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Exploring Service Quality and Consumer Acceptance of Autonomous Convenience Stores

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Abstract

Background: Automation is revolutionizing retail operations, leading consumers to increasingly interact with advanced retail technologies. While there have been studies on the influence of service quality on consumer acceptance, research examining the service quality of hybrid services and consumer acceptance in automated retail is limited.
Objective: This study aims to examine consumer acceptance of automated retail stores.
Methods: This study tested a proposed model by surveying 101 consumers and using a questionnaire for hypothesis testing. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to explore the effect of e-service quality dimensions on technology acceptance (perceived ease of use, perceived usefulness, and behavior intention) in the context of unmanned automated retail stores.
Results: The findings reveal that information quality positively affects perceived ease of use, while system quality positively affects perceived usefulness.
Conclusion: This study generates new insights by incorporating e-service quality dimensions from the E-Service Quality model into the Technology Acceptance Model. Additionally, the results highlight the growing importance of seamless digital experiences and reliable systems in shaping user perceptions and behavioral intentions. These findings offer practical implications for retailers aiming to enhance customer satisfaction and adoption of unmanned retail technologies through improved service design and digital infrastructure. Future research can further explore other influencing factors such as trust, perceived risk, and user demographics to better understand the evolving dynamics of consumer-technology interaction in automated retail environments.

Keywords: artificial intelligence; autonomous convenience store; consumer acceptance; e-service quality; technology acceptance model

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I. INTRODUCTION

Artificial Intelligence (AI) is revolutionizing the retail business by automating existing processes [1]. An AI-powered autonomous convenience store offers a fully automated shopping experience through innovative technologies like AI and software applications. This concept has recently emerged in Malaysia with the new smart convenience store, also known as the AI-powered autonomous convenience store. With AI-based technologies enabling automated checkout services, this smart convenience store provides a smooth and seamless shopping experience[2]. This unstaffed store allows customers to grab and go, with in-store technology recognizing and charging for the selected items [3] [4].

The smart convenience store provides a hybrid service within the electronic services (e-services) context. Hybrid services are based on traditional business models, offering limited online processes and offline service result [5]. Typically, customers use a dedicated store application on their mobile phones and make purchases with an online electronic payment system in the store. Such AI-powered autonomous convenience stores are poised to revolutionize physical retail in the post-pandemic world by eliminating the hassles of shopping in a physical store under new normal Standard Operating Procedures (SOPs) [3][6][7]. Therefore, AI-powered autonomous convenience stores can enhance the traditional retail experience for consumer [8], [9].

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Recent articles have explored various aspects of self-service and autonomous retail technologies, including user experience, sustainability, and post-adoption behavior. For example, [6] integrates perceived risk into the technology acceptance model (TAM) to assess consumer acceptance of autonomous convenience stores. Similarly, [10] extends TAM by incorporating social factors including convenience, tech savviness and consumer learning. Trust and privacy concerns have also been explored, as seen in [11], which adapts the unified Theory of Acceptance and Use of Technology (UTAUT) model for autonomous shopping adoption. [12] highlights the role of perceived enjoyment by introducing the "fun" variable into TAM, while [13] emphasizes technology readiness as a key driver of acceptance in self-service stores.[14] identifies performance expectancy, facilitating conditions, perceived enjoyment, perceived trust, technology autonomy, and perceived risk as critical determinants in self-service store acceptance.

While these studies offer important insights, they tend to focus on isolated psychological or social constructs and often neglect the role of service quality dimensions—a critical factor in shaping consumer experience in unmanned retail settings. Moreover, most existing research is situated in specific cultural or regional contexts, limiting generalizability to emerging markets such as Malaysia, where AI-powered autonomous convenience stores are still at an early stage of development. Thus, there is a need for a more integrated model that combines technology acceptance constructs with service quality perceptions to better understand both initial adoption and continued usage intentions in this evolving retail landscape.

