Journal of Infrastructure, Policy and Development 2024, 8(5), 4577.
https://doi.org/10.24294/jipd.v8i5.4577

Article

Impact of reverse logistics on customer satisfaction: A research on e-commerce platforms in Vietnam

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CITATION

Thu HTT, Nguyen KH, Vu MH, Cong PT. (2024). Impact of reverse logistics on customer satisfaction: A research on e-commerce platforms in Vietnam. Journal of Infrastructure, Policy and Development. 8(5): 4577. https://doi.org/10.24294/jipd.v8i5.4577

ARTICLE INFO

Received: 6 February 2024
Accepted: 11 April 2024
Available online: 30 May 2024

Abstract: Vietnamese e-commerce has recently experienced a robust growth, especially e-commerce platforms such as Shopee, Lazada, Tiki. Reverse logistics has been pointed out as having a significant impact on the performance of an e-commerce platform. To capture the actual impact of some reverse logistics factors, i.e, Return Processing Time (RPT), Return Policy (RP), Return Cost (RC), Customer Service (CSR), and Post-Return Product (PRP), on Customer Satisfaction (CS), an OLS model was conducted. The results indicated significant correlation between all independent variables and dependent variables, which CSR shows the greatest correlation and PRP shows the weakest correlation. The study then made some suggestions for e-commerce platforms in Vietnam to enhance their reverse logistics process to get higher customer satisfaction.

Keywords: reverse logistics; customer satisfaction; e-commerce; e-commerce platforms; Vietnamese e-commerce

1. Introduction

Following the successful containment of the Covid-19 pandemic, Vietnam's e-commerce industry has continued to thrive, driven by the adaptability and proactive approach of Vietnamese businesses and consumers in embracing digital transformation and online business (VECOM, 2022). The e-Conomy SEA 2022 report, jointly conducted by Google, Temasek, and Bain & Company, assessed Vietnam's digital economy in 2022, estimating its value at 23 billion USD, with a projected growth rate of 28%, the highest in the Southeast Asia region for that year. Notably, the e-commerce sector recorded an impressive growth rate of 26%, reaching a value of 14 billion USD. Despite this remarkable growth, there is still a 35% dissatisfaction rate among the nearly 60 million online users in Vietnam, mainly attributed to reasons such as products not meeting advertised quality standards (68%), subpar shipping and delivery services (44%), and inadequate customer care services (28%). Consequently, the rate of unsuccessful orders on websites and e-commerce applications has reached as high as 18.2%. In response to these challenges and to boost customer satisfaction and trust, 80.4% of existing websites and e-commerce applications in Vietnam have implemented return and refund policies, as well as product warranty and maintenance policies (Department of E-commerce and Digital Economy, 2022). In other words, with the growing demand for enhanced customer confidence and satisfaction, reverse logistics has assumed an increasingly crucial role in facilitating product returns, warranties, and maintenance for e-commerce platforms. However, the cost and

management challenges of optimizing reverse logistics processes continue to present difficulties for these platforms in further elevating customer satisfaction.

Drawing from the issues, the authors conducted a study to measure the impact of reverse logistics on customer satisfaction when shopping on e-commerce platforms in Vietnam. The study would examine aspects such as return policies, return processing times, return costs, post-return products, and customer service. Based on the findings, the paper would offer some recommendations to help Vietnamese e-commerce platforms enhance customer satisfaction by improving their reverse logistics operations.

2. Literature review

2.1. Reverse logistics in e-commerce

Since the mid-20th century, Beckley and Logan (1948), and Terry (1967) have drawn attention to the concept of goods recovery activities, but they did not refer to them as reverse logistics. One of the earliest ideas about reverse logistics was proposed by Lambert and Stock in 1981, where they described it as "the movement not in the normal forward direction of most of the items moving in the supply chain." Murphy and Poist (1989) emphasized the reverse movement, defining reverse logistics as "the movement of goods from the consumer back to a manufacturer in the distribution channel." Fleischmann (1997) focused on the transformative aspect of reverse logistics in terms of repurposing discarded products to recover their value, conceptualizing it as "the process involving all logistics activities that transform used products into marketable products." However, the most prominent concept to date is that of Rogers and Tibben Lembke (1999), who defined reverse logistics as "the efficient planning, implementation, and control of materials, works in progress, finished products, and related information from consuming points to origin points to recover value or handle appropriately."

