

Sustainability in Urban Transit: The Role of Expectancy Theory to Gain Loyalty Among Passengers of Free Bus Services in Klang Valley, Malaysia

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DOI: <https://doi.org/10.30880/ijscet.2025.16.02.019>

Article Info

Received: 18 February 2025
Accepted: 2 November 2025
Available online: 18 November 2025

Keywords

Sustainability, urban transit, expectancy theory, loyal passengers, free bus services

Abstract

This study investigates the impact of free bus services on passenger satisfaction, loyalty and environmental sustainability in Klang Valley. By applying the Expectancy Theory, the study explores the relationship between passenger expectations and actual service performance across various dimensions. The survey was conducted in Klang Valley among a sample of 314 regular passengers of the free bus service. Notably, while few passengers explicitly used the service for environmental reasons, all participants contributed to sustainability by reducing reliance on private vehicles, thereby lowering carbon emissions without realizing it. This highlights the environmental benefits of free bus services and their role in promoting eco-friendly urban transit. The findings revealed significant gaps between expectations and satisfaction levels, particularly in comfort (mean difference = 4.11041) and responsiveness (mean difference = 3.61529), which adversely affected passenger loyalty (mean difference = 3.37847). The Spearman's rho coefficients indicated statistically significant correlations at the 0.01 level across all examined factors, with moderate correlations observed for responsiveness (0.420) and information accuracy (0.453). Findings suggest that by addressing these gaps and integrating passenger feedback, service providers can enhance both user satisfaction and environmental benefits. This study emphasizes the role of free bus services as a practical solution to urban transit challenges, demonstrating how Expectancy Theory offers a framework to improve passenger loyalty while advancing sustainability in rapidly urbanizing regions.

1. Introduction

Sustainability in urban transit is an essential component of modern urban planning, which is influenced by the need to reduce environmental impact while promoting economic growth and social well-being [1]. As urban populations grow, cities encounter increased demands to design transit systems that are not only economical and reliable, but also beneficial to the environment. Sustainable urban transit seeks to solve these issues by lowering the release of greenhouse gases, lowering air and noise pollution, as well as decreasing traffic congestion [2]. This is accomplished by combining modern green technology, such as electric buses and renewable energy sources, with innovative public transportation solutions that emphasize accessibility, affordability, and public participation [3]. In addition to the challenge of urban sustainability, the United Nations forecasts that by 2030, 60% of the world's population will live in urban areas, with this figure rising to 70% by 2050. As global urbanization accelerates, cities will play a critical role in developing and implementing sustainable, safe, and resilient economic and social policies to foster urban wealth [4]. However, this trend also involves numerous challenges. A significant issue is that cities are expanding their physical boundaries faster than their population is growing. This rapid urbanization results in substantial infrastructure costs, increased energy consumption, and elevated carbon dioxide emissions [5].

Asman et al. [6] stated that applying sustainability as a part of the urbanization process in everyone's daily life is essential, along with the need to transition to renewable energy and a circular economy. This is essential for mitigating climate change and decreasing fossil fuel emissions. As an example, urban travelers are encouraged to adopt active transportation which can significantly reduce the reliance on motorized vehicles, thereby effectively safeguarding the environment from pollution while promoting healthier lifestyles [7]. Despite these efforts, many people still insist on using personal motorized vehicles. This statement is in line with the claim by Ahmad Termida et al. [8] that the transportation sector is the major contributor to the rise of energy consumption in Malaysia.

Transportation is widely acknowledged as the primary source of harmful gases that contribute to air pollution and climate change [9], [10]. Though electricity and heat have been labelled as the highest contributors of greenhouse gases as illustrated in Fig. 1, the graph by the Climate Watch shows the transportation sector coming close to electricity and heat. The transportation sector saw a decline in emissions in 2020 during the pandemic's movement control order, however, as expected, it had since then skyrocketed as restrictions were lifted and free travel resumed [11]-[14].

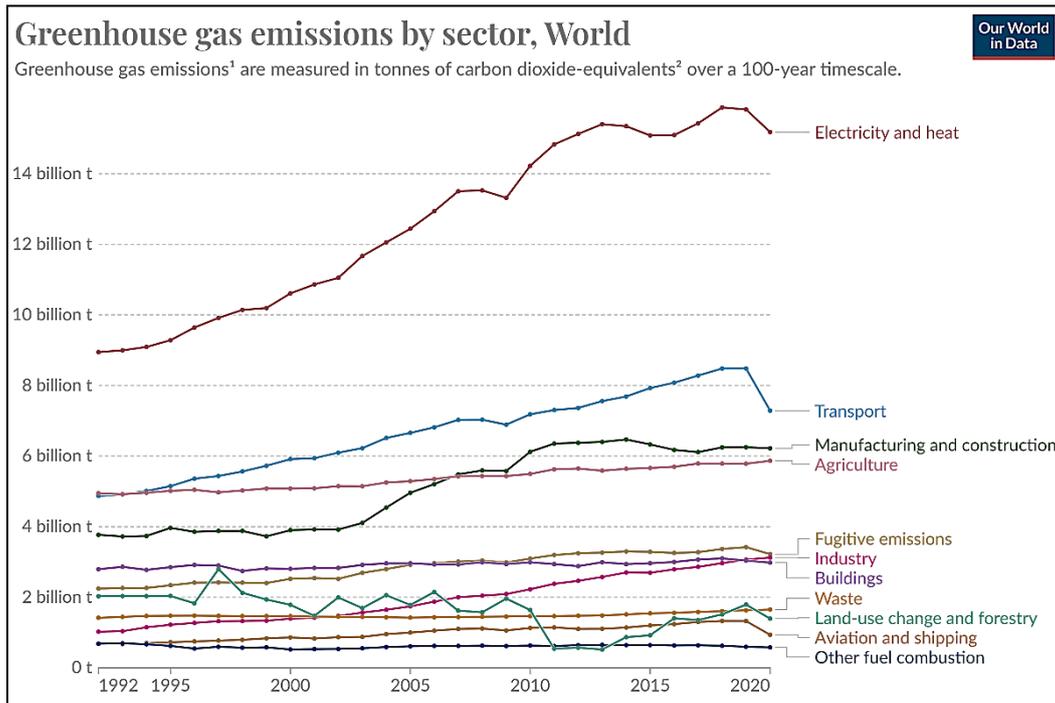


Fig. 1 Greenhouse gases emissions (worldwide) [14]

However, a well-maintained urban transit not just offers more than environmental benefits, but also providing significant economic and societal advantages [15]. Economically, reduced fuel consumption decreases reliance on fossil fuels and leads to cost savings for passengers, particularly those from lower-income groups. Lower travel costs enhance financial accessibility, ensuring greater equity in mobility [16]. Societal impacts

include promoting fairness by offering equal access to public transport regardless of socioeconomic status, bridging the mobility gap between urban and suburban areas. Improved access to employment, education, and healthcare fosters social inclusion and enhances the quality of life for underserved communities. These economic and societal benefits, combined with environmental advantages, highlight the comprehensive sustainability potential of free bus services [17], [18].

