

Understanding Customer Recommendation Intentions in Human-AI Collaborative Smart Vending Services Through Perceived Satisfaction

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Abstract

This study aims to examine the mediating role of perceived satisfaction in the relationship between service quality and willingness to recommend in the context of a custom phone case vending machine. Despite the growing adoption of automated retail technologies, limited empirical studies have explored customer behavior in personalized vending services, particularly in emerging markets. Addressing this gap, the study employed a descriptive-correlational research design with 319 respondents from selected shopping malls (Robinsons Galleria, SM Fairview, and SM Aura). Data were analyzed using weighted mean, regression analysis, and Sobel test to assess both direct and indirect relationships among variables. The findings indicate that respondents reported high perceptions across all SERVQUAL dimensions (reliability, assurance, tangibles, empathy, and responsiveness), suggesting strong overall service performance. Perceived satisfaction ($M = 4.36$) and willingness to recommend ($M = 4.38$) were also rated highly, indicating positive customer evaluations and advocacy intentions. Mediation analysis revealed that perceived satisfaction partially mediates the relationship between service quality and willingness to recommend. This suggests that while service quality directly influences recommendation behavior, it also exerts an indirect effect through enhanced customer satisfaction. This study contributes to the extension of service quality and customer behavior models in automated retail contexts by demonstrating both direct and mediated effects of service quality on recommendation intention. Practically, the findings highlight the importance of maintaining high service standards and optimizing customer experience in vending-based retail systems to strengthen satisfaction and encourage positive word-of-mouth.

Keywords: Service Quality, Perceived Satisfaction, Willingness to Recommend, Vending Machine, Mediation Effect

1. Introduction

Technological advancement has fundamentally transformed the landscape of modern retail, reshaping how businesses deliver value and how consumers interact with products and services. In recent years, the integration of automation into retail systems has given rise to innovative service formats, particularly automated vending machines that offer efficiency, speed, and round-the-clock accessibility. The global fully automated vending machine market is projected to reach USD 89.27 billion by 2030, driven by increasing consumer demand for convenience-oriented solutions [1]. This shift reflects a broader transition toward self-service technologies, where customers expect seamless, fast, and reliable service encounters without direct human interaction.

Parallel to this technological evolution is the growing demand for personalized products, especially in consumer electronics accessories such as phone cases. Originally designed for protection, phone cases have evolved into tools for self-expression, allowing consumers to customize designs according to personal preferences. This convergence of automation and personalization has led to the emergence of custom phone case vending machines, which represent a hybrid retail model combining self-service technology with product customization. Such systems introduce a new dimension of customer experience, where both technological performance and perceived service quality influence user satisfaction.

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In the field of marketing and service management, customer satisfaction has long been recognized as a central determinant of business success. It plays a critical role in shaping customer loyalty and behavioral intentions, particularly the willingness to recommend products or services to others [2]. Satisfied customers are more likely to engage in positive word-of-mouth communication, which is considered one of the most influential forms of informal marketing [3]. Consequently, understanding the factors that drive customer satisfaction remains a key priority for businesses aiming to sustain competitive advantage.

A substantial body of literature has established that service quality is a primary antecedent of customer satisfaction. The SERVQUAL model, which encompasses dimensions such as reliability, assurance, tangibles, empathy, and responsiveness, has been widely used to evaluate service performance across various industries [4]. Empirical studies have consistently demonstrated that higher levels of perceived service quality lead to increased customer satisfaction and favorable behavioral outcomes, including repurchase intention and willingness to recommend [5], [6]. These findings highlight the importance of delivering consistent and high-quality service experiences to influence customer perceptions and behaviors.

However, most existing studies on service quality, satisfaction, and behavioral intentions have been conducted in traditional service environments such as hospitality, healthcare, and online platforms [7], [8]. Limited research has explored these relationships within the context of automated retail systems, particularly those involving self-service technologies and minimal human interaction. In such environments, the absence of direct employee-customer interaction may alter how customers perceive service quality and evaluate their overall experience. This suggests that established theoretical models may not fully capture customer behavior in automated service settings.

Furthermore, while prior studies have examined the direct relationships among service quality, satisfaction, and behavioral intentions, fewer studies have investigated the mediating mechanisms that explain how these variables interact in emerging retail contexts. Customer satisfaction is often conceptualized as a mediating variable that links service quality to behavioral outcomes, such as willingness to recommend [9], [10]. However, empirical evidence on this mediating role remains limited in the context of automated and personalized vending systems. This gap highlights the need for further investigation into whether satisfaction functions similarly in technology-driven retail environments.

In response to these gaps, this study aims to examine the mediating effect of perceived satisfaction on the relationship between service quality and willingness to recommend in the context of custom phone case vending machines. Specifically, this study seeks to determine whether service quality directly influences recommendation behavior and whether this relationship is partially or fully mediated by perceived satisfaction. By addressing these research questions, the study contributes to the extension of service quality and customer behavior theories in automated retail settings while providing practical insights for businesses seeking to optimize customer experience and enhance recommendation behavior in vending-based services [11], [12], [13].

