Robust monitoring mechanisms and feedback channels are crucial for the effective implementation of these corrective actions.

Table 7: CSI Calculation for Route AL-01

Route AL-01: Khereshwar to Panethi				
Attributes	Importance Score (I_k)	Importance Weight (W_k)	Satisfaction Score (S_k)	Weighted Score (CSI)
Service Frequency	4.25	0.101	4.35	0.440
Punctuality Reliability	4.33	0.103	4.97	0.512
Seat Availability	4.36	0.104	5.00	0.519
Bus Travel Time	4.53	0.108	4.95	0.534
Access to Bus Stop	4.49	0.107	4.05	0.433
Availability of Proper Bus Stops	4.52	0.108	3.97	0.427
Bus Route Information	4.16	0.099	3.95	0.391

Fare	4.90	0.117	3.15	0.368
Security	3.21	0.076	4.15	0.317
Overall Service Quality	3.25	0.077	4.20	0.325
Total	**42.00**			**4.267**
Percentage				**85.34%**

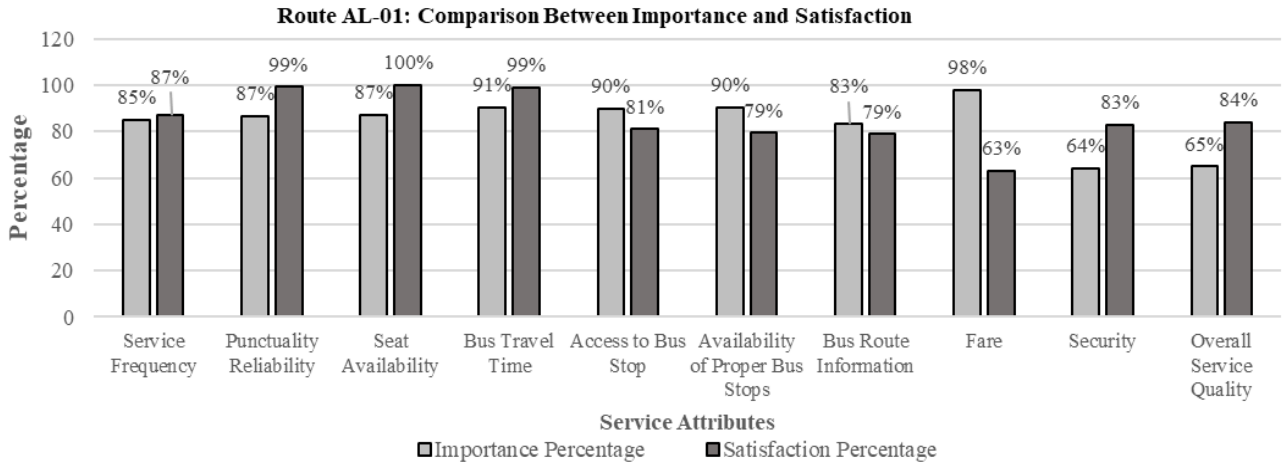

Fig. 3: Route AL-01: Comparison between Importance and Satisfaction.

5.2. Route Al-02: Harduaganj to Mehrawal

Route AL-02 spans 20 kilometres, connecting Harduaganj to Mehrawal. This vital route serves as a crucial link between urban centres and essential landmarks, including transit nodes such as Aligarh Bus Stands and Railway Station. Currently, eight electric buses operate on this route.

5.2.1. Critical Attributes for Satisfaction and Dissatisfaction (See table 8)

Costumers Dissatisfied (Satisfaction Score Below 3.25 or 65%) with:

- Fare 2.41 (48%).
- Bus Route Information 3.14 (63%).

Costumers Satisfied (Satisfaction Score above or equal to 3.25 or 65%) with:

- Service Frequency: 3.85 (77%)
- Punctuality/ Reliability: 3.75 (75%)
- Seat Availability: 4.52 (90%)
- Bus Travel Time: 4.29 (86%)
- Access to Bus Stop: 4.08 (82%)
- Availability of Proper Bus Stops: 3.42 (79%)
- Security: 4.60 (92%)
- Overall Service Quality: 4.12 (82%)

5.2.2. Important Attributes for costumers (Importance score above or equal to 4.25 or 85%) (See table 8)

- Punctuality/Reliability: 4.30 (86%)
- Bus Travel Time: 4.47 (89%)
- Access to Bus Stop: 4.28 (86%)
- Availability of Proper Bus Stops: 4.30 (86%)
- Fare: 4.62 (92%)
- Security: 4.61 (92%)
- Overall Service Quality: 4.30 (86%)

Customers on Route AL-02 exhibit high satisfaction with the security and bus travel time, evidenced by the minimal difference among the importance and satisfaction scores for these aspects (See Figure 4). This indicates that customers perceive the buses as safe and reliable. Conversely, similar to Route AL-01, the fare section displays the maximum difference between importance and satisfaction scores. This underscores the impact of fare pricing on customer satisfaction and usage patterns. The overall customer satisfaction percentage on route AL-02 is 76.32%.

5.2.3. Corrective measures

Corrective measures include enhancing fare affordability and improving bus route information to ease dissatisfaction among customers. Additionally, it's imperative to prioritize and improve attributes deemed important by customers, including punctuality/reliability, bus travel time, access to bus stops, availability of proper bus stops, fare, security, and overall service quality of the bus service. Implement comprehensive training programs for staff, maintain cleanliness and comfort onboard buses and at bus stops, and prioritize customer feedback to address issues promptly and effectively.