In order to implement sustainability practices in urban transit networks, a multidimensional strategy is needed which includes the development of infrastructure, legislative reforms and public involvement [19]. Initiatives such as free bus services in Klang Valley, Malaysia, serve as an example of how public transit can be made more sustainable while improving user experience and increasing customer loyalty. Public transport initiatives can be a sustainable solution to reduce dependence on private vehicles, which are major contributors to carbon dioxide emissions and environmental degradation [20]. As of 2015, only 17.1% of public transport users in Malaysia utilized ridesharing alternatives, one of the lowest rates among major cities. Despite enhancements in capacity and the expansion of modern rail transits, this trend increased to 25% by 2020. However, this remains well below the National Key Result Areas target of achieving 40% ridesharing alternatives by 2030 [21]. The relatively modest increase is attributed to Malaysia having the highest vehicle ownership rate among ASEAN countries as per data from 2018, with 439 vehicles per 1,000 people—four times the continental average. Kosai et al. [22] stated that the primary and most demanding challenge in reducing emissions lies in addressing energy consumption within the transportation sector.

When compared to rural areas that have limited access to public transport services, urban areas are equipped with modern transportation networks such as rail transits (including express rail link [ERL], commuter, and monorail), taxis, and buses [23]. This leads to a high demand for urban transit due to various reasons; it is cost effective, accessible, avoids the hassle of traffic congestion, and addresses the issue of limited parking spaces [2]. Promoting sustainable transit options provides valuable insights for local authorities and bus companies, as the need to keep the services running requires various efforts. Among them is maintaining the number of daily passengers while discouraging them from shifting to a different mode of transit. Therefore, this paper highlights the application of the Expectancy Theory in assessing passenger loyalty among users of free bus services in Klang Valley, Malaysia.

1.1 Free Bus Services in Klang Valley, Malaysia

Klang Valley, Malaysia, is a highly urbanized region encompassing Kuala Lumpur, the country's capital, and its surrounding areas within the state of Selangor. Known as the heart of Malaysia's economic and cultural activities, Klang Valley hosts a diverse population exceeding eight million people [24]. The region is characterized by its extensive network of transportation corridors, including highways like the Federal Highway, LDP, and the North-South Expressway, as well as comprehensive public transportation systems such as the public bus, KTM commuter, LRT, MRT and monorail lines. These corridors facilitate the movement of people and goods, supporting Klang Valley's dynamic economy, which is driven by industries ranging from finance and commerce to education and tourism. With these various industries in the region, significant efforts have been made to improve public transportation accessibility and reduce traffic congestion by enhancing free bus services.

Initiated by the local government and supported by federal initiatives, these free bus services aim to provide affordable and efficient transit options for residents and visitors alike. Key services include the GoKL City Bus in Kuala Lumpur (refer Fig. 2) and the Smart Selangor Bus in Selangor and Nadiputra Bus in Putrajaya, which cover extensive routes that connect major commercial areas, residential zones and transport hubs. These free bus services not only alleviate the financial burden on commuters but also promote the use of public transportation, contributing to environmental sustainability by reducing the reliance on private vehicles. The initiative has been well-received, with high daily ridership as shown in Table 1 reflecting its importance in the daily commute of many Malaysians. Additionally, these free bus services support the local economy by improving access to employment, education and social services, making Klang Valley a more connected and inclusive urban region in Malaysia. Therefore, this study included the three free bus services operating within Klang Valley.



Fig. 2 GoKL City Bus in Kuala Lumpur

Table 1 Average daily user ridership annually of free bus services operating in Klang Valley [47]

Year	Average daily user ridership annually			Total (passenger/day)
	Smart Selangor Bus	PJ CityBus	Nadiputra Bus	
2017	29,160	13,623	4,203	46,986
2018	43,619	14,648	2,740	61,007
2019	46,340	15,673	1,450	63,463
2020	27,234	7,201	827	35,262
2021	8,572	4,339	513	13,424
2022	14,041	7,756	920	22,717

1.2 Application of Expectancy Theory to Determine Passenger Loyalty

To create loyalty, public transportation companies have to show passengers the clear link between their efforts (such as selecting a service) and the rewards (such as dependable and comfortable public transportation) [25]. By synchronizing service quality with passenger expectations and facilitating consistent delivery, public transportation companies can boost passenger loyalty by strengthening the belief that their efforts will result in successful outcomes. This maximizes the effectiveness of the Expectancy Theory in shaping passenger behavior [26], [27]. The theory, developed by psychologist Victor Vroom in 1964, is a psychological term that explains what drives people in their decision-making processes. At its core, the Expectancy Theory proposes that people are driven to act in various ways depending on their beliefs about the consequences of their actions and their chances of reaching certain outcomes [28]. It proposes three fundamental components: expectation, instrumentality, and valence. Expectancy is the assumption that effort will lead to performance, instrumentality is the notion that performance will result in certain outcomes, and valence is the value that people place on those results [29], [30]. Based on the Expectancy Theory, people have the greatest motivation when they feel that their actions will result in desired results that are valuable to them.

Fig. 3 and Fig. 4 show the basic application of the Expectancy Theory in the context of passenger loyalty in public transportation services. By comparing both figures, passenger expectation represents expectancy, service quality represents instrumentality, and the outcome which is passenger loyalty represents valence. From the figure, knowing the role of valence in Expectancy Theory is critical in increasing passenger loyalty. Valence is the feeling of value or beauty of the rewards that go along with a specific behavior [31]. In the context of public transportation, passengers evaluate the benefits of taking advantage of a certain service through factors such as cost-effectiveness, safety and punctuality [32]–[34]. Public transportation providers can impact valence by providing incentives such as loyalty programs, coupons, or unique advantages, which would enhance the appeal of using the service against competitors. By constantly monitoring and changing the perceived value of rewards,

public transportation providers can increase passenger loyalty by balancing the advantages with the price of their services [35]. Passenger loyalty benefits transportation providers by increasing passenger retention, passenger growth and making better use of existing resources. From a marketing and management strategy standpoint, it is thus interesting to understand in greater detail the elements that determine public transport passengers' loyalty [36]. This can help passengers build good emotional connection with the company while also encouraging repeated usage that solidifies their loyalty.