2. Literature Review and Hypothesis Development

2.1. Service Quality and Perceived Satisfaction

Service quality has been widely recognized as a fundamental determinant of customer satisfaction across various service contexts. The SERVQUAL framework, which evaluates service performance through dimensions such as reliability, assurance, tangibles, empathy, and responsiveness, provides a comprehensive basis for understanding how customers form satisfaction judgments [4]. Prior studies consistently demonstrate that when customers perceive services as reliable and responsive, their overall satisfaction increases significantly [14]. This relationship is further reinforced by findings that emphasize the role of assurance and empathy in shaping positive emotional responses toward service encounters [15].

Moreover, empirical evidence suggests that not all service quality dimensions exert equal influence on satisfaction. For instance, responsiveness has been identified as a particularly strong predictor, as timely and helpful service delivery directly enhances customer experience [16]. Similarly, dependable and consistent service performance contributes to trust formation, which in turn strengthens satisfaction levels [17]. These findings indicate that service quality operates as a multidimensional construct that collectively influences customer evaluations.

However, while the positive relationship between service quality and satisfaction is well established in traditional service environments, its applicability in automated and self-service contexts remains less explored. In vending machine settings, where human interaction is minimal, customers may evaluate service quality differently, relying more on system performance, usability, and reliability. This suggests the need to re-examine the service quality–satisfaction relationship within technology-driven retail environments. Based on these arguments, the following hypothesis is proposed:

H1: Service quality has a significant positive effect on perceived satisfaction.

2.2. Perceived Satisfaction and Willingness to Recommend

Customer satisfaction plays a crucial role in shaping behavioral intentions, particularly the willingness to recommend a product or service to others. It is widely accepted that satisfied customers are more likely to engage in positive word-of-mouth communication, which serves as an important driver of business growth [3]. Empirical studies across different sectors, including education and healthcare, consistently show that higher satisfaction levels lead to stronger recommendation intentions [18], [19].

Furthermore, satisfaction reflects customers' overall evaluation of their service experience, which influences their likelihood of endorsing the service to others. When expectations are met or exceeded, customers tend to develop favorable attitudes that translate into advocacy behavior [20]. This is particularly relevant in experience-based services, where customer perceptions play a critical role in shaping future behavioral outcomes.

In addition, studies conducted in emerging markets highlight that satisfied customers actively share their experiences within their social networks, thereby amplifying the impact of word-of-mouth communication [21], [22]. This indicates that satisfaction not only affects individual behavior but also contributes to broader market influence through recommendations.

Despite these findings, limited research has examined this relationship in automated retail contexts, where customer interaction is primarily technology-mediated. This raises questions about whether satisfaction derived from machine-based services translates similarly into recommendation behavior. Thus, the following hypothesis is proposed:

H2: Perceived satisfaction has a significant positive effect on willingness to recommend.

2.3. Service Quality and Willingness to Recommend

Beyond its indirect effect through satisfaction, service quality has also been found to directly influence customers' willingness to recommend. High-quality service creates favorable impressions that encourage customers to promote the service to others, even without the mediating role of satisfaction [5]. Studies have shown that key dimensions such as reliability and assurance significantly enhance customers' confidence in a service, leading to stronger recommendation intentions [23].

Additionally, responsiveness and service efficiency have been identified as critical factors that directly shape customers' advocacy behavior. When customers perceive that a service provider delivers prompt and effective solutions, they are more inclined to recommend the service based on their positive experience [24]. Consistency in service delivery further reinforces this relationship by building trust and reducing perceived risk [25].

However, the direct effect of service quality on willingness to recommend may vary depending on the service context. In automated systems, where interactions are primarily technology-based, customers may place greater emphasis on functional performance rather than interpersonal service attributes. This suggests that the strength of the direct relationship may differ from traditional service settings. Therefore, the following hypothesis is proposed:

H3: Service quality has a significant positive effect on willingness to recommend.

2.4. Perceived Satisfaction as a Mediator Between Service Quality and Willingness to Recommend

Customer satisfaction is often conceptualized as a key mediating variable that explains how service quality influences behavioral intentions. Theoretical and empirical studies suggest that service quality enhances satisfaction, which in turn drives outcomes such as loyalty, repurchase intention, and willingness to recommend [9]. This mediating

mechanism highlights the role of satisfaction as an emotional and cognitive evaluation that translates service experiences into behavioral responses.

Empirical evidence supports the mediating role of satisfaction in various service industries. For instance, satisfaction has been found to partially or fully mediate the relationship between service quality and behavioral intentions, depending on the context [10]. In many cases, service quality influences recommendation behavior both directly and indirectly through satisfaction, indicating a partial mediation effect [26]. This suggests that while satisfaction is an important pathway, service quality may also exert an independent influence on customer behavior.

However, the mediating role of satisfaction has not been extensively examined in automated and personalized retail environments, such as custom vending machines. Given the unique nature of these systems, where customer experience is shaped by both technology and service attributes, it is important to investigate whether satisfaction functions as a mediator in the same way as in traditional services. Accordingly, the following hypothesis is proposed:

H4: Perceived satisfaction mediates the relationship between service quality and willingness to recommend.

Figure 1 illustrates the conceptual framework of the study, highlighting the relationships among service quality, perceived satisfaction, and willingness to recommend. Service quality, represented by its five dimensions, namely reliability, assurance, tangibles, empathy, and responsiveness, is proposed to have both a direct and indirect influence on willingness to recommend. Specifically, service quality is hypothesized to directly affect willingness to recommend (H3) and indirectly influence it through perceived satisfaction as a mediating variable (H4). Additionally, service quality is expected to significantly impact perceived satisfaction (H1), which in turn affects willingness to recommend (H2). This framework emphasizes the dual pathway through which service quality shapes customer behavioral intentions, both through cognitive evaluation and emotional response.