In the current context of strong development in online business, managing reverse logistics plays a crucial role for e-commerce enterprises. Wang and Sun (2022) have pointed out that reverse logistics in e-commerce mainly involves the processes of product returns and recovery. The returned products can be faulty items, products recalled due to sudden changes in customer preferences, items in need of maintenance or repair. Products appearing in the reverse logistics of e-commerce can be in high integrity condition, requiring no repairs, and can be repackaged and introduced back into the next sales channel (Vlachos and Dekker, 2003). Additionally, some products in the reverse logistics flow may suffer from quality issues and need to be returned to the seller for repair (Li et al., 2014). Therefore, Nanayakkara et al. (2022) have developed a reverse logistics model for returned and recovered products in e-commerce as shown in **Figure 1**. In this model, e-commerce enterprises classify returned goods and determine appropriate recovery and processing options. They can then use this data to understand customer behavior and market trends, focusing on adjusting future reverse logistics to optimize costs, reduce processing time, increase value for returned products, and better satisfy customer requirements (de Araújo et al., 2017). Also, results from recent research such as Song et al. (2023) and Wang and Sun

(2022) also indicated the increasing concern of customer on green consumption, thus referring to the increasing importance of reverse logistics.

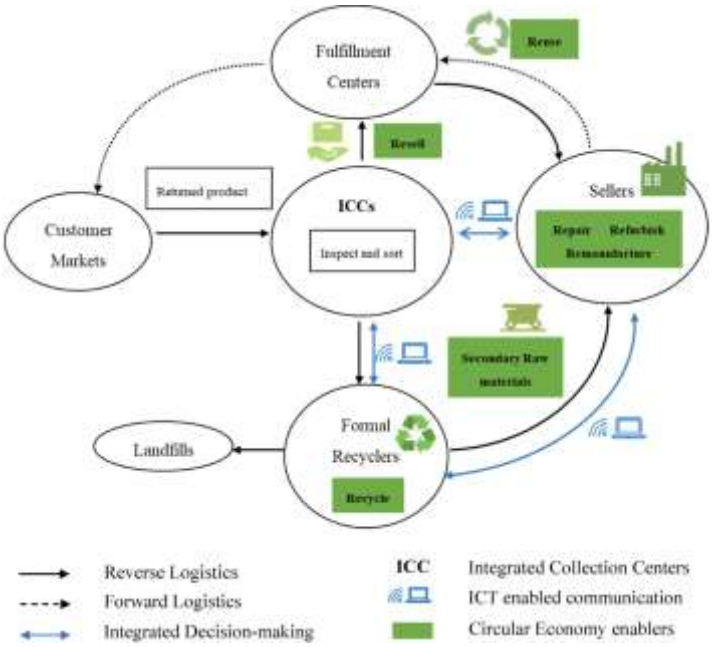

Figure 1. Model of reverse logistics in e-commerce.

Source: Nanayakkara et al., 2022.

2.2. Customer satisfaction

The concept of customer satisfaction was first introduced and widely adopted in the 1980s. Customer satisfaction can be seen as an overall feeling and attitude of customers towards certain factors influencing their experience with a product or service (Bailey and Pearson, 1983). Kotler and Armstrong (2004) suggested that satisfaction is determined by comparing the results obtained from a product or service with the customer's expectations. According to Schiffman and Kanuk (2004), customer satisfaction is defined as "an individual's perception of the performance of a product/service in relation to his/her expectations." Similarly, Wang et al. (2005) interpret customer satisfaction as the state that customer perceives based on their comparison between the actual results achieved and their specific expectations regarding a particular product or service.

Customer satisfaction is one of the crucial factors that contribute to increasing the sales performance of a business, as it leads to customer loyalty and repeated purchasing behavior (Wilson et al., 2008). Additionally, Quan et al. (2020) have also highlighted that electronic satisfaction will foster electronic loyalty among customers engaged in online shopping.

2.3. Impact of reverse logistics on customer satisfaction in e-commerce

The impact of reverse logistics on customer satisfaction has been studied in both traditional business environments and e-commerce. In traditional business environments, Rogers and Tibben-Lembke (1999) assert that consumers are concerned about return policies at the time of purchase. Additionally, Autry et al. (2001) indicate that the effectiveness of service quality incorporating specific measures such as ease

of return, refund methods, and promptness is consistently recognized by customers. Thus, maintaining flexible product return policies can yield numerous benefits, especially in customer retention and sales volume enhancement (de Brito and Dekker, 2004; Daugherty et al., 2002; Tan et al., 2003) also concur that reverse logistics can create opportunities for companies to differentiate themselves with customers, and this differentiation factor influences the company's competitiveness. Companies can offer various options for faster product returns depending on different customer demands, geographical locations, or return shipment volumes (Malone, 2004). Neglecting reverse logistics processes not only diminishes the value that companies can derive from returned products but also adversely affects customer relationships (Souza et al., 2006).