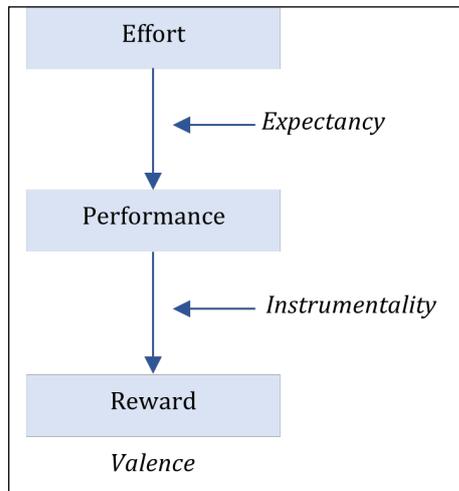


Fig. 3 Basic expectancy theory framework

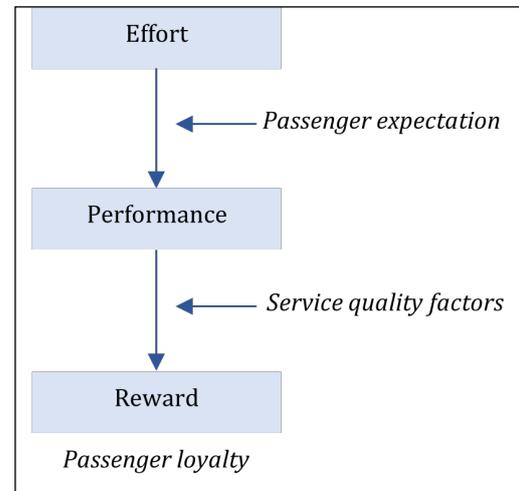


Fig. 4 Application of expectancy theory to determine passenger loyalty

Good communication is essential when implementing the Expectancy Theory to passenger loyalty for public transportation. Clear and honest communication regarding service offers, modifications, and changes can help passengers understand the relationship between their efforts and the expected benefits [37]. It also fosters confidence and trust in the public transportation provider, maintaining the assumption that using their services would lead to beneficial results [38]. In addition, requesting input and actively listening to passengers' problems shows dedication toward addressing their wants and preferences, which can help improve the expectancy-loyalty relationship [34]. By encouraging open communication channels, transport businesses can better align passenger expectations with the actual service experience, resulting in a devoted client base that feels appreciated and respected [39].

Service quality is an important factor in determining passenger loyalty in the transportation business [39]. Service quality encompasses several elements, including dependability, responsiveness, certainty, empathy, and tangibles. Passengers evaluate their entire experience based on these factors to form opinions on the competency and dependability of the transportation provider [40]. Maintaining a consistently high level of service quality not only meets but often exceeds passenger expectations, fostering trust and contentment [41]. Moreover, exceptional service quality can cultivate positive emotional connections with the company, thereby increasing loyalty and advocacy among travelers. Conversely, any deficiencies in service quality can erode confidence and loyalty, prompting passengers to explore alternative options [42]. Consequently, transportation businesses must prioritize continuous service quality improvement to nurture and retain passenger loyalty in a highly competitive market. Several factors have been identified by various researchers to determine service quality. These factors exist because the term 'service quality' alone cannot fully capture the actual meaning of how well certain services are performed. Hence, the concept relies on multiple factors [38], [43]–[45].

2. Research Design

The goal of enhancing free bus services works both ways; bus providers must serve to meet the expectations of passengers so that in return, they will gain loyal passengers. In Malaysia, free bus services are mostly funded by the government of each state as one of the options for road users who opt to utilize ridesharing alternatives [46]. As a result, this research has developed a more in-depth framework derived from the basic Expectancy Framework (Fig. 3 and Fig. 4) to make the application more understandable. Therefore, Fig. 5 illustrates the Expectancy Theory framework that highlights the relationship between providers and passengers in the context of free bus services. The three fundamental components of the Expectancy Theory (effort, performance and reward) are still at its core, which are influenced by the expectations and satisfaction levels of both parties. The bus provider's efforts, encompassing factors such as quality of service, affordability, and accessibility, are directed

towards meeting passenger expectations. On the other side, passengers' demands, which are influenced by their reasons for use and socio-demographic factors, create expectations that guide their satisfaction with the service they receive.

A critical component of this framework is the feedback loop between expectation and performance. Bus providers aim to match or exceed passenger expectations through their efforts, which include maintaining high-quality service, offering affordable prices and ensuring accessibility. These efforts are directly linked to the actual performance that measures how well the services can meet passengers' demands. The actual performance can be assessed using satisfaction surveys that capture passengers' feedback on various aspects of the service. This feedback is crucial as providers can gain specific insights into passengers' expectations, highlighting areas where certain services stand out as well as areas that need improvement. By continuously analyzing and responding to feedback, providers can modify their services and ensure they are consistently aligned with passenger expectations. This active interaction creates a responsive service environment where improvements are driven by actual passenger experiences, leading to enhanced service quality over time.

The final component of the framework is the reward process, which is influenced by the level of satisfaction derived from the actual performance of services by the providers. For bus providers, the primary reward is the development of passenger loyalty. Loyal passengers are more likely to continue using the service, recommend it to others, and provide constructive feedback, all of which are critical for the long-term success of the service provider. This loyalty is built by consistently meeting or exceeding passenger expectations. On the passenger side, the reward comes in the form of happiness and satisfaction when their expectations are fulfilled. This can lead to improved overall experience, a greater likelihood of continued use of the service, and positive word-of-mouth recommendations. Thus, the reward process underscores the importance of a balanced and mutually beneficial relationship between providers and passengers, where both parties derive significant value, leading to sustained satisfaction and long-term engagement. Through an in-depth examination of the Expectancy Theory, it becomes evident that the outcome of applying this theory results in a win-win situation for both bus providers and passengers.