To bridge this gap, this study proposes a conceptual model that integrates TAM with the Service Quality (SERVQUAL) framework. While TAM provides insights into perceived usefulness and ease of use, it lacks dimensions that capture consumer expectations formed by traditional retail experiences, such as assurance, reliability, and responsiveness. Incorporating SERVQUAL into TAM provides a more holistic view of consumer behavior in the context of autonomous convenience stores—especially when customers are expected to interact primarily with technology rather than human staff.

This research specifically investigates Malaysian consumers' acceptance and continued usage intentions toward AI-powered autonomous convenience stores. By focusing on Malaysia—a country where this retail concept is still nascent—this study offers contextual relevance to local businesses and policymakers who aim to promote digital innovation in the retail sector. The scope includes measuring how service quality dimensions influence TAM constructs and, in turn, how these affect both initial acceptance and continued usage behavior.

The objectives of this study are threefold: (1) to examine the influence of service quality dimensions on perceived usefulness and perceived ease of use; (2) to assess the impact of these factors on consumers' acceptance and continued usage intentions; and (3) to provide empirical evidence from a developing market context to inform theory and practice. This study contributes to theory by extending TAM with service quality elements, offering a more robust model for explaining consumer behavior in AI-driven retail. Practically, the findings provide actionable insights for retail operators and system developers aiming to improve consumer experience and encourage repeat usage in autonomous store environments.

II. Literature Review

A. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was first introduced by Davis in 1985 [15]. This model has become the primary tool for explaining how users might accept technology (see Figure 1). TAM was derived from two psychological theories that explain and predict behavior: the Theory of Reasoned Action (TRA) [16] and the Theory of Planned Behavior (TPB) [17]. The TAM includes two variables: Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). These variables mediate the relationship between potential system usage and external factors like system characteristics. PU refers to the extent to which a user believes that using a dedicated system will improve job performance. PEOU, on the other hand, indicates the degree to which a user believes that using a dedicated system will be effortless [18]. It has been noted that both PU and PEOU are strongly related. That is, the perceived usefulness of a system will increase if it is deemed easier to use [19]. TAM can identify the external factors that affect PU and PEOU, which, in turn, affect user adoption and acceptance of a system [20].

B. Service Quality Theory

Service quality is defined as the attitude that reflects the overall excellence of a service [21]. Perceived service quality will affect customers' repurchase intention [22]. Generally, the Service Quality (SERVQUAL) Model can be used to evaluate service quality based on the various types of services. Nevertheless, the measurement scales need slight modifications for different services as perceived by customers. As e-commerce has become an increasingly important channel for purchasing products, [23] initiated a new model, namely, E-S-QUAL, to evaluate the quality of

electronic service (e-service) (see Figure 2). The model contains two scales: the e-service quality scale (E-S-QUAL) and the e-service quality recovery scale (E-RecS-QUAL). These scales can assess the service quality experienced by customers who shop online via websites. Subsequently, [5] revised E-S-QUAL model to outline how customers assess their experience and continuance intention in the context of hybrid or digital e-services. The model gauges service quality through customer expectations and perceptions of the service. The new model is superior in predicting e-service quality and its continual adoption. The model encompasses five customer experience-based dimensions: quality of result, system quality, customer support quality, process quality, and information quality. In general, these dimensions are aligned with the E-S-QUAL model's service quality parameters.

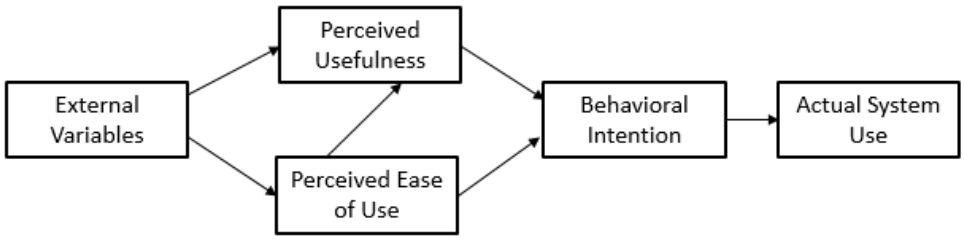

Fig. 1 Technology Acceptance Model [15]

