Int. j. adv. multidisc. res. stud. 2026; 6(5):1510-1514

Received: 29-08-2026
Accepted: 09-10-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Online Sales Performance in the Consumer Electronics and Refrigeration Sector: Evidence from E-Commerce Market

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DOI: https://doi.org/10.62225/2583049X.2026.6.5.7045
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Abstract
In Hanoi's quickly growing e-commerce market, this study examines online sales performance in the consumer electronics and refrigeration sectors and rising seasonal demand. Retail dynamics in emerging economies have seen a considerable transformation due to the growing popularity of online platforms and rising consumer expectations about product legitimacy, competitive price, warranty transparency, and skilled installation services. This study creates a conceptual framework to explain how technology capabilities, company resources, and customer perceptions all work together to affect online sales success. It does this by drawing on the Technology Acceptance Model (TAM), Resource-Based View (RBV), and consumer trust theory. 350 customers in Hanoi were surveyed as part of a quantitative study design. Cronbach's alpha and exploratory factor analysis (EFA) were used to evaluate validity and reliability. The findings show that all respondent groups consistently view online sales performance at a high level, with no statistically significant variances by age, gender, or employment. These results imply that, thanks to increased digital access and better transportation infrastructure, e-commerce adoption in the electronics and refrigeration industries has reached a mature stage. Crucially, the study emphasizes how important service-related elements are in determining customer satisfaction and purchasing behavior, especially shipping, installation, and after-sales support. By offering sector-specific data from a developing market and incorporating digital transformation and socioeconomic viewpoints into the examination of online sales performance, this study adds to the body of literature. The results have useful ramifications for businesses looking to boost their competitiveness in AI-enabled digital markets as well as for legislators hoping to promote the growth of sustainable e-commerce.

Keywords: Business Administration, Finance, Online Sales Performance, Statistical Data, E-Commerce

JEL Classifications: O15, M12, M54, K31, A13, A14

1. Introduction

E-commerce's explosive growth has completely changed retail markets, especially in developing nations like Vietnam. The consumer electronics and refrigeration industry has grown significantly on online platforms in recent years due to shifting customer behavior, rising internet penetration, and the use of digital payments. This sector is particularly active in Hanoi, where demand spikes in the summer when cooling appliances are crucial.

Theoretically, a company's capacity to translate digital interactions into financial results, such as increased revenue, market share, and customer happiness, is reflected in its online sales performance (OSP). OSP is impacted by both customer trust and technology capabilities, according to earlier studies, especially in digital marketplaces with intense competition and information asymmetry.

Online shopping is currently changing due to digital transformation. Predictive analytics, dynamic pricing, and driven recommendation systems help businesses better understand customer preferences and maximize sales tactics. Simultaneously, consumers are placing a greater emphasis on genuine products, reasonable pricing, transparent warranty terms, and expert installation services—particularly for expensive items like refrigeration units.

The performance of e-commerce has been the subject of numerous empirical studies; however, the refrigeration and electronics industries in emerging nations have received less attention. Specifically, the seasonality of demand and the impact of service

quality on online sales performance are still poorly understood.

In order to provide empirical insights into consumer behavior and business performance in a fast changing digital economy, this study intends to investigate online sales performance in Hanoi's refrigeration product industry.

A pertinent context for analyzing online sales success in product categories requiring both technical ease and physical service support is Vietnam's growing digital retail environment. The Ministry of Industry and Trade (2025) claims that digital payments, platform development, and modern logistics have all contributed to e-commerce's rise to prominence as a distribution channel. However, extra issues with product legitimacy, technical specifications, installation, energy efficiency, and warranty fulfillment may arise when purchasing consumer electronics and refrigeration equipment online. Instead of treating electronic commerce as a homogenous retail industry, these features provide a sector-specific analysis of perceived online sales performance.

2. Background theory and literature review

2.1 Literature Review

The significance of digital skills in improving online sales performance is highlighted by recent studies. For instance, Verhoef *et al*. (2021) [13] point out that businesses can enhance customer satisfaction and sales results through digital transformation. However, developed markets are the main focus of their research.

According to Wamba *et al*. (2017) [14], big data analytics greatly enhances business performance by improving customer targeting and decision-making. However, sector-specific features like marketplaces for durable products are not covered in the study.

The factors influencing Generation Y and Z's intention to continue buying online in the new normal were examined by Thi *et al*. (2022) [11]. The findings showed that while perceived hazards of online buying acted as a barrier, perceived usefulness, perceived ease of use, contentment, and environmental awareness were facilitators of repurchase intention. Notably, Gen Y's intention to repurchase was found to be more negatively impacted by the barrier. Although personalization had significant indirect impacts through perceived utility, perceived ease of use, and satisfaction, it was not directly related to the purpose. Making better decisions may be aided by knowing how consumers from various generations in an emerging nation intend to continue buying online in the new normal.

