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Analyzing Barriers to Reverse Logistics Systems for E-Commerce in Vietnam

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Abstract

Efficient reverse logistics management not only reduces costs but also plays a crucial role in creating added value for businesses and protecting the environment. The objective of this study is to explore and classify barriers and then prioritize them based on their importance using pairwise comparison methods. To this end, a two-stage mixed-methods research design was employed. The initial qualitative stage involved a comprehensive literature review to identify key themes and categorize them into five main barrier groups: government, organization and management methods, coordination in supply chain, finance and economics, and infrastructure. The subsequent quantitative stage utilized the Analytical Hierarchy Process (AHP) and Relative Importance Index (RII) to analyze and prioritize the specific barriers within these groups. The results show that the unclear organizational structure for reverse logistics activities, the lack of mechanisms and support from the government, and a lack of coordination from customers are the biggest barriers. This paper proposed solutions for the government and e-commerce businesses to eliminate barriers and operate efficiently reverse logistics systems.

Keywords: AHP, barriers, ecommerce, reverse logistics, RII

1. Introduction

In recent years, e-commerce has become an indispensable part of global trade with retail e-commerce sales in 2024 forecasted to exceed 6.3 trillion U.S. dollars worldwide (Statista). To enhance customer experience and satisfaction, e-commerce firms are paying significant attention to their return policies such as facilitating and standardizing product returns. Especially, e-commerce platforms are implementing express return policies and extending the return period. As a result, the return rate of online retailing is alarmingly high [1]. According to Statista, the reverse logistics market worldwide was 664.9 billion U.S. dollars in 2022 and is expected to exceed 954 billion U.S. dollars in 2029. Therefore, to sustain success in the recent e-commerce environment, operating supply chains and reverse logistics have become crucial factors. Reverse logistics plays a significant role in optimizing profits, improving customer experience, and building a sustainable economy. However, reverse logistics systems for e-commerce have to face challenges such as identifying the causes of returns, efficiently storing returned products, and managing the transportation and reuse of goods require sophisticated and innovative logistics management. Moreover, for small and medium-sized enterprises, dominant in almost all economies, effective access to and implementation of reverse logistics may encounter limitations in finance and technology.

In Vietnam, the e-commerce has exploded during and after the COVID-19 pandemic and shows no signs of slowing down in 2024. According to Statista and Savills, the market size of Vietnam's e-commerce market was over 20 billion U.S. dollars in 2023 and will reach $32 billion by 2025. This has posed both opportunities and challenges in recent years for logistics services in e-commerce. In addition, the return rate become higher than ever due to the customer care policy of sellers and the competition strategy of major e-commerce platforms by their express speed return services. As a result, reverse logistics, involving the return movement of goods away from their final destination, is becoming increasingly complex and requires high efficiency. For example, Shopee recently increased buyer rights by extending the time to request returns and refunds to 15 days from the time the parcel is successfully delivered instead of three to seven days as before. Some e-commerce companies have developed and operated a digital platform to manage returned products and transportation service providers for their reverse logistics flows.

Reverse logistics for e-commerce is not only prevalent in practitioners but also in academia. So far,

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there are several studies on reverse logistics in e-commerce have been conducted. For instance, [1] and [2] developed reverse logistics network models to optimize how businesses handle returned goods. [3] proposed a strategy using third-party reverse logistics providers (3PRLP) to support business reverse logistics operations. [4] examined the reverse logistics process through a study of warehouse operations in a large grocery store. Nevertheless, although previous studies have identified barriers and analyzed their impact on reverse logistics performance, they have only listed these barriers without evaluating the relationships between them or their relative importance. This approach reduces the practical applicability of the research and fails to provide clear guidance for businesses.

Globally, research on reverse logistics has predominantly focused on developed markets, such as the United States, Europe, and the United Arab Emirates, while perspectives from developing markets like Vietnam remain scarce. Managing reverse logistics in developing countries will be different from developed countries in terms of diverse operational conditions, infrastructure systems, and cultural factors.