Table 8: CSI Calculation for Route AL-02

Route AL-02: Harduaganj to Mehrawal				
Attributes	Importance Score (I_k)	Importance Weight (W_k)	Satisfaction Score (S_k)	Weighted Score (CSI)
Service Frequency	4.17	0.096	3.85	0.370
Punctuality Reliability	4.30	0.099	3.75	0.371
Seat Availability	4.24	0.098	4.52	0.441
Bus Travel Time	4.47	0.103	4.29	0.441
Access to Bus Stop	4.28	0.099	4.08	0.402
Availability of Proper Bus Stops	4.30	0.099	3.42	0.339
Bus Route Information	4.15	0.096	3.14	0.300
Fare	4.62	0.106	2.41	0.256
Security	4.61	0.106	4.60	0.488
Overall Service Quality	4.30	0.099	4.12	0.408
Total	**43.44**			**3.816**
Percentage				**76.32%**

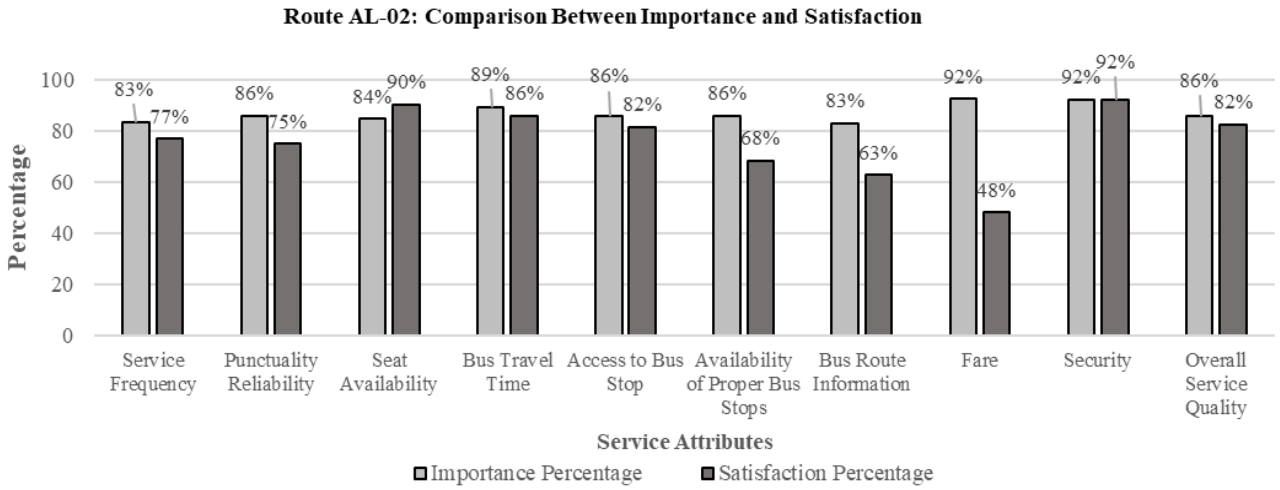

Fig. 4: Route AL-02: Comparison between Importance and Satisfaction.

5.3. Route al-04: Harduaganj to Hastpur

Route AL-04 stretches over 28 kilometres, making it the longest route in the network. This route connects the industrial area of Harduaganj to the Hastpur village. It serves as a vital link between industrial, institutional, and urban centres, facilitating connectivity to key landmarks such as Talanagri, Aligarh College of Engineering & Technology, Shivdan Singh Institute of Technology & Management, Vivekananda College, and Aligarh Mandi. Currently, seven electric buses operate along this route.

5.3.1. Critical Attributes for Satisfaction and Dissatisfaction (See table 9)

Costumers Dissatisfied (Satisfaction Score Below 3.25 or 65%) with:

- Availability of Proper Bus Stops: 1.31 (26%)
- Fare 2.10 (42%).

Costumers Satisfied (Satisfaction Score above or equal to 3.25 or 65%) with:

- Service Frequency: 3.80 (76%)
- Punctuality/ Reliability: 3.65 (73%)
- Seat Availability: 4.57 (91%)
- Bus Travel Time: 3.77 (75%)
- Access to Bus Stop: 4.00 (80%)
- Bus Route Information: 3.40 (68%)
- Security: 4.85 (92%)
- Overall Service Quality: 3.62 (82%)

5.3.2. Important Attributes for costumers (Importance score above or equal to 4.25 or 85%) (See table 9)

- Availability of Proper Bus Stops: 4.89 (98%)
- Bus Route Information: 4.54 (91%)
- Fare: 4.29 (86%)
- Security: 4.94 (99%)
- Overall Service Quality: 4.89 (98%)

On route AL-04, customers demonstrate a notable level of satisfaction with the security and service frequency attributes, as evidenced by the nominal difference between the importance and satisfaction scores for these aspects (See Figure 5). This indicates that passengers perceive the buses as safe, and they appreciate the frequency of bus operations, finding them adequate for their transportation needs. However, attributes such as the availability of proper bus stops and fare exhibit the maximum difference between importance and satisfaction scores. This highlights passengers' concerns regarding the necessity for dedicated bus stops equipped with shelters and seating, as

well as their affordability concerns regarding bus tickets. The overall customer satisfaction percentage on Route AL-04 is 68.87%, indicating a moderate level of satisfaction with the service.

5.3.3. Corrective measures

Corrective measures to address these concerns involve constructing and maintaining designated bus stops equipped with shelters and seating. Additionally, there is a need to review fare structures, consider subsidies or discounts for specific demographics, and ensure transparency in pricing policies. Furthermore, it's crucial to enhance attributes that are considered important by customers, such as the availability of proper bus stops, bus route information, security, and overall service quality.