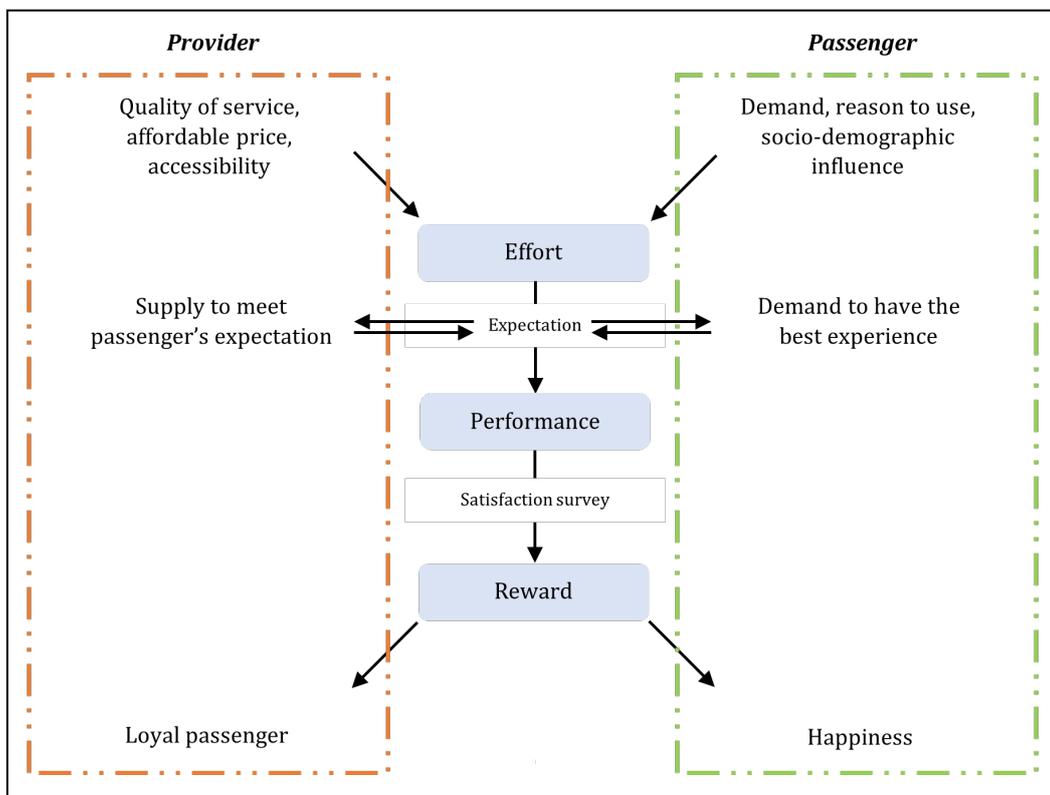


Fig. 5 Critical framework of expectancy theory used in this study

2.1 Population and Sample Size

Table 2 presents the average daily user ridership for the free bus services in Klang Valley based on the statistical report produced by The Land Public Transport Agency Malaysia [47]. However, only the first three years (2017, 2018, 2019) are considered representative of the population, as there were disruptions in estimating passenger ridership in subsequent years due to global pandemic restrictions. Considering the average ridership over these

three years, the population (P) is approximately 57,152 passengers daily. Based on the population and sample size interpolation by Krejcie and Morgan [48], this research requires at least 381 respondents as the sample size (S) and 400 sets were being distributed. However, this research managed to obtain only 314 respondents, as more foreign passengers were using the service compared to locals. Since the primary aim of this study is to understand and analyze the perspectives, preferences and satisfaction levels of local passengers, to include foreign passengers might disrupt the aim. Foreign passengers may have different expectations and needs that are not directly aligned with the cultural and demographic relevance central to this study. Therefore, the response rate only achieved 82% of the targeted sample size. According to Wu et al. [49], for sample sizes less than 500, a 20%–25% response rate is needed to provide fairly confident estimates. Since this research managed to exceed a 25% response rate, the results are considered acceptable.

Table 2 Average daily user ridership annually of free bus services operating in Klang Valley

Year	Average daily user ridership annually			Total (passenger/day)
	Smart Selangor Bus	PJ CityBus	Nadiputra Bus	
2017	29,160	13,623	4,203	46,986
2018	43,619	14,648	2,740	61,007
2019	46,340	15,673	1,450	63,463
			Average	57,152

2.2 Research Instrument and Reliability Testing

The research instrument for the social survey on free bus services in Klang Valley was designed to comprehensively assess user experiences and satisfaction. This approach was being used previously by various researchers in transportation studies [50]–[54]. The questionnaire consists of four key sections. Firstly, the demographic profile section collects essential information about the respondents, including their age, gender, income level, and occupation among others to understand the diverse backgrounds of the passengers. This includes their reasons for using free bus services to explore the motivations behind choosing these services, such as financial savings, convenience, environmental concerns, or lack of alternative transportation options. There were 18 items adapted from Wang and Liu [55]. The second section assesses passenger expectations with 3 items sourced from Shen et al. [56]. The third section looks at the passengers' experience regarding the actual performance of the free bus services based on various aspects of service quality, including those shown in Table 2. The last section was to gauge the loyalty level of passengers after using the free bus services to measure the passengers' commitment to continue using these services, their likelihood of recommending them to others, and to identify any changes in their transportation habits since utilizing the free bus services. Together, the questionnaire provides a holistic view of the impact and effectiveness of the free bus services from the passengers' perspective.

Table 3 shows the reliability analysis results for all sections of the survey. Reliability testing, often referred to as a pilot study, assesses the consistency of respondents' answers. A test or scale is considered reliable if it produces consistent results under the same conditions. According to Gliem and Gliem [57], a Cronbach's alpha (α) value exceeding 0.90 is deemed excellent and highly acceptable. If the Cronbach's alpha (α) value falls below the acceptable range, modifications and deletions of items may be necessary. The pilot study is repeated until the value meets the acceptable threshold. In this study, 20 respondents participated, and all items in Section B and Section C achieved Cronbach's alpha (α) values between 0.852 and 0.968. This high range suggests that the survey received positive feedback from the respondents regarding the questions asked. With these good Cronbach's alpha (α) results, data collection could proceed.

Table 3 Items available in the survey

Section	Item	No. of item	Source	α
A	Demographic profile, motivations using the service	18	By authors, Wang & Liu [55]	-
B	Passenger expectation (EXP)	3	Shen et al. [56]	0.918
C	Comfort (CF)	8		0.920
	Responsiveness (R)	5	Ibrahim [58],	0.943
	Capacity (CAP)	4	Mohd Talmizi & Tahir [59],	0.852
	Facility (FAC)	6	Obsie et al. [60],	0.933
	Safety (SF)	5	Ojo et al. [33],	0.968
	Speed (SPD)	3	Prasad & Raja Shekhar [61],	0.958
	Ticketing service (TS)	3	Susilawati & Nilakusmawati [62]	0.867
	Information accuracy (IN)	4		0.967
D	Passenger loyalty (LYT)	9	Noriswana & Zainudin [50]	0.930

2.3 Data Collection Process

To conduct the social survey on the free bus services in Klang Valley, a comprehensive and structured approach was adopted to avoid the collection of irrelevant data. The sampling technique that was being used in this study is the purposive non-probability sampling. This is due to the target population was highly specific (experienced Malaysian users of free bus services). A random sampling approach might include ineligible participants, making it inefficient. The purposive non-probability sampling technique allows to deliberately select participants who meet the specific criteria. Accessing these criteria may rely on direct identification methods (e.g., reaching out to passengers at bus stops or terminals). Targeted individuals were chosen based who they believe are qualified to engage in the research study [63]. Although these buses are accessible to the general public (including foreigners), the survey participation was restricted to Malaysian citizens only to ensure the data's cultural and demographic relevance. Additionally, only respondents who had previously used the service were eligible to participate. This criterion was crucial to gather insights from experienced passengers who could provide informed feedback, rather than first-time passengers whose experiences might not yet be fully formed. To ensure accuracy, respondents were encouraged to ask questions throughout the survey process to make sure they fully understood the content and intent of each item in the survey form. This open line of communication was essential to reduce misunderstandings and enhance the quality of the responses.

The confidentiality of all survey responses was a top priority, with assurances given that all collected data would be used solely for research purposes. This process helped to enhance trust and encourage honest and open feedback from respondents. The survey was made available both in physical form and a QR code to cater to different respondent preferences and promote sustainability by offering a paperless option. The QR code was intended for respondents who preferred to contribute electronically, supporting the environmental-friendly practice. However, to control the distribution of the link, respondents were explicitly instructed not to share the QR code with others. This careful step ensured that only the targeted respondents, which are those with genuine experience of using the bus services, contributed to the survey, thereby maintaining the quality and reliability of the collected data.