Recognizing the necessity and the lack of research on reverse logistics in e-commerce in developing countries like Vietnam, our research group proposed the following research questions to analyze barriers to reverse logistics systems for e-commerce in Vietnam. This research aims to answer the following questions:

(i) What are the barriers to implementing reverse logistics in e-commerce businesses in Vietnam?

(ii) Which barrier has the most significant impact on the reverse logistics system in Vietnamese e-commerce businesses?

(iii) What are the solutions to overcome these barriers and enhance the efficiency of the reverse logistics system for e-commerce in Vietnam?

2. Literature Review

Reverse logistics, a subset of logistics, refers to the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin to recapture value or proper disposal (Council of Logistics Management). While traditional logistics focuses on the forward flow of goods, reverse logistics is essentially the "return journey" [5], defined reverse logistics, as encompassing all activities present in traditional logistics but in a reverse direction.

In commerce, reverse logistics is the process of retrieving products from end consumers to recover value or ensure proper disposal. Reverse logistics activities include collection, inspection/ detection/ selection, refurbishment/ direct recycling, redistribution, and disposal [6]. In the B2C e-commerce model, reverse logistics, as defined by the American Reverse Logistics Executive Committee, focuses on recovering product value or proper disposal. This process involves moving online-purchased goods back to the seller or manufacturer due to product issues or customer dissatisfaction [7]. The increase in e-commerce expansion, enhanced product recovery, and widespread adoption of reverse logistics services are consistently driving the growth of the reverse logistics market. The Asia-Pacific region held the largest market share (52.68%) in 2022, driven by the surge in e-commerce and the growing demand for reverse logistics services for electric vehicles. Thanks to strong consumer return rights, Europe contributed 45% of the total global market value. Customers can return online, phone, or email purchases under any circumstances within 14 days. Therefore, if such strong consumer return rights become widespread worldwide, the reverse logistics market will likely play an even more important role in the transportation and logistics ecosystem, further supporting the growth of online commerce.

Fueled by Vietnam's booming e-commerce sector and a rapidly developing logistics industry, the situation of reverse logistics is undergoing significant transformation. Vietnam's digital economy value is projected to reach $49 billion by 2025, solidifying its position as one of the fastest growing in Southeast Asia. This rapid growth has significantly impacted consumer behavior, leading to a higher return rate for online orders. As a result, the demand for efficient reverse logistics solutions is propelling the development of this crucial sector.

Recognizing the challenges of practitioners, there are a number of studies in academia, both domestic and international, focusing on exploring reverse logistics framework and defining barriers to implementing reverse logistics in e-commerce. Both qualitative and quantitative approaches have taken advantage to identify barriers to the deployment and application of reverse logistics services in e-commerce. Through the literature review process, five groups of barriers affecting the efficiency of logistics activities in the e-commerce sector can be identified as following.

Political and governmental barriers: [8] stated one of the most significant barrier to reverse logistics system is that government agencies may not offer incentives to encourage manufacturers to participate in reverse logistics or may lack the tax expertise to implement laws related to returned products. Additionally, supportive policies promoting the circular economy might be missing. To address these issues, the government should establish clear laws and regulations for e-commerce reverse logistics. Furthermore, they can encourage and provide

technical support for reverse transportation practices while also monitoring businesses' compliance and implementing a system of rewards or penalties [9].

Supply chain and coordination barriers: Reverse logistics involves a complex network of returns, locations, and customers. Efficient handling requires a well-organized system for receiving, sorting, inspecting, reprocessing, storing, and packaging [10]. Inefficiencies in these activities can significantly increase costs. This complexity can also lead to uncertainty and reliability issues in reverse transportation, particularly with multiple return channels and a wide variety of returned products [8]. As a result, many companies may struggle to effectively manage these operations due to a lack of specialized supply chain knowledge [11].