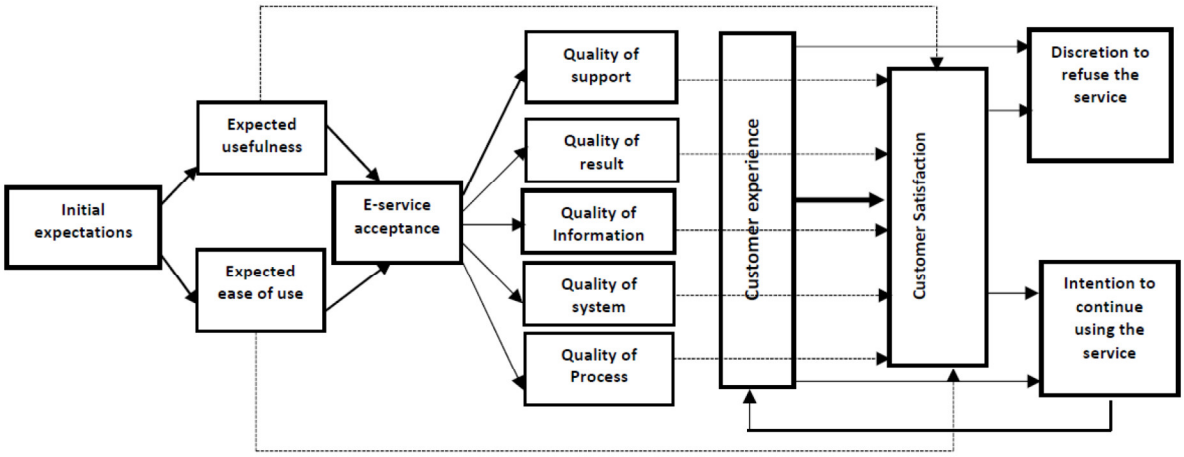

Fig. 2 Revised Integrated E-service Adoption-continuance Quality Model [5]

C. Research Hypotheses

1) Quality of Information

In general, information quality represents the quality of output delivered by an information system [24]. Such information quality is of paramount importance in determining whether the information delivered in an e-service can satisfy customer needs and instrument objectives[5]. Such a notion is verified in a study by [25], which shows that good customer reviews enhance subsequent product evaluations and purchase intentions among customers. In a similar vein, the study by [26] also shows that quality information enhances users' perceived ease of use. Users tend to view a system as easy to use and can improve work performance if is the quality of information derived from the system.

In the context of automated retail stores, information is considered to be complete when it satisfies the user's needs, and timely when it is up-to-date[27] [28]. Accuracy, timeliness, understandability, and completeness of information are the cornerstone of information quality. We believe that such information quality will increase the perceived ease of use in an automated retail store. Therefore, we propose the following hypothesis:

H1: Quality of information positively affects perceived ease of use among customers in an automated retail store.

2) Quality of Process

The quality of a process illustrates the way how a service provider provides services to a customer [21] [29]. Good process quality is building upon the capability of vendors to deliver an e-service process to meet customer needs and wants[5]. The studies by [30] and [31]show that the customers' perceived ease of use is derived from their evaluation concerning the process quality.

In a similar vein, the study by [6] shows that customers who perceive the transaction process as easy to use tend to have a positive attitude toward using the automated retail store. The quality of a process is evaluated based on attributes such as efficiency, waiting time, availability, and security. In this study, we argue that customers' evaluation of their interaction with the automated retail store, namely, process quality, will enhance the overall shopping experience. Thus, the following hypothesis was formulated:

H2: Quality of process positively affects the perceived ease of use among customers in an automated retail store.

3) Quality of Customer Support

In the e-service context, the quality of customer support represents the extent to which customer support can satisfy customers' needs in carrying out the e-service effectively[5]. Customer support is substantial in determining e-service quality and thus it should ignored in measuring e-service quality[32]. Furthermore, prior studies have verified the causal role of customer service on usage intention [33] [34].

