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ARTICLE

Enhancing Customer Loyalty in Vietnamese Agricultural E-commerce: The Role of Quality Dimensions and the Moderating Effect of Perceived Value

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ABSTRACT

The rapid advancement of digital technology and e-commerce has changed the way people buy agricultural products, providing increased accessibility, convenience, and traceability. As Vietnam emerges as a major player in the global agricultural industry, the use of internet platforms to sell farm produce is becoming increasingly important in connecting producers with tech-savvy consumers. This study examines the influence of service quality and electronic service quality on customer satisfaction and loyalty within the framework of agricultural e-commerce in Vietnam. Utilizing the Technology Acceptance Model (TAM) and Partial Least Squares Structural Equation Modeling (PLS-SEM), the study examines data gathered from 526 consumers who acquire agricultural products via online platforms. The data indicate that e-service quality substantially improves the purchasing experience and perceived customer control, both of which favorably affect consumer satisfaction. Likewise, conventional service quality parameters, particularly reliability and responsiveness, are crucial in influencing satisfaction. Customer happiness is a significant predictor of loyalty, underscoring its pivotal role in consumer behavior. Significantly, perceived value adversely moderates the link between satisfaction and loyalty, indicating that when customers perceive high value, the impact of satisfaction on loyalty diminishes marginally. These findings underscore the significance of providing

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superior electronic service and consistent conventional service to cultivate and maintain consumer loyalty. The research offers actionable insights into e-commerce platforms in the agricultural sector to enhance usability, responsiveness, transparency, and customer value. Improving technological capabilities and human-centered services is crucial for cultivating long-term customer involvement and promoting the sustainable development of Vietnam's digital farm sector.

Keywords: Agricultural E-Commerce; Customer Loyalty; E-Service Quality; Perceived Value; Service Quality

1. Introduction

With the increasing availability, speed, and development of the Internet, online shopping is undergoing rapid changes due to advancements in digital technology and applications that provide consumers with easier access to a broader selection of goods at lower prices than they could obtain in traditional brick-and-mortar stores. Global retail e-commerce sales reached approximately $6 trillion in 2024, and this figure is predicted to increase by 31% over the next several years, reaching around $8 trillion by 2028 [1]. Moreover, the e-commerce market of agricultural products was valued at USD 511 million in 2024 and is expected to grow to USD 629 million in 2025 with a CAGR of 23.05% from 2025 to 2033 [2]. Vietnam is emerging as one of the fast-growing e-commerce markets in the region, with an expanding number of shoppers [3]. Statista (2025) [4] has shown that approximately 27 million Vietnamese use e-commerce platforms and this figure is expected to grow to 36 million by 2029. This showed the dynamic development of e-commerce in the Internet economy era.

In addition to keeping pace with the process of digital transformation, Vietnam is becoming a major player in the Internet economy of Southeast Asia [3]. The Vietnam E-commerce and Digital Economy Agency's summary conference report states that the country's e-commerce is still growing at an amazing rate of 18–25% annually. Leading e-commerce platforms contributed significantly to Vietnam's exponential e-commerce growth in 2023, accounting for almost half of the nation's total e-commerce revenue. The market is anticipated to grow by 20% from 2023 to 2024, reaching a size of nearly 22 billion USD, or almost 9% of the nation's total retail sales of goods and consumer service income [5]. Furthermore, by 2030, the e-commerce market in Vietnam is expected to grow to a value of $60 billion [2]. The Ministry of Industry and Trade reports that by 2024, e-commerce for agricultural products in Vietnam will see substantial growth, representing about 6–8% of the agricultural sector's total retail revenue, with an average annual growth rate of 25–30% [6]. According to Vietnamnet [7], the Postmart platform now features approximately 150,000 agricultural products, sourced from over 5.5 million registered accounts of farmers, cooperatives, and businesses, underscoring the scale of listings on Vietnamese e-commerce platforms. This trend is a result of businesses using technology to scale their operations, improve customer experiences, and streamline corporate processes, in addition to the rise of online shoppers.

Despite facing numerous challenges in an era of economic fluctuations and being affected by weather conditions such as natural disasters and floods, Vietnam's agricultural industry continues to grow steadily each year. It is becoming a pivotal factor in the global agricultural landscape. The official press agency of the Vietnam Ministry of Agriculture and Environment (2024) reported that Vietnam's agricultural, forestry, and fishery sector achieved an export turnover of USD 62.4 billion in 2024, marking an 18.5% increase from 2023, with a record trade surplus of USD 18.6 billion. Moreover, in 2024, Vietnam ranked as the second biggest agricultural exporter in Southeast Asia and the fifteenth largest worldwide due to its robust export growth [8].

E-commerce is becoming increasingly important in the agricultural industry [9,10]. Driven by technological advancements, e-commerce has emerged as a new form of commerce and a potential strategic tool for businesses to achieve greater success in the digital economy as buyers gain more information and market access [10]. Online trading platforms and e-commerce markets enable

farmers to communicate directly with consumers worldwide, providing them with access to global consumer markets, facilitating more efficient product marketing, reducing their reliance on conventional distribution networks, and enhancing brand recognition [10]. In 2024, the One Commune One Product (OCOP) Market cooperated with TikTok Vietnam, witnessed more than 800 livestream sessions, bringing in more than $4 million in revenues and supporting more than 3000 agricultural items [11]. Therefore, e-commerce supports the sale of goods and agricultural products from farmers and businesses, particularly during harvest times [12].

Prior work on agrifood e-commerce has emphasized adoption or intention during COVID-19 and in large markets, often without drilling into post-adoption satisfaction and loyalty for agricultural products (as distinct from general retail) or into Vietnam's platform context [13,14]. Studies on fresh-food e-commerce highlight the salience of service quality, logistics quality for satisfaction and loyalty, yet they rarely integrate this with a technology-acceptance lens or with perishability or traceability concerns that are unique to agricultural goods [15]. We address these omissions by focusing on Vietnam's agricultural products on e-commerce, modelling how service quality and e-service quality shape customer satisfaction and loyalty, while explicitly incorporating perceived value.