Management and organizational barriers: Companies, especially those in their early stages, may not prioritize reverse logistics because senior leadership focuses primarily on core business activities [12]. This lack of focus can lead to insufficient investment in technology and supply chain software needed to handle the growing volume of online returns. Furthermore, a poor understanding of reverse logistics and organizational resistance can hinder the establishment and implementation of effective reverse logistics practices [8]. Poor management in building strategies and support for these activities translates to weaker supply chain performance. Additionally, a poorly structured organization with a weak culture around reverse logistics can significantly decrease reverse transportation efficiency [8].

Financial and economic barriers: Reverse transportation in e-commerce is determined by high initial investments and operating costs [10]. One contributing factor to the high costs associated with reverse transportation is the lack of economies of scale, resulting in the inability to reap benefits such as utilization in transportation and storage [13]. Developing a reverse logistics system requires substantial financial and material resources as well as a knowledgeable workforce [12].

Infrastructure barriers: Effective reverse logistics relies on good internal technology infrastructure to streamline processes [14, 15]. However, even with strong internal systems, companies can be hampered by poor external infrastructure [11]. This highlights the need for both robust internal IT systems for returns and well-developed external infrastructure for smooth reverse transportation.

In Vietnam, there is only few research on reverse logistics including reverse logistics for the plastics industry [16], supermarkets [17], and the relationship between reverse logistics and customer satisfaction in e-commerce [18].

In brief, there is a lack of (i) a comprehensive view of barriers to reverse logistics systems for e-commerce, (ii) empirical investigation into the relative importance or prioritization orders of these barriers in the context of Vietnam, and (iii) synchronized solutions to overcome those challenges. Our research aims to address these research gaps through the RII and the AHP.

3. Research Methodology

3.1. Research Process

To answer the proposed research questions, we carried out the research process as follows. Firstly, the research team conducted a literature review to synthesize relevant academic articles, both domestic and international in terms of research methods, barriers encountered, and solutions employed by e-commerce companies during product recovery activities. In the next step, these barriers were classified and verified by expert interviews. After that, we use the AHP and theRII to analyze the importance level and priority ranking of reverse logistics barriers in Vietnamese e-commerce. Stemming from AHP and RII analysis, literature survey, and expert interviews, we proposed solutions to operate effectively the reverse logistics system for e-commerce in Vietnam.

3.2. Data Collection

Authors conducted semi-structured interviews with five senior managers from e-commerce companies in five different sectors operating from five to ten years in Vietnam. The AHP method does not require an exact and high number of experts. In this research, authors chose five experts from different sectors (general retail, cosmetics, fashion, electronics, and household appliances) and type of business (e-commerce platform, e-commerce business selling product and operating return process via e-commerce platforms, e-commerce business selling product and operating return process by themselves).

To ensure the understanding questionnaire and the reliability of responses, we conducted direct interviews in April, 2024 through both online meeting via Google Meet and personal meetings together with site visit. Each interview lasted 45 to 60 minutes and is recorded to analysis. During the interviewing, researchers explain all questions to the interviewee and the input answers to the questionnaires.

The survey focused on three key areas: (i) the current state of reverse logistics organization and implementation within these companies, (ii) the impact of various barriers on their product return management processes (5-point Likert scale, ranging from “not important at all” to “very important”), and

(iii) the relative importance of those barriers in pair-wise comparison (9-point Likert scale, ranging from "equal importance" to "extreme more importance of one over other").

3.3. Data Analysis with AHP and RII

The AHP, a multi-criteria decision-making (MCDM) method developed by mathematician Saaty T.L. in 1980, is a quantitative tool used to prioritize options and select the one that best satisfies predetermined criteria. Among many explored barriers, it would be extremely important for managers to identify which barriers are the most significant to deeply investigate and manage. However, a simple comparison cannot ensure the consistency of evaluation results because of the subjectivity of the qualitative approach and the lack of numeric data for the quantitative approach in this research context. Meanwhile, the semi-quantitative approach, MCDM techniques including AHP, based on pairwise comparison and a specific computational mechanism, is well-suited for prioritizing these new concepts. Therefore, this study employed AHP to assess the relative effect level of various barriers to the reverse logistics system for e-commerce in Vietnam. The analysis considers a hierarchical structure with 5 main barrier groups and 14 sub-barriers (see section 4.1) and pairwise comparisons are conducted to identify relationships between these barriers.