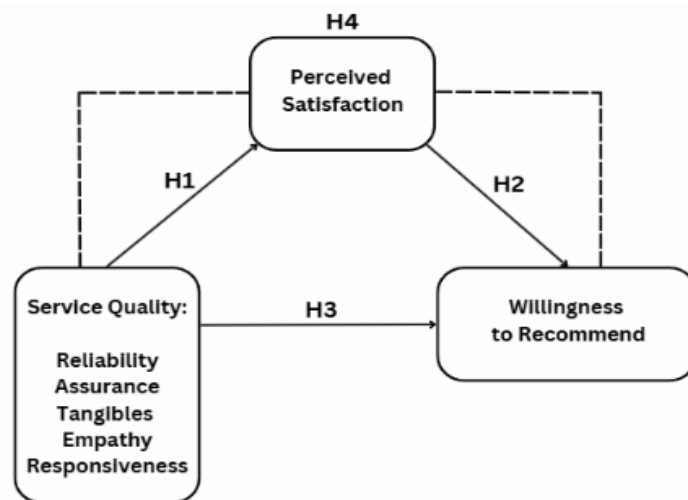


Figure 1. Research Paradigm

3. Methodology

This study employed a descriptive correlational research design to examine the relationships among service quality, perceived satisfaction, and willingness to recommend in the context of a custom phone case vending machine. This design was selected because it enables the investigation of naturally occurring relationships among variables without experimental manipulation, making it suitable for real-world service environments.

The descriptive component of the design allows for a systematic assessment of respondents' perceptions regarding service quality, satisfaction, and recommendation behavior. It provides a comprehensive overview of how customers evaluate the performance of automated vending services. At the same time, the correlational component enables the analysis of the direction and strength of relationships among the study variables.

This approach is particularly relevant for testing theoretical models that involve multiple interrelated constructs. In this study, it supports the examination of both direct and indirect relationships among service quality, perceived satisfaction, and willingness to recommend. This is essential for validating the mediating role of perceived satisfaction within the proposed framework. Furthermore, the use of a non experimental design ensures that the study reflects actual customer experiences in a natural setting. This enhances the ecological validity of the findings, as respondents evaluate the service based on real interactions rather than simulated scenarios. Overall, the chosen research design provides a robust methodological foundation for addressing the research objectives. It allows for empirical testing of the conceptual model while maintaining relevance to practical service contexts.

3.1. Participants and Sampling

The study involved 319 respondents who had prior experience using the Custom Phone Case Vending Machine located in three major shopping malls, namely SM Aura, SM Fairview, and Robinsons Galleria. These locations were selected due to their high customer traffic and accessibility, increasing the likelihood of obtaining respondents with relevant service experience. A non probability convenience sampling technique was employed to recruit participants. This method was chosen due to practical considerations, including time constraints and the need to target respondents who had directly interacted with the vending machine. By focusing on actual users, the study ensures that responses are based on firsthand experience rather than assumptions.

The sample size of 319 respondents is considered adequate for conducting regression and mediation analysis. A larger sample size improves the reliability of statistical estimates and enhances the stability of the results. It also provides sufficient statistical power to detect significant relationships among variables. However, it is important to acknowledge the limitations associated with convenience sampling. This approach may introduce sampling bias, as respondents are not randomly selected and may not fully represent the broader population. As a result, the generalizability of the findings may be limited to similar contexts or user groups. Despite these limitations, the sampling approach is appropriate for exploratory and applied research in emerging service contexts. It allows for efficient data collection while providing valuable insights into customer perceptions and behavior in automated retail environments.

3.2. Research Instrument

The study utilized a structured questionnaire to collect data on service quality, perceived satisfaction, and willingness to recommend. The instrument was designed to capture respondents' perceptions and evaluations of their experience with the vending machine service. Service quality was measured using five key dimensions: reliability, assurance, tangibles, empathy, and responsiveness. These dimensions reflect different aspects of service performance, including consistency, trustworthiness, physical appearance, customer orientation, and responsiveness to customer needs. Together, they provide a comprehensive assessment of service quality in an automated setting.

Perceived satisfaction was measured as an overall evaluation of the customer's experience, capturing both cognitive and emotional responses. This construct reflects the extent to which customer expectations are met or exceeded during the service encounter. Willingness to recommend was measured as a behavioral intention, indicating the likelihood that customers would promote the service to others. All measurement items were assessed using a 5 point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scaling method allows for the quantification of subjective perceptions and facilitates statistical analysis. The questionnaire was carefully structured to ensure clarity, coherence, and ease of response. Questions were arranged logically to guide respondents through the survey, reducing confusion and minimizing response bias. This contributes to the overall quality and reliability of the collected data.

3.3. Measurement Model

The measurement model defines how each construct in the study is operationalized and measured. In this study, service quality is treated as a multidimensional construct composed of five indicators, while perceived satisfaction and willingness to recommend are treated as unidimensional constructs. The operational definitions of the variables and their corresponding indicators are presented in [table 1](#). This table provides a clear mapping between theoretical constructs and empirical measurements, ensuring that each variable is properly defined and measurable.