Online shopping has become an increasingly important way for clients to acquire agricultural products, thanks to the rapid expansion of the Internet and e-commerce over the last 20 years. However, most recent studies have focused on the retail or service sectors, while in-depth analysis of customer loyalty to the agricultural sector is still limited [13]. Barka and Solis (2020) [16] also said that online sales of agricultural products do not represent a major share of overall global agricultural product sales [15,16], particularly in Vietnam. The industry in this country is rapidly expanding and is emerging as a major participant in global agriculture [17]. Furthermore, in Vietnam, where agriculture is a major economic driver, understanding customer loyalty in agricultural e-commerce is critical for supporting long-term agricultural growth and increasing the economic worth of local agricultural products. Given the reliance on digital platforms for accessing credence attributes like product freshness and traceability, the Technology Acceptance Model (TAM) is employed to examine how perceived usefulness and ease of use shape consumer behavior in adopting these platforms. This framework is particularly suited to Vietnam's context, where technological barriers and trust in e-commerce significantly influence purchasing decisions. As a result, this study uses the Technology Acceptance Model (TAM) and Structural Equation Modeling (SEM) [18] to investigate how core factors of service quality and e-service quality influence customer satisfaction while also analyzing how this satisfaction affects customer loyalty in the context of purchasing agricultural products on e-commerce platforms in Vietnam. Furthermore, the study investigates how customer-perceived value influences the relationship between satisfaction and loyalty. Based on these findings, the study will recommend practical strategies to help e-commerce enterprises in Vietnam's agricultural industry boost consumer satisfaction and loyalty.

The remaining sections of this article are organized as follows: The second section summarizes the literature and provides research hypothesis. The third section discusses research design. The fourth portion presents the findings, examining sample characteristics and evaluating hypotheses. The fifth section reviews the results, comparing them to previous research and drawing theoretical and practical conclusions. The sixth section concludes by summarizing major findings, making business recommendations, and suggesting directions for future research.

2. Literature Review & Hypothesis Development

2.1. Theoretical Background (TAM)

The Technology Acceptance Model (TAM), proposed by Davis (1989) [19] provides a theoretical framework for understanding consumer adoption of e-commerce platforms for agricultural products in Vietnam. TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) shape users' attitudes and intentions toward technology adoption. In agricultural e-commerce, PU reflects consumers' belief that platforms

enhance access to reliable information, such as traceability and quality certifications, critical for credential attributes like freshness and safety. PEOU captures the effortlessness of navigating platforms, vital for overcoming barriers like limited tech literacy or rural-urban digital divides in Vietnam. Unlike other retail sectors, agricultural e-commerce relies heavily on digital cues to reassure consumers about product quality, making PEOU particularly critical. Intuitive interfaces, such as simple search functions for product origins or user-friendly mobile apps, simplify access to these cues, fostering trust and engagement [20]. PU is enhanced by dependable services, like consistent delivery of fresh goods or accurate information, addressing consumer concerns about safety [21]. External variables such as purchasing experience (PE), customer control (CC), reliability (RE), and responsiveness (RESP)—further influence PU and PEOU, thereby shaping customer satisfaction (CS). For example, seamless navigation (PEOU) and reliable delivery (PU) increase trust and satisfaction, which in turn mediate the link between platform quality and loyalty. Prior studies confirm that high PU and PEOU predict actual usage rates in agricultural e-commerce, with customer satisfaction serving as the mechanism that translates these perceptions into loyalty outcomes such as repurchase intention and word-of-mouth [22,23].

2.2. E-Service Quality

Anser et al. (2023) [24] describe electronic service quality (e-service quality) as the trust, efficiency, and customer service connected with websites that firms use to provide online services. Furthermore, Anser et al. (2023) [24] found that, due to the widespread global online business activities, electronic service quality has become an essential component of organizational operations in the digital economy.

Yu, Zhiyuan, and Kun Zhang (2022) [14] investigated the purchase experience, which includes judgments of shifting product quality and accompanying emotions. Individuals who often shop online are more likely to have explicit cognitive biases regarding agricultural products promoted by live-streaming hosts [14]. Furthermore, Ma et al. (2020) [25] found that people with significant online shopping experience may frequently filter out unimportant elements, allowing them to focus more on their interactions with the website and therefore engage more deeply in cognitive information processing. According to the study conducted by Yousaf et al. (2018) [26], customers get increased trust in completing online economic activities based on their experience and assurance about the information and services offered by the website. As a result, to contribute to encouraging a great shopping experience in Vietnam's e-commerce for agricultural food products, firms must maximize electronic service quality to the highest possible level.

In marketing, customer control is defined as "the extent to which a company provides its customers with avenues to connect with the company and actively shape the nature of transactions and connect and collaborate sharing information," as studied by Auh et al. (2019) [27]. According to research by Kim, J., and Yum, K. (2024) [28], high electronic service quality, supported by technologies such as artificial intelligence, big data, and blockchain, enables innovative, secure, and efficient transactions, thereby allowing customers to make more informed purchasing decisions. Therefore, if customers perceive that the quality of electronic services during the purchase of agricultural products on an e-commerce platform is effectively met, they are likely to feel greater control, thereby increasing their satisfaction with the company's service quality. Based on these arguments, we therefore formulated the subsequent hypothesis:

H1. *E-service quality significantly impacts the purchasing experience.*

H2. *E-service quality significantly affects customer control.*

2.3. Service Quality

Service quality is a core concept in service research, defined as consumers' overall assessment of the excellence or superiority of a service or the organization that provides it [29]. The SERVQUAL model, developed by Parasuraman et al. (1988) [30], is widely used to assess service quality and includes five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. In the food and beverage (F&B) industry, service quality is

critical for achieving a competitive advantage. It is critical in meeting the needs of consumers and has a substantial impact on how they rate the services provided [31,32]. This emphasis on service quality is not restricted to the F&B sector, as research by Palese and Usai (2018) [33] has demonstrated that it is crucial to success in a variety of industries, particularly the quickly expanding arena of e-commerce.