In the Internet retailing context, customer service is often viewed as a dimension in measuring service quality construct [35]. [30] suggest that customer service is of paramount importance when customers face issues during and after transactions. In a similar, [36] also suggest online customer service before, during, or after an online transaction is equally important. [36] subsequently developed the transaction process-based (eTransQual) scale to measure e-service quality. On the other hand, the study by [37] found that customers perceive personalized customer services as more beneficial than non-personalized ones.

We argue that the transaction operation of an automated retail store is similar to internet retailing context. High-quality customer support is thus important to address transaction issues when consumers perform shopping activities in automated retail stores. In this study, customer support quality is assessed based on responsiveness, accessibility, and empathy. Thus, the following hypothesis was proposed:

H3: Quality of customer support positively affects the perceived usefulness among customers in an automated retail store.

4) Quality of System

The system quality of an information system represents the users' evaluation of the aspect of the information processing system [38]. Such system quality reflects the extent to which the structure and design of a website (or app) can meet customer criteria in accomplishing their goals [5]. The study by [39] shows that the system quality of a Ubiquitous Robot Companion (URC) personal robot positively users' perceived usefulness. In the context of the online reputation system, the study by [40] also suggests there is a positive relationship between perceived system quality positively and perceived usefulness. The level of perceived system quality perception influences users' trust, which in turn, determines their decision-making performance. We believe system quality, i.e., structure, design, and availability in an automated retail store is also an important factor impacting perceived usefulness. Therefore, the following hypothesis was formulated:

H4: Quality of system positively affects the perceived usefulness among customers in an automated retail store.

5) Quality of Result

The result of a service transaction is the outcome quality (or result quality) that involves two parties, who are customers and service providers [41]. The services delivered by service providers through customers' transactions are an important consumer experience in assessing the overall service quality. [42] suggests that result quality can be measured by consumer experience after customers have visited and made the transaction. Specifically, outcome quality is conceptualized as the fulfillment criteria that represent the result of the service experience in the E-S-Qual model [23].

On the other hand, [5] argue that result quality represents to what extent the e-service provider meets customers' needs and wants in accomplishing the transaction. In a similar vein, the study by [43] verified the positive relationship between output quality and perceived usefulness. That is, athletes perceive accurate information provision provided

by GPS sports watches are useful for their training and competition. In the automated retail store, we believe result quality will affect perceived usefulness among customers.

H5: Quality of the result positively affects the perceived usefulness among customers in an automated retail store.

Based on the hypotheses above, a research framework is proposed (see Figure 3). While traditional TAM includes established pathways from PEOU and PU to acceptance, these relationships have been extensively validated in past literature [15]. As such, this study does not seek to re-examine those direct effects, but rather to explore how perceived service quality shapes users' technology perceptions in the context of AI-powered autonomous convenience stores.

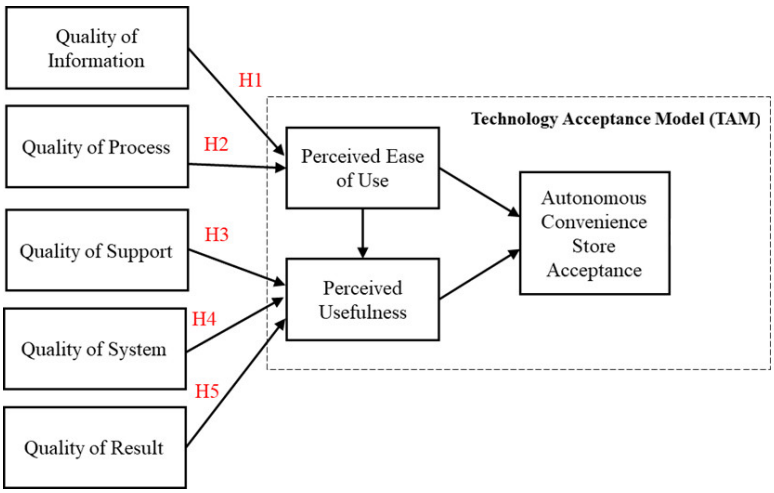

Fig. 3 Research Framework

III. METHODS

A. Research Instrument

The research model comprises multi-item constructs, as shown in Table 1. First, we construct the five dimensions of e-service quality from [5]. These dimensions are quality of information, quality of process, quality of support, quality of system, and quality of result. We adapt the service quality instruments of service quality dimensions based on previous studies [5] [27] [28] [44]. To measure perceived ease of use, perceived usefulness, and autonomous convenience store acceptance, we adapted the instruments from a previous study investigating technology acceptance in AI-powered convenience stores [6]. All items for multi-item constructs were measured using a 5-point Likert scale. The questionnaire was written in English.