Table 9: CSI Calculation for Route AL-04

Route AL-04: Harduaganj to Hastpur				
Attributes	Importance Score (I_k)	Importance Weight (w_k)	Satisfaction Score (S_k)	Weighted Score (CSI)
Service Frequency	3.82	0.093	3.80	0.352
Punctuality Reliability	4.20	0.102	3.65	0.372
Seat Availability	3.09	0.075	4.57	0.342
Bus Travel Time	3.46	0.084	3.77	0.316
Access to Bus Stop	3.14	0.076	4.00	0.304
Availability of Proper Bus Stops	4.89	0.119	1.31	0.155
Bus Route Information	4.54	0.110	3.40	0.374
Fare	4.29	0.104	2.10	0.218
Security	4.94	0.120	4.85	0.581
Overall Service Quality	4.89	0.119	3.62	0.429
Total	**41.26**			**3.444**
Percentage				**68.87%**

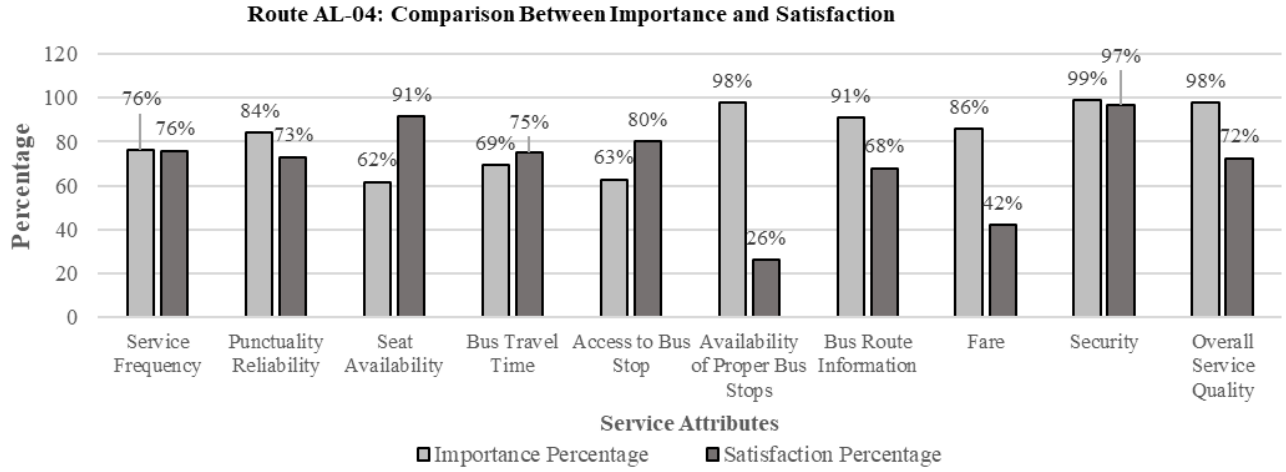

Fig. 5: Route AL-04: Comparison between Importance and Satisfaction.

5.4. Overall Customer Satisfaction Index of E-bus service in Aligarh city

To calculate the overall customer satisfaction and derive the Customer Satisfaction Index (CSI) of the electric bus service in Aligarh, we aggregate satisfaction and importance scores from all three operational E-bus routes. By averaging these scores across routes and using them to calculate the overall CSI, we attain a comprehensive evaluation of customer satisfaction with the E-Bus service in the city. (See Table 10). This approach allows us to understand how customers perceive the service as a whole and identify areas for improvement based on their feedback.

5.4.1. Critical Attributes for overall Satisfaction and Dissatisfaction (See table 10)

Costumers Dissatisfied (Satisfaction Score Below 3.25 or 65%) with:

- Availability of Proper Bus Stops: 2.90 (58%)
- Fare 2.55 (51%).

Costumers Satisfied (Satisfaction Score above or equal to 3.25 or 65%) with:

- Service Frequency: 4.00 (80%)
- Punctuality/ Reliability: 4.12 (82%)
- Seat Availability: 4.70 (94%)
- Bus Travel Time: 4.34 (87%)
- Access to Bus Stop: 4.04 (81%)
- Bus Route Information: 3.50 (70%)
- Security: 4.53 (91%)
- Overall Service Quality: 3.98 (80%)

5.4.2. Important Attributes for costumers (Importance score above or equal to 4.25 or 85%) (See table 10)

- Punctuality/ Reliability: 4.28 (86%)
- Availability of Proper Bus Stops: 4.57 (91%)
- Bus Route Information: 4.28 (86%)
- Fare: 4.60 (92%)
- Security: 4.25 (85%)

Passenger satisfaction with the E-Bus service in Aligarh is reflected through various attributes evaluated across routes. Particularly, customers express a notable level of satisfaction with the service frequency, access to bus stops, and overall service quality aspects (See Figure 6). This is evident from the minimal difference between the importance and satisfaction scores for these attributes, indicating that passengers find the frequency of bus operations adequate and appreciate the accessibility of bus stops. However, there are areas where passenger satisfaction is lower. Attributes such as the availability of proper bus stops, bus route information, and fare exhibit the maximum difference between importance and satisfaction scores. This suggests that while passengers consider these aspects important, they are less satisfied with the current offerings. The overall customer satisfaction percentage of E-Bus service in Aligarh is 76.76%.

5.4.3. Corrective measures

Targeted corrective measures are necessary to address areas of lower passenger satisfaction on all routes. Improving the availability of proper bus stops is crucial, as passengers value having designated stops equipped with amenities for their comfort and convenience. Additionally, enhancing bus route information is essential to provide passengers with clear and accurate guidance on routes and schedules, facilitating smoother journeys. Implementing measures to review fare structures and offering discounts for specific demographics can help ensure that the service remains accessible to all passengers, regardless of their financial constraints.