The use of clearly defined indicators enhances the validity of the study by ensuring that each construct accurately reflects the concept it is intended to measure. It also facilitates the interpretation of results by linking statistical findings

to specific dimensions of service quality and customer experience. Furthermore, the measurement model supports the testing of relationships among variables by providing a structured framework for analysis. It ensures consistency in measurement across respondents and enables meaningful comparisons of responses.

Table 1. Operational Definition of Variables

Variable	Definition	Indicators	Scale
Service Quality	Customer perception of service performance in automated retail	Reliability, Assurance, Tangibles, Empathy, Responsiveness	Likert 1–5
Perceived Satisfaction	Overall evaluation of customer experience after using the service	Satisfaction, expectations met, service evaluation	Likert 1–5
Willingness to Recommend	Customer intention to recommend the service to others	Referral intention, positive word of mouth	Likert 1–5

3.4. Validity and Reliability

The validity of the research instrument was ensured through alignment with established theoretical constructs and measurement frameworks. Content validity was achieved by ensuring that all questionnaire items accurately represent the constructs being measured. Construct validity was assessed through internal consistency and coherence among measurement items. This ensures that items within each construct are related and collectively measure the same underlying concept.

Reliability analysis was conducted using Cronbach’s alpha to evaluate the internal consistency of the instrument. The results of the reliability analysis are presented in [table 2](#), which shows that all variables achieved acceptable to excellent levels of reliability. The Cronbach’s alpha values ranged from 0.72 to 0.96, indicating that the measurement items are consistent and reliable. These values exceed commonly accepted thresholds, confirming the robustness of the instrument. The overall Cronbach’s alpha value of 0.970 further supports the reliability of the questionnaire, demonstrating that the instrument provides stable and consistent measurements across respondents.

Table 2. Reliability of the Results

Variable	Cronbach’s Alpha	Interpretation
Reliability	0.83	Good
Assurance	0.81	Good
Tangibles	0.72	Acceptable
Empathy	0.86	Good
Responsiveness	0.82	Good
Perceived Satisfaction	0.94	Excellent
Willingness to Recommend	0.96	Excellent

3.5. Data Collection Procedure

Data collection was conducted over a one week period from September 22 to September 29, 2025. A hybrid data collection approach was implemented to maximize the number of respondents and ensure diversity in responses.

The face to face data collection method involved approaching respondents immediately after they used the vending machine. This approach allows for the capture of real time evaluations, reducing recall bias and improving the accuracy of responses.

In addition, an online survey was distributed through digital platforms to reach respondents who had previously used the vending machine. This method provides flexibility and increases accessibility for participants.

Participation in the study was voluntary, and respondents were informed about the purpose of the research. Anonymity was maintained to ensure confidentiality and encourage honest responses.

The combination of data collection methods enhances the reliability of the data by capturing both immediate and reflective customer experiences.

3.6. Data Analysis Techniques

The data analysis process involved both descriptive and inferential statistical techniques. Descriptive statistics were used to summarize respondents' perceptions and identify general trends in the data. The weighted mean was used to determine the level of agreement for each measurement item.

$$\bar{X} = \frac{\sum fx}{N} \tag{1}$$

Regression analysis was conducted to examine the relationships among variables and to test the proposed hypotheses. This method allows for the estimation of the effect of independent variables on dependent variables.

$$Y = \beta_0 + \beta_1 X + \varepsilon \tag{2}$$

Furthermore, mediation analysis was performed using the Sobel test to evaluate whether perceived satisfaction significantly mediates the relationship between service quality and willingness to recommend.

$$Z = \frac{a \times b}{\sqrt{b^2 s_a^2 + a^2 s_b^2}} \tag{3}$$

These analytical techniques provide a comprehensive framework for examining both direct and indirect relationships among variables, ensuring that the research objectives are thoroughly addressed.

4. Results and Discussion

4.1. Results

The demographic profile of the respondents is presented in Table 3, which summarizes the distribution of participants according to gender. As shown in the table, male respondents comprised the largest proportion of the sample, accounting for 150 individuals or 47.02% of the total respondents. This is closely followed by female respondents, who represented 141 individuals or 44.20%. The relatively small difference between male and female respondents suggests that the usage of the custom phone case vending machine is not heavily skewed toward a specific gender, indicating a relatively balanced appeal across male and female users.

In addition, a smaller segment of respondents identified as LGBTQ+, comprising 23 individuals or 7.10% of the sample. This indicates that the service is also utilized by a diverse group of users beyond traditional gender categories. Meanwhile, only 5 respondents, representing 1.57% of the total sample, preferred not to disclose their gender. The low percentage of non-disclosure suggests that most respondents were comfortable providing demographic information, which enhances the reliability of the dataset.

Overall, the gender distribution presented in table 3 reflects a diverse and relatively balanced user base. This suggests that the custom phone case vending machine has broad market appeal across different gender groups. Such diversity is particularly important in the context of personalized products, where consumer preferences may vary. The findings imply that the service is not limited to a specific demographic segment, thereby increasing its potential for wider market penetration.