2.4 Analysis Procedure

The analysis procedure for this study was designed to comprehensively evaluate the impact of free bus services on passenger satisfaction, loyalty and environmental sustainability in Klang Valley. Data collected from 314 respondents were systematically analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. This software was chosen due to its robust capabilities in handling large datasets and performing complex statistical analyses [64]. The initial step involved conducting normality tests to ensure that the data followed a normal distribution, which is a critical assumption for many parametric tests. Normality was assessed using the Kolmogorov-Smirnov test and the result is shown in Table 4.

Table 4 Summary value for Kolmogorov-Smirnov coefficient in normality test

Section	Kolmogorov-Smirnov Sig. (<0.05)
A	.000
B	.000
C	.000
D	.000

Descriptive statistics were utilized to provide a clear overview of the demographic profile and general trends within the dataset. Frequency analysis was conducted to summarize categorical variables such as age, gender, education level, and frequency of bus usage. Passenger motivations were then visually represented through pie charts and bar graphs, offering an intuitive understanding of the data distribution. The descriptive statistics provided essential insights into the profile of the typical passenger, highlighting key segments on those who frequently utilize the service.

To delve deeper into the relationships between variables, correlation analysis was employed. In this study, Spearman's rho was used as the result of the normality test in Table 5 showed that the data obtained was not normally distributed. This is why the non-parametric test was applied. Spearman's rho helps examine the strength and direction of associations between passenger satisfaction across various service dimensions and overall loyalty. This non-parametric method was selected due to its effectiveness in handling ordinal data and its robustness against non-normal distributions. The interpretation of the correlation coefficients was based on Tholibon et al. [65] in Table 5 to provide a clear picture of which service aspects were most strongly linked to passenger loyalty to guide targeted improvements.

Table 5 Correlation strength guidelines [65]

Correlation coefficients	Value	Correlation strength
Between 0.10 and 0.29	Small	Poor relationship
Between 0.30 and 0.49	Medium	Medium relationship
Between 0.50 and 1.0	Large	Strong relationship

The t-test with significance level (α) at 0.05 was conducted to compare the mean differences between; (1) passenger expectations and actual satisfaction levels, and (b) passenger actual satisfaction levels and loyalty. Paired sample t-tests were used to determine whether the observed differences were statistically significant, providing a rigorous evaluation of the service performance gaps. These tests helped identify critical areas where the service failed to meet passenger expectations, such as in comfort and responsiveness. By systematically applying these statistical methods, the study was able to offer detailed and actionable insights, highlighting areas for improvement and reinforcing the importance of continuous service enhancement to achieve higher levels of passenger satisfaction and loyalty. Two hypotheses were set in this study with the criteria that the null hypothesis is rejected if the p -value is less than the significance level. The hypotheses used in this study are:

- $H_{0(1)}$: There is no significant difference in passenger expectations and actual satisfaction levels.
- $H_{a(1)}$: There is a significant difference in passenger expectations and actual satisfaction levels.
- $H_{0(2)}$: There is no significant difference in passenger actual satisfaction levels and loyalty.
- $H_{a(2)}$: There is a significant difference in passenger actual satisfaction levels and loyalty.

3. Results and Discussion

The demographic profile of respondents in Table 6 revealed a diverse and varied population with 314 respondents in total. The survey captured a balanced representation of genders, with 173 male respondents (55.1%) and 141 female respondents (44.9%). This even distribution suggests that both genders utilize the free bus services regularly. Age-wise, the largest group of passengers fell under the age of 20, accounting for 38.9% of the respondents. This was followed by the 21-30 age group, which makes up 30.6% of the respondents. The numbers decreased with increasing age, with 11.8% aged 31-40, 12.4% aged 41-50, 3.5% aged 51-60 and a mere 2.9% aged above 61. This indicates higher usage among younger passengers, possibly due to factors such as lack of personal transportation due to unstable monthly incomes.

In terms of marital status, the majority of the respondents were single, comprising 77.7% of the total population. Married individuals made up 19.1% and single parents constituted 3.2%. This demographic suggests that single passengers who might have fewer financial responsibilities were more likely to utilize free bus services.

The educational background of the respondents varied significantly. A large portion of the respondents had completed SPM (28.0%), followed by those with STPM/Certificate/Diploma qualifications (34.1%) and those holding a degree or Master's degree (34.4%). Only a small number had attained a PhD (1.6%) or other forms of education (1.3%). This variation in educational backgrounds indicates that the service is utilized by a well-educated demographic, which may reflect their reliance on public transport during their educational and early career stages.

Occupation-wise, nearly half of the respondents were students (47.5%), highlighting the importance of the free bus service for the student population in Klang Valley. The private sector employed 31.8% of the respondents, while 8.9% were unemployed. Smaller percentages were observed for government workers (8.3%) and the self-employed (3.5%). This indicates that the free bus service is crucial for students and those in the private sector who might not have the financial capability to afford personal transportation. Income levels among respondents also varied, with 28.3% reporting no income, likely reflecting the high number of students. Another 25.2% earned less than MYR 1,000, and only small percentages reported higher monthly incomes, with 9.2% earning over MYR 3,501. This highlights the service's role in supporting lower-income individuals.

When it comes to driving license and vehicle ownership, 67.2% of the respondents had a driving license, but only 50.6% owned a vehicle, suggesting that many licensed drivers still rely on public transport due to economic or personal reasons. Vehicle ownership was further broken down into 49.4% without a vehicle, 30.9% owning one vehicle, 12.1% owning two vehicles, and 7.6% owning more than three vehicles. This data reinforces the importance of the service for those who may have licenses but lack access to personal vehicles. The frequency of using the free bus service also varied, with 61.8% using it occasionally, 16.9% using it 1-2 days a week, 8.3% using it 3-4 days a week, and 13.1% using it more than 4 days a week. This indicates that while the majority use the service irregularly, a significant portion relies on it regularly, underlining its necessity for many residents of Klang Valley. This comprehensive demographic profile underscores the diverse passengers base of the free bus service, highlighting its critical role in supporting various segments of the population, especially students, lower-income individuals, and those with zero access to personal transportation.