A. Data Collection and Sample

In this study, data were collected from consumers who had visited and made a purchase at an unmanned automated retail store located in Malaysia. The store operates without on-site personnel and utilizes an artificial intelligence-powered system to deliver a fully automated shopping experience. Consumers use either a dedicated mobile application or a bank card to enter the store, select their items, place them in a bag, and exit without manually scanning any products. The checkout process is fully automated, with payment processed upon exit.

To collect data from actual users of the store, an on-site intercept survey was conducted. Trained research assistants were stationed near the store's entrance and exit to approach consumers immediately after they completed their shopping. Participation was voluntary, and only respondents who confirmed making a purchase at the store were invited to complete the questionnaire. Data were collected using a structured self-administered questionnaire, either on paper or via a mobile-accessible survey link. A total of 101 valid responses were obtained. The sample size meets the minimum requirement of 85, as determined through power analysis using G*Power software [45].

B. Statistics Analysis

In this study, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to analyze the collected data. PLS-SEM is well-suited for exploratory research and is capable of handling complex cause-effect structural models [46]. Additionally, it is widely recognized for its ability to manage small sample sizes and non-

normal data distributions [46]. SmartPLS 4.0 software was used to conduct the analysis, including both the measurement model and the structural model assessments [47] [48].

TABLE 1
QUESTIONNAIRE ITEMS

Construct	Adapted items	Source
Quality of information (QI)	QI1: The information shared by the automated retail store is timely.	[27]
	QI2: The information shared in app is pretty much what I need to complete my shopping process.	[44]
	QI3: The information shared in the automated retail store adequately meets my information needs.	[28]
	QI4: Overall information shared by the automated retail store is accurate.	[27]
	QI5: Overall information shared by the automated retail store is easy to understand.	[27]
	QI6: I am satisfied with the information quality the automated retail store provides.	[5]
Quality of process (QP)	QP1: The shopping process in the automated retail store is easy.	[28]
	QP2: I have no difficulties with making a payment via using the automated retail app.	[28]
	QP3: I feel safe in my transactions with the automated retail.	[28]
	QP4: Completing a transaction in the automated retail store is easy and quick.	[44]
	QP5: The automated retail has adequate security for digital transactions.	[44]
	QP6: I am satisfied with the process of shopping in the automated retail store.	[5]
Quality of customer support (QC)	QC1: Customer service representatives of the automated retail store can conveniently be contacted.	[44]
	QC2: While solving the issues of customers, sincerity is shown by the automated retail store.	[44]
	QC3: The guide in app and automated retail store addresses my problems.	[44]
	QC4: The automated retail store often provides their customer support chat service.	[44]
	QC5: The automated retail store gives prompt support to the customers.	[44]
	QC6: I am satisfied with the customer support quality provided by the automated retail store.	[5]
Quality of system (QS)	QS1: The automated retail app has a clear structure.	[5]
	QS2: I like how the automated retail app looks like.	[5]
	QS3: The automated retail app loads quickly.	[28]
	QS4: When I sue the automated retail, there is very little waiting time between my actions and its response.	[28]
	QS5: The automated retail exactly performs as promised.	[44]
	QS6: I am satisfied with the system quality of the automated retail.	[5]
Quality of result (QR)	QR1: The automated retail provides me with what I want or require.	[5]
	QR2: I think that the automated retail is reliable.	[5]
	QR3: The automated retail can meet my needs.	[5]
	QR4: The automated retail helps me to save time.	[5]
	QR5: The transactions from the automated retail are error-free.	[44]
	QR6: I am satisfied with the result quality provided by the automated retail.	[5]
Perceived usefulness (PU)	PU1: Shopping in the automated retail store can improve my shopping convenience.	[6]
	PU2: Shopping in the automated retail store can improve my shopping efficiency.	[6]
Perceived ease of use (PE)	PE1: I think shopping at the automated retail store would not expend much of my energy.	[6]
	PE2: I think the facilities and services in the automated retail store are easy to use.	[6]
Acceptance	A1: The shopping experience provided by the automated retail store will increase my willingness to make purchases in it.	[6]
	A2: I may shop in the automated retail store frequently in the future.	[6]