Reliability is defined as the capacity to deliver the promised service consistently and accurately [30]. In online meal delivery services, reliability is defined as the timely delivery of the proper goods and the preservation of product quality during transit [34]. To attain excellent overall service quality in online sales services, providers must prioritize the reliability of delivery operations, from delivering the correct things to the correct place to fulfilling delivery deadlines [31]. Numerous previous studies found that when a service is rated as "high quality," it indicates that it has met the criterion for dependability, which means the capacity to keep commitments accurately and consistently [33–35].

In the context of Online Food Delivery Services, responsiveness refers to the service provider's readiness and commitment to assist clients immediately and promptly [34]. It is a dimension of service quality [30]. Furthermore, delayed responses can result in negative feedback for both the restaurant and the online food delivery service provider [35].

While reliability and responsiveness have historically been seen as crucial elements of the SERVQUAL model's five pillars of service quality, some studies have found that the reliability and responsiveness of e-retailers are more critical than other factors [36,37]. Furthermore, Subramanian et al. (2014) [38] supported this finding by proving that both reliability and responsiveness in service quality have a significant impact on customer satisfaction. As a result, this study builds on the previous research and provides the theories listed below:

H3. *Service quality significantly affects reliability.*

H4. *Service quality significantly affects responsiveness.*

2.4. Customer Satisfaction

In the context of modeling, customer satisfaction is an overall assessment of a company or brand contingent on its core features and attributes, as perceived by consumers [39]. Satisfaction is fundamentally determined by how well the delivered

product or service meets customer expectations [40]. Within the e-commerce environment for agricultural goods as fresh food, these expectations are heightened due to product sensitivity and the demand for punctual and trustworthy delivery [41]. There are various strategies to enhance customer satisfaction that have already been emphasized by research in traditional commerce settings [42]; however, studies focusing on the unique challenges of satisfaction in the digital sale of agri-products remain relatively limited.

Two key determinants influencing satisfaction in this domain are e-service quality and service quality. Previous studies indicate that enhancement in product and service quality, particularly in digital contexts, leads to higher customer satisfaction, as service quality functions as a primary driver of customer satisfaction that can be proactively managed and optimized [29]. This supports TAM's assumption that system-related factors influence user satisfaction and behavioral responses.

As customers evaluate the performance of service attributes, these assessments directly influence their overall satisfaction [43,44]. This is especially relevant for agricultural goods, where delivery timeliness and issue handling (e.g., spoilage or incorrect items) are frequent concerns [41]. Grounded in both TAM and service quality literature, this research proposes the following hypotheses:

H5. *E-service quality significantly affects customer satisfaction.*

H6. *Service quality significantly affects customer satisfaction.*

2.5. Customer Loyalty

Zhu et al. (2024) [45] found that customer loyalty is a crucial topic in marketing that has been extensively

researched for over a century. Additionally, research by Malki et al. (2024) [46] shows that customer loyalty is a form of repeat purchase behavior for a particular product or service that has been a significant behavioral outcome in customer behavior for many years. Undoubtedly, there is a connection between satisfied customers and their continued loyalty because happy customers are more likely to return to the same e-commerce platform again in the future [46]. Several studies demonstrate a significant relationship between customer satisfaction and online loyalty [47,48]. Customer satisfaction is identified as a key variable that positively impacts customer loyalty by meeting needs such as playfulness, safety, epidemic prevention, and convenience in agricultural products [20].

Malki et al. (2024) [46] stated that existing customer loyalty correlates with e-consumer satisfaction, which serves as a primary source of trust. An online retailer is more likely to maintain relationships with satisfied customers [46]. They also have proposed that customer loyalty is directly and positively affected by customer satisfaction [46]. The findings mentioned above highlight the critical role of customer satisfaction in influencing customer loyalty, forming the cornerstone of our hypotheses.

While some authors argue that satisfaction directly influences customer loyalty, as studied by Naini et al. (2022) [49], others suggest that its impact on loyalty can be moderated by additional factors such as perceived value, according to Matsuoka (2022) [50]. A study by Zeithaml (1988) [51], which is the most cited article in the pricing literature [52], elaborates on perceived value. Perceived value is "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" (p. 14) [53]. According to research by Matsuoka (2022) [51], to enhance customer loyalty, businesses need to not only satisfy their customers but also ensure that they feel the value they receive is worth it; this is especially important in pricing strategies and revenue management strategies. Based on these arguments, we therefore formulated the subsequent hypothesis:

H7. *Customer satisfaction significantly affects customer loyalty.*

H8. *Customer perceived value significantly affects the relationship between customer satisfaction and customer loyalty.*

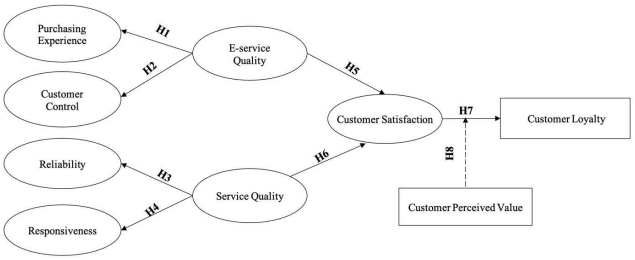

Figure 1. Conceptual framework.

3. Results

This study applies a quantitative causal research method to collect and analyses data, aiming to provide a detailed insight into the causal relationships between variables within the proposed model. Quantitative methods provide a structured, objective framework for testing hypotheses and providing insights with high generalizability [53].

