



Subscription Parking Usage Behavior in Medan: An Integrated Theory of Planned Behavior and Service Quality Model

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Abstract

Background: Subscription parking in Medan City aims to improve parking services, transparency, and local revenue. However, public participation remains low, indicating that policy success depends on user behavior. Previous studies have rarely integrated the *Theory of Planned Behavior* (TPB), service quality, and satisfaction to explain subscription parking usage in a public-sector context.

Objective: This study aims to analyze public perceptions of subscription parking implementation, examine the factors influencing subscription parking usage behavior, and provide recommendations for improving policy implementation in Medan City.

Methods: A quantitative survey was conducted among 390 subscription parking users in Medan City. Respondents were selected using purposive sampling based on their status as registered subscription parking users and their experience using the service. Data were collected using a five-point Likert-scale questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS).

Results: Service quality was the strongest determinant of user satisfaction ($\beta = 0.757$; $p < 0.001$), while attitude was the strongest direct determinant of usage behavior ($\beta = 0.748$; $p < 0.001$). Service quality also influenced usage behavior through satisfaction and attitude, including a significant serial mediation effect ($\beta = 0.258$; $p < 0.001$). Subjective norms significantly influenced usage behavior, whereas perceived behavioral control did not.

Conclusion: Subscription parking usage is shaped by an integrated process in which service quality enhances satisfaction, satisfaction strengthens positive attitudes, and attitudes encourage continued usage. The study contributes to the TPB literature by extending the behavioral model with service quality and satisfaction in the context of public-sector subscription parking.

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INTRODUCTION

The continuous growth of motorized vehicles and urban mobility has increased the demand for adequate parking facilities, particularly in metropolitan areas such as Medan. The imbalance between vehicle growth and parking availability can contribute to illegal parking, traffic congestion, reduced road capacity, and ineffective parking management. In addition, conventional parking systems may face challenges related to inconsistent tariff implementation, limited transparency in parking levy management, and potential revenue leakage. These conditions highlight the need for a more effective, transparent, and technology-supported parking

management system that can improve service quality while supporting sustainable urban mobility and local revenue generation (Erfina et al., 2025; Priambodo et al., 2022).

Parking management has consequently become an important component of urban mobility policy because the availability, accessibility, and management of parking facilities are closely related to the efficiency of urban transportation systems. In metropolitan areas, increasing vehicle ownership and mobility intensity create greater pressure on limited parking infrastructure. Previous research has examined the need for motorcycle and car parking spaces as part of efforts to respond to increasing transportation demand (Adi et al., 2026; Priambodo et al., 2022). Research on parking policy in Indonesian metropolitan cities has also highlighted the complexity of implementing parking regulations in environments characterized by diverse mobility patterns and infrastructure conditions (Wangi et al., 2024). These studies indicate that parking policy cannot be viewed solely as an infrastructure or tariff issue but also requires attention to management effectiveness and user responses.

To address these challenges, the Medan City Government issued Medan City Regulation Number 1 of 2024 concerning Regional Taxes and Regional Levies, followed by Medan Mayor Regulation Number 26 of 2024 concerning Procedures for Implementing Subscription Parking. The policy introduced subscription parking alongside the conventional parking system. Under the subscription system, users make an annual payment and receive a barcode sticker as vehicle identification, allowing them to use designated public roadside parking facilities without paying a separate parking fee for each visit. The policy is intended to simplify the payment mechanism, improve transparency in parking management, reduce potential revenue leakage, and optimize Regional Original Revenue (PAD). However, the effectiveness of this policy ultimately depends not only on its regulatory and technological design but also on the quality of services experienced by users and their willingness to continue using the system.

The implementation of the subscription parking policy is expected to improve the quality of parking services, simplify the payment system, increase transparency in parking levy management, reduce illegal parking practices, and optimize local revenue (PAD) (Akhtar & Jackson, 2025). To support the program's success, the Medan City Government has undertaken various efforts, including outreach through mass media and digital media, opening registration locations at Transportation Agency offices and shopping centers, and implementing barcode technology and vehicle documentation to validate user data (Pakpahan et al., 2025; Utomo & Arif, 2024). These efforts received a positive response early in the program, as evidenced by the sale of 1,093 subscription parking stickers on the first day of implementation, comprising 512 for two-wheeled vehicles, 570 for four-wheeled vehicles, and 11 for heavy vehicles (Analisdaily, 2024).

However, this public enthusiasm was not sustained. Data from the Medan City Transportation Agency show that subscription parking revenue decreased from IDR 5.97 billion in July 2024 to IDR 1.46 billion in August, IDR 345.73 million in September, and only IDR 70.96 million by mid-October 2024, resulting in a total realization of IDR 7.84 billion (Pakpahan et al., 2025; Utomo & Arif, 2024). In addition, the number of subscription parking users reached only 58,903 vehicles, or approximately 3.73% of the target vehicle population in 2024. The adoption rate consisted of 1.41% for two-wheeled vehicles, 13.20% for four-wheeled vehicles, and 0.96% for heavy vehicles. This condition indicates that public participation in the subscription parking program remains low and has not yet supported the expected PAD target. The policy was implemented partly to optimize the potential PAD of the parking sector, estimated at more than IDR 167 billion, while revenue realization from the conventional parking system by mid-2024 had reached only around IDR 20 billion (Pakpahan et al., 2025; Utomo & Arif, 2024).