C. Common Method Bias (CMB)

CMB can influence the validity and reliability of self-administered survey data [49]. During data collection, we assured respondents of anonymity and confidentiality to prevent social desirability issues as a mean to reduce CMB [50]. We also use a statistical remedy to detect CMB [51]. Our analysis shows all substantive factor loading (Ra) values were significant at $P < 0.001$, while most method factor loadings (Rb) were nonsignificant. Finally, the average Ra (0.821) was larger than the average Rb (0.012). Therefore, we concluded that CMB was not a major concern in this research.

IV. RESULTS

A. Demographic Profile of Respondents

A total of 101 respondents participated in this study (See Table 2). Of these, 60.40% were female and 39.60% were male. The majority (52.48%) were aged 18-25, followed by 33.66% aged 26-35. Most respondents (65.35%) had a university (or college) education. Over 80% visited automated retail stores less than once a month.

B. Analysis of Measurement Model

The data was examined using PLS-SEM with SmartPLS software, estimating reliability, internal consistency, convergent validity, and discriminant validity. With regard to indicator loadings, indicators with non-significant loadings should be eliminated, and those with loadings of 0.6 or less should be considered for removal [47, 48]. As a

result, we removed one item of QC, two items of QS, and two items of QP due to their indicator loadings falling below 0.6.

TABLE 2
DEMOGRAPHIC PROFILE

Demographic	Characteristics	Frequency	Percentage (%)
Gender	Female	61	60.40
	Male	40	39.60
Age	17 or below	1	0.99
	18 – 25	53	52.48
	26 – 35	34	33.66
	36 – 45	4	3.96
	46 – 55	4	3.96
	56 or over	5	4.95
Education	Secondary School or Below	31	30.70
	College / University	66	65.35
	Master	3	2.97
	Ph.D.	1	0.99
Frequency of automated retail store visits	Less than once a month	86	85.15
	1 -3 times per month	10	9.90
	4 – 6 times per month	4	3.96
	More than 6 times per month	1	0.99

We measured internal consistency and reliability using Cronbach's Alpha (CA) and Composite Reliability (CR) [47] [52], In general, the minimum value of CA is 0.7 is desirable. A CR value between 0.7 and 0.9 is deemed acceptable. Convergent validity is also assessed using the Average Variance Extracted (AVE). The minimum value of AVE is 0.5 to establish acceptable convergent validity. The results show the criteria of reliability and convergent validity are satisfactory in this study (see Table 3).

TABLE 3
MEASUREMENT MODEL ANALYSIS

Construct	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Quality of Result	QR1	0.63	0.83	0.85	0.50
	QR2	0.71			
	QR3	0.67			
	QR4	0.77			
	QR5	0.66			
	QR6	0.77			
Quality of System (QS)	QS1	0.78	0.77	0.85	0.59
	QS2	0.70			
	QS3	0.80			
	QS4	0.79			
Quality of Customer Support (QC)	QC1	0.85	0.90	0.92	0.71
	QC2	0.84			
	QC4	0.83			
	QC5	0.87			
	QC6	0.82			
Quality of Process (QP)	QP1	0.78	0.82	0.88	0.65
	QP2	0.86			
	QP4	0.90			
	QP6	0.66			
Quality of Information (QI)	QI1	0.81	0.88	0.91	0.62
	QI2	0.82			
	QI3	0.76			
	QI4	0.72			
	QI5	0.82			
	QI6	0.80			
Perceived Usefulness (PU)	PU1	0.92	0.76	0.89	0.80
	PU2	0.87			
Perceived Ease of Use (PE)	PE1	0.74	0.42	0.77	0.63
	PE2	0.84			
Behavior intention (BA)	A1	0.91	0.81	0.91	0.84
	A2	0.92			

Note: 5 items were removed due to the unsatisfactory factor loadings.