The RII method is used to determine the importance level of barriers affecting the reverse logistics implementation in e-commerce in Vietnam. This method is widely used in many studies [19]. The RII index is calculated using the following formula:

$$RII = \frac{\sum_{i=1}^{5} W_i * X_i}{\sum_{i=1}^{5} X_i} \quad (1)$$

where: w_i: represents the level of assessment of importance on a scale of 1 to 5 by the respondents.

x_i: represents the number of respondents who selected the ith scale, where i ranges from 1 to 5.

4. Findings

4.1. Barriers to Implementing Reverse Logistics Activities for E-Commerce in Vietnam

Fig. 1 presents a synthesis of the barriers identified in reverse logistics for e-commerce. These barriers were initially discovered through research and then confirmed through interviews with businesses. The figure categorizes the 14 identified sub-barriers into 5 main barrier groups.

4.2. Prioritizing the Key Barriers

The experts' responses were categorized into five levels, ranging from "not important at all" to "very important"). The authors then calculated the percentage of votes for each level, relative to the total responses for each criterion within the survey data. Finally, the *RII* was calculated using the formula (1). The analysis results are presented in Table 1.

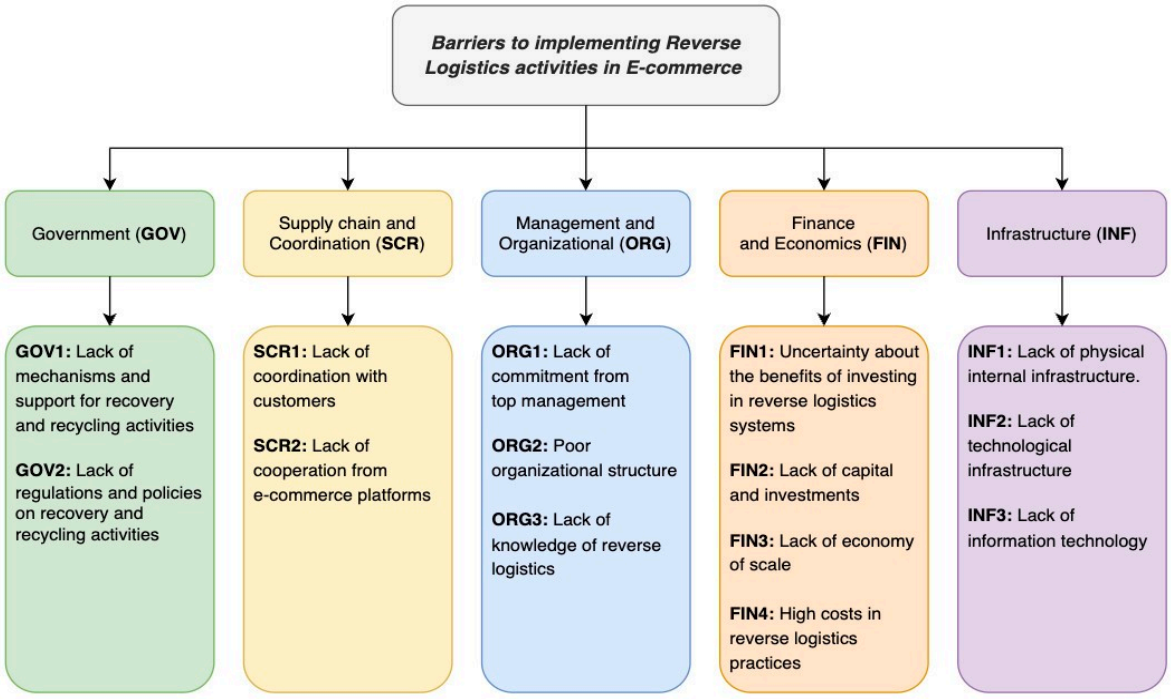

Fig. 1. Barriers to implementing reverse logistics activities in e-commerce

Table 1. The result RII for each sub-barrier

Barriers	Results					RII
	1	2	3	4	5	
GOV1	0/5 (0%)	1/5 (20%)	1/5 (20%)	3/5 (60%)	0/5 (0%)	3.40
GOV2	0/5 (0%)	1/5 (20%)	1/5 (20%)	2/5 (40%)	1/5 (20%)	3.60
SCR1	**0/5 (0%)**	**0/5 (0%)**	**0/5 (0%)**	**3/5 (60%)**	**2/5 (40%)**	**4.40**
SCR2	0/5 (0%)	0/5 (0%)	1/5 (20%)	2/5 (40%)	2/5 (40%)	4.20