The low adoption rate indicates that the success of subscription parking implementation is influenced not only by regulatory and operational factors but also by user behavior (Manalu et al., 2026; Rambe et al., 2025). Limited parking availability, differences in service quality among parking attendants, user satisfaction, and the effectiveness of public outreach may influence users' willingness to adopt and continue using the service. Therefore, understanding the behavioral mechanisms underlying subscription parking usage is important for evaluating whether the policy can be implemented sustainably.

Previous studies provide several relevant perspectives but have generally examined the determinants of parking management and transportation behavior from different angles. Studies

of parking facilities have focused on parking-space requirements and management challenges Priambodo et al. (2022) and Bermawi et al. (2024), while research on parking policy has emphasized regulatory and infrastructure issues in metropolitan environments (Wangi et al., 2024). In another stream of research, service quality has been shown to influence customer satisfaction in public transportation services Khatun et al. (2025) and Laisak et al. (2021), suggesting that the quality of the service experience can shape users' evaluations of public services. Meanwhile, the Theory of Planned Behavior (TPB) explains behavioral intention and behavior through attitude, subjective norms, and perceived behavioral control (Ajzen, 2020; Zhao et al., 2025). Although these perspectives are individually relevant, they have rarely been integrated to explain subscription parking usage behavior, particularly in the context of regional public services in Indonesia. Thus, the existing literature provides a limited explanation of how service quality and satisfaction interact with TPB variables in shaping continued subscription parking usage.

The Theory of Planned Behavior provides a useful theoretical foundation for understanding subscription parking usage because decisions to use a service may reflect users' evaluations, perceived social expectations, and perceptions of behavioral control. However, public-service behavior may also depend on the quality of the service experience. When users perceive that facilities are adequate, parking attendants are responsive, parking locations are accessible, and the service provides security, these experiences may increase satisfaction. Higher satisfaction can subsequently strengthen positive attitudes toward the service, which may encourage continued usage. Previous research on public transportation has demonstrated the relevance of service quality to customer satisfaction (Khatun et al., 2025; Laisak et al., 2021). Therefore, integrating service quality and satisfaction with TPB provides a more comprehensive framework for explaining subscription parking behavior than relying on TPB variables alone.

The research gap of this study lies specifically in the limited integration of three perspectives Theory of Planned Behavior, service quality, and customer satisfaction to explain subscription parking usage within a public-sector context in Indonesia. Existing parking studies tend to emphasize infrastructure, policy implementation, management, or parking-space requirements, whereas TPB studies primarily explain behavioral determinants without necessarily incorporating the quality of the public service experience. Similarly, service-quality studies generally focus on satisfaction and behavioral intentions in transportation or other service settings rather than subscription-based parking. This study addresses this gap by examining how service quality influences satisfaction and attitude and how these factors subsequently affect subscription parking usage behavior, alongside the effects of subjective norms and perceived behavioral control.

The novelty of this research lies in the development and empirical testing of an integrated behavioral model that combines TPB constructs with service quality and customer satisfaction in the context of subscription parking as a regional public service. Rather than examining the constructs independently, the proposed model assesses their direct, indirect, and sequential relationships using Structural Equation Modeling–Partial Least Squares (SEM-PLS). In particular, the study examines whether service quality influences usage behavior through satisfaction and attitude, thereby identifying the psychological mechanism through which users' service experiences are translated into continued behavioral responses. This integrated approach provides a more comprehensive explanation of subscription parking usage and extends the application of TPB to a relatively underexplored public-sector service context.

The study also has policy implications for the implementation of subscription parking in Medan City. Identifying the determinants of continued usage can assist the Medan City Government and the Medan City Transportation Agency in designing policies that are not limited to increasing registration but also focus on improving the quality of users' service experiences. The findings can provide a basis for prioritizing improvements in parking facilities, the distribution and availability of parking locations, security, parking-attendant professionalism, digital payment and identification systems, and public communication. Thus, understanding user behavior can support the development of a subscription parking policy that is more responsive to user needs, sustainable in implementation, and supportive of local revenue objectives.

Based on this background, this study aims to (1) analyze public perceptions of subscription parking implementation in Medan City, (2) analyze the influence of service quality,

user satisfaction, attitudes, subjective norms, and perceived behavioral control on subscription parking usage behavior, and (3) develop managerial recommendations to improve the effectiveness and sustainability of subscription parking policy implementation in Medan City.

METHOD

This study used a quantitative approach with a survey method to analyze the factors influencing subscription parking usage behavior in Medan City. The study was conducted in Medan City, North Sumatra Province, a region that has implemented a subscription parking policy based on Medan City Regional Regulation Number 1 of 2024 concerning Regional Taxes and Regional Levies and Medan Mayor Regulation Number 26 of 2024 concerning Procedures for Implementing Subscription Parking. The study population comprised all residents registered as subscription parking users with the Medan City Transportation Agency.