Table 6 Demographic profile of passengers

Item	Variation	Frequency	Percentage (%)
Gender	Male	173	55.1
	Female	141	44.9
Age	<20	122	38.9
	21-30	96	30.6
	31-40	37	11.8
	41-50	39	12.4
	51-60	11	3.5
	>61	9	2.9
Marriage status	Single	244	77.7
	Married	60	19.1
	Single father/mother	10	3.2
Education level	PT3/PMR/SRP	2	0.6
	SPM	88	28.0
	STPM/Certificate/Diploma	107	34.1
	Degree/Master	108	34.4
	PHD	5	1.6
	Others	4	1.3
Occupation	Private	100	31.8
	Government	26	8.3
	Self-employed	11	3.5
	Student	149	47.5
	Unemployed	28	8.9

Item	Variation	Frequency	Percentage (%)
Income level (MYR)	No	89	28.3
	<1,000	79	25.2
	1,001-1,500	10	3.2
	1,501-2,000	26	8.3
	2,001-2,500	22	7.0
	2,501-3,000	29	9.2
	3,001-3,500	13	4.1
	3,501-3,500	17	5.4
	>3,501	29	9.2
Driving license ownership	No	103	32.8
	Yes	211	67.2
Vehicle ownership	No	155	49.4
	1	97	30.9
	2	38	12.1
	>3	24	7.6
Frequency of using the free bus service	Sometimes	194	61.8
	1-2 days/week	53	16.9
	3-4 days/week	26	8.3
	>4 days/week	41	13.1

Fig. 6 describes the passengers' motivations for using the free bus services in Klang Valley. The most common reason, cited by 216 respondents, is to save on transportation costs. Other significant reasons include convenience of use, noted by 183 passengers, and the accessibility of terminals or stops, which is important for 123 respondents. Limited parking spaces motivate 113 passengers, while 105 use the service to reduce travel duration. Environmental benefits attract only 65 passengers, excellent trip frequencies appeal to 50, and 43 passengers use the service due to a lack of access to personal transportation. This may be due to other household members having the privilege to use personal transportation.

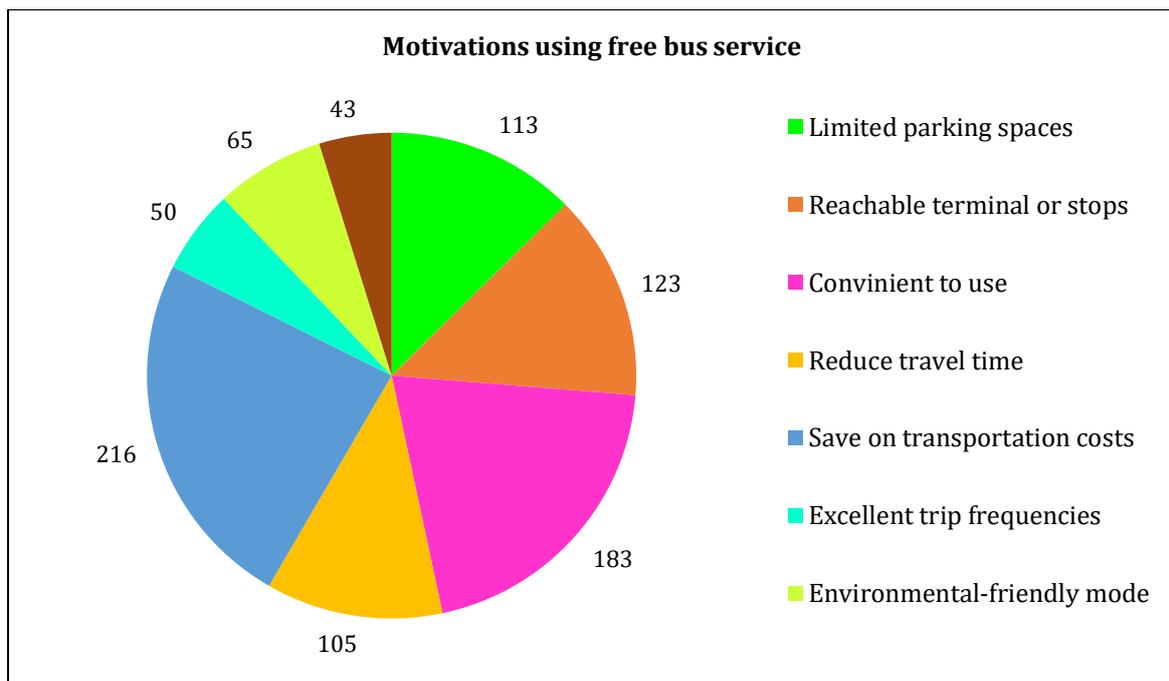


Fig. 6 Motivations using the free bus services

The bar chart in Fig. 7 that illustrates the purposes for using the free bus service highlights several key activities. Shopping emerged as the most frequent purpose, with 165 passengers indicating this reason. Education-

related travel was also significant, with 146 passengers. Other notable purposes include traveling to work (97 passengers), other miscellaneous purposes (120 passengers) and medical visits (49 passengers). Notably, no passengers indicated leisure as the purpose for using the service. This may be due to the lower perceived necessity to use the free bus service for leisure activities compared to more essential activities like work, education or shopping. Additionally, leisure travel may not be as time-sensitive, therefore, passengers may opt for other modes of transport that offer more flexibility or comfort for their leisurely trips.