3.1. Questionnaire Design

The survey questionnaire is designed with a clear structure, comprising two main sections. The first section aims to gather demographic information (gender, age, monthly income) and shopping behavior (purchase frequency, preferred platform, willingness to pay, payment methods) of the participants. In a study by Ried et al. (2022) [54], social desirability bias is the tendency of a person to respond in a way that they believe is socially acceptable rather than their true feelings, which may include self-deception and lead to underreporting of "bad" behaviors and overreporting of "good" behaviors. Ensuring the anonymity of survey participants will minimize social desirability bias during data collection, making participants feel more psychologically safe in answering truthfully [54]. Therefore, this study ensured anonymity by not collecting identifying information, such as names and email addresses, thereby creating a safe and non-judgmental environment that encouraged participants to provide more honest and open responses.

The second section includes research questions adapted from the questionnaires of Chang et al.

(2009) [55] and Subramanian et al. (2014) [38]. The questionnaire was conducted with a lecturer review to ensure the content suits Vietnamese agricultural product procurement in an e-commerce context. The questionnaire measures the following aspects: purchasing experience (3 items), customer control (2 items), reliability (3 items), responsiveness (2 items), e-service quality (10 items), service quality (9 items), customer satisfaction (6 items), customer perceived value (4 items), and customer loyalty (6 items). Variables were measured using a 5-point Likert scale.

3.2. Data Collection Method

The study used a questionnaire designed using Google Forms and convenience sampling techniques to collect data through online platforms. The survey scope focused on people living in Vietnam and having purchased agricultural products on e-commerce platforms, with the survey period extending from January 2025 to March 2025. With its young, tech-savvy population and high Internet usage, Vietnam is considered to accurately reflect online consumer trends in the developing agricultural e-commerce market. The minimum sample size required is five times the number of measured variables and the maximum sample size is ten times the number of measured variables [56]. Therefore, the optimal sample size for the 45 variables measured in this research should range from a minimum of 225 samples. The data collection process received 550 responses. However, after reviewing and eliminating 24 incomplete responses, the research team retained 526 valid responses for data analysis.

3.3. Data Analysis Method

Data analysis is performed using two main methods, ensuring the comprehensiveness and reliability of the results. Firstly, descriptive analysis is used to summarize the characteristics of samples, including demographic information and shopping behavior. Secondly, Structural Equation Modeling (SEM) with a Partial Least Squares (PLS-SEM) approach is applied to test hypotheses about the relationships between observed and latent variables [57]. SEM allows for the analysis of abstract concepts measured through observed variables. Exogenous variables are latent variables influenced by external factors to the model, acting as independent variables, while endogenous variables are influenced by other variables, and can be dependent variables or both. If all variables are observed variables, causal relationships are analyzed using regression or path analysis.

3.4. Sample Characteristics

The demographic profile reveals a notable skew toward female respondents, who constituted 66.33% of the sample, while males accounted for 33.67%. This distribution may reflect the increasing role of women in household decision-making and online purchasing, especially in food and agricultural products, which are traditionally associated with family consumption. In terms of age, the predominant age group observed was 18–22 years old, while those over 22 only accounted for 16.33% of participants, and 10.67% were under 18. Regarding income, 49% of the participants have an average monthly income of less than 5 million Vietnamese Dong (VND). Another significant portion, 35.33% reported a monthly income ranging from 5 to less than 10 million VND, with the remaining 15.67% earning over 10 million VND per month. Concerning agriculture e-commerce platform preferences, Shopee was overwhelmingly chosen by 51.33% of respondents, followed by TikTok at 32% (**Table 1**). This reflects the platforms' widespread reach among Vietnamese young people, especially Gen Z consumers, and suggests potential for agricultural stores to prioritize and promote campaigns on these channels. Lazada was used by 8.67%, Buudien.vn by 6% and Tiki by 2%. In terms of buying intensity, the frequency of online purchasing was high, with 82% of survey participants purchasing on e-commerce platforms more than 2 times per month (53.33% purchasing 2 to 5 times per month and 28.67% purchasing more than 5 times per month). Finally, in this study, about 49.67% of respondents were willing to pay under 500.000 VND each time they bought. 35.67% of them were paying from 500,000 to 1,000,000 VND each time. Therefore, most of them have had experiences in online shopping and can answer our survey effectively and accurately, which helps to improve the reliability of the research.

Table 1. Sample Characteristics.

Variables	Category	Frequency	Percentage (%)
Gender	Male	177	33.67
	Female	349	66.33
Age	Under 18 years old	56	10.67
	18–22 years old	384	73
	Over 22 years old	86	16.33
Income	Less than 5 million VND/month	258	49
	From 5 to less than 10 million VND/month	185	35.33
	Over 10 million VND/month	83	15.67
Buying intensity	Less than 2 times/month	94	18
	2 to 5 times/month	281	53.33
	More than 5 times/month	151	28.67
Shopping platform	Shopee	270	51.33
	Tiktok	168	32
	Lazada	45	8.67
	Buudien	32	6
	Tiki	11	2
Willingness to pay	Under 500,000 VND	261	49.67
	From 500,000 to 1,000,000 VND	188	35.67
	Over 1,000,000 VND	74	14.66

3.5. Reliability and Discriminant Validity

SmartPLS 4.0 was employed to evaluate the measurement model, encompassing reliability and discriminant validity assessments to ascertain the consistency of the variables (**Table 2**). The measurements' reliability and validity were assessed by Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach's Alpha values surpassed the 0.7 level, signifying satisfactory dependability [58]. Cronbach's Alpha values for all constructions varied from 0.744 to 0.875, all surpassing the threshold of 0.7. Additionally, CR values varied from 0.744 to 0.935, all within the excellent to good range, hence affirming the construct's robust reliability [59]. Furthermore, all constructs showed an AVE greater than 0.5, with values ranging from 0.605 to 0.879, confirming convergent validity [58].

Table 2. AVE Values, Composite reliability.