Sampling was conducted using a purposive sampling technique, selecting respondents who met the criteria of being registered as subscription parking users and having used the service. A total of 390 respondents were included in the analysis, meeting the minimum sample size requirements for Partial Least Squares Structural Equation Modeling (PLS-SEM). Primary data were collected through questionnaires using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. In addition to primary data, the study also used secondary data obtained from the Medan City Transportation Agency, the Central Statistics Agency (BPS), laws and regulations, and various relevant scientific publications.

The research model integrates the Theory of Planned Behavior (TPB) with service quality and user satisfaction variables to explain subscription parking usage behavior. The constructs analyzed include Attitude, Subjective Norm, Perceived Behavioral Control, Service Quality, Customer Satisfaction, and Usage Behavior. All research indicators were adapted from previous studies.

Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS 4 software. The analysis stages included evaluation of the measurement model (outer model) and the structural model (inner model). Evaluation of the measurement model was conducted through convergent validity testing using outer loading and Average Variance Extracted (AVE) values, discriminant validity testing, and construct reliability testing using Cronbach's alpha and composite reliability. Furthermore, the structural model was evaluated using the coefficient of determination (R^2), predictive relevance (Q^2), Variance Inflation Factor (VIF), and Standardized Root Mean Square Residual (SRMR). Hypothesis testing was conducted using a bootstrapping procedure with a significance level of 5%; therefore, a hypothesis was considered supported if it had a t-statistic value > 1.96 or a p-value < 0.05 .

Hypothesis testing in this study used the Structural Equation Modeling (SEM) method with SmartPLS version 4.0. According to [author] et al. (2017), SEM is a multivariate method that combines regression analysis and factor analysis. It allows researchers to evaluate relationships between measured variables and latent variables (i.e., the assessment of measurement theory) as well as relationships among latent variables. There are two categories of SEM methods: covariance-based structural equation modeling (CB-SEM) and partial least squares structural equation modeling (PLS-SEM). Partial least squares (PLS) is a powerful analysis method because it does not require normally distributed data and can be applied to relatively small sample sizes. The following presents the PLS-SEM research model used in this study, as shown in Figure 2.

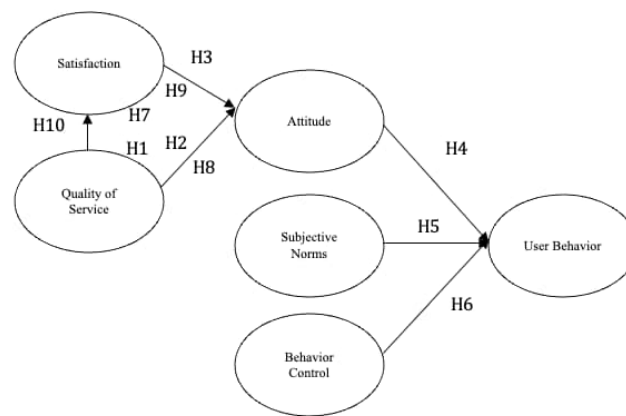


Figure 1. SEM PLS Model

Based on the figure, the hypotheses in this study are as follows:

1. H1. Service Quality Influences Satisfaction
2. H2. Service Quality Influences Attitude
3. H3. Satisfaction Influences Attitude
4. H4. Attitude Influences Usage Behavior
5. H5. Subjective Norm Influences Usage Behavior
6. H6. Behavioral Control Influences Usage Behavior
7. H7. Service Quality Influences Attitude Through Satisfaction
8. H8. Service Quality Influences Usage Behavior Through Attitude
9. H9. Satisfaction Influences Usage Behavior Through Attitude
10. H10. Service Quality Influences Usage Behavior Through Satisfaction and Attitude

RESULTS AND DISCUSSION

This study involved 390 respondents who were subscription parking users in Medan City. Based on demographic characteristics, the respondents were predominantly female (56.41%), while male respondents accounted for 43.59%. The majority of respondents were between 25 and 29 years of age (41.54%), followed by those aged 30–34 years (27.95%), indicating that subscription parking users were predominantly from the productive-age group. In terms of education, the majority of respondents held a Bachelor's degree (S1/D4), accounting for 64.36% of the sample. In terms of occupation, the respondents were predominantly private-sector employees (35.38%), followed by entrepreneurs (25.38%) and civil servants (25.12%).

Table 1

Respondents' Characteristics (n = 390)

Characteristics	Category	n	%
Gender	Male	170	43.59
	Female	220	56.41
Age	< 25 years	42	10.77
	25–29 years	162	41.54
	30–34 years	109	27.95
	35–39 years	58	14.87
	40–44 years	16	4.10
	45–49 years	3	0.77
Education Level	High School or equivalent	56	14.36
	Diploma (D3)	63	16.15
	Bachelor's Degree (S1/D4)	251	64.36
	Master's Degree (S2)	17	4.36
	Doctoral Degree (S3)	3	0.77
Occupation	Private Employee	138	35.38
	Civil Servant	98	25.12
	Entrepreneur / Business Owner	99	25.38
	Student	36	9.23

Characteristics	Category	n	%
	Daily Worker / Laborer	12	3.07
	Unemployed	7	1.79

Source: Processed primary data (2025)

Usage characteristics show that most respondents travel to Medan City using a private vehicle 11–15 times per month (27.69%) and use subscription parking services 4–6 times per month (40.00%). The main reason for using subscription parking is lower parking costs (33.33%), followed by the convenience and practicality of the service (30.77%). In addition, the majority of respondents use subscription parking services when carrying out activities at their office or workplace (64.87%). These findings indicate that subscription parking services are more widely utilized by people with high mobility who regularly use private vehicles.