Table 3. Frequency and Percentage Distribution of Respondents by Gender

Gender	Frequency	Percentage
Male	150	47.02%
Female	141	44.20%

LGBTQ+	23	7.10%
Prefer not to say	5	1.57%
Total	319	100%

The level of agreement on the service quality dimensions is presented in tables 4 to 8, providing a comprehensive assessment of how respondents perceive different aspects of service performance. These dimensions reflect key attributes of service quality that influence customer evaluation, particularly in an automated retail context.

As shown in Table 4, the reliability dimension recorded a grand weighted mean of 4.30, indicating that respondents generally agree that the vending machine performs its functions dependably and consistently. Among the indicators, “dependable service” obtained the highest mean score of 4.33, suggesting that customers perceive the machine as reliable in delivering its core function. This is followed closely by “timely service delivery” with a mean of 4.32, indicating that the system meets customer expectations in terms of promptness and efficiency.

Meanwhile, “accurate records” received a slightly lower mean score of 4.26, although it still falls within the “Agree” range. This suggests that while respondents are generally satisfied with the system’s accuracy, there may be minor areas for improvement in ensuring consistent and error-free transactions. The relatively small variation among the indicators indicates that all aspects of reliability are perceived positively and consistently by users.

Overall, the findings imply that reliability is a strong attribute of the custom phone case vending machine. The high level of agreement across all indicators suggests that customers trust the system to deliver its services accurately and consistently. This is particularly important in automated services, where reliability serves as a critical determinant of user confidence and overall satisfaction.

Table 4. Reliability

Indicator	Weighted Mean	Interpretation
Dependable service	4.33	Agree
Timely service delivery	4.32	Agree
Accurate records	4.26	Agree
Grand Mean	4.30	Agree

As presented in table 5, the assurance dimension obtained a grand weighted mean of 4.31, indicating that respondents generally agree that the vending machine provides a secure and trustworthy service experience. This suggests that users feel confident when interacting with the system, which is essential in automated retail environments where direct human interaction is minimal.

Among the indicators, “reliable system support” recorded the highest mean score of 4.35, highlighting that respondents perceive the vending machine as well-maintained and capable of operating smoothly without disruptions. This reflects strong confidence in the system’s technical reliability and backend support. Meanwhile, “polite service” achieved a mean score of 4.32, suggesting that the overall service interaction, despite being automated, is perceived as user-friendly and respectful in its interface and communication.

On the other hand, “safe transactions” obtained a slightly lower mean score of 4.29, although it still falls within the “Agree” category. This indicates that while respondents generally feel secure when using the machine, there may be minor concerns or uncertainties related to transaction safety or payment processes. The relatively small variation among the indicators demonstrates that all aspects of assurance are consistently rated positively.

Overall, the findings imply that assurance is a strong component of service quality in the custom phone case vending machine. The high level of agreement suggests that customers trust the system in terms of security, reliability, and operational performance. This is particularly important in technology driven services, where customer confidence in system safety and functionality directly influences satisfaction and continued usage.

Table 5. Assurance

Indicator	Weighted Mean	Interpretation
Safe transactions	4.29	Agree
Polite service	4.32	Agree
Reliable system support	4.35	Agree
Grand Mean	4.31	Agree

As presented in [table 6](#), the tangibles dimension recorded the highest grand weighted mean of 4.36 among all service quality dimensions, indicating that respondents strongly agree on the importance of the physical and visual aspects of the vending machine. This finding suggests that the aesthetic appeal and modern design of the machine play a significant role in shaping customer perceptions and overall service evaluation.

Among the indicators, “visual appeal” obtained the highest mean score of 4.37, highlighting that respondents are particularly influenced by the attractiveness and design of the vending machine. This implies that customers are drawn to visually engaging and well-designed systems, which enhance their overall experience. Both “up-to-date equipment” and “appearance consistency” recorded mean scores of 4.36, indicating that respondents perceive the machine as modern and aligned with the type of service it provides.

The consistency of scores across all indicators suggests that the tangible elements of the service are uniformly perceived as strong and well-executed. This reflects the importance of physical evidence in automated retail environments, where customers rely heavily on visual cues to evaluate service quality in the absence of direct human interaction.

Overall, the findings indicate that tangibles are the most prominent dimension influencing customer perception in this study. The high ratings across all indicators suggest that the vending machine successfully delivers a visually appealing and technologically modern experience. This emphasizes the critical role of design, aesthetics, and equipment quality in enhancing user satisfaction and encouraging continued usage in automated service settings.

Table 6. Tangibles

Indicator	Weighted Mean	Interpretation
Up-to-date equipment	4.36	Agree
Visual appeal	4.37	Agree
Appearance consistency	4.36	Agree
Grand Mean	4.36	Agree

As presented in [table 7](#), the empathy dimension achieved a grand weighted mean of 4.33, indicating that respondents generally perceive the service as attentive and responsive to their needs, despite being delivered through an automated system. This finding is particularly noteworthy, as empathy is traditionally associated with human interaction, yet the results suggest that the vending machine is able to simulate a customer-oriented experience through its design and functionality.

Among the indicators, “effective communication” recorded the highest mean score of 4.36, suggesting that the system interface is clear, user-friendly, and capable of guiding customers throughout the service process. This highlights the importance of interface design in conveying a sense of interaction and support in automated environments. Similarly, “understanding customer needs” obtained a mean score of 4.34, indicating that respondents perceive the service as aligned with their preferences, particularly in terms of customization features.