Discriminant validity was assessed using Fornell and Larcker's criterion. Discriminant validity is established when the square root of AVE of a construct should correlate more strongly with its construct than with others in the model. The results of the Fornell and Larcker criterion verified the discriminant validity of the research model (see Table 4).

TABLE 4
FORNELL AND LACKER'S CRITERION

	BA	PE	PU	QC	QI	QP	QR	QS
BA	0.92							
PE	0.43	0.79						
PU	0.60	0.49	0.90					
QC	0.37	-0.09	0.28	0.84				
QI	0.34	0.62	0.48	-0.06	0.79			
QP	0.43	0.56	0.42	0.11	0.75	0.81		
QR	0.52	0.26	0.54	0.66	0.18	0.29	0.70	
QS	0.50	0.60	0.67	0.20	0.58	0.53	0.52	0.77

C. Analysis of Structural Model

The hypotheses were assessed using the bootstrapping method with 5000 subsamples in the path analysis. Explained variance (R^2) and predictive relevance (Q^2) were also estimated. In this study, the R^2 values demonstrate that the model explains 38.3%, 40.5%, and 50.2% of the variance in consumer acceptance, perceived ease of use, and perceived usefulness, respectively. In PLS-SEM, Q^2 represents the model's predictive relevance. A Q^2 value greater than 0 signifies its predictive relevance. The Q^2 values for all constructs exceed 0, confirming the model's predictive validity (see Table 5). The path analysis shows that hypotheses H1 and H4 are supported while H2, H3, and H5 are not supported.

TABLE 5
STRUCTURAL MODEL

Endogenous Variable	R-Square	Q-Square			
A	0.38	0.30			
PE	0.41	0.23			
PU	0.50	0.35			
Hypothesis	Path	Path Coefficient	T Statistics	P Value	Test Result
H1	QI → PE	0.46	4.16	0.00	Supported
H2	QP → PE	0.21	1.76	0.08	Rejected
H3	QC → PU	0.01	0.02	0.98	Rejected
H4	QS → PU	0.54	7.26	0.00	Supported
H5	QR → PU	0.26	1.92	0.06	Rejected

V. DISCUSSION

This study explores whether the consumption experience is based on perceived service quality on intention to use an automated retail store. The service quality dimensions include information quality, process quality, customer support quality, system quality, and result quality while the technology acceptance variables are perceived ease of use, perceived usefulness, and consumer acceptance.

This study shows that information quality exhibits a positive and significant effect on perceived ease of use ($\beta = 0.46$, $p = 0.001$). when customers perceive the information provided by the system to be accurate, relevant, and reliable, they are more likely to find the automated retail store easy to use. This finding aligns with [26] [53] [54], who emphasized the role of high-quality information in shaping user experience in smart technologies. Extant studies also found that verified, accessible, and informative content significantly contributes to user satisfaction and acceptance [26] [55]. In the context of smart convenience stores, consumers often depend on product information—such as availability, pricing, and specifications—to make informed purchasing decisions without human assistance. Therefore, ensuring the accuracy, relevance, and completeness of information is essential for a seamless and intuitive shopping experience [2].

The results indicate that process quality does not have a significant relationship with perceived ease of use ($\beta = 0.21$, $p = 0.08$), a finding that contradicts the earlier work of [6], who reported a positive association. This suggests that, in the context of automated retail environments, the efficiency or smoothness of the service process may no longer be a primary concern for users when evaluating ease of use. One possible explanation is that frequent users of unmanned smart convenience stores have become accustomed to the self-service model and may have developed a

higher tolerance for minor inefficiencies in the service process. As a result, variations in process quality may have limited influence on their perception of how easy the system is to use.