Furthermore, Pollock (2007) affirms that appropriate return management improves customer service and enhances market competitiveness. Improved service quality can lead to enhanced customer relationships (Genchev, 2007). Therefore, the company's product return policy must be strategically designed to achieve a balance between customer satisfaction levels and the costs incurred in managing reverse logistics processes (Bernon et al., 2011). Moreover, Ogunleye's study (2013) suggests that the product return experience can influence customers' perceptions of the service received, and when customers are dissatisfied with purchased products due to certain reasons, they may decide to return them if a return policy exists. Companies must address return issues throughout the product lifecycle (Lysenko-Ryba, 2017). Consequently, Somuyiwa and Adebayo (2014) propose that successful reverse logistics systems require integrating all relevant activities impacted by or affecting returned products and establishing tighter links between marketing and logistics functions to ensure a smooth, prompt, and accurate return process for customers. In the retail industry specifically, Adebayo (2022) demonstrates that the ability to execute reverse logistics significantly impacts customer satisfaction. Based on research findings, Adebayo (2022) recommends that retailers establish formal return policies encompassing reasons for returns, return and refund requirements, and turnaround times, while maintaining clear communication channels with customers, as these aspects collectively influence overall customer satisfaction and the sustainable competitive advantage of the business.

In the field of e-commerce, there have been several studies investigating the influence of reverse logistics on customer satisfaction. According to Coyle et al. (2002), recognizing customer service as a "product" is crucial and aids companies in achieving a competitive advantage, as modern customers not only purchase physical products but also value the services provided by companies post-transaction, particularly the ability to return products. In other words, consumers' purchasing decisions are influenced by the ease of returning goods, especially those purchased online (Charles, 2014). Additionally, Charles demonstrated that access to reverse logistics systems significantly impacts online customer satisfaction, as customers always seek easy and cost-effective ways to return defective items but may lack information on the return process. Furthermore, according to Zumbach (2016), free return shipping is not always available, which can impose an additional burden on online consumers, leading to increasing costs. Massey (2018) also shares a similar

view, noting that online consumers are often limited in contacting and returning products because online retailers do not provide return policies for their customers.

In a study on e-commerce in Malaysia, Jalil (2019) observed that online shoppers face difficulties in returning products, even when dealing with faulty items. Therefore, reverse logistics plays a significant role in e-commerce in enhancing trust among online buyers and customer satisfaction in this country. Moreover, the results of this study also indicate that the ability to access reverse logistics activities is the most critical factor influencing customer satisfaction. Additionally, Das et al. (2020) conducted a study related to the design of a reverse logistics network for a fashion e-commerce company, balancing costs and the ability to meet customer demands.

Thus, based on the author's review, in addition to the studies mentioned above, there is still a lack of research surveying reverse logistics activities in e-commerce in general and the impact of reverse logistics on customer satisfaction in e-commerce specifically, especially in the context of a rapidly developing e-commerce sector in emerging markets in Southeast Asia such as Vietnam.

3. Research model and hypotheses

3.1. Return processing time

The return processing time is the period from when the business receives a return request from a customer to when the reverse logistics process is completed, and a replacement product is provided to the customer. Malone (2004) pointed out that the company's ability to quickly address recovery and returns can be a significant differentiating factor. Somuyiwa and Adebayo (2014) also emphasized that easy product returns and prompt response times have a significant impact on differentiating satisfied customers from those who do not return. Customers need to be formally and clearly informed about the return processing time, including compensation arrangements if the processing time is not met (Genchev, 2007). Recently, Adebayo (2022) also suggested that the "time" factor significantly influences customer satisfaction.

H1: The time taken for product returns positively impacts customer satisfaction when shopping on e-commerce platforms in Vietnam.

3.2. Return policies

Return policies, including reasons for returns, return and refund requirements, return processing time, and other notes, should be communicated to customers (Adebayo, 2022). The return experience can influence customers' perceptions of the service they receive. Therefore, when customers are dissatisfied with a purchased product for certain reasons, they may decide to return it to the seller if there is a clear return policy. In line with this viewpoint, Rao et al. (2018) state that clear return policies can ensure the quality of purchased products and make consumers feel reassured upon receiving the goods. Moreover, how well a company adheres to its return policy and whether it has appropriate adjustments to meet specific customer needs can determine long-term customer engagement (Ogunleye, 2013).