Table 10: Overall Customer Satisfaction Index of E-Bus Service in Aligarh

E-Bus Service Overall Customer Satisfaction Index										
Attributes	Importance Score (I_k)				Importance Weight (W_k)	Satisfaction Score (S_k)				Weighted Score (CSI)
	Route AL-01	Route AL-02	Route AL-04	Average		Route AL-01	Route AL-02	Route AL-04	Average	
Service Frequency	4.25	4.17	3.82	4.08	0.097	4.35	3.85	3.80	4.00	0.386
Punctuality Reliability	4.33	4.30	4.20	4.28	0.101	4.97	3.75	3.65	4.12	0.418
Seat Availability	4.36	4.24	3.09	3.90	0.092	5.00	4.52	4.57	4.70	0.433
Bus Travel Time	4.53	4.47	3.46	4.15	0.098	4.95	4.29	3.77	4.34	0.426
Access to Bus Stop	4.49	4.28	3.14	3.97	0.094	4.05	4.08	4.00	4.04	0.380
Availability of Proper Bus Stops	4.52	4.30	4.89	4.57	0.108	3.97	3.42	1.31	2.90	0.314
Bus Route Information	4.16	4.15	4.54	4.28	0.101	3.95	3.14	3.40	3.50	0.355
Fare	4.90	4.62	4.29	4.60	0.109	3.15	2.41	2.10	2.55	0.278
Security	3.21	4.61	4.94	4.25	0.101	4.15	4.60	4.85	4.53	0.457
Overall Service Quality	3.25	4.30	4.89	4.15	0.098	4.20	4.12	3.62	3.98	0.391
Total	**42.00**	**43.44**	**41.26**	**42.23**						**3.838**
Percentage										**76.76%**

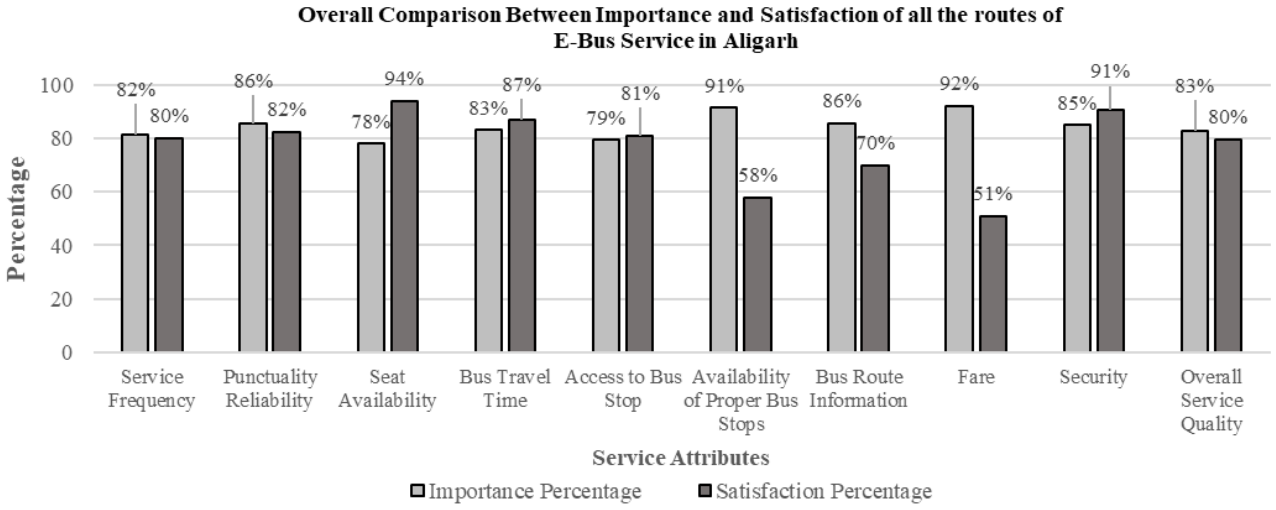

Fig. 6: Overall Comparison between Importance and Satisfaction of All the Routes of E-Bus Service in Aligarh.

6. Results

Table 11 presents critical attributes for customer dissatisfaction and important attributes for customers across three different routes (AL-01, AL-02, AL-04) and when combined. Across all routes, fare and availability of proper bus stops emerge as the main attributes causing customer dissatisfaction, with low satisfaction scores of 2.90 (58%) and 2.55 (51%), respectively. However, these attributes are considered extremely important by all passengers, with high importance scores of 4.57 (91%) and 4.60 (92%), respectively. Also, the overall Customer Satisfaction Index (CSI) of the bus service in Aligarh is calculated at 76.76%. This indicates that while there is a reasonable level of satisfaction among passengers, there is still room for improvement, particularly in addressing the critical attributes causing dis-

satisfaction. There is a critical need for improvement strategies to address customer dissatisfaction. These improvement strategies are outlined in Section 7.