	Cronbach's Alpha	Composite Reliability (Rho_a)	Composite Reliability (Rho_c)	Ave
Customer control (CC)	0.821	0.827	0.918	0.848
Customer loyalty (CL)	0.810	0.820	0.913	0.840
Customer perceived value (CPV)	0.782	0.794	0.859	0.604
Customer satisfaction (CS)	0.799	0.805	0.857	0.500
E-Service quality (ESQ)	0.882	0.884	0.927	0.809
Purchasing experience (PE)	0.788	0.792	0.876	0.702
Reliability (RE)	0.767	0.780	0.866	0.683
Responsiveness (RESP)	0.732	0.733	0.882	0.789
Service quality (SQ)	0.912	0.923	0.944	0.850

Moreover, discriminant validity was tested using the Fornell-Larcker criterion [60], which states that each construct must have a square root of its AVE greater than its highest correlation with any other construct. The findings in **Table 3** support discriminant validity by confirming that all constructs satisfied this requirement.

3.6. Hypothesized Model Testing

The author employs SmartPLS 4.0 to evaluate the structural model, emphasizing the importance of the calculated path coefficients and R-squared (R^2). R^2 indicates the proportion of variance in the dependent variable explained by the independent variables in the model. To improve the reliability of the computed path

coefficients, the author adhered to the recommendations of Hair, Ringle, and Marko (2011)[61] by employing 5,000 bootstrap samples. In PLS-SEM, R^2 values of 0.75, 0.50, and 0.25 are generally regarded as indicative of strong, moderate, and weak explanatory power, respectively[61]. The importance of the path coefficients was assessed using *t*-values and *p*-values obtained via bootstrapping. Hypotheses are deemed supported if the path is significant and the direction aligns with the postulated relationship[62].

Table 3. Correlations between Research Constructs (Fornell-Larcker Criterion).

	CC	CL	CPV	CSA	ESQ	PE	RE	RESP	SQ
CC	0.921								
CL	0.518	0.917							
CPV	0.519	0.752	0.777						
CSA	0.409	0.755	0.701	0.707					
ESQ	0.680	0.610	0.592	0.515	0.899				
PE	0.627	0.613	0.571	0.420	0.761	0.838			
RE	0.283	0.400	0.362	0.551	0.351	0.250	0.826		
RESP	0.314	0.461	0.456	0.559	0.350	0.300	0.718	0.888	
SQ	−0.013	0.214	0.178	0.429	0.016	0.061	0.600	0.633	0.922

Furthermore, the study examines second-order constructs, which are conceptually more expansive and abstract representations derived from interconnected first-order constructs. Henseler et al. (2015)[60] identify two primary methodologies for estimating constructs in PLS route modeling: the repeated indicators approach and the two-stage approach, which are detailed in the subsequent sections.

3.6.1. The Repeated Indicators Approach

The repeated indicators method involves reusing the indicators of first-order constructs as measurement variables for their respective second-order constructs. This approach aligns with the hierarchical component model proposed by Wold (1982)[63], where a higher-order construct is measured using all indicators of its lower-order dimensions.

In this study, the second-order construct E-service quality is modeled using the indicators from its first-order dimensions: Web Design (3 items), Security/Privacy (3 items), and Customer Service (3 items). Likewise, Service quality is represented by Assurance (3 items), Empathy (3 items), and Tangibles (3 items); and Customer loyalty includes Repurchase Intention (4 items) and Word of Mouth (2 items). Each indicator thus appears twice—first for its respective dimension, and again for the second-order latent variable. The results confirm that all first-order constructs meet the required reliability and validity criteria, supporting their inclusion in the final model.

3.6.2. The Two-Stage Approach

The two-stage approach involves estimating the first-order constructs in the initial stage to obtain latent variable scores. These scores are then used as manifest indicators for the second-order constructs in the second stage. This technique effectively transforms each first-order construct into a single-indicator latent variable, which has the statistical advantage of minimizing multicollinearity and simplifying the structural model[64].

One major advantage of this method is that it allows second-order constructs to be modeled as endogenous variables in the structural model, as supported by Ringle et al. (2015)[65]. This approach was particularly beneficial in the context of this study, which includes several second-order constructs.

3.7. The Results of PLS-SEM

3.7.1. Quality Testing

Table 4 presents the R^2 and adjusted R^2 values for all endogenous variables. These values represent the proportion of variance explained by the model for each construct. Notably, customer loyalty exhibited the highest explanatory power (R^2 = 0.682), suggesting that the model explains over 68% of its variance. Other constructs such as customer satisfaction (R^2 = 0.439), purchasing experience (R^2 = 0.578), responsiveness (R^2 = 0.399), and customer control (R^2 = 0.460) also demonstrated substantial levels of explained variance.

Table 4. R-Square values.

	R-Square	R-Square Adjusted
Customer control	0.462	0.460
Customer loyalty	0.685	0.682
Customer satisfaction	0.442	0.439
Purchasing experience	0.579	0.578
Reliability	0.361	0.358
Responsiveness	0.401	0.399

3.7.2. Hypothesis Testing

Table 5 summarizes the results of the effects analysis using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The table includes key statistical metrics such as path coefficients (β), standard deviations, T statistics, and P values to assess the significance of the hypothesized relationships. The path coefficient (β) reflects the strength and direction of the relationship between constructs, while the P value indicates the level of statistical certainty. A large β suggests a stronger effect, whereas a small β indicates a weaker influence. Meanwhile, a P value below the conventional thresholds ($p < 0.05$, $p < 0.01$, or $p < 0.001$) demonstrates that the relationship is unlikely to have occurred randomly and can therefore be considered statistically significant. The results indicate that all hypotheses are supported, with P values below 0.001.

Table 5. Summary of hypothesis testing results.