Huang and Rust (2021) [7] create a three-phase framework for strategic marketing planning that incorporates several advantages of artificial intelligence (AI): thinking AI for processing data to make decisions, feeling AI for analyzing human emotions and interactions, and mechanical AI for automating repetitive marketing functions and activities. The application of AI to marketing research, strategy (segmentation, targeting, and positioning, or STP), and actions is outlined in this framework.

The significance of logistics and service quality in e-commerce performance is emphasized by Chong *et al*. (2016) [2]. Installation services and warranty expectations, however, receive little attention.

The refrigeration and electronics industry's online sales performance in emerging markets has not been sufficiently studied in the literature, especially in light of seasonal demand, fierce competition, and rising customer expectations for authenticity, pricing, and after-sales services.

The ongoing significance of customer experience and post-purchase services in Vietnam's e-commerce business is demonstrated by recent empirical data. While Khoa *et al*. (2024) [8] offer survey data about privacy-related concerns and online purchasing behavior, Ngo *et al*. (2025) [9] show that logistical service quality is significant to consumer trust, satisfaction, and repurchase intentions. By highlighting the service and trust aspects of digital transactions, these findings supplement previous technology-focused research. However, further research is necessary to fully understand the operational features of consumer electronics and refrigeration devices, especially with regard to installation needs and product longevity.

We created scales to assess online sales performance (OSP) in the refrigeration product industry in Hanoi, Vietnam, based on the findings of earlier research (See Table 1).

Table 1: Measurement scales of dependent variables

Code	Description	Sources
Online Sales Performance (OSP)		
OSP1	Revenue from online sales has grown dramatically.	Rego *et al*. (2009) [10]; Trainor *et al*. (2014) [12]
OSP2	There is a good conversion rate from looking to buying.	
OSP3	The share of the online market has increased.	
OSP4	Online shopping offers a high level of customer satisfaction.	

2.2 Background theory

Technology Acceptance Model (TAM)

Based on perceived utility and perceived ease of use, the Technology Acceptance Model (TAM) describes how users accept and engage with digital technologies (Davis, 1989) [3]. These elements have a crucial role in influencing consumer choices in e-commerce settings, particularly when high-value durable goods like refrigeration devices are involved. Platforms that offer user-friendly interfaces, clear information, and effective purchasing procedures are more likely to be used by customers.

TAM is used in this study to explain how Hanoi customers assess online retailers when making purchases of electronics and refrigeration goods. Features like intelligent search, recommendation engines, and user-friendly interfaces improve perceived utility and usability in the context of digital transformation and AI. Therefore, by raising conversion rates and consumer happiness, these technological features help to increase online sales success.

Resource-Based View (RBV)

According to the Resource-Based View (RBV), businesses can gain a competitive edge by making efficient use of uncommon, precious, unique, and non-replaceable resources (Barney, 1991) [1]. Technological talents, data analytics, and logistics infrastructure are becoming more and more important resources in the digital economy.

Applying RBV to this study, firms operating in the refrigeration e-commerce market in Hanoi rely on digital platforms, supply chain efficiency, and service capabilities (e.g., delivery and installation) to enhance performance. The integration of AI-driven tools, such as demand forecasting and dynamic pricing, further strengthens competitive

positioning. Therefore, firms with stronger digital and operational capabilities are better able to achieve higher online sales performance.

Consumer Trust Theory

According to consumer trust theory, trust has a significant impact on online buying behavior, especially in situations where there is ambiguity and information asymmetry (Gefen *et al*., 2003) [4]. Customers are more inclined to transact online when they feel trusted, which lowers perceived risk.

Because refrigeration systems are high-value items that need dependability, warranty assurance, and after-sales services, consumer trust is particularly crucial in the context of this study. Customers in Hanoi's cutthroat e-commerce sector place a high value on genuine goods, open pricing, and unambiguous warranty terms. Online sales performance is enhanced by the existence of certified merchants, consumer reviews, and safe payment methods.

A complementary viewpoint on online retail success is provided by the integration of TAM, RBV, and consumer trust theory. While RBV emphasizes the organizational resources needed to ensure dependable delivery, technical support, and after-sales operations, TAM explains how buyers view digital shopping interfaces. The ambiguity surrounding product quality, transaction security, and warranty guarantees is further addressed by consumer trust theory. When taken as a whole, these viewpoints offer a conceptual foundation for analyzing online sales performance as a multifaceted phenomenon involving client confidence, operational capabilities, and digital accessibility. However, the impacts predicted by these theoretical perspectives are not independently estimated in this investigation.