H2: The return policy positively influences customer satisfaction when shopping on e-commerce platforms in Vietnam

3.3. Return cost

The cost associated with returns is of particular concern to customers and requires clear notification so that customers can consider and make decisions regarding product returns. Customers always seek the easiest way to return items but with the lowest possible cost (Jalil, 2019). However, according to Zumbach (2016), the provision of free return shipping is not always available, leading online consumers to bear this additional burden, resulting in increasing costs for them.

H3: The cost of product returns negatively affects customer satisfaction when shopping on e-commerce platforms in Vietnam.

3.4. Customer service

Customer service represents added value that businesses can provide to enhance customer satisfaction. Having to return a product can have a negative impact on customers' perceptions (Ogunleye, 2013). Therefore, online retailers should view the provision of return services as an opportunity to recover service quality. Customers who have to return products may become more loyal to online retailers and continue shopping if they are satisfied with the service recovery efforts made by the online retailer (Coyle et al., 2002).

H4: Customer service positively impacts customer satisfaction when shopping on e-commerce platforms in Vietnam.

3.5. Post-return product

Through the customer satisfaction model, Zeithaml and Bitner (2000) demonstrate that the quality of post-return products, in relation to the quality of the original products, has a certain impact on customer satisfaction, extending beyond service quality and pricing.

H5: The quality of post-return products positively influences customer satisfaction when shopping on e-commerce platforms in Vietnam.

Figure 2 below demonstrates the research model.

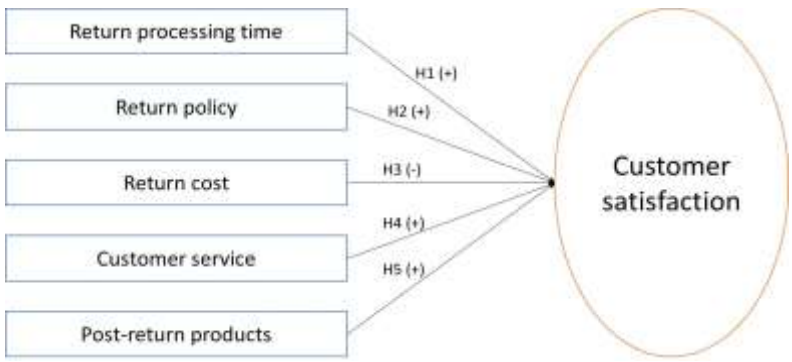

Figure 2. Research model.

Source: proposed by authors.

Based on the above literature, five constructs associated with five hypotheses were formed. To measure these five constructs, the authors suggested observation variables as shown in Table 1 below. Then EFA was conducted to test the reliability of these observation variables. The results of EFA are presented later in this research.

Table 1. Summary of reverse logistics factors affecting customer satisfaction.

Factor	Observation variable	Code	Source	Key impact
Return processing time (RPT)	Quick response time for return requests	RPT1	Malone (2004); Genchev (2007); Somuyiwa and Adebayo (2014); Adebayo (2022)	Affecting customer satisfaction and the differentiation of e-commerce businesses
	Fast acceptance time for return requests	RPT2		
	Fast processing time for return item preparation	RPT3		
	Fast shipping time for return items	RPT4		
	Quick refund	RPT5		
Return Policy (RP)	Clear, understandable, and transparent return policy	RP1	Ogunleye (2013); Rao et al. (2018); Adebayo (2022);	Impact customer perception of services, customer peace of mind when shopping in e-commerce, and reflection of ease of access to reverse logistics activities of e-commerce businesses.
	Refund policy when the seller does not respond	RP2		
	Dispute resolution policy between buyers and sellers	RP3		
	Return policy based on purchase history	RP4		
Return cost (RC)	Customers bear the cost of returning the item for exchange	RC1	Zumbach (2016); Jalil (2019).	Create cost burden for customer when purchasing on e-commerce platforms
	Customers are responsible for paying depreciation costs for the returned product.	RC2		
	Customers receive a refund of an amount lower than the original purchase price	RC3		
Customer Service (CSR)	Promptly addressing the return policy on all platforms	CSR1	Ogunleye (2013); Coyle and Bardi (2002)	Create opportunities to restore service quality and maintain customer loyalty
	Updating the order status throughout the return process	CSR2		
	Friendly attitude, enthusiastic support for product returns	CSR3		
	Partnering for shipping and payment in the return process	CSR4		
	Assistance in processing the order until the return is complete	CSR5		
Post-Return Product (PRP)	The quantity of returned products meets the requirements	PRP1	Zeithaml and Bitner (2000)	Impact customer satisfaction in relation to the original product
	The quality of the returned product meets the expectations	PRP2		
	The seller carefully and professionally packages the returned product	PRP1		
Customer Satisfaction (CS)	Continuing using the return service when shopping	CS1	Wilson et al. (2008); Quan et al. (2020)	
	Reordering with the same business in which returns occurred	CS2		
	Reordering with the same platform in which returns occured	CS3		
	Satisfied with the return process of the business and the e-commerce platform	CS4		

Source: Summarized by authors.