Hypothesis	β	Standard Deviation	T-Statistics	*p*-Values	Conclusion
H1: ESQ->PE	0.761	0.042	18.048	0.000	Accepted
H2: ESQ->CC	0.678	0.042	16.211	0.000	Accepted
H3: SQ->RE	0.600	0.043	14.108	0.000	Accepted
H4: SQ->RESP	0.633	0.042	15.075	0.000	Accepted
H5: ESQ->CSA	0.509	0.048	10.624	0.000	Accepted
H6: SQ->CSA	0.420	0.055	7.651	0.000	Accepted
H7: CSA->CL	0.408	0.053	7.748	0.000	Accepted
H8: CPV x CSA->CL	**−0.083**	0.020	4.419	0.000	Accepted

Figure 2 presents the findings of the structural modeling test by displaying path coefficients. Among all relationships, e-service quality had the strongest effect on purchasing experience (β = 0.761, p = 0.000), underscoring the central role of digital interface quality in shaping consumer perceptions. E-service quality also strongly influenced customer control (β = 0.678, p = 0.000) and satisfaction (β = 0.509, p = 0.000), confirming its position as a critical driver of positive customer outcomes. In comparison, service quality, which is thought to be more traditional in nature, still had a significant impact on reliability (β = 0.600, p = 0.000), responsiveness (β = 0.633, p = 0.000), and satisfaction (β = 0.420, p = 0.000). These results suggest that while e-service quality dominates, conventional service factors continue to matter, particularly for agricultural products that require careful handling and timely delivery. Customer satisfaction was found to be a strong predictor of loyalty (β = 0.408, p = 0.000). Although the moderating role of customer perceived value was significant and negative (β = −0.083, p = 0.000), indicating that when customers perceive very high value, their loyalty is driven not only by satisfaction but also by the tangible benefits and utility they associate with the products or services.

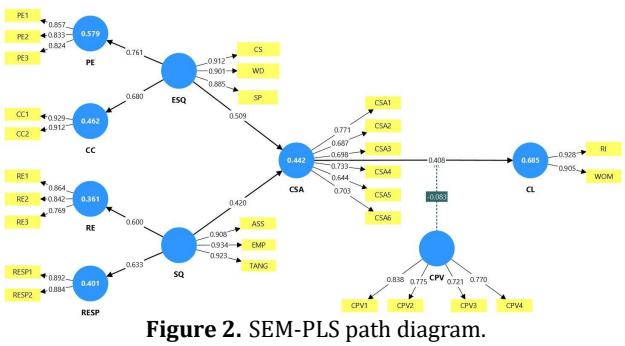

Figure 2. SEM-PLS path diagram.

4. Discussion

This study explores how e-service quality and traditional service quality jointly shape the purchasing ex-

perience, customer satisfaction, and loyalty in Vietnam's agricultural e-commerce sector. The findings contribute to a deeper

understanding of the factors influencing consumer loyalty, particularly those of young and tech-savvy buyers, who approach agricultural products differently from other goods when shopping online.

Prior research in China has shown that e-commerce enables farmers to improve market access, reduce dependence on traditional distribution channels, and enhance brand recognition Zhou et al., (2023) [66]. In China, the development of cross-border e-commerce has been strongly supported by government policies, advanced logistics infrastructure, and digital payment systems, allowing agricultural producers to directly connect with both domestic and international consumers. This has significantly improved product traceability, quality control, and the overall competitiveness of Chinese agricultural exports. In Vietnam, although the agricultural e-commerce sector is still at an earlier stage, similar patterns are emerging. Platforms such as Shopee, TikTok Shop, and Buudien.vn have become important channels for farmers and cooperatives to reach wider markets and promote regional specialties. However, compared to China, Vietnam faces different contextual challenges. Consumer trust in agricultural products sold online remains limited due to concerns about the reliability, security, rights control and responsiveness of e-commerce platforms. However, shopping on e-commerce platforms also brings many benefits to consumers. For example, customers can enjoy the convenience of placing orders anytime and anywhere with home delivery and electronic payment, which has also been demonstrated in the study by Duarte et al (2018) [67]. In addition, platforms are increasingly improving technologies that allow consumers to track orders online, review products, and participate in livestream shopping, which provides a more interactive experience and enhances overall satisfaction, which has also been demonstrated in an experimental study by Akturk et al. (2022) [68].

The findings also align with studies in other contexts that highlight the role of both e-service quality and service quality in driving satisfaction and loyalty in perishable product categories. For instance, Kang & Namkung (2024) [69] found that service quality attributes and perceived value are critical in shaping U.S. consumers' online impulsive purchases of fresh food. Compared to previous studies, the present research emphasizes that the combined effect of E-service Quality and Service Quality attributes is particularly critical in the Vietnamese context. This is because agricultural products are highly perishable, difficult to preserve, and often lack transparent information, which leads to higher levels of product risk and information asymmetry than in many other markets. In such a situation, relying on only one dimension—either electronic or traditional service quality is insufficient to ensure consumer satisfaction. Instead, the integration of both dimensions helps mitigate consumer concerns, strengthen trust in the products, and ultimately enhance satisfaction as well as loyalty in online agricultural purchases.

The results confirm that H1 is supported (β = 0.761). In agricultural e-commerce, where products are highly perishable and delivery performance is critical, service attributes such as delivery capacity and system responsiveness are pivotal in ensuring customer satisfaction and reducing perceived uncertainty, especially in environments where consumers cannot physically inspect goods before purchase [70]. In their study of local agricultural specialties in Vietnam, they identify system responsiveness and delivery capability as key contributors to a smoother purchasing experience. Moreover, agricultural products are often considered low-involvement yet high risk, given the variability in quality and inability to inspect items before delivery [71]. This finding aligns with Kang & Namkung (2024) [69], who emphasized that responsiveness and delivery reliability are among the most critical drivers of consumer trust in fresh food e-commerce. Similarly, Yang et al. (2024) [72] found that logistics service quality directly enhances satisfaction and reduces perceived uncertainty in fresh agricultural products. The consistency between our findings and previous studies reinforces the perspective of the Technology Acceptance Model (TAM): when digital platforms are perceived as increasingly useful and improved for ease of use, customers experience a better purchasing experience and reduce perceived risks, thereby enhancing their satisfaction. Practically, this

suggests that agricultural e-commerce platforms should prioritize seamless delivery tracking, real-time updates, and responsive customer service to reassure buyers in a high-risk product category where physical inspection is not possible. Such improvements not only mitigate perceived risks but also build consumer trust, which is essential for enhancing the purchasing experience in the digital agricultural market. As a result, high-quality e-service acts as a foundational enabler that transforms functional interactions into a seamless and reassuring purchasing experience, particularly in high-risk product categories like agriculture.