Table 2

Perceived Benefit

Characteristics	Category	n	%
Frequency of traveling to Medan City using a private vehicle (per month)	≤ 5 times	28	7.17
	6–10 times	97	24.87
	11–15 times	108	27.69
	16–20 times	76	19.48
	≥ 20 times	81	20.76
Frequency of using subscription parking	1–3 times	104	26.66
	4–6 times	156	40.00
	7–9 times	56	14.35
	≥ 10 times	74	18.97
Main reason for using subscription parking	Convenience and practicality	120	30.77
	Safety and security	30	7.69
	Fixed parking tariff	94	24.10
	Lower parking cost	130	33.33
	Good service from parking attendants	16	4.10
Most frequently visited destination	Office/Workplace	253	64.87
	School/University	36	9.23
	Business location	97	24.87
	Others	4	1.03

Source: Processed primary data (2025)

Measurement model evaluation was conducted to ensure that each construct in the study met the validity and reliability requirements before testing the structural model. The evaluation included convergent validity, discriminant validity, and construct reliability.

Table 3

Outer loading

Variables	Indicator Symbols	Outer Loading	Information
Attitude	SK1	0.735	Valid
	SK2	0.797	Valid
	SK3	0.754	Valid
	SK4	0.784	Valid
Subjective norms	NS1	0.754	Valid
	NS2	0.725	Valid
	NS3	0.714	Valid
	NS4	0.727	Valid
Behavior control	KP1	0.790	Valid
	KP2	0.860	Valid
	KP3	0.707	Valid
	KP4	0.762	Valid

Variables	Indicator Symbols	Outer Loading	Information
Quality of service	KL1	0.753	Valid
	KL2	0.720	Valid
	KL3	0.723	Valid
	KL4	0.724	Valid
Satisfaction	KS1	0.728	Valid
	KS2	0.703	Valid
	KS3	0.733	Valid
	KS4	0.772	Valid
Usage behavior	PP1	0.785	Valid
	PP2	0.695	Valid
	PP3	0.730	Valid
	PP4	0.721	Valid

Source: Processed primary data (2025)

The analysis results showed that all indicators had outer loading values above 0.70, thus meeting the criteria for convergent validity. Furthermore, the Average Variance Extracted (AVE) value for each construct was above the minimum threshold of 0.50, indicating that each construct explained more than 50% of the variance in its measured indicators.

Furthermore, the results of the discriminant validity assessment using the Fornell-Larcker criterion showed that the square root of the AVE for each construct was greater than its correlations with the other constructs. These results were further supported by the Heterotrait-Monotrait Ratio (HTMT) values, all of which were below the threshold of 0.90. Thus, each construct demonstrated adequate discriminant validity and was sufficiently distinct from the other constructs.

Reliability testing also demonstrated satisfactory results. All constructs had Cronbach's alpha and composite reliability values above 0.70, indicating good internal consistency and confirming that the indicators were suitable for structural model analysis.

Table 4

Results of Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) tests

Variable	Cronbach's alpha	Composite reliability (rho c)	Average variance extracted (AVE)
Attitude	0.768	0.852	0.590
Subjective norms	0.708	0.820	0.533
Behavioral control	0.791	0.862	0.611
Service quality	0.709	0.820	0.533
Satisfaction	0.715	0.824	0.539
Usage behavior	0.712	0.823	0.538

After the measurement model was determined to be valid and reliable, the next step was to evaluate the structural model to determine its ability to explain the relationships among the research variables. The analysis results showed that the R^2 values for the endogenous variables fell within the moderate-to-strong range, indicating that the exogenous variables in the study were able to adequately explain variations in subscription parking usage behavior. A Q^2 predictive relevance value greater than zero indicated that the model had predictive relevance for the observed data.

Furthermore, the Variance Inflation Factor (VIF) test results showed that all values were below the maximum threshold of 5, indicating no evidence of problematic multicollinearity among the independent variables. The Standardized Root Mean Square Residual (SRMR) value was also below 0.08, indicating an acceptable model fit. Overall, the structural model evaluation results indicated that the research model met the relevant SEM-PLS assessment criteria and was therefore suitable for testing the proposed hypotheses.