ORG1	**0/5 (0%)**	**0/5 (0%)**	**0/5 (0%)**	**1/5 (20%)**	**4/5 (80%)**	**4.80**
ORG2	**0/5 (0%)**	**0/5 (0%)**	**0/5 (0%)**	**3/5 (60%)**	**2/5 (40%)**	**4.40**
ORG3	0/5 (0%)	0/5 (0%)	3/5 (60%)	2/5 (40%)	0/5 (0%)	3.40
FIN1	1/5 (0%)	0/5 (0%)	0/5 (0%)	4/5 (80%)	0/5 (0%)	3.40
FIN2	0/5 (0%)	1/5 (20%)	0/5 (0%)	3/5 (60%)	1/5 (20%)	3.80
FIN3	0/5 (0%)	2/5 (40%)	0/5 (0%)	3/5 (60%)	0/5 (0%)	3.20
FIN4	0/5 (0%)	1/5 (20%)	0/5 (0%)	3/5 (60%)	1/5 (20%)	3.80
INF1	0/5 (0%)	1/5 (20%)	1/5 (20%)	3/5 (60%)	0/5 (0%)	3.40
INF2	0/5 (0%)	1/5 (20%)	1/5 (20%)	2/5 (40%)	1/5 (20%)	3.60
INF3	0/5 (0%)	0/5 (0%)	0/5 (0%)	5/5 (100%)	0/5 (0%)	4.00

(Source: Calculated by authors)

Table 2. Pairwise comparisons results

Pairs of barriers	Results					Geometric mean (II)	1/II
	1	2	3	4	5		
GOV:SCR	3	9	1/9	7	1/7	**1.25**	**0.80**
GOV:ORG	1	1	1	9	1/7	**1.05**	**0.95**
GOV:FIN	1/3	3	1	5	1/5	**1.00**	**1.00**
GOV:CS	1/3	1/3	1/5	7	1/7	**0.47**	**2.14**
SCR:ORG	1/3	1/7	3	1	1/3	**0.54**	**1.84**
SCR:FIN	1/3	1/5	3	1	1	**0.72**	**1.38**
SCR:INF	1	1/9	1	3	3	**1.00**	**1.00**
ORG:FIN	1	3	1	1/5	3	**1.12**	**0.89**
ORG:INF	1	7	1	1/3	3	**1.48**	**0.68**
FIN:INF	3	1	1	5	3	**2.14**	**0.47**
GOV1:GOV2	1/3	1/5	1	5	5	**1.11**	**0.90**
SCR1:SCR2	1/3	5	7	1	1	**1.63**	**0.61**
ORG1:ORG2	1/5	1/7	1/3	1/3	1	**0.32**	**3.16**
ORG1:ORG3	1/7	1/7	1/3	1/5	1/3	**0.21**	**4.66**
ORG2:ORG3	1	7	1	3	3	**2.29**	**0.44**
FIN1:FIN2	1/3	9	5	1	1	**1.72**	**0.58**
FIN1:FIN3	1	1/7	1/5	1	1	**0.49**	**2.04**
FIN1:FIN4	3	3	1/5	1	1	**1.12**	**0.89**
FIN2:FIN3	5	3	1/3	3	1	**1.72**	**0.58**
FIN2:FIN4	5	3	1	1	1	**1.72**	**0.58**
FIN3:FIN4	1	3	1/3	1	3	**1.25**	**0.80**
INF1:INF2	1/3	1/7	1	5	1/3	**0.60**	**1.66**
INF1:INF3	1/5	3	1	3	1/5	**0.82**	**1.23**
INF2:INF3	1/3	5	1	3	1/3	**1.11**	**0.90**