Meanwhile, “convenient operating hours” received a mean score of 4.32, reflecting the advantage of accessibility and flexibility offered by the vending machine. On the other hand, “customer interest consideration” recorded the lowest mean score of 4.29, although it still falls within the “Agree” category. This suggests that while the system is generally perceived as customer-oriented, there may be opportunities to further enhance personalization and responsiveness to individual user needs.

Overall, the findings imply that empathy, even in an automated service context, can be effectively conveyed through system design, communication, and functionality. The consistently high ratings across all indicators demonstrate that the vending machine is capable of delivering a user-centered experience. This underscores the importance of integrating human-like elements into automated services to enhance customer perception and satisfaction.

Table 7. Empathy

Indicator	Weighted Mean	Interpretation
Convenient operating hours	4.32	Agree
Customer interest consideration	4.29	Agree
Effective communication	4.36	Agree
Understanding customer needs	4.34	Agree
Grand Mean	4.33	Agree

As shown in [table 8](#), the responsiveness dimension obtained a grand weighted mean of 4.32, indicating that respondents generally perceive the service as prompt and efficient in addressing customer needs. This suggests that the vending machine performs well in delivering timely service, which is a critical factor in automated retail environments where speed and convenience are key expectations.

Among the indicators, “prompt service” recorded the highest mean score of 4.35, highlighting that customers value the system’s ability to deliver services quickly and without unnecessary delays. This reflects the effectiveness of the vending machine in meeting customer expectations for immediate service. Similarly, “customer updates” achieved a mean score of 4.34, suggesting that respondents appreciate being informed about the service process, which enhances transparency and user confidence.

Meanwhile, “willingness to help” obtained a mean score of 4.32, indicating that the system is perceived as supportive, likely through clear instructions and user guidance embedded within the interface. On the other hand, “quick response” recorded the lowest mean score of 4.29, although it still falls within the “Agree” category. This may suggest minor delays or inconsistencies in system responsiveness that could be further optimized to improve the overall user experience.

Overall, the findings indicate that responsiveness is a strong dimension of service quality in the custom phone case vending machine. The consistently high ratings across all indicators demonstrate that the system is capable of delivering efficient and timely service. This reinforces the importance of speed, system feedback, and operational efficiency in shaping positive customer perceptions in technology-driven service environments.

Table 8. Responsiveness

Indicator	Weighted Mean	Interpretation
Prompt service	4.35	Agree
Willingness to help	4.32	Agree
Quick response	4.29	Agree
Customer updates	4.34	Agree
Grand Mean	4.32	Agree

Customer behavioral intention and perceived satisfaction are presented in [tables 9](#) and [10](#), providing insight into how customers respond to their overall service experience. As shown in [table 9](#), willingness to recommend achieved a high grand weighted mean of 4.38, indicating that respondents generally have a strong intention to promote the custom phone case vending machine to others. This reflects a high level of customer advocacy, which is often associated with positive service experiences and satisfaction.

Among the indicators, three items, namely “encourage others,” “confidence in recommendation,” and “promote service,” each obtained the highest mean score of 4.39. This suggests that respondents not only have a favorable perception of the service but also actively express their willingness to endorse it to friends and family. Such strong endorsement behavior indicates that the service has successfully created a positive impression that extends beyond individual usage to social influence.

Meanwhile, “likelihood to recommend” recorded a slightly lower mean score of 4.36, although it still falls within the “Agree” category. This slight variation suggests that while respondents generally intend to recommend the service, their level of certainty may vary depending on situational factors such as specific user experiences or preferences. Nevertheless, the consistently high scores across all indicators demonstrate a strong and stable intention to recommend.

Overall, the findings indicate that willingness to recommend is a highly rated outcome variable in this study. The strong agreement across all indicators suggests that the custom phone case vending machine has effectively generated positive customer experiences that translate into advocacy behavior. This highlights the importance of delivering high-quality service, as satisfied customers are more likely to engage in positive word-of-mouth and contribute to business growth.

Table 9. Willingness to Recommend

Indicator	Weighted Mean	Interpretation
Encourage others	4.39	Agree
Confidence in recommendation	4.39	Agree
Likelihood to recommend	4.36	Agree
Promote service	4.39	Agree
Grand Mean	4.38	Agree

Similarly, [table 10](#) presents the results for perceived satisfaction, which recorded a high grand weighted mean of 4.36. This indicates that respondents are generally satisfied with their overall experience when using the custom phone case vending machine. The consistently high ratings across all indicators suggest that the service is effective in meeting customer expectations and delivering a positive user experience.

Among the indicators, “overall satisfaction” obtained the highest mean score of 4.38, indicating that respondents have a favorable holistic evaluation of the service. This suggests that the vending machine successfully delivers value in terms of both functionality and user experience. Meanwhile, both “design satisfaction” and “product quality” recorded mean scores of 4.36, reflecting that customers are pleased with the customization features and the final output of the product.

In addition, “needs fulfillment” achieved a mean score of 4.35, indicating that the service is capable of addressing customer preferences and expectations. On the other hand, “error-free service” recorded the lowest mean score of 4.34, although it remains within the “Agree” category. This slight difference suggests that while the system is generally reliable, there may be minor operational issues or inconsistencies that could be further improved to enhance user satisfaction.