4. Methodology

4.1. Data collection

Primary data collection was conducted through a convenient survey using Google Form. The survey questionnaire consisted of 15 questions divided into 3 parts. Part 1 included 4 multiple-choice questions asking about the shopping characteristics of customers on various e-commerce platforms (preferred e-commerce platforms, shopping frequency, experienced types of returns), and customers' evaluation of the role of reverse logistics in return processes on e-commerce platforms. Part 2 included 6 Likert-scale questions with 5 levels to assess customers' evaluations of the current state of reverse logistics for return processes in e-commerce platforms such as Shopee, Tiki, Lazada, Sendo, etc. Part 3 included 4 demographic questions about customers' characteristics, such as gender, age, occupation, and average income.

The primary data was collected from December 2022 to January 2023. A total of 308 survey responses were obtained, of which 252 responses were considered valid, ensuring a sample size larger than the minimum required, which is 5 times the total number of observation variables of 24 (Hair et al., 1998). These responses represent customers who have been or are currently shopping and have experienced one of the reverse logistics types on e-commerce platforms in Vietnam.

The research sample consisted of 64.3% female respondents, and 88.1% were aged between 18 and 33, coming from all three regions of North, Central, and South in Vietnam (including Hanoi, Hung Yen, Hai Duong, Dien Bien, Thai Binh, Hai Phong, Hue, Quang Tri, Quang Ngai, and Ho Chi Minh City). The following **Table 2** summarizes some descriptive statistics of the sample.

Table 2. Descriptive statistics of data.

	Age					**Grand Total**
Sex	<18	18–23	23–30	30–45	>45	
Male	8	75	4	1		**88**
Female	11	128	14	7	2	**162**
Other		1			1	**2**
Grand Total	**19**	**204**	**18**	**8**	**3**	**252**

The majority of respondents shopped with a frequency of 1–2 times per week (42.1%). Regarding the preferred e-commerce platforms, 48% of the sample shopped on Shopee, the largest e-commerce platform in Vietnam at present, followed by 27% and 19% on Lazada and Tiki, respectively, while Sendo and Tik Tok shop accounted for only 6%.

4.2. Data analysis

The collected data was processed using SPSS 26.0 software to assess the reliability of the measurement scale. Since observation variables were developed for the first time, not by utilizing existing measures, the validity of measures was tested by conducting an exploratory factor analysis (EFA). The linear relationship between

variables was examined using Pearson's correlation analysis. Finally, an OLS multiple regression analysis was conducted to examine the multivariate relationships among the variables.

5. Results

5.1. Cronbach's Alpha reliability test

The Cronbach's Alpha reliability test was used in the study to measure the internal consistency of the 24 observations representing 6 factor groups. The evaluation thresholds included: Cronbach's Alpha value greater than 0.6, correlations values greater than 0.3, and Cronbach's Alpha values when excluding variables should be smaller than the total Cronbach's Alpha value. After conducting the assessment for each factor group, no observation variables were excluded from the measurement scale as all of them met the evaluation thresholds. The specific results are described in **Table 3**.

Table 3. Cronbach's Alpha results.

	Mean when excluding variables	**Variance when excluding variables**	**Total inter-item correlation**	**Cronbach's Alpha when excluding variables**
Return processing time	Cronbach's Alpha = 0.915			
RPT1	15.88	14.273	0.784	0.896
RPT2	15.92	14.540	0.748	0.903
RPT3	15.88	14.706	0.776	0.898
RPT4	15.86	14.075	0.824	0.888
RPT5	15.87	14.239	0.785	0.896
Return policy	Cronbach's Alpha = 0.847			
RP1	12.02	6.653	0.633	0.829
RP2	11.92	6.548	0.701	0.799
RP3	11.97	6.553	0.754	0.778
RP4	12.00	6.538	0.657	0.818
Return cost	Cronbach's Alpha = 0.691			
RC1	5.53	2.895	0.436	0.690
RC2	5.32	2.751	0.608	0.477
RC3	5.37	2.767	0.487	0.625
Customer service	Cronbach's Alpha = 0.934			
CSR1	14.73	16.501	0.804	0.922
CSR2	14.56	16.312	0.791	0.924
CSR3	14.73	15.736	0.846	0.914
CSR4	14.67	15.817	0.846	0.914
CSR5	14.70	16.315	0.830	0.917
Post-return product	Cronbach's Alpha = 0.907			
PRP1	7.91	3.188	0.817	0.864
PRP2	7.89	3.175	0.828	0.855
PRP3	7.96	3.146	0.798	0.881

Table 3. (*Continued*).