Table 5*R square value*

Latent Variables	R-square	Category
Satisfaction	0.573	Moderate
Usage Behavior	0.758	Strong
Attitude	0.412	Weak

- 1) Satisfaction ($R^2 = 0.573$) – Category: Moderate. Table 5 shows that the R^2 value of 0.573 indicates that 57.3% of the variability in respondent satisfaction can be explained by the independent constructs, such as service quality, attitude, and subjective norms. This value falls into the moderate category, meaning that the factors included in the model are sufficiently capable of explaining user satisfaction, although 42.7% of the variability is attributable to factors outside the model.
- 2) Usage Behavior ($R^2 = 0.758$) – Category: Strong. An R^2 value of 0.758 indicates that 75.8% of the variability in subscription parking usage behavior can be explained by variables such as satisfaction, attitude, behavioral control, and subjective norms. This value falls into the strong category, indicating that the model has substantial explanatory power for usage behavior. The result indicates that the factors included in the model are highly relevant to predicting actual user behavior.
- 3) Attitude ($R^2 = 0.412$) – Category: Weak. An R^2 value of 0.412 means that 41.2% of the variation in respondents' attitudes can be explained by the constructs influencing attitude within the model. This falls into the weak category, indicating that other external factors outside the model may influence users' attitudes toward subscription parking.

SRMR = 0.074. Because the value is below 0.08, the model demonstrates an acceptable level of fit. A Q^2 value above 0 indicates that the model has predictive relevance (Yamin, 2023).

Table 6*Model fit*

	$Q^2 (=1-SSE/SSO)$
Satisfaction	0.300
Usage Behavior	0.398
Attitude	0.228

The attitude variable describes respondents' assessments of the use of subscription parking in Medan City. Measuring this variable is important because a positive attitude can encourage continued usage behavior. Analyzing the distribution of respondents' responses reveals the level of acceptance and users' perceptions of the benefits offered by subscription parking services. The distribution of respondents' responses to the attitude variable is presented in the table 7.

Table 7*Distribution of questionnaire responses to attitudes*

Code	Statement	Percentage (%)				
		Strongly disagree	Do Not agree	Disagree Less	Agree	Strongly agree
S1	I believe that using subscription parking will save more money and time than daily parking.	1.03	2.31	13.85	59.49	23.33
S2	I feel that subscription parking provides greater convenience for vehicle users.	0.77%	2.56%	15.13%	66.92%	14.62%
S3	I feel that subscription parking can help address parking issues in Medan.	1.03%	2.56%	14.87%	63.85%	17.69%

Code	Statement	Percentage (%)				
		Strongly disagree	Do Not agree	Disagree Less	Agree	Strongly agree
S4	I have a positive view of subscription parking.	1.03%	3.33%	13.59%	65.13%	16.92%

Table 7 shows that statement S1 had the highest level of agreement, indicating perceived cost and time savings compared with daily parking. Although S1 had the highest total agreement, the combined agreement (Agree + Strongly agree) was 82.82%. The proportion of respondents who agreed was greater than the proportion who strongly agreed, indicating a positive but not particularly strong perception of cost and time savings. This may be influenced by differences in perceptions based on frequency of use and the parking rates perceived by individual respondents.

Statement S4, with a total agreement of 82.05%, reflects respondents' general attitudes toward subscription parking. Although its total agreement was higher than that of S2 and S3, the proportion of respondents who strongly agreed was lower than that for S3, while the proportion who disagreed was slightly higher. This indicates that a small number of respondents remained uncertain or were not fully positive about the service.

The statements concerning "greater convenience for vehicle users" (S2) and "helping resolve parking problems in Medan City" (S3) ranked lowest in terms of total agreement, with the same total agreement score (Agree + Strongly agree) of 81.54%. The majority of respondents perceived convenience as an important reason for their positive attitudes toward subscription parking. This indicates that convenience is a key element in developing positive attitudes toward the service. Respondents also considered the systemic function of subscription parking namely, its potential to alleviate urban parking problems to be important and to have a meaningful influence on their perceptions.

The subjective norm variable reflects the level of social influence perceived by respondents in using subscription parking services. This influence may come from family members, friends, coworkers, or government agencies that encourage the use of the service. Analyzing the distribution of respondents' responses is important for understanding the role of the social environment in shaping subscription parking behavior in Medan. The distribution of respondents' responses to the subjective norm variable is presented in the 7 table 8.

Table 8
Distribution of questionnaire answers to subjective norms

Code	Statement	Percentage (%)				
		Strongly disagree	Do Not agree	Disagree Less	Agree	Strongly agree
NS1	I use subscription parking services because of directions and orders from others.	1.54%	2.05%	14.87%	44.10%	37.44%
NS2	People important to me (family, friends, coworkers) support subscription parking, which is why I use it.	1.54%	2.05%	14.62%	46.41%	35.38%
NS3	I feel that most people in my neighborhood use subscription parking, which is why I use it.	0.77%	2.56%	16.15%	46.41%	34.10%
NS4	The government and parking management encourage people to use subscription parking, which is why I use it.	1.03%	3.08%	13.08%	41.79%	41.03%

Table 8 shows that statement NS4, concerning "encouragement from the government and parking managers," received the highest level of agreement, with a total agreement of 82.82%. This indicates that support and encouragement from authorities, such as the government and

parking managers, play a significant role in influencing individuals to use subscription parking. Perceived legitimacy and authority therefore appear to be important social factors shaping subjective norms.