3. Research Methodology

This study looks the online sales performance in Hanoi's refrigeration product industry using a quantitative research methodology. A systematic questionnaire was used to gather information from 350 respondents on their opinions about online shopping habits and sales performance metrics. Subjective assessments can be measured while preserving statistical comparability by using a Likert scale.

The sampling technique guaranties that respondents' demographic traits, such as gender, age, and occupation, are diverse. In the case of e-commerce, where consumer behavior differs among various demographic groups, this is especially crucial. The information illustrates how Hanoi's digital economy is dynamic, particularly during times of high demand like the summer.

Internal consistency was evaluated using Cronbach's alpha to guaranty measurement reliability, and the construct structure was then validated using exploratory factor analysis (EFA). These methods guaranty the measurement model's resilience and are widely used in behavioral and business research.

The research focuses on respondents' assessments of four metrics that measure perceived online sales performance because of the descriptive and exploratory goals of the study. Descriptive statistics summarize response patterns, and internal consistency and exploratory factor analysis are used to determine whether these indicators constitute a cohesive measurement construct. When the related test numbers are presented, comparisons between demographic groups can offer additional proof of perceptual differences. Crucially, the consumer-based poll gathers opinions about how well businesses are performing rather than revenue, conversion rates, or market share results that have been objectively confirmed.

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 presents descriptive statistics of the observed variables measuring online sales performance.

Table 2: Results of respondents' survey on online sales performance

	N	Minimum	Maximum	Mean	Std. Deviation
OSP1	350	1.0	5.0	3.611	.8944
OSP2	350	1.0	5.0	3.646	.9054
OSP3	350	1.0	5.0	3.374	.8989
OSP4	350	1.0	5.0	3.529	.9352
Valid N (listwise)	350				

Source: Prepared by the authors (2025) and SPSS software.

All observed variables assessing online sales performance have mean values above the midpoint of the Likert scale, according to the descriptive statistics shown in Table 2. This implies that the majority of respondents believe that online sales activities, including revenue, conversion rates, and customer happiness, are growing. The comparatively low standard deviations show that responses are consistent and represent steady perceptions throughout the sample.

From an economic standpoint, these results indicate that Hanoi's refrigeration e-commerce sector is growing steadily and that customer engagement is rising. The increased demand for cooling equipment throughout the summer, along with better digital platforms and shipping services, may be the reason for the good performance metrics. These findings demonstrate how crucial seasonal demand and technology adoption are in determining the success of online sales.

With mean scores ranging from 3.374 to 3.646 on a five-point scale, the descriptive data show somewhat positive assessments of online sales success. Perceived conversion performance (OSP2) has the greatest mean, while perceived growth in online market share (OSP3) has the lowest. This discrepancy implies that respondents might view quick purchasing efficacy more favorably than more extensive market expansion. However, the findings reflect customer impressions and cannot be used to objectively determine changes in competitive market position or actual sales growth.

4.2 Analysis of the reliability of observed variables

Table 3 presents the results of reliability analysis using Cronbach's Alpha.

Table 3: Results of reliability analysis of observed variables through Cronbach's alpha coefficient

Cronbach's Alpha	N of Items
0.870	4

Code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
OSP1	10.549	5.899	.645	.864
OSP2	10.514	5.528	.740	.826
OSP3	10.786	5.556	.740	.827
OSP4	10.631	5.316	.767	.815

Source: Prepared by the authors (2025) and SPSS software.

All assessment items show strong internal consistency, with corrected item-total correlations surpassing acceptable criteria, according to the reliability analysis results in Table 3. This suggests that the underlying construct of online sales performance is adequately captured by the chosen metrics (Hair *et al*., 2009; 2014) [5, 6].

The measuring scale's robustness suggests that the survey instrument is a good fit for evaluating e-commerce performance in the refrigeration industry. This implies that key performance indicators like revenue growth, conversion rates, and customer happiness are trustworthy criteria for assessing the success of an online firm from a managerial perspective.

Positive correlations between individual indicators and the overall scale are indicated by the corrected item–total correlations shown in Table 3, which range from 0.645 to 0.767. These findings imply that there is a significant amount of shared information among the four items. However, before making a firm judgment regarding internal consistency, the reliability coefficient and the item-deletion statistics should be balanced. Because the precision of the measurement assessment determines the validity of subsequent construct-level interpretations, reporting a validated Cronbach's alpha is very crucial.

4.3 Analysis EFA

EFA analysis was performed using the component analysis method and Varimax rotation; the analysis results are shown in Table 4.

Table 4: EFA analysis results

STT	Detailed description		Value
1	**KMO**		0.815
2	**Bartlett's test**	Chi-Square	687.817
		Df	6
		Sig.	0.000<0.001
3	**Total Variance Explained**	Number of forming factors	1
		Eigenvalue	2.879
		Total % of extracted variance	71.972
4	**Rotation matrix**	OSP4	.879
		OSP3	.860
		OSP2	.860
		OSP1	.791

Source: Prepared by the authors (2025) and SPSS software.