	Mean when excluding variables	Variance when excluding variables	Total inter-item correlation	Cronbach's Alpha when excluding variables
Customer satisfaction	Cronbach's Alpha = 0.822			
CS1	12.38	4.084	0.655	0.772
CS2	12.32	4.353	0.620	0.787
CS3	12.42	4.356	0.677	0.762
CS4	12.39	4.310	0.631	0.782

Source: SPSS results.

5.2. Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) was performed, including the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity, total variance extracted, and factor rotation for both independent and dependent variables. The results of the EFA (**Table 4**) indicate that the 20 observations of the independent variables converged into 5 factor groups (**Figure 3**), and the 4 observations of the dependent variables converged into 1 factor group. The KMO values for the independent variables (0.898) and dependent variables (0.808) were both greater than 0.5, demonstrating adequate sampling adequacy. The Eigenvalues were greater than 1 for all factors. The significance (Sig) values of Bartlett's test for both independent and dependent variables were 0.000 (less than 0.05), indicating factorability. The total variance extracted for the independent variables was 75.264%, and for the dependent variables was 65.308%, both exceeding 50%. Additionally, all factor loading coefficients were greater than 0.5.

Table 4. EFA analysis results.

Factor loading coefficients						
	Factors					
	1	**2**	**3**	**4**	**5**	**6**
CSR3	0.866					
CSR1	0.850					
CSR4	0.835					
CSR5	0.833					
CSR2	0.800					
RPT4		0.869				
RPT5		0.821				
RPT3		0.807				
RPT1		0.795				
RPT2		0.774				
RP3			0.806			
RP4			0.792			
RP1			0.760			
RP2			0.729			

Table 4. (*Continued*).

Factor loading coefficients						
	Factors					
	1	**2**	**3**	**4**	**5**	**6**
PRP3				0.868		
PRP1				0.829		
PRP2				0.811		
RC2					0.844	
RC3					0.793	
RC1					0.709	
CS3						0.830
CS1						0.816
CS4						0.798
CS2						0.788
Eigenvalue	7.946	2.211	1.885	1.602	1.409	2.612

Source: SPSS results.

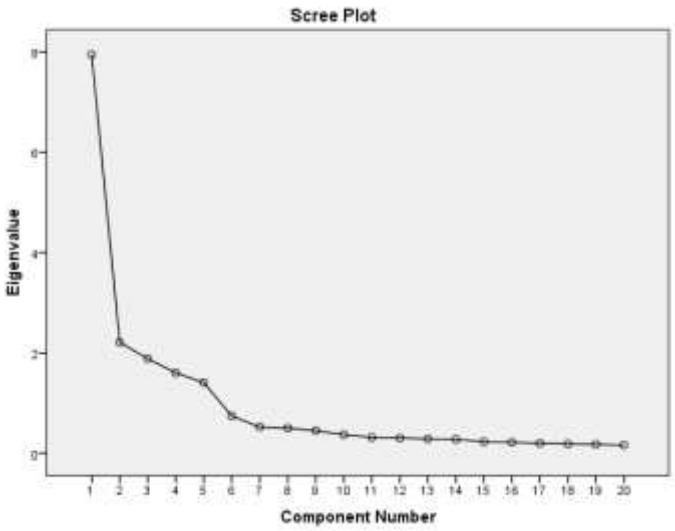

Figure 3. EFA scree plot for independent variables.

Source: SPSS results.

5.3. Pearson correlation coefficient analysis

The Pearson correlation coefficient analysis was conducted to examine the linear relationship between the independent and dependent variables. The results (**Table 5** showed that the Sig values for the Pearson correlation of the independent variables RC, RP, RPT, SCR, PRP with the dependent variable CS were all less than 0.05. Thus, there exists a linear relationship between these independent variables and the dependent variable CS. Among these, the variable CSR exhibited the strongest correlation with CS, with a coefficient of $r = 0.510$. On the other hand, RC showed the weakest correlation with CS, with a coefficient of $r = -0.306$, indicating a negative correlation between RC and CS.

Table 5. Pearson correlation.