Table 11: Identification of Critical and Important Attributes

Route Codes	Critical Attributes for Costumers Dissatisfaction	Important Attributes for Costumers	Customer Satisfaction Index
AL-01	• Fare 3.15 (63%).	• Service Frequency: 4.25 (85%) • Punctuality/Reliability: 4.33 (87%) • Seat Availability: 4.36 (87%) • Bus Travel Time: 4.53 (91%) • Access to Bus Stop: 4.49 (90%) • Availability of Proper Bus Stops: 4.52 (90%) • Fare: 4.90 (98%)	85.34%.
AL-02	• Fare 2.41 (48%). • Bus Route Information 3.14 (63%).	• Punctuality/Reliability: 4.30 (86%) • Bus Travel Time: 4.47 (89%) • Access to Bus Stop: 4.28 (86%) • Availability of Proper Bus Stops: 4.30 (86%) • Fare: 4.62 (92%) • Security: 4.61 (92%) • Overall Service Quality: 4.30 (86%)	76.32%
AL-04	• Availability of Proper Bus Stops: 1.31 (26%) • Fare 2.10 (42%).	• Availability of Proper Bus Stops: 4.89 (98%) • Bus Route Information: 4.54 (91%) • Fare: 4.29 (86%) • Security: 4.94 (99%) • Overall Service Quality: 4.89 (98%)	68.87%
All Routes Combined	• Availability of Proper Bus Stops: 2.90 (58%) • Fare 2.55 (51%).	• Punctuality/ Reliability: 4.28 (86%) • Availability of Proper Bus Stops: 4.57 (91%) • Bus Route Information: 4.28 (86%) • Fare: 4.60 (92%) • Security: 4.25 (85%)	76.76%

7. Improvement Strategies for E-bus service in the city

- Construct additional designated bus stops at strategic locations to improve accessibility for passengers.
- Ensure that all bus stops are equipped with shelters, seating, and proper signage for clear identification.
- Review fare structures to make them more affordable for passengers, particularly for low-income demographics.
- Consider implementing subsidies or discounts for specific groups to ensure equitable access to transportation services.
- Maintain and potentially increase the frequency of bus services to meet passenger demand, especially during peak hours.
- Implement measures to enhance punctuality and reliability, such as optimizing schedules and addressing potential causes of delays.
- Enhance the provision of accurate and up-to-date bus route information through digital platforms, signage at bus stops, and mobile applications.
- Ensure that passengers have easy access to route maps, schedules, and any service updates or changes.
- Implement robust security protocols and surveillance systems on buses and at bus stops to ensure passenger safety.
- Train staff and drivers to handle security-related incidents effectively and provide assistance to passengers as needed.
- Continuously monitor and evaluate service quality standards to identify areas for improvement.
- Implement regular maintenance checks for buses to ensure they are clean, comfortable, and in good working condition.

In the short term, several urgent steps must be taken to improve the effectiveness and efficiency of the bus-based public transport system in Aligarh City:

- Develop an Integrated Public Transport Plan: Establish a comprehensive plan that ensures the financial and operational sustainability of the public transport system.
- Implement Bus Priority Lanes: Conduct feasibility studies and design bus priority lanes in the most congested areas of the city to improve bus travel times and reliability.
- Develop Planning and Design Guidelines: Hire consultants to develop guidelines for public transport planning and design, ensuring uniform standards and quality across the city
- Introduce Intelligent Transport Systems: Implement intelligent transport systems as part of the Aligarh smart city initiative to enhance the planning, design, and operation of bus services.
- Improve Transport Information: Develop and introduce new tools and methods to provide better transport information to users, including real-time updates on bus schedules and routes.
- Conduct a Feasibility Study on Bus Fare System: Evaluate the feasibility of implementing a new bus fare system to make public transport more accessible and affordable.
- Stakeholder Training Program: Conduct training programs for all stakeholders involved in planning, designing, operating, maintaining, and procuring bus-based public transport to enhance their skills and knowledge.
- Enhance Public Transport Infrastructure: Invest in the improvement and expansion of bus-based public transport infrastructure within the city to accommodate growing demand and improve passenger experience.
- Integrate Communication between Stakeholders: Develop processes to facilitate communication and collaboration between different stakeholders involved in the public transport system, ensuring seamless operations and service delivery

8. Conclusion

In conclusion, the research paper highlights the significance of public transportation, particularly in developing nations like India, where it plays a crucial role in promoting mobility and sustainability. The introduction of electric buses presents a promising solution to mitigate environmental degradation caused by traditional transit systems. However, to ensure the success of E-bus services and encourage greater public transportation usage, it is imperative to align service offerings with customer needs and expectations. The study conducted in Aligarh aimed to assess customer satisfaction among electric bus users using the Customer Satisfaction Index (CSI) analysis. Critical attributes such as affordability, safety, comfort, and accessibility were examined to identify areas for improvement. The findings revealed that while customers expressed satisfaction with attributes like service frequency, punctuality, and overall service quality, dissatisfaction stemmed from issues related to the availability of proper bus stops and fare affordability. To address these challenges and enhance customer satisfaction, several improvement strategies were proposed. These include constructing additional designated bus stops, ensuring shelters and amenities are available at all stops, reviewing fare structures to make them more affordable, and implementing subsidies or discounts for specific demographics. Other strategies involve maintaining and increasing service frequency, enhancing punctuality and reliability, improving the provision of accurate bus route information, implementing robust security measures, and continuously monitoring service quality standards. In general, the research underscores the importance of customer satisfaction in shaping the effectiveness and success of public transportation systems. By identifying areas for improvement and implementing targeted strategies, cities like Aligarh can enhance the quality, accessibility, and sustainability of their public transportation services, ultimately contributing to the well-being and satisfaction of their residents while mitigating environmental impacts.