Building on this, the findings support H2 (β = 0.678). When platforms provide intuitive features such as delivery tracking, order modification, and timely notifications, customers feel empowered to manage their purchases independently. This sense of control is particularly important for perishable agricultural items, where concerns about freshness and delivery timing can cause anxiety. Kang and Namkung (2024) [69] further reveal that ease of use, problem resolution (akin to responsiveness/fulfillment), and information quality significantly boost utilitarian value suggesting these attributes help consumers feel more in control particularly critical for perishable agricultural products. Additionally, reviews covering agricultural e-commerce note that platforms enabling clear communication and transparency in logistics directly improve customer autonomy and satisfaction [73]. The consistency of these findings reinforces the technology acceptance model (TAM), as features that enhance perceived ease of use (e.g., intuitive delivery tracking, timely notifications, and order modification

options) increase customer control. Platforms should invest in real-time tracking systems, transparent logistics communications, and flexible order management tools to increase customer control. By improving the quality of e-services, businesses will help consumers feel empowered, reduce uncertainty, and build long-term trust in the digital agriculture market.

Further, the analysis confirms H3 (β = 0.600), which plays a pivotal role in retaining customers especially in agricultural e-commerce transactions. Consumers purchasing perishable goods such as vegetables, meat, or dairy depend heavily on the platform's ability to deliver consistent quality and on-time service [70]. As reliability becomes the baseline for trust in high-risk product categories, platforms must ensure operational consistency and clear communication of delivery timelines and product handling procedures [74]. This aligns with research by Palese and Usai (2018) [33], who emphasized that among various service quality dimensions, responsiveness and reliability remain the strongest predictors of consumer trust in online commerce. Similarly, Arli et al. (2024) [34] found that reliability reflected in timely and accurate order fulfillment, was a decisive factor driving customer satisfaction and loyalty in food delivery services. This finding supports our H3, as agricultural e-commerce also requires delivery performance and product accuracy to build customer trust. The platforms should prioritize consistency in service quality, such as maintaining the frozen logistics, ensuring shipping on time and providing transparent updates of the processing process. These measures not only strengthen the quality of service but also act as the foundation for building long-term reliability for customers.

Consistently, the analysis supports H4 (β = 0.633). In e-commerce, responsiveness reflects how promptly and effectively platforms address customer inquiries, complaints, or issues during and after the purchase process. This result aligns with Yang et al. (2024) [72]. In the context of fresh food e-commerce emphasized that key service quality dimensions including tangibility, reliability, assurance, empathy, and particularly responsiveness strongly shape customers' perceptions of service responsiveness and their expectations regarding timely problem resolution This is particularly crucial in agricultural e-commerce, where service disruptions such as delivery delays, product damage in transit, or order mismatches can significantly diminish customer satisfaction. Prompt service recovery not only mitigates these negative experiences but also reinforces perceived fairness and reliability [68]. When consumers perceive that their concerns are handled quickly and professionally, they feel that this sense of being esteemed enhances brand trust, fosters positive word-of-mouth, and contributes significantly to long-term loyalty in the competitive agricultural online retail market. Platforms should prioritize real-time com-

munication channels (e.g., AI-powered chatbots, 24/7 support hotlines) and establish transparent service recovery mechanisms (e.g., refunds, compensation, or replacement policies). These strategies not only improve service quality but also enhance responsiveness, thereby fostering long-term loyalty in the competitive agricultural e-commerce market.

Moreover, this study confirms H5 (β = 0.509). Critical elements such as website usability, payment security and clear product information directly influence how customers evaluate agricultural platforms. In Vietnam, where buyers cannot directly check freshness, grading, or pesticide use before delivery, satisfaction depends largely on transparent product descriptions, traceability features, and reliable logistics systems [75]. This finding aligns with Rita et al. (2019) [76], who reported that fulfillment of one of the critical dimensions like payment security, fast checkout, clear product info has a strong positive impact on overall e-service quality, and that e-service quality in turn significantly enhances customer satisfaction. Similarly, Shyu et al. (2023) [20] demonstrated that in agricultural e-commerce, service attributes such as detailed product information, responsive systems, and efficient logistics significantly enhance customer satisfaction and loyalty. These results underscore that when platforms offer intuitive navigation, traceability features, and reliable digital interfaces, customers perceive lower risk and feel more emotionally reassured.

Interestingly, the data support H6 (β = 0.420). This result indicates that traditional service quality dimensions including assurance, empathy and tangibles remain important even in digital commerce settings. Despite the dominance of online interfaces in agricultural e-commerce, buyers in Vietnam still expect timely support and transparent updates when purchasing perishable products such as fruits and vegetables. This finding aligns with Ping Yu and Dongmei Zhao (2013) [77], who showed that in agricultural e-commerce, both technical service dimensions (e.g., reliability, responsiveness) and human-centric elements (like timely and transparent information) significantly impact customer satisfaction and platform selection. In the Vietnamese agricultural context, where inconsistent quality and delivery delays are common, human-centered service factors help reduce perceived risk, provide emotional reassurance, and ultimately reinforce satisfaction (Thi et al, 2023) [78]. Therefore, strengthening customer support and transparent communication can build greater trust and long-term loyalty in agricultural e-commerce.