Correlation coefficient							
		SHL	**TG**	**CS**	**CP**	**DV**	**SP**
CS	Pearson correlation	1	0.466**	0.485**	−0.306**	0.510**	0.436**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N	252	252	252	252	252	252
RPT	Pearson correlation	0.466**	1	0.478**	−0.118	0.445**	0.483**
	Sig. (2-tailed)	0.000		0.000	0.061	0.000	0.000
	N	252	252	252	252	252	252
RP	Pearson correlation	0.485**	0.478**	1	−0.149*	0.451**	0.417**
	Sig. (2-tailed)	0.000	0.000		0.018	0.000	0.000
	N	252	252	252	252	252	252
RC	Pearson correlation	−0.306**	−0.118	−0.149*	1	−0.165**	−0.080
	Sig. (2-tailed)	0.000	0.061	0.018		0.009	0.205
	N	252	252	252	252	252	252
CSR	Pearson correlation	0.510**	0.445**	0.451**	−0.165**	1	0.509**
	Sig. (2-tailed)	0.000	0.000	0.000	0.009		0.000
	N	252	252	252	252	252	252
PRP	Pearson correlation	0.436**	0.483**	0.417**	−0.080	0.509**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.205	0.000	
	N	252	252	252	252	252	252

(Source: SPSS results).

5.4. OLS mutiple regression analysis

Multiple regression analysis was utilized to assess the overall fit of the model and the relative contribution of each independent variable to the explained variance of the dependent variable (Soo, 2018). The adjusted R-squared value of 0.411 indicates that the independent variables included in the regression model account for 41.1% of the variation in the dependent variable, while the remaining 58.9% is attributed to external factors and random error. The Durbin-Watson statistic of 2.022 (falling within the range of 1.5 to 2.5) suggests no occurrence of first-order autocorrelation in the data series. The Sig value of the F-test is less than 0.05 (equal to 0.000), indicating that the linear regression model is suitable for the dataset. Furthermore, the t-tests for the regression coefficients of the independent variables all have Sig values less than 0.05, demonstrating that these independent variables are statistically significant in explaining the dependent variable. The variance inflation factor (VIF) for each independent variable is less than 2, indicating the absence of multicollinearity.

The regression coefficients corresponding to the variables RPT, RP, CSR, PRP are all positive, suggesting that the independent variables RPT, RP, CSR, PRP have a positive impact on the dependent variable. Conversely, the regression coefficient for the variable RC is negative, indicating that the independent variable RC has a negative effect on the dependent variable. Based on the magnitude of the standardized beta coefficients, the order of the relative impact from strongest to weakest of the independent variables on the dependent variable CS is as follows: CSR (0.240) > RP

(0.210) > RC (0.205) > RPT (0.173) > PRP (0.127). The specific results of the multiple regression analysis are presented in **Table 6**.

Table 6. OLS results.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Multicollinearity	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2.457	0.237		10.377	0.000		
TG	0.123	0.043	0.173	2.880	0.004	0.652	1.533
CS	0.169	0.047	0.210	3.585	0.000	0.682	1.467
CP	−0.176	0.042	−0.205	−4.150	0.000	0.964	1.037
DV	0.161	0.041	0.240	3.978	0.000	0.643	1.554
SP	0.097	0.046	0.127	2.100	0.037	0.644	1.552

Dependent variable: SHL;
Adjusted R^2 = 0.411;
Durbin-Watson = 2.022;
F-test signigicant value = 0.000;
Source: SPSS results.

From the results of the multiple regression analysis, the standardized regression equation is as follows:

$$CS = 0.240 \times CSR + 0.210 \times RP - 0.205 \times RC + 0.173 \times RPT + 0.127 \times PRP + \varepsilon$$

6. Discussion and implications

6.1. Discussion

With data collected from 252 valid responses, the research findings have demonstrated that all five factors: Return Time, Return Policy, Return Cost, Customer Service, and Post-Return Product, significantly influence customer satisfaction when shopping on e-commerce platforms in Vietnam. Among these factors, only the independent variable Return Cost (CP) exhibits a standardized regression coefficient (Beta = −0.205) and unstandardized coefficient (β = −0.176) with a negative sign, indicating a negative impact on customer satisfaction. The remaining variables possess positive standardized and unstandardized regression coefficients, indicating a positive influence on customer satisfaction. Additionally, β_0 = 2.457 holds a positive value, representing external factors outside the model (e.g., advertising, accessibility, etc.) that positively affect customer satisfaction with reverse logistics in e-commerce. Among the independent variables, Customer Service (CSR) exerts the greatest influence with a Beta value of 0.240, while Post-Return Product (PRP) has the smallest impact with a Beta value of 0.127 on customer satisfaction (CS). The Beta values of the five independent variables do not significantly differ in magnitude, indicating a relatively balanced impact of these factors within the model.