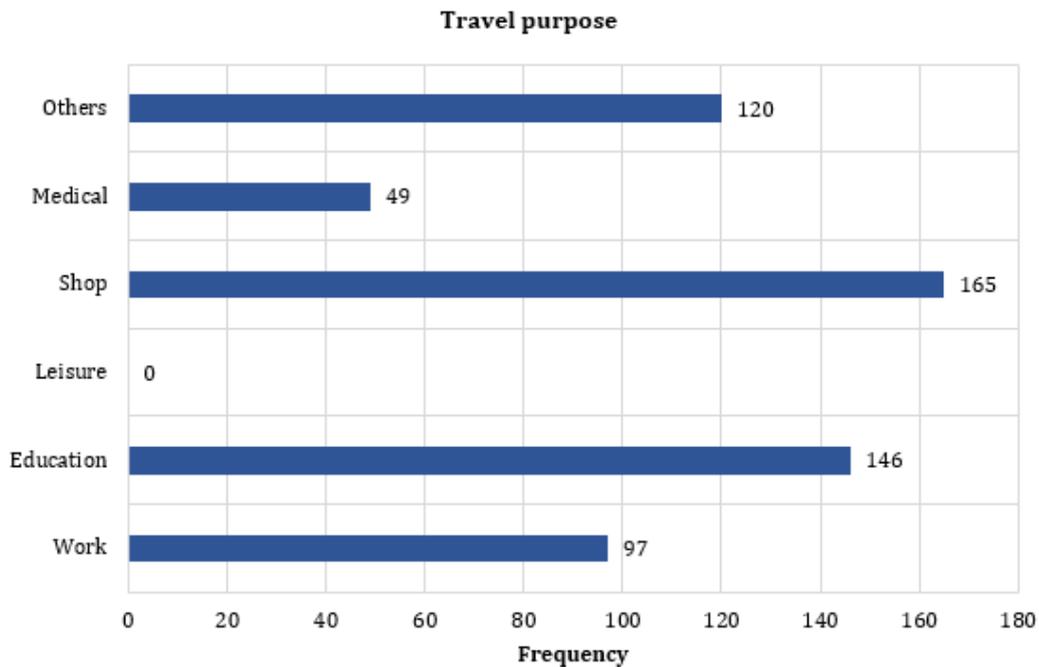


Fig. 7 Travel purpose when using free bus services

3.1 Correlation Between Passenger Expectation and Real Satisfaction Level

Table 7 presents the results of Spearman’s rho correlation analysis, which evaluates the relationship between passenger expectations and their actual satisfaction levels across various aspects of the free bus service. The correlation coefficients for the different items are as follows: comfort (0.393), responsiveness (0.440), capacity (0.403), facility (0.434), safety (0.486), speed (0.434), ticketing system (0.483) and information accuracy (0.463). All correlations are significant at the 0.01 level (2-tailed), indicating that there is a statistically significant relationship between passenger expectations and their satisfaction levels for all these aspects. The coefficients fall within the range of 0.393 to 0.486, which is classified as medium relationship. This suggests a meaningful, though not strong but medium, the relationship between what passengers expect and how satisfied they are with the services still occurs [65]–[67]. The correlation between passenger expectation and comfort shows the lowest value (0.393) among the various aspects evaluated. This lower correlation could be because comfort is a subjective measure that can vary widely among passengers based on personal preferences and prior experiences. What one passenger finds comfortable may not be the same for another, leading to a broader range of satisfaction levels even if their expectations are similar. There may also be disparities in what the service providers consider as comfort improvements and what passengers actually perceive as enhancements in comfort. This gap can lead to lower satisfaction even when efforts to improve comfort are made, thus reflecting a lower correlation between expectation and satisfaction in this area. The moderate correlation implies that while improving these aspects could lead to higher satisfaction, there may be other factors that influence passenger satisfaction that are not captured in this analysis. Therefore, further investigation into additional variables could provide a more comprehensive understanding of what drives passenger satisfaction in the free bus service.

Table 7 Correlation analysis result based on passenger expectation and real satisfaction level

Item	Spearman’s rho (ρ) coefficient							
	CF	R	CP	FAC	SF	SPD	TS	IN
EXP	.393**	.440**	.403**	.434**	.486**	.434**	.483**	.463**

** . Correlation is significant at the 0.01 level (2-tailed).

3.2 Correlation Between Passenger Loyalty and Real Satisfaction Level

Table 8 presents the correlation analysis between passenger loyalty and the actual satisfaction levels of various aspects of the free bus services in Klang Valley. The Spearman's rho coefficients reveal statistically significant correlations at the 0.01 level across all examined factors. Based on the correlation strength guidelines in Table 4, the coefficients indicate a range of low to moderate correlations. Specifically, comfort shows a low correlation (0.245), while other factors such as responsiveness (0.420), capacity (0.404), facility (0.437), safety (0.388), speed (0.410), ticketing system (0.416) and information accuracy (0.453) fall within the moderate correlation range. These findings suggest that while all these aspects significantly impact passenger loyalty, the strongest influences come from the accuracy of information, facilities, and responsiveness of the service. Again, the low Spearman's rho coefficient of 0.245 for comfort, which indicates a low correlation between passenger loyalty and comfort, suggests that other factors may play a more significant role in shaping passenger loyalty for the free bus services in Klang Valley. One possible reason for this could be that the passengers prioritize practicality and efficiency over comfort. Given that these services are free, the passengers may have lower expectations for comfort and may instead focus on other functional aspects of the service. Additionally, the demographic that use the free bus services may include individuals who are more tolerant of discomfort due to economic constraints or lack of alternative transportation options. As a result, their loyalty may be less influenced by comfort and more by the operational efficiency and accessibility of the service, thus shaping the observed lower coefficient value.

Table 8 Correlation analysis result based on passenger loyalty and real satisfaction level

Item	Spearman's rho (ρ) coefficient							
	CF	R	CP	FAC	SF	SPD	TS	IN
LYT	.245**	.420**	.404**	.437**	.388**	.410**	.416**	.453**

** . Correlation is significant at the 0.01 level (2-tailed).

3.3 Gap Analysis on The Application of Expectancy Theory

The T-test analysis results in Table 9 provide a critical insight into the discrepancies between passenger expectations and the actual satisfaction levels of free bus services in Klang Valley. Each item shows a statistically significant result with p -values of 0, indicating that the mean differences observed were highly significant. As per this test, the null hypothesis, $H_{0(t)}$ was rejected and the alternative hypothesis, $H_{a(t)}$ was accepted since the Spearman's rho coefficient obtain in correlation analysis is more than zero ($\rho > 0$). Thus, the data support the hypothesis that there is a significant difference in passenger expectations and actual satisfaction levels. Since both items are significantly related ($\rho > 0.35$, p -value < 0.05), $H_{a(t)}$ is supported. This suggests that the differences in means for each item were not due to random chance. The mean differences ranged from 3.37847 (passenger loyalty) to 4.11041 (comfort), with 95% confidence intervals that did not overlap zero, further confirming the statistical significance. The analysis indicates statistically significant gaps for all evaluated service attributes, with the largest mean differences observed for comfort (4.11041) and loyalty (3.37847). This suggests that while passengers have high expectations for these aspects, the services fall short in delivering the anticipated experience, potentially leading to dissatisfaction and lower loyalty. From a critical perspective, these results highlight several important issues. Firstly, the substantial gap in comfort suggests that passengers prioritize comfort significantly, but the current services do not meet these needs adequately. This shortfall could be due to factors such as overcrowding, inadequate seating, or poor vehicle conditions. Addressing these issues is crucial as comfort is a fundamental aspect that influences the overall travel experience.

Secondly, the lower scores in responsiveness (3.61529), capacity (3.74204), and facility (3.65720) indicate areas where the service can be improved. Responsiveness, which involves how quickly and effectively the service responds to passenger needs and issues, is critical for maintaining passenger satisfaction. A low score suggests that there might be delays or inefficiencies in handling passenger concerns. Capacity issues, reflected in the mean difference, may point to overcrowding or inadequate frequency of bus services, leading to inconvenience for passengers. The significant gaps in the ticketing system (3.79841) and information accuracy (3.56290) also suggest that passengers find these aspects lacking. A reliable ticketing system and accurate information are essential for a smooth and predictable travel experience. Inaccuracies or inefficiencies in these areas can lead to frustration and decreased trust in the service. Finally, the relatively low score in loyalty (3.37847) reflects the cumulative effect of these deficiencies. When passengers' expectations are consistently unmet, it erodes their trust and commitment to the service. This erosion of loyalty can have long-term implications, potentially reduce ridership and undermine the goal of the free bus services.