NS2, concerning support from important people (family, friends, and coworkers), had a total agreement of 81.79%. The high level of agreement with this statement indicates that social support from the immediate social environment, such as family and friends, is a significant motivator. This aligns with the Theory of Planned Behavior, which states that subjective norms are formed through an individual's perception of social pressure from important people around them (Ajzen, 2020; Zhao et al., 2025).

NS3, concerning the use of subscription parking by people in the surrounding neighborhood, had a total agreement of 80.51%. Many respondents also felt that collective behavior within the community influenced their decisions. This reflects social conformity, in which majority behavior can influence individual decisions.

NS1, concerning direction or instructions from another party, had a total agreement of 81.54%. Although the overall agreement rate remained high, this statement has a relatively passive connotation, suggesting that subscription parking is used because someone else instructed or encouraged the respondent to do so. This suggests that, although external influences are present, personal initiative or internal motivation may be less prominent, with some users potentially following others' behavior without strong personal motivation.

The behavioral control variable describes respondents' perceptions of the ease and ability to use subscription parking services. Measuring this variable is important because the greater a person's perceived control over an action, the more likely they are to perform that action. An analysis of the distribution of respondents' responses was conducted to determine the level of ease, accessibility, and availability of supporting facilities perceived by users when utilizing subscription parking services in Medan City. The distribution of respondents' responses to the behavioral control variable is presented in the table 9.

Table 9

Distribution of questionnaire answers regarding behavioral control

Code	Statement	Percentage (%)				
		Strongly disagree	Do not agree	Disagree Less	Agree	Strongly agree
KP1	I find it easy to access subscription parking services in areas I frequently visit.	2.05%	3.59%	20.77%	47.95%	25.64%
KP2	I feel confident that I can afford the subscription parking fees on a regular basis.	1.79%	3.85%	17.95%	46.15%	30.26%
KP3	I have full control over whether or not to use subscription parking.	3.33%	7.95%	22.05%	42.31%	24.36%
KP4	I have no barriers to using this service because the supporting facilities are readily available.	2.05%	6.67%	15.90%	47.69%	27.69%

Table 9 shows that KP2, concerning confidence in the ability to pay subscription parking fees, received the highest level of agreement, with a total agreement of 76.41%. This indicates that the majority of respondents felt financially capable of using the service. This finding reflects perceived behavioral control, suggesting that confidence in one's own ability is an important driver of behavior (Ajzen, 2020; Zhao et al., 2025).

KP4, concerning the absence of barriers due to adequate supporting facilities, had a total agreement of 75.38%. This indicates that the majority of respondents did not experience significant obstacles when using the service because of adequate supporting facilities, such as location availability, payment systems, or application access. This suggests that external or

situational factors supporting service use were generally adequate, thereby facilitating continued use.

KP1, concerning ease of access to services in frequently visited areas, had a total agreement of 73.59%. Respondents generally perceived subscription parking services as accessible in locations they frequently visit. This indicates that the availability of services in strategic locations strengthens perceptions of ease of use and contributes to perceived behavioral control.

KP3, concerning full control over decision-making, had the lowest level of agreement among the four indicators, at 66.67%, although this level was still relatively high. This means that some respondents may have perceived external influences, such as workplace rules, recommendations from others, or their surrounding environment, as limiting their choices. Consequently, their perception of personal control may have been weaker than their perceptions of other aspects of behavioral control.

The service quality variable describes respondents' assessments of the performance of the subscription parking service they received. Measuring this variable is important because good service quality can increase user satisfaction and encourage positive attitudes and usage behavior. An analysis of the distribution of respondents' responses was conducted to determine user perceptions of the facilities, staff service, security, and accessibility of subscription parking services in Medan City. The distribution of respondents' responses to the service quality variable is presented in the table 10.

Table 10
Distribution of questionnaire responses to service quality

Code	Statement	Percentage (%)				
		Strongly disagree	Do not agree	Disagree Less	Agree	Strongly agree
KL1	I feel the subscription parking service has adequate facilities.	1.79%	1.79%	7.18%	42.05%	47.18%
KL2	The parking attendants provide friendly and courteous service.	2.82%	1.03%	9.23%	42.56%	44.36%
KL3	There are enough subscription parking spaces in the locations I need.	2.31%	3.85%	13.85%	44.10%	35.90%
KL4	I feel safe parking my vehicle when using the subscription parking service.	1.79%	1.79%	10.26%	45.64%	40.51%

Table 10 shows that the level of agreement with the service quality indicators for subscription parking services in Medan City was very high, with all indicators recording agreement levels above 80%. The KL1 statement concerning physical facilities received the highest level of agreement (89.23%), reflecting a positive perception of the tangible aspects of the SERVQUAL model proposed by Parasuraman et al. (1988), Dedigamage (2026) and Kruadsungnoen and Upayokin (2025) such as signage, payment systems, parking areas, and physical security. This was followed by KL2, concerning the friendliness of parking attendants, which received a total agreement of 86.92%, indicating that courteous and responsive direct interactions are highly valued by users, consistent with the empathy and responsiveness dimensions of SERVQUAL. Furthermore, KL4, concerning the feeling of security when using the service, recorded a high level of agreement (86.15%), indicating that users generally feel protected while using subscription parking and supporting the assurance dimension of SERVQUAL. Meanwhile, the indicator with the lowest level of agreement was KL3, concerning the availability of parking spaces, with 80.00% of respondents stating that they agreed or strongly agreed. Although this result remains in the high category, it indicates challenges related to limited land availability or the uneven distribution of parking locations in several strategic areas. Therefore, parking managers and local governments should prioritize the equitable distribution

and expansion of parking capacity to ensure a more consistent perception of service quality and meet the expectations of all users.