Overall, the findings indicate that perceived satisfaction is a strong construct in this study, with consistently high evaluations across all indicators. This reinforces the role of satisfaction as a key factor in shaping customer behavior, particularly in influencing willingness to recommend. The results also suggest that maintaining product quality, system reliability, and user experience is essential in sustaining high levels of customer satisfaction in automated retail services.

Table 10. Perceived Satisfaction

Indicator	Weighted Mean	Interpretation
Overall satisfaction	4.38	Agree
Design satisfaction	4.36	Agree
Product quality	4.36	Agree

Needs fulfillment	4.35	Agree
Error-free service	4.34	Agree
Grand Mean	4.36	Agree

4.2. Hypothesis Testing

The results of hypothesis testing are presented in table 11. Regression analysis was conducted to examine the direct relationships among service quality, perceived satisfaction, and willingness to recommend. In addition, mediation analysis was performed to assess the indirect effect of service quality on willingness to recommend through perceived satisfaction, as illustrated in figure 2.

As shown in table 11, service quality has a significant positive effect on perceived satisfaction (H1: $\beta = 0.778$, $p = 0.000$), indicating that higher levels of perceived service quality lead to increased customer satisfaction. This finding confirms that service performance plays a critical role in shaping customer evaluations in automated retail environments.

Table 11. Hypothesis Testing Results

Hypothesis	Path	Beta	t-value	p-value	Interpretation
H1	SQ → PS	0.778	17.621	0.000	Supported
H2	PS → WR	0.637	22.081	0.000	Supported
H3	SQ → WR	0.703	8.435	0.000	Supported
H4	SQ → PS → WR	Indirect Effect = 0.225	3.646	0.000	Supported (Partial Mediation)

Furthermore, perceived satisfaction was found to have a significant positive effect on willingness to recommend (H2: $\beta = 0.637$, $p = 0.000$). This suggests that satisfied customers are more likely to engage in positive word-of-mouth and recommend the service to others. This highlights the importance of satisfaction as a key driver of customer advocacy.

The direct relationship between service quality and willingness to recommend was also found to be significant (H3: $\beta = 0.703$, $p = 0.000$). This indicates that service quality not only influences recommendation behavior indirectly through satisfaction but also exerts a direct effect on customer intention to recommend. This finding suggests that certain aspects of service quality, such as reliability and system performance, may independently encourage customers to promote the service.

The mediation analysis further reveals that perceived satisfaction partially mediates the relationship between service quality and willingness to recommend (H4: indirect effect = 0.225, $t = 3.646$, $p = 0.000$). As illustrated in Figure 2, the indirect path from service quality to willingness to recommend through perceived satisfaction (Path A × Path B) is statistically significant. However, the direct path (Path C = 0.669) remains significant, confirming a partial mediation effect.

These results indicate that service quality influences willingness to recommend through two mechanisms. First, it enhances perceived satisfaction, which subsequently drives recommendation behavior. Second, it directly affects willingness to recommend independent of satisfaction. This dual pathway highlights the importance of both cognitive evaluation and experiential response in shaping customer behavior.

The findings presented in table 11 provide strong empirical support for all proposed hypotheses. All relationships were found to be statistically significant, indicating that the proposed model effectively explains the relationships among service quality, perceived satisfaction, and willingness to recommend.

The mediation model illustrated in figure 2 further clarifies the structural relationships among variables, showing that perceived satisfaction serves as a significant intermediary mechanism through which service quality influences customer recommendation behavior.

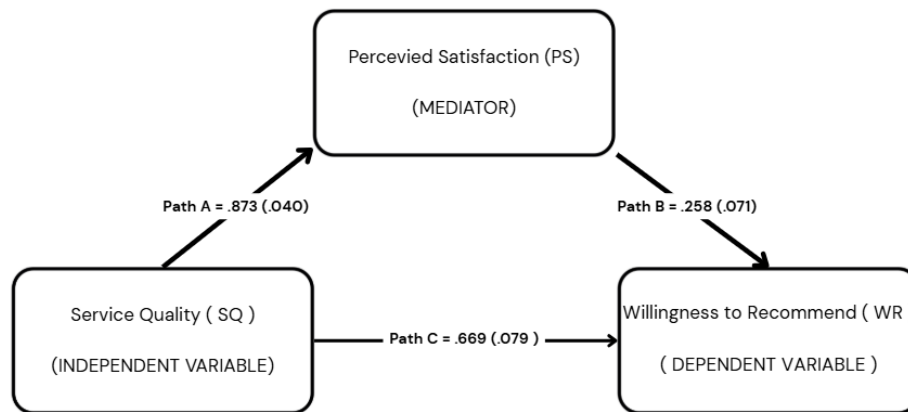


Figure 2. Research Framework

4.3. Discussions

This study examined the mediating role of perceived satisfaction in the relationship between service quality and willingness to recommend. The findings provide strong empirical support for the proposed model, demonstrating that service quality significantly influences both perceived satisfaction and recommendation behavior. This result is consistent with prior studies which emphasize that service quality is a primary antecedent of customer satisfaction across various service contexts [14], [15]. The findings also reinforce the applicability of established service quality frameworks, even within automated retail environments.