Similarly, this study finds that customer support quality is not significantly related to perceived usefulness ($\beta = 0.01$, $p = 0.98$), which contradicts the findings of [37]. While traditional retail environments often rely on customer support to enhance service usefulness, this does not appear to hold true in the context of unmanned convenience stores. Consumers who choose these stores may inherently prefer a fully autonomous shopping experience and have minimal expectations for human interaction or support. As such, the availability or absence of customer support may not significantly influence their perception of the store's usefulness. This shift in expectations highlights the evolving nature of consumer behavior in technology-driven service environments, where convenience and independence often outweigh the perceived benefits of interpersonal support.

Fourth, the quality of the system is positive and significantly related to perceived usefulness ($\beta = 0.54$, $p = 0.001$). This finding is consistent with previous studies that highlights system quality as a key construct of perceived usefulness [53]. Similarly, [54] emphasized that system quality plays a vital role in shaping users' acceptance of a system, as it directly influences their perception of system usefulness. In the context of autonomous convenience stores, system quality becomes even more critical. These stores lack human service personnel and rely entirely on technology to facilitate transactions. The interaction between consumers and the automated service delivery system determines their experience and satisfaction. Therefore, if consumers perceive the system to be reliable, efficient, and user-friendly, they are more likely to find the unmanned retail store useful and adopt its services [39] [40].

Finally, the findings reveal that result quality does not have a significant relationship with perceived usefulness among customers ($\beta = 0.26$, $p = 0.06$). This suggests that the quality of the final outcome or service performance, as perceived by users, does not necessarily enhance their perception of the store's usefulness. This result contrasts with the findings of [43], who reported a significant positive effect of result quality on perceived usefulness. One possible interpretation is that in the context of unmanned smart convenience stores, consumers may prioritize speed, convenience, and functional efficiency over experiential aspects such as satisfaction, comfort, or service enjoyment. Unlike traditional retail settings, where personalized service and high result quality can greatly influence customer perceptions, users of automated stores may place less emphasis on the overall service experience. Instead, their evaluation of usefulness is likely shaped more by the system's ability to deliver basic functions—such as rapid transactions, ease of navigation, and product availability—rather than by the perceived excellence of the outcome. This shift underscores the utilitarian nature of consumer expectations in fully automated retail environments.

There are several limitations in this study. First, this is a cross-sectional study using an online survey for data collection. Second, our questionnaire may not contain sufficient items to explore the relationship between service quality and consumer acceptance in unmanned convenience stores. The questionnaire only contains some items extracted from current literature. Since the shopping experience in the unmanned convenience store is relatively new and unexplored, our findings may be biased. Finally, we found that around 87% of respondents are below 36 years old while around 69% of respondents have tertiary education backgrounds. We argue that the consumer group for unmanned convenience stores may be unique compared to traditional convenience stores. Investigating consumers' demographic characteristics is thus a potential research agenda for unmanned convenience stores.

VI. Conclusions

This study addressed three key research questions. First, regarding the impact of service quality dimensions on perceived ease of use and perceived usefulness, the findings confirm that reliability, responsiveness, and assurance significantly influence both TAM constructs. Second, in relation to how these perceptions affect users' acceptance and continued usage of autonomous convenience stores, the results support the indirect role of service quality through its influence on technology perceptions. Third, the study contributes to literature by integrating e-SERVQUAL with TAM in a retail automation context, particularly in an emerging market. Practically, the findings provide actionable insights for enhancing customer experience and technology adoption in unmanned retail environments.

This study advances both theory and practice by extending the Technology Acceptance Model (TAM) with e-service quality (e-SERVQUAL) in the context of unmanned autonomous retail. It demonstrates that information quality strongly influences perceived ease of use, while system quality significantly affects perceived usefulness, highlighting the importance of service quality in shaping consumer acceptance of AI-powered convenience stores. By integrating these elements, the research offers a novel perspective on digital transformation in retail and provides practical insights for retailers and technology providers: ensuring accurate, user-friendly information and reliable system functionality is essential to foster consumer satisfaction and adoption.

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