References

[1] Andreassen, T., & Lindestad, B. (1998). The effect of corporate image in the formation of customer loyalty. *Journal of Service Marketing, 1*, 82-92. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=The%20effect%20of%20corporate%20image%20in%20the%20formation%20of%20customer%20loyalty.&publication_year=1998&author=T.W.%20Andreassen&author=B.%20Lindestad

[2] Andreassen, T., & Lervik, L. (1999). Perceived relative attractiveness today and tomorrow as predictors of future repurchase intention. *Journal of Service Research, 2*, 164-172. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=Perceived%20relative%20attractiveness%20today%20and%20tomorrow%20as%20predictors%20of%20future%20repurchase%20intention.&publication_year=1999&author=T.W.%20Andreassen&author=L.%20Lervik

[3] Barroso, C. C., & Martin, E. A. (1999). *Marketing relacional.* ESIC Editorial. Retrieved April 02, 2024

[4] Central Statistics office. (2017). *Energy Statistics Report*. New Delhi: Ministry of statistics and programme implementation. Retrieved April 02, 2024, from https://smartnet.niua.org/sites/default/files/resources/energy_statistics_2017r.pdf.pdf

[5] Chauhan, k. S. (2023, June 08). *The Unplanned Growth of Indian Cities: Unveiling the Urban Mess*. Retrieved April 02, 2024, from Times of India: https://timesofindia.indiatimes.com/readersblog/theintersection/the-unplanned-growth-of-indian-cities-unveiling-the-urban-mess-54905/

[6] Cronin, J., & Taylor, S. (1994). SERVPERF versus SERVQUAL: Reconciling performance-based and perceptions-minus-expectations measurement of service quality. *Journal of Marketing, 58*(1), 125-131. Retrieved April 03, 2024, from https://journals.sagepub.com/doi/abs/10.1177/002224299405800110

[7] Department of Empowerment of Persons with Disabilities. (2016). *The Rights of Persons with Disabilities (RPwD) Act, 2016.* New Delhi: Department of Empowerment of Persons with Disabilities. Retrieved April 02, 2024, from DEPWD: https://depwd.gov.in/acts/#:~:text=Responsibility%20has%20been%20cast%20upon,an%20evolving%20and%20dynamic%20concept.

[8] Di Martino, A., Longo, M., Prasad, G., Foiadelli, F., Yaici, W., & Zaninelli, D. (2022). Implementation and Validation Modelling of Energy Demand of Electric Buses for Local Public Transport. *In 2022 10th International Conference on Smart Grid (icSmartGrid)* (pp. 266-270). Istanbul: IEEE. doi: https://doi.org/10.1109/icSmartGrid55722.2022.9848756

[9] District Administration Aligarh. (2023, May 12). *Census 2011*. Retrieved April 03, 2024, from Aligarh NIC: https://aligarh.nic.in/census/#:~:text=Aligarh%20is%20one%20of%20district,and%2017%2C21%2C893%20are%20females.

[10] Eboli, L., & Mazzulla, G. (2007). Service Quality Attributes Affecting Customer Satisfaction for Bus Transit. *Journal of Public Transportation, 10*(03), 21-34. Retrieved April 02, 2024, from https://www.sciencedirect.com/science/article/pii/S1077291X22003009/pdfft?md5=f2da876435ced859bfe212bbd5950165&pid=1-s2.0-S1077291X22003009-main.pdf

[11] Eboli, L., & Mazzulla, G. (2008a). An SP Experiment for Measuring Service Quality in Public Transport. *Transportation Planning and Technology, 31*(5), 509-523. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=An%20SP%20Experiment%20for%20Measuring%20Service%20Quality%20in%20Public%20Transport.&publication_year=2008&author=L.%20Eboli&author=G.%20Mazzulla

[12] Eboli, L., & Mazzulla, G. (2008b). Willingness-to-Pay of Public Transport Users for Improvement in Service Quality. E*uropean Transport, 38*, 107-118. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=Willingness-to-Pay%20of%20Public%20Transport%20Users%20for%20Improvement%20in%20Service%20Quality.&publication_year=2008&author=L.%20Eboli&author=G.%20Mazzulla

[13] Eboli, L., & Mazzulla, G. (2009). A New Customer Satisfaction Index for Evaluating Transit Service Quality. *Journal of Public Transportation, 12*(3), 21-37. doi: https://doi.org/10.5038/2375-0901.12.3.2

[14] Eklof, J. (2000). *European customer satisfaction index pan-European telecommunication sector report based on the pilot studies 1999.* Stockholm, Sweden: European organization for quality and European foundation for quality management. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=European%20customer%20satisfaction%20index%20pan-European%20telecommunication%20sector%20report%20based%20on%20the%20pilot%20studies%201999.&publication_year=2000&author=J.A.%20Eklof

[15] Factum Group. (2014, March 13). *Customer Satisfaction Index*. Retrieved April 02, 2024, from Factum Group: https://www.factum-group.com/solutions/customer-satisfaction-index/

[16] Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India. (2015). *Ministry of Heavy Industry & Public Enterprises.* New Delhi: Government of India. Retrieved March 24, 2024, from https://dhi.nic.in/sites/default/files/2023-09/OM_FAME_India.PDF

[17] Fornell, C. (1992). A national customer satisfaction barometer: The Swedish experience. *Journal of Marketing, 56*, 6-21. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=A%20national%20customer%20satisfaction%20barometer%3A%20The%20Swedish%20experience.&publication_year=1992&author=C.%20Fornell

[18] Fornell, C., Johnson, M., Anderson, E., Cha, J., & Bryant, B. (1996). The American Customer Satisfaction Index: Nature, purpose, and findings. *Journal of Marketing, 60*, 7-18. Retrieved April 03, 2024, from https://www.scopus.com/inward/record.url?eid=2-s2.0-0030518346&partnerID=10&rel=R3.0.0

[19] Fornell, C. V. (2005). *The American Customer Satisfaction Index at Ten Years, ACSI 1994-2004. A Summary of Findings: Implications for the Economy, Stock Returns and Management.* Michigan: National Quality Research Center, Stephen M. Ross School of Business, University of Michigan. Retrieved April 02, 2024, from https://www.google.co.in/books/edition/The_American_Customer_Satisfaction_Index/lqsOGQAACAAJ?hl=en