Turning to behavioral outcomes, the analysis confirms H7 (β = 0.408). This finding is consistent with Guo et al. (2022) [79], who emphasized that satisfaction reduces perceived risk and constitutes a fundamental driver of customer loyalty. In the Vietnamese agricultural e-commerce context, where uncertainty regarding product freshness, quality, and delivery reliability remains prevalent, satisfaction operates as a crucial mechanism to alleviate consumer concerns and promote repeated transactions. This reflects the broader observation that trust is not easily established in agricultural supply chains

characterized by fragmentation and information asymmetry. Similarly, Camilleri and Filieri (2023) [80], highlighted that sustained positive experiences and consistent value provision reinforce customer commitment, especially in high-risk consumption environments. From a practical perspective, e-commerce platforms should prioritize transparent product information, rigorous quality assurance, and dependable delivery systems to strengthen customer satisfaction. Such strategies are likely to cultivate trust, encourage repeat purchases, and sustain long-term loyalty within Vietnam's high-risk, perishable agricultural markets.

Finally, H8 is supported (β = −0.083). The negative coefficient indicates that as perceived value increases, the direct effect of satisfaction on loyalty decreases slightly. This aligns with the meta-analytic findings of Chi and Phan (2025) [81], which confirms that customer satisfaction fully mediates the relationships between service quality, perceived value, and loyalty, although the negative coefficient in our study highlights a subtle difference in the context of agricultural e-commerce. In Vietnam, consumers increasingly consider product attributes such as freshness, organic certification, eco-friendly packaging, and local sourcing, which can independently influence loyalty beyond service satisfaction (Rizzo et al., 2024) [82]. These contextual factors, in-

cluding fragmented supply chains and seasonal product availability, explain why perceived value may partially substitute for satisfaction in shaping loyalty. Practically, e-commerce platforms and suppliers should focus on transparent labeling, quality verification, and ethical product attributes to enhance perceived value. By doing so, businesses can strengthen customer loyalty even when service experiences are not fully consistent. This strategy is particularly relevant in high-risk, perishable markets like agricultural products, where product quality and ethical features play a critical role in consumer decision-making.

5. Conclusions

This should clearly explain the main conclusions of the article, highlighting its importance and relevance. This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex. The study examined the impact of service quality and e-service quality elements on customer satisfaction and loyalty in the online purchase of agricultural products via e-commerce platforms in Vietnam. The study, which analyzed responses from 526 individuals, predominantly young consumers with habitual online purchasing behaviors identified that platforms such as Shopee, TikTok Shop, Buudien.vn, and Lazada are frequently utilized for these transactions. This behavior was influenced by critical dimensions of e-service quality, including website design, security, and privacy, alongside elements of service quality such as assurance, empathy, and tangibles. These elements are crucial in influencing consumer satisfaction and fostering loyalty in agricultural e-commerce, where customer-perceived value serves as a significant moderating variable that reinforces the relationship between satisfaction and loyalty.

5.1. Theoretical Contributions

The application of Structural Equation Modeling (SEM), combined with the theoretical foundation of the Technology Acceptance Model (TAM), revealed that e-service quality has a significant impact on customer satisfaction, which in turn has a substantial effect on customer loyalty. This highlights the increasing importance of digital interfaces and overall user experience in the context of e-commerce, particularly for agricultural goods. Customers value ease of navigation, transaction security, and real-time support more than conventional service cues. Moreover, the study confirmed that customer-perceived value intensifies the satisfaction-loyalty link, pointing to the relevance of perceived benefits in customer retention. The greater the value perceived by customers, the stronger their emotional and behavioral commitment to a platform becomes.

5.2. Practical Implications

In practice, e-commerce providers in the agricultural sector should adopt a dual strategy: enhancing e-service quality and delivering perceived value. Improving website usability, system responsiveness, and real-time delivery tracking can enhance the purchasing experience, satisfaction, and perceived control over the purchasing process. At the same time, ensuring consistent service quality through reliable delivery, secure payment, and responsive support helps build customer trust and platform reliability. Since customer-perceived value moderates the satisfaction-loyalty relationship, businesses should offer value-added features such as ethical sourcing, eco-friendly packaging, traceability, and personalized promotions. These strategies not only reinforce satisfaction but also deepen emotional engagement and encourage long-term loyalty, which is crucial in agricultural e-commerce, where product risk and information asymmetry remain high.

5.3. Limitations and Future Research

Despite offering relevant findings, this research has some limitations. The reliance on a convenience sampling approach constrains the representativeness of the findings. The final sample size might not fully capture the demographic and behavioral diversity of the broader Vietnamese population purchasing agricultural products online. The respondents were skewed toward young, urban, and digitally active consumers, which restricts the generalizability of the findings to other market segments, such as older or rural popula-

tions who may also engage in agricultural e-commerce. Future research should employ probability-based sampling and consider qualitative approaches to explore deeper insights into the underlying motivations shaping consumer perceptions and behaviors.

In summary, the study offers valuable insights for businesses seeking to enhance customer retention in the Vietnamese online agricultural market. As digital commerce continues to grow, aligning service design with customer expectations and perceived value will be essential for building long-term relationships. Companies that recognize and adapt to these evolving demands will likely secure a more loyal customer base and gain a competitive edge in the expanding digital economy.

Author Contributions

Conceptualization, N.-H.D. and Q.P.N.; methodology, N.-H.D. and Q.P.N.; software, D.V.L.N.; validation, H.L.T. and T.P.T.N.; formal analysis, H.L.T.; investigation, Q.P.N. and D.V.L.N.; resources, N.T.N.T.; data curation, D.V.L.N. and H.L.T.; writing—original draft preparation, N.-H.D. and Q.P.N.; writing—review and editing, N.T.N.T. and T.P.T.N.; visualization, D.V.L.N.; supervision, N.-H.D.; project administration, N.-H.D.; funding acquisition, N.-H.D. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

Data will be made available on request.

Conflicts of Interest

The authors declare no conflict of interest.

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