The results indicate that service quality has both direct and indirect effects on willingness to recommend. The significant indirect effect confirms that perceived satisfaction functions as an important mediating mechanism through which service quality translates into customer advocacy. This supports previous research suggesting that satisfaction plays a central role in linking service evaluation to behavioral intentions such as recommendation and loyalty [9], [10]. At the same time, the presence of a significant direct effect suggests that certain dimensions of service quality, such as reliability and responsiveness, may independently influence customer recommendation behavior without being fully mediated by satisfaction [23], [24].

These findings highlight the dual role of service quality in shaping customer behavior. On one hand, service quality enhances perceived satisfaction, which subsequently drives willingness to recommend. On the other hand, service quality directly affects recommendation behavior based on customers' immediate evaluation of service performance. This dual pathway is consistent with studies indicating that both cognitive evaluations and experiential responses contribute to customer decision-making processes [5], [6]. The results therefore suggest that customer behavior is influenced by both rational assessment and experiential perception.

From a theoretical perspective, the findings extend existing service quality and customer behavior models into the context of automated retail systems. While traditional studies have primarily focused on human-mediated services, this study demonstrates that similar mechanisms apply in technology-driven environments. This aligns with prior research suggesting that service quality dimensions remain relevant even when delivered through self-service technologies [7], [8]. However, the findings also indicate that system performance, interface design, and operational reliability may play a more prominent role in shaping customer perceptions in automated contexts.

From a managerial perspective, the results suggest that businesses should adopt a dual strategy that emphasizes both service quality and customer satisfaction. Improving system reliability, responsiveness, and visual appeal can directly enhance customer perceptions, while simultaneously strengthening satisfaction levels that lead to positive word-of-mouth behavior. This implies that organizations operating automated retail services should focus not only on technical performance but also on delivering a user-centered experience that fosters emotional engagement.

Overall, this study contributes to a deeper understanding of customer behavior in automated retail environments. It demonstrates that even in technology-driven services, traditional constructs such as service quality and perceived

satisfaction remain critical determinants of customer outcomes. Furthermore, the identification of partial mediation highlights the complexity of customer decision-making processes, suggesting that multiple pathways exist through which service experiences influence behavioral intentions.

5. Conclusion

This study examined the mediating role of perceived satisfaction in the relationship between service quality and willingness to recommend within the context of a custom phone case vending machine. The findings confirm that service quality has a significant positive effect on perceived satisfaction and willingness to recommend, both directly and indirectly. Specifically, higher levels of service quality, reflected in reliability, responsiveness, assurance, tangibles, and empathy, lead to increased customer satisfaction, which subsequently enhances recommendation behavior.

The results further reveal that perceived satisfaction partially mediates the relationship between service quality and willingness to recommend. This indicates that while service quality directly influences customers' intention to recommend, a substantial portion of its effect operates through the enhancement of customer satisfaction. This finding highlights the dual pathway through which service quality shapes customer behavior, emphasizing both direct evaluation and experiential response mechanisms.

From a theoretical perspective, this study contributes to the extension of service quality and customer behavior models in automated retail environments. It demonstrates that traditional constructs, such as service quality and satisfaction, remain highly relevant even in technology-driven services. Moreover, the identification of partial mediation provides deeper insight into the complexity of customer decision-making processes in self-service contexts.

From a managerial perspective, the findings suggest that businesses should prioritize both operational performance and customer experience. Ensuring system reliability, responsiveness, and ease of use is essential for directly influencing customer perceptions, while enhancing satisfaction through improved customization features and user engagement strategies can further strengthen recommendation behavior. A dual-focus strategy that integrates technical excellence with customer-centered design is therefore critical for sustaining competitive advantage.

In addition, the results indicate that the service appeals to a relatively broad and diverse customer base, particularly among young adult users. This presents an opportunity for businesses to expand their market reach by optimizing machine placement in high-traffic locations and exploring additional product offerings within the customization domain.

Despite its contributions, this study has several limitations. The use of convenience sampling may limit the generalizability of the findings, and the focus on a specific demographic group may not fully represent all potential users. Future research is encouraged to employ probability sampling techniques and examine a wider range of age groups to enhance generalizability. Furthermore, future studies may explore additional variables, such as perceived value, user experience, or technological acceptance, to provide a more comprehensive understanding of customer behavior in automated retail settings.

Overall, this study provides valuable insights into how service quality and perceived satisfaction influence customer recommendation behavior. It underscores the importance of delivering consistent, high-quality service and positive customer experiences to drive advocacy and long-term business success in automated retail environments.

6. Declarations

6.1. Author Contributions

Conceptualization: A.M.E.B., A.M.C.B., A.K.G.B., J.C.S.B., T.J.B.D.G., and J.O.G.; Methodology: A.M.E.B.; Software: A.M.C.B.; Validation: A.M.E.B., A.M.C.B., and A.K.G.B.; Formal Analysis: A.M.E.B., J.C.S.B., and T.J.B.D.G.; Investigation: A.K.G.B.; Resources: J.O.G.; Data Curation: J.C.S.B.; Writing Original Draft Preparation: A.M.E.B., A.M.C.B., and J.O.G.; Writing Review and Editing: A.M.E.B., A.K.G.B., and T.J.B.D.G.; Visualization: A.M.C.B.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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