[20] Friman, M., Edvardsson, B., & Gärling, T. (2001). Frequency of negative critical incidents and satisfaction with public transport services. *Journal of Retailing and Consumer Services, 8*(2), 95-104. doi: http://dx.doi.org/10.1016/S0969-6989(00)00003-5

[21] Hensher, D. (2001). Service quality as a package: What does it mean to heterogeneous consumers. *9th World Conference on Transport Research* (p. N.D.). Seoul, Korea: Korean Society of Transportation and The Korea Transport Institute. Retrieved April 03, 2024, from https://scholar.google.com/scholar?q=Hensher%2C%20D.A.%202001.%20Service%20quality%20as%20a%20package%3A%20What%20does%20it%20mean%20to%20heterogeneous%20consumers.%209th%20World%20Conference%20on%20Transport%20Research%2C%20Seoul%2C%20Korea%2C%2022-27%20

[22] Hensher, D., & Prioni, P. (2002). A service quality index for an area-wide contract performance assessment regime. *Journal of Transport Economics and PolicY, 36*(1), 93-113. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=A%20service%20quality%20index%20for%20an%20area-wide%20contract%20performance%20assessment%20regime.&publication_year=2002&author=D.A.%20Hensher&author=P.%20Prioni

[23] Hensher, D., Stopper, P., & Bullock, P. (2003). Service quality-developing a service quality index in the provision of commercial bus contracts. *Transportation Research Part A, 37*, 499-517. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=Service%20quality-developing%20a%20service%20quality%20index%20in%20the%20provision%20of%20commercial%20bus%20contracts.&publication_year=2003&author=D.A.%20Hensher&author=P.%20Stopper&author=P.%20Bullock

[24] Henze, V. (2018, May 21). *E-Buses to Surge Even Faster Than EVs as Conventional Vehicles Fade*. Retrieved May 21, 2024, from Bloomberg New Energy Finance: https://about.bnef.com/blog/e-buses-surge-even-faster-evs-conventional-vehicles-fade/#:~:text=We%20now%20think%20EVs%20will,6%25%20to%20global%20electricity%20demand.

[25] Hill, N., & Brierley, J. (2003). *How to measure customer satisfaction.* London: Routledge. doi: https://doi.org/10.4324/9781315253107

[26] Ilieska , K. (2013). Customer Satisfaction Index – as a Base for Strategic Marketing Management. *TEM Journal, 2*(4), 327-331. Retrieved April 02, 2024, from https://www.temjournal.com/documents/vol2no4/Customer%20Satisfaction%20Index%20–%20as%20a%20Base%20for%20Strategic%20Marketing%20Management.pdf

[27] International Energy Agency (IEA). (2021). *World Energy Outlook.* Paris: International Energy Agency (IEA). Retrieved April 02, 2024, from https://pib.gov.in/PressReleasePage.aspx?PRID=1809204

[28] International Energy Agency (IEA). (2022). *Tracking Transport.* Paris: International Energy Agency (IEA). Retrieved April 2, 2024, from https://www.iea.org/energy-system/transport

[29] Iseki, H., & Taylor, B. (2008). Style versus service? An analysis of user perceptions of transit stops and stations in Los Angeles. *87th Annual Meeting of the TRB*, 13-17. Retrieved April 02, 2024, from https://trid.trb.org/View/848858

[30] Joewono, T. B., & Kubota, H. (2007). User Perceptions of Private Paratransit Operation in Indonesia. *Journal of Public Transportation, 10*(4), 99-118. Retrieved April 02, 2024, from https://www.sciencedirect.com/science/article/pii/S1077291X22003101/pdfft?md5=dc6b0efa18cfcc7cbbd5dfe9579a6b19&pid=1-s2.0-S1077291X22003101-main.pdf

[31] Johnson, M., Gustafsson, A., Andreassen, T., Lervik, L., & Cha, J. (2001). The evolution and future of national customer satisfaction index models. *Journal of Economic Psychology, 22*, 217-245. Retrieved April 03, 2024, from https://www.sciencedirect.com/science/article/pii/S0167487001000307/pdfft?md5=356659125856aebb95e39d700f7b526b&pid=1-s2.0-S0167487001000307-main.pdf

[32] Kotler, P. (2001). *Kotler on Marketing: How to Create, Win and Dominate Market.* New York: Simon & Schuster.

[33] Laura, N. (2016). The effect of trust and service quality toward patient satisfaction with customer values intervening variable. *Binus Business Review, 7*(2), 157-162. doi: 10.21512/bbr.v7i2.1589

[34] Lim, J. (2012, December 01). *Bus Stands in Malaysia: Significance, Reality, Perceptions & 10 Aspects to Improve On*. Retrieved April 02, 2024, from JaphethLim: https://blog.japhethlim.com/index.php/2012/12/01/bus-stands-in-malaysia-significance-reality-perceptions-10-aspects-to-improve-on/

[35] Lott, M., & Daly, H. E. (2015). Environmental Sustainability/Climate Change (A62) A62 The Impacts of Transport Sector Decarbonisation Pathways on Air Quality and Public Health in the United Kingdom. *Journal of Transport & Health, 2*(2), S37. doi: http://dx.doi.org/10.1016/j.jth.2015.04.550

[36] Lu, L., Zhou, W., & Xue, L. (2018, April 04). *How Did Shenzhen, China Build World's Largest Electric Bus Fleet?* Retrieved April 02, 2024, from World Resource Institute: https://www.wri.org/insights/how-did-shenzhen-china-build-worlds-largest-electric-bus-fleet