The result for passenger loyalty, with a mean difference of 3.37847, is notably lower when compared to other mean difference values such as comfort (4.11041) and responsiveness (3.61529). According to the result of Spearman's rho coefficient in Table 6 between passenger loyalty and real satisfaction level, the correlation coefficient was more than zero ($\rho > 0$), which was significant at the p -value of 0.01. As per this test, null hypothesis,

$H_{0(2)}$ was rejected and the alternative hypothesis, $H_{a(2)}$ since $p\text{-value} < 0.05$. Thus, $H_{a(2)}$ is supported since the data support the hypothesis that there is a significant difference between real satisfaction level and passenger loyalty ($\rho = 0.21$, $p\text{-value} < 0.05$). This lower score in passenger loyalty suggests a critical issue: the cumulative dissatisfaction across various service attributes is significantly impacting passengers' willingness to remain loyal to the free bus services in Klang Valley. This is because passenger loyalty is inherently influenced by numerous factors including overall satisfaction, their expectations, and consistency in service quality. The lower loyalty score can be attributed to the compounded effect of unmet expectations across several key areas. Comfort, being a high priority for many passengers, has the highest mean difference, indicating significant dissatisfaction. When passengers find the bus service uncomfortable, it directly affects their daily commuting experience, making them less likely to remain loyal. Similarly, issues with responsiveness and capacity highlight operational inefficiencies that inconvenience passengers, further eroding their trust and satisfaction.

Moreover, the gaps in the ticketing system and information accuracy suggest that passengers face uncertainties and frustrations regarding the reliability and predictability of the service. These operational challenges create a perception of unreliability, making passengers feel less inclined to depend on and commit to the service. The compounded dissatisfaction across these attributes leads to a lower overall perception of the service quality, directly impacting passenger loyalty. When passengers' expectations are consistently unmet, their loyalty declines as they might seek alternative modes of transportation that better meet their needs and expectations. This decline in loyalty is a critical concern for the sustainability of free bus services, as maintaining a consistent passenger base is essential for justifying and supporting the continued provision of these services. In summary, the lower result for passenger loyalty compared to other mean difference values reflects the cumulative impact of unmet expectations across various service dimensions. Addressing these issues holistically is essential to enhance overall satisfaction and rebuild passenger loyalty to ensure the long-term success of free bus services in Klang Valley.

Table 9 *T-test analysis result on the application of expectancy theory*

Item	Sig. (2-tailed) <i>p</i> -value	Mean Difference	95% Confidence Interval of the Difference	
			Lower	Upper
EXP	0.000	3.96382	3.8638	4.0638
CF	0.000	4.11041	4.0292	4.1916
R	0.000	3.61529	3.5180	3.7126
CP	0.000	3.74204	3.6465	3.8376
FAC	0.000	3.65720	3.5576	3.7568
SF	0.000	3.78344	3.6849	3.8820
SPD	0.000	3.55105	3.4405	3.6616
TS	0.000	3.79841	3.6874	3.9094
IN	0.000	3.56290	3.4501	3.6757
LYT	0.000	3.37847	3.2767	3.4802

4. Conclusion

This study highlights the critical role of sustainability initiatives in the transport sector, particularly through the implementation of free bus services in Klang Valley, Malaysia. This approach can significantly benefit three key parties: bus providers, passengers, as well as the environment. The results indicate that while free bus services effectively address environmental sustainability by reducing reliance on private vehicles and lowering carbon emissions, there are notable gaps in meeting passenger expectations. The findings reveal that passengers place high importance on comfort, responsiveness and the reliability of the ticketing system, yet these areas currently exhibit significant deficiencies, impacting overall satisfaction and loyalty. These gaps underscore the need for continuous improvement in service delivery to meet the expectations of passengers.

For bus providers, the provision of free bus services presents an opportunity to enhance service quality and operational efficiency. Addressing the identified gaps in comfort and responsiveness can lead to improved passenger satisfaction, fostering loyalty and encouraging more consistent use of the service. Additionally, improving the accuracy of information and the reliability of the ticketing system can mitigate passenger frustrations, enhancing the overall travel experience felt by passengers. By investing in these areas, bus providers can not only meet passenger expectations but also ensure the sustainability and long-term viability of the service. This, in turn, can lead to increased ridership and a more efficient use of resources, ultimately contributing to the financial stability of the service providers as the government will provide more funds if only the initiatives receive positive feedback from passengers. This highlights the significance of the findings of this study, as passengers are only loyal when they feel happy with the services provided.

Meanwhile, on the passenger side, they benefit from the accessibility and cost savings associated with free bus services. However, to maximize these benefits, it is crucial for service providers to align their offerings with passenger expectations. Ensuring a comfortable, responsive and reliable service can significantly enhance passenger satisfaction, leading to increased loyalty and continuity to use the service. This, in turn, can promote a shift from private vehicle use to public transport, which can reduce traffic congestion and environmental sustainability. Passengers who find that the service meets or exceeds their expectations are more likely to advocate for it, thereby attracting more users and creating a positive feedback loop that supports the overall sustainability of the service. This, in turn, can promote a shift from private vehicle use to public transport, contributing to reduced traffic congestion and environmental sustainability. Notably, although only a few passengers claim to use the free bus services due to environmental concerns, every passenger who opts for ridesharing significantly contributes to saving the environment without intending to do so. This means passengers are saving the environment without even realizing it, highlighting the broader impact of their shared behavior.

The application of The Expectancy Theory in this study provides a more in-depth understanding of the relationship between passenger expectation and actual service performance by bus providers toward passenger loyalty. By aligning service performance with passenger expectations and clearly communicating the benefits of the service, providers can enhance passenger motivation and satisfaction. The Expectancy Theory posits that individuals are motivated when they perceive a clear link between their efforts and the desired outcomes. In the context of free bus services, this means that passengers are more likely to remain loyal if they believe that their choice to use the service will consistently result in a positive and rewarding experience. This theoretical framework helps to identify the specific areas where improvements can make the most significant impact on passenger satisfaction and loyalty.

Future studies should adopt a comprehensive approach to further investigate and address the gaps identified in this study. Conducting detailed surveys and focus groups with passengers can provide deeper insights into specific areas of dissatisfaction and potential improvements. Additionally, exploring the integration of modern green technologies, such as electric buses, can further enhance the environmental benefits of free bus services. By continuously monitoring and adapting to passenger needs, service providers can ensure that free bus services remain a sustainable, reliable and preferred mode of transport in Klang Valley. Future research could also examine the long-term effects of these improvements on passenger loyalty and environmental sustainability, providing a comprehensive understanding of the benefits of free bus services. Through these efforts, the goal of creating a more sustainable and efficient urban transit system can be achieved, benefiting all stakeholders involved.

Acknowledgement

This research was supported by Universiti Tun Hussein Onn Malaysia through the Tier 1 Research Grant (vot Q477) and the Postgraduate Research Grant (vot Q247). The authors would also like to express their sincere gratitude to the Faculty of Civil Engineering and Built Environment for its invaluable support and contributions throughout the completion of this study.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

All authors contributed equally to the development of this manuscript. Their collaborative efforts encompassed the overall research design, data collection, statistical analysis, interpretation of findings, and the drafting and revision of the manuscript. Each author played an integral role in ensuring the academic quality, coherence, and clarity of the final work, including contributions to literature review, discussion, and language editing.

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