The satisfaction variable reflects users' assessments of the experience they obtain after using subscription parking services. Measuring this variable is important because satisfaction can influence attitudes and continued use of a service. An analysis of the distribution of respondents' responses was conducted to determine the extent to which subscription parking services meet users' expectations and needs in Medan City. The distribution of respondents' responses to the satisfaction variable is presented in the table 11.

Table 11

Distribution of questionnaire responses to satisfaction

Code	Statement	Percentage (%)				
		Strongly disagree	Do Not agree	Disagree Less	Agree	Strongly agree
KS1	I am satisfied because the cost of the subscription parking service is commensurate with the benefits provided.	2.31%	1.79%	13.08%	46.67%	36.15%
KS2	The subscription parking service meets my expectations as a user.	2.56%	1.54%	13.08%	42.31%	40.51%
KS3	I am satisfied because the subscription parking service will be more beneficial for me when traveling to my destination.	2.31%	1.79%	12.56%	42.82%	40.51%
KS4	I am satisfied because the subscription parking service will be more beneficial for me, who frequently travels by private vehicle.	1.79%	1.54%	10.77%	45.38%	40.51%

Table 11 shows that user satisfaction with subscription parking services in Medan City was very high, with all indicators receiving agreement levels of $\geq 82\%$. Statement KS4, which states that subscription parking is beneficial for frequent travelers, received the highest level of agreement (85.89%). This indicates that the efficiency and long-term benefits of the service are highly perceived by active private vehicle users, consistent with Expectancy-Disconfirmation Theory, which states that satisfaction arises when perceived benefits meet or exceed expectations (Oliver). Statements KS3 and KS2, concerning benefits during travel (83.33%) and service performance relative to expectations (82.82%), respectively, also reflect strong satisfaction with the convenience and performance of the service. Meanwhile, statement KS1, concerning the cost-benefit ratio, received a high level of agreement (82.82%) but a lower proportion of strong agreement, indicating that a small proportion of users still consider economic aspects important (Gao & Liu, 2026; Vijay, 2025). Overall, these findings confirm that utility value, service suitability, and time efficiency are important determinants of satisfaction with subscription-based public services.

The usage behavior variable describes respondents' actual actions in using subscription parking services, including frequency of use, continuity of use, and the tendency to continue choosing the service in the future. An analysis of the distribution of respondents' responses to this variable was conducted to determine the extent to which subscription parking services have been accepted and sustainably utilized by the people of Medan City. The distribution of respondents' responses to the usage behavior variable is presented in the table 12.

Table 12*Distribution of questionnaire responses to usage behavior*

Code	Statement	Percentage (%)				
		Strongly disagree	Do Not agree	Disagree Less	Agree	Strongly agree
PP1	I will continue to choose subscription parking because it's more convenient than conventional parking.	1.28%	0.77%	9.23%	48.46%	40.26%
PP2	I will continue to use subscription parking for my parking needs long-term.	0.77%	1.03%	6.92%	44.62%	46.67%
PP3	I use subscription parking regularly when I'm out and about in Medan.	1.28%	0.77%	11.03%	42.82%	44.10%
PP4	I will continue to use subscription parking because the payment system is more convenient.	0.77%	0.77%	9.23%	45.90%	43.33%

Table 12 shows that subscription parking usage behavior in Medan City is well established, as reflected by high levels of agreement ($\geq 86\%$) across all four indicators. Statement PP2, concerning the intention to use the service in the long term, recorded the highest level of agreement (91.29%) and reflects continued commitment, consistent with the Theory of Planned Behavior, which emphasizes the role of behavioral intention in shaping actual behavior (Ajzen, 2020; Zhao et al., 2025). PP4, concerning the convenience of the payment system, also received strong support (89.23%), indicating that technological convenience plays an important role in maintaining service usage. Meanwhile, PP3 indicated that the service has become part of respondents' routines (86.92%), suggesting stable actual usage behavior. Although PP1 also recorded high agreement (88.72%), the proportion of respondents who strongly agreed was relatively lower, suggesting that some practical aspects of the service may still require improvement. Overall, these results reinforce the view that usage behavior is driven not only by intention but also by positive experiences and perceived ease of use, consistent with TPB and research on consumer behavior in public services.

Hypothesis testing was conducted using the bootstrapping method in the SmartPLS 4 application to determine the direct and indirect effects among the research variables. A hypothesis was considered supported if it had a t-statistic value > 1.96 and a p-value < 0.05 .