[37] Marcucci, E., & Gatta, V. (2007). Quality and public transport service contracts. *European Transport, 36*, 92-106. Retrieved April 03, 2024, from https://scholar.google.com/scholar_lookup?title=Quality%20and%20public%20transport%20service%20contracts.&publication_year=2007&author=E.%20Marcucci&author=V.%20Gatta

[38] Martin, W. B. (1995). *Managing Quality Customer Service.* California: Crisp Publications Inc. Retrieved April 02, 2024

[39] (2015). *Ministry of Heavy Industry & Public Enterprises.* New Delhi: Government of India. Retrieved March 24, 2024, from https://dhi.nic.in/sites/default/files/2023-09/OM_FAME_India.PDF

[40] Ministry of Housing and Urban Affairs. (2015, June 25). *Smart Cities*. Retrieved April 03, 2024, from MOHUA: https://mohua.gov.in/cms/smart-cities.php#:~:text=The%20Government%20of%20India%20has,Mission%20on%2025%20June%202015.&text=The%20objective%20is%20to%20promote,application%20of%20'Smart'%20Solutions.

[41] Ministry of Petroleum and Natural Gas. (2022). *Annual Report 2022-23.* New Delhi: Government of India. Retrieved April 02, 2024, from https://mopng.gov.in/files/TableManagements/annualreport2223.pdf

[42] National Electric Mobility Mission Plan (NEMMP). (2020). *National Electric Mobility Mission Plan 2020 (NEMMP).* New Delhi: Ministry of Heavy Industries and Public Enterprises, Government of India. Retrieved March 21, 2024, from https://heavyindustries.gov.in/sites/default/files/2023-07/NEMMP-2020.pdf

[43] Olio, L. D., Ibeas, A., Cecín, P., & Olio, F. d. (2011). Willingness to pay for improving service quality in a multimodal area. *Transportation Research Part C: Emerging Technologies, 9*(6), 1060-1070. doi: https://doi.org/10.1016/j.trc.2011.06.004

[44] Parasuraman, A., Zeithaml, V., & Berry, L. (1985). A conceptual model of service quality and its implication for future research. *Journal of Marketing, 40*, 41-50. Retrieved April 03, 2024, from https://journals.sagepub.com/doi/abs/10.1177/002224298504900403

[45] Reichheld, F. F., & Sasser, W. E. (1990, September 15). *Zero Defections: Quality Comes to Services*. Retrieved April 02, 2024, from Harward Business Review: https://hbr.org/1990/09/zero-defections-quality-comes-to-services

[46] Shabarien, M. S., Abdullah, M. F., Sufahani, S. F., & Ahmad, W. N. (2023). Customer Satisfaction Index On The Electrical Buses (Electrical Vehicle) In Malaysia: Case Study On The Affordability, Safety and Accessibility. *International journal of renewable energy research, 13*(2), 757-767. Retrieved April 02, 2024, from https://www.ijrer.org/ijrer/index.php/ijrer/article/view/13798

[47] Soltani, S. H., Sham, M., Awang, M., & Yaman, R. (2012). Accessibility for Disabled in Public Transportation Terminal. *Procedia - Social and Behavioral Sciences, 35*, 89-96. doi: https://doi.org/10.1016/j.sbspro.2012.02.066

[48] Teas, R. (1993). Expectations, performance evaluation, and consumers' perceptions of quality. *Journal of Marketing, 57*(4), 18-34. Retrieved April 02, 2024, from https://journals.sagepub.com/doi/abs/10.1177/002224299305700402

[49] Tiseo, I. (2023). *Per capita carbon dioxide (CO_2) emissions from fossil fuels in India from 1970 to 2022.* New York: Statista. Retrieved April 02, 2024, from https://www.statista.com/statistics/606019/co2-emissions-india/
[50] Tjiptono, F. (2000). *Manajemen Jasa (Management -- Information services)* (02 ed.). Yogyakarta: Andi Offset. Retrieved April 02, 2024, from https://lib.ui.ac.id/detail?id=20189163&location=lokal
[51] Transportation Research Board. (2003a). *A Guidebook for Developing a Transit Performance-Measurement System. Transit Cooperative Research Program, Report 88.* Washington, D.C: National Academy Press. Retrieved April 02, 2024, from https://scholar.google.com/scholar_lookup?title=A%20Guidebook%20for%20Developing%20a%20Transit%20Performance-Measure-ment%20System.%20Transit%20Cooperative%20Research%20Program%2C%20Report%2088&publication_year=2003&author=Transportation%20Research%20Board
[52] Transportation Research Board. (2003b). *Transit Capacity and Quality of Service Manual. Transit Cooperative Research Program, Report 100.* Washington, D.C: National Academy Press. Retrieved April 02, 2024, from https://scholar.google.com/scholar_lookup?title=Transit%20Capacity%20and%20Quality%20of%20Service%20Manual.%20Transit%20Cooperative%20Research%20Program%2C%20Report%20100&publication_year=2003&author=Transportation%20Research%20Board
[53] Tyrinopoulos, Y., & Antoniou, C. (2018). Public transit user satisfaction: Variability and policy implications. *Transport Policy, 15*(4), 260-272. doi: https://doi.org/10.1016/j.tranpol.2008.06.002
[54] Urban Mass Transit Company Limited. (2022). *Aligarh Comprehensive Mobility Plan.* New Delhi: Urban Mass Transit Company Limited. Retrieved April 03, 2024
[55] Zeithaml, V., & Bitner, M. (2000). *Services Marketing: Integrating Customer Focus across the Firm* (02 ed.). Boston: McGraw-Hill. Retrieved April 02, 2024, from https://www.google.co.in/books/edition/EBOOK_Services_Marketing_Integrating_Cus/ysovEAAAQBAJ?hl=en&gbpv=1&printsec=frontcover