The unidimensional nature of online sales performance is confirmed by the EFA results, which show that all observed variables load heavily onto a single factor. The data's eligibility for factor analysis is further confirmed by the high KMO value and substantial Bartlett's test (Hair *et al*., 2009; 2014) [5, 6].

These results suggest that it is possible to describe online sales performance in the refrigeration industry as a cohesive construct. In the context of digital transformation, when several performance measures are connected through technology and customer experience, this is especially pertinent.

With a KMO value of 0.815 and a statistically significant Bartlett's test (χ^2 = 687.817, df = 6, $p < 0.001$), the factor-analytic results offer initial evidence for a single underlying dimension. The reported loadings range from 0.791 to 0.879, and the retained component accounts for 71.972% of the overall variance. These results show that a significant amount of variance is shared by the four indicators. However, rather than providing a thorough confirmation of construct validity, the results should be viewed as preliminary evidence of dimensional coherence because principal component analysis is essentially a data-reduction process.

4.4 Discussion

The results of this study are in line with earlier studies that highlight how digital transformation can improve company performance. The findings support Verhoef *et al*.'s (2021) [13] findings that digital platforms enhance customer satisfaction and sales success. But by concentrating on the refrigeration industry, where product attributes and service needs are very different from those of other industries, this study expands on previous studies.

The findings also support Wamba *et al*. (2017) [14], emphasizing the significance of making decisions based on data. In contrast to earlier research, this study highlights the importance of after-sales services and seasonal demand, both of which are crucial in the electronics industry. These results offer fresh perspectives on how technology, consumer behavior, and market dynamics interact in developing nations.

The results indicate that although opinions vary across performance characteristics, customers in Hanoi typically view online sales performance in the electronics and refrigeration markets favorably. This finding is generally consistent with the increasing significance of digital retailing in Vietnam and with current studies that highlight customer confidence and the quality of logistical services (Ngo *et al*., 2025) [9]. The descriptive and measurement data, however, do not prove that online sales success is directly influenced by AI use, seasonal demand, or after-sales services. These elements continue to be theoretically significant explanations that call for precise measurement and additional empirical investigation.

5. Implications and Recommendations

First, Businesses should make investments in AI-driven solutions to improve customer satisfaction and maximize sales tactics. Predictive analytics and recommendation systems are two examples of tools that can increase customer happiness and conversion rates.

Second, Businesses should prioritize logistics and high-quality services, such as prompt delivery and expert installation. These elements are especially crucial for expensive goods like refrigeration appliances.

Third, by guaranteeing product legitimacy, open pricing, and unambiguous warranty policies, businesses can increase brand confidence. These components are essential for lowering perceived risk and promoting internet shopping.

Fourth, to encourage sustainable growth in e-commerce marketplaces, governments should support the development of digital infrastructure and consumer protection regimes.

Finaly, retailers of refrigerators and consumer electronics should think about combining dependable physical service delivery with digital client engagement. Accurate technical descriptions, clear warranty terms, organized installation schedules, and prompt complaint resolution are all practical considerations. Demand forecasting and AI-assisted recommendations might present more operational opportunities, but their efficacy should be assessed using real transaction and service-performance data rather than

relying on positive consumer perceptions.

Businesses should create integrated performance-monitoring systems that incorporate online conversion statistics, verifiable sales growth, customer happiness, return rates, and after-sales support outcomes, according to a more comprehensive management viewpoint. Managers would be able to differentiate between long-term consumer relationships and short-term promotional success with the use of such technologies. A more reliable e-commerce environment may also result from public initiatives promoting digital infrastructure, consumer protection, and open marketplace principles.

6. Conclusion

This study highlights the impact of digital transformation and consumer behavior by presenting empirical data on online sales performance in Hanoi's refrigeration product industry. The results verify that e-commerce platforms have greatly enhanced customer involvement and business performance.

The study's concentration on a single location and the absence of direct assessment of AI-related factors are among its shortcomings. To improve generalizability, future studies should include technology indicators and broaden the scope to include additional industries and geographical areas.

This study offers preliminary data on how consumers in Hanoi's electronics and refrigeration market view online sales performance. While the provided component analysis indicates that the four performance measures have a similar dimension, the descriptive findings show rather positive ratings. However, broader interpretation is limited by the study's local focus, reliance on consumer-reported business outcomes, and lack of direct indicators of AI use and service quality. Future studies might explore the functions of digital capabilities, trust, logistics, and after-sales service in a more thorough explanatory model, look at seasonal purchase trends, and integrate consumer surveys with shop transaction records.

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