Table 13*Hypothesis Testing Results*

Influence of Variables	Original sample (O)	T statistics	P values	Significance level	Information
Service quality -> Satisfaction	0.757	16.422	0.000	Significant	Accepted
Service quality -> Attitude	0.224	3.159	0.002	Significant	Accepted
Satisfaction -> Attitude	0.455	6.230	0.000	Significant	Accepted
Attitude -> Usage behavior	0.748	16.946	0.000	Significant	Accepted
Subjective norm -> Usage behavior	0.218	4.246	0.000	Significant	Accepted
Behavioral control -> Usage behavior	-0.024	1.023	0.306	Not significant	Not Accepted
Service quality -> Satisfaction -> Attitude	0.344	5.556	0.000	Significant	Accepted
Service quality -> Attitude -> Usage behavior	0.168	2.998	0.003	Significant	Accepted

Influence of Variables	Original sample (O)	T statistics	P values	Significance level	Information
Satisfaction -> Attitude -> Usage behavior	0.340	5.444	0.000	Significant	Accepted
Service quality -> Satisfaction -> Attitude -> Usage behavior	0.258	4.961	0.000	Significant	Accepted

The test results show that service quality is the primary determinant of user satisfaction ($\beta = 0.757$; $p < 0.001$). This finding indicates that improving the quality of facilities, security, ease of access, and staff service can significantly increase the satisfaction of subscription parking users. These results support the SERVQUAL concept proposed by Parasuraman et al. (1988) and Ros and Mok (2026) are consistent with Expectancy-Confirmation Theory, which explains that customer satisfaction is formed when service performance meets or exceeds user expectations.

In addition to increasing satisfaction, service quality was also shown to positively influence user attitudes ($\beta = 0.224$; $p = 0.002$). This indicates that perceptions of service quality can shape positive public evaluations of the subscription parking program. Furthermore, user satisfaction positively influenced attitudes ($\beta = 0.455$; $p < 0.001$), indicating that a satisfactory service experience strengthens users' confidence in and acceptance of the subscription parking policy. These findings align with Kotler and Keller (2016) and Jokar et al. (2023) who explained that satisfaction contributes to the formation of positive attitudes toward a service.

In the behavioral model, attitude was the factor with the greatest influence on subscription parking usage behavior ($\beta = 0.748$; $p < 0.001$). These results indicate that the more positive users' perceptions of the benefits of subscription parking are, the greater their likelihood of continuing to use the service. Conversely, perceived behavioral control did not significantly influence usage behavior ($\beta = -0.024$; $p = 0.306$). These findings indicate that perceptions of ease of use and financial ability were not significant factors differentiating respondents' decisions to use subscription parking services. Most respondents felt capable of accessing and utilizing the service, resulting in relatively little variation in perceived behavioral control.

The mediation effect test indicated that satisfaction mediated the relationship between service quality and attitude ($\beta = 0.344$; $p < 0.001$). Furthermore, attitude mediated the effects of service quality on usage behavior ($\beta = 0.168$; $p = 0.003$) and satisfaction on usage behavior ($\beta = 0.340$; $p < 0.001$). Further serial mediation testing demonstrated that service quality positively influenced usage behavior through a chain of satisfaction and attitude ($\beta = 0.258$; $p < 0.001$). These results indicate that service quality influences usage behavior through an indirect mechanism in which improved service quality first increases user satisfaction, which then contributes to a more positive attitude and ultimately encourages continued use of subscription parking.

CONCLUSION

This study demonstrates that subscription parking users in Medan City generally have positive perceptions of the service, particularly regarding convenience, cost efficiency, facilities, staff service, and security. The empirical results show that service quality is the primary determinant of user satisfaction and also contributes to the formation of positive attitudes. Attitude is the strongest direct predictor of subscription parking usage behavior, while subjective norms also have a significant positive effect. In contrast, perceived behavioral control does not significantly influence usage behavior. The mediation analysis further demonstrates that service quality influences usage behavior through satisfaction and attitude, confirming a sequential mechanism in which improved service quality increases satisfaction, satisfaction strengthens positive attitudes, and positive attitudes encourage continued use. Theoretically, this study contributes to the Theory of Planned Behavior by extending its application through the integration of service quality and user satisfaction, thereby providing a more comprehensive explanation of behavioral responses to public-sector subscription parking services.

From a practical perspective, the findings indicate that the sustainability of subscription parking requires continuous improvement in service quality, particularly through adequate parking facilities, equitable distribution of parking locations, vehicle security, and professional

service from parking attendants. These improvements should be supported by coordinated implementation among the Medan City Government, the Transportation Agency, and parking operators. Nevertheless, this study is limited by its cross-sectional design, purposive sampling, and focus on subscription parking users in Medan City, which may limit the generalizability of the findings to other regions and non-users. Future research should employ longitudinal or comparative designs, involve broader populations and different cities, and incorporate additional behavioral and contextual factors to further explain subscription parking adoption and continued usage.

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AUTHOR CONTRIBUTION STATEMENT

Irhamsyah Pulungan: Conceptualization, methodology, data collection, data analysis, investigation, and writing original draft. Hartoyo: supervision, methodology, and validation. Popong Nurhayati: supervision, validation, and interpretation of results. All authors contributed to the revision of the manuscript and approved the final version for publication.

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