This research outcome contributes to a more concrete understanding of the impact of reverse logistics on customer satisfaction, particularly in the context of a newly emerging economy with the most robust growth in the e-commerce sector in the region. These aspects represent novel contributions of this study compared to previously published research. Based on the authors' review and understanding, this is the first

research that combined various factors to examine the impact of those on customer satisfaction and could provide a stronger foundation for statements and conclusions in existing literature.

6.2. Implications

Based on the results of the multivariate regression model, the research team proposes several recommendations to enhance customer satisfaction when shopping on e-commerce platforms in Vietnam by improving reverse logistics operations, as follows:

Improving the Return Time factor: (a) E-commerce businesses should prioritize their responsibility towards reverse logistics and collaborate with proficient retrieval service providers to reduce the time taken for the return process. (b) Returned products should be collected by delivery personnel and stored in a dedicated space to minimize confusion and facilitate proper sorting, thus expediting the overall return process and contributing to higher customer satisfaction in online shopping. (c) E-commerce platforms can consider introducing e-wallets instead of merely linking with banks to accelerate the refund process for customers.

Enhancing the Return Policy factor: (a) E-commerce platforms should establish a unified return policy among the selling businesses to streamline the implementation of reverse logistics. For instance, implementing charges for pre-delivery inspections or return transportation fees if the return is justified but the customer did not receive the item directly or failed to capture an unboxing video during the process. (b) Strengthening the dissemination of information regarding sales policies, including return policies, to ensure customers are well-informed.

Improving the Return Cost factor: (a) A close integration between forward and reverse logistics should be established to create a closed-loop supply chain for executing retrieval operations in e-commerce platforms. This involves collaborating with transportation service providers to leverage transportation assets, distribution centers, and storage facilities from the forward logistics for return product transportation and storage, thereby optimizing the implementation process and minimizing reverse logistics costs. (b) Standard procedures for the retrieval process should be established and closely coordinated with transportation, delivery, and loading/unloading service providers to ensure the safety of returned products, avoiding any potential damage or further degradation in product quality during transportation.

Enhancing the Customer Service factor: (a) E-commerce platforms and transportation companies should focus on professional training for their staff to enhance service responsiveness. Regularly evaluating work attitudes and implementing clear employee incentive policies while strictly handling violations and negative attitudes towards customers. (b) Developing a dedicated team and customer care system to provide prompt and professional responses to customer complaints and inquiries. Introducing features such as “chat bubbles” to expedite and improve the convenience of information exchange in reverse logistics. (c) Building and enhancing information technology systems to enhance customer data security while addressing system errors and congestion caused by high traffic during peak shopping periods.

Improving the Post-Return Product factor: (a) In the future, to increase customer satisfaction, e-commerce platforms may consider integrating exchange services in addition to return and refund policies. Alongside this, specific and transparent terms and conditions should be established. (b) E-commerce platforms should enforce penalties for sellers with high return rates, for example, if the return rate for a particular product exceeds 10% of total orders sold, that item will be removed from the seller's inventory. This measure helps to minimize errors during the return process and ensures that the quality of post-return products meets the buyers' needs to the fullest. (c) Considering the increasing demand for electronic consumption and efficient recycling operations, one potential solution to address e-commerce waste is to develop a packaging retrieval stream, which also contributes to increased customer satisfaction in online shopping. E-commerce platforms can formulate and enforce policies for the retrieval of reusable packaging types, and actively communicate these policies to customers.

These recommendations aim to improve the efficiency and effectiveness of reverse logistics operations in e-commerce platforms, thereby enhancing overall customer satisfaction with the online shopping experience.

6.3. Research limitations and future opportunities

The adjusted determination coefficient shows a value of 41.1%, indicating that the model remains meaningful. However, this percentage suggests that there are still other factors influencing customer satisfaction when shopping on e-commerce platforms in Vietnam that have not been assessed in this study. Therefore, the research team proposes several directions for future research, such as incorporating additional factors into the research model, expanding the surveyed customer sample, and exploring the impact of reverse logistics operations on the satisfaction of Vietnamese consumers in comparison with their experiences when shopping on international e-commerce platforms.

Author contributions: Conceptualization, HTTT, KHN and MHV; methodology, HTTT and PTC; software, HTTT and MHV; validation, HTTT and PTC; formal analysis, HTTT, MHV and NKH; investigation, HTTT; resources, HTTT and KHN; data curation, HTTT and PTC; writing—original draft preparation, HTTT and PTC; writing—review and editing, HTTT, KHN and PTC; visualization, PTC; supervision, HTTT; project administration, HTTT. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

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