(Source: Calculated by authors)

All barriers were rated as important by the experts (average score is greater than 3). However, three barriers emerged as particularly critical: lack of commitment from top management (4.8), lack of coordination with customers (4.4), and poor organizational structure (4.4). These highly crucial barriers highlight the importance of commitment, coordination, and a clear organizational structure for successful reverse logistics implementation. They emphasize the need for effective collaboration among all involved parties. While the remaining 11 barriers received slightly lower ratings, they were still deemed very important for businesses.

These findings are consistent with previous domestic and international studies. Barriers like a lack of commitment from top management, lack of coordination with customers, and poor organizational structures for reverse logistics are consistently identified as highly significant. Additionally, lack of capital and investments for reverse logistics, lack of physical internal infrastructure, and lack of knowledge/awareness/education on reverse logistics also deserve attention, as the specific challenges will vary depending on the circumstances of each business.

4.3 Using the AHP Method to Identify Key Barriers to Reverse Logistics in E-Commerce

Table 2 presents the results of pairwise comparisons between barriers, obtained from individual experts. The geometric mean values are also included. The resulting weights assigned to each barrier group are presented in Table 3. With the number of criteria being 5, the random index *RI* is 1.12. We have: λ_{max} = 5.23; *CI* = 0.058, so *CR* = 0.052% < 10%: accepted. To determine the relative influence of sub-barriers within each main barrier group, we created a series of comparison matrices. The table 3 to table 8 present the data gathered from the experts' comparisons of these sub-barriers.

Table 3. Pairwise Comparisons matrix for the key barriers

Criterion	GOV	SCR	ORG	FIN	INF	**Wj**
GOV	1	1.25	1.05	1.00	0.47	0.185
SCR	0.80	1	0.54	0.72	1.00	0.151
ORG	0.95	1.84	1	1.12	1.48	0.238
FIN	1.00	1.38	0.89	1	2.14	0.236
INF	2.14	1.00	0.68	0.47	1	0.191
	5.89	**6.46**	**4.16**	**4.32**	**6.08**	**1.000**

(Source: Calculated by authors)

Table 4. Pairwise Comparisons matrix for GOV

Criterion	GOV1	GOV2	**Wj**
GOV1	1	1.11	0.53
GOV2	0.90	1	0.47
	1.90	**2.11**	**1.00**

Table 5. Pairwise Comparisons matrix for SCR

Criterion	SCR1	SCR2	**Wj**
SCR1	1	1.63	0.62
SCR2	0.61	1	0.38
	1.61	**2.63**	**1.00**

Table 6. Pairwise Comparisons matrix for ORG

Criterion	ORG1	ORG2	ORG3	**Wj**
ORG1	1	0.32	0.21	0.12
ORG2	3.16	1	2.29	0.53
ORG3	4.66	0.44	1	0.35
	8.82	**1.75**	**3.50**	**1.00**

Table 7. Pairwise Comparisons matrix for FIN

Criterion	FIN1	FIN2	FIN3	FIN4	**Wj**
FIN1	1	1.72	0.49	1.12	0.25
FIN2	0.58	1	1.72	1.72	0.29
FIN3	2.04	0.58	1	1.25	0.27
FIN4	0.89	0.58	0.80	1	0.19
	4.51	**3.88**	**4.01**	**5.09**	**1.00**

Table 8. Pairwise Comparisons matrix for INF

Criterion	INF1	INF2	INF3	**Wj**
INF1	1	0.60	0.82	0.26
INF2	1.66	1	1.11	0.40
INF3	1.23	0.90	1	0.34
	3.89	**2.51**	**2.92**	**1.00**

Table 9. The consistency index (CI), random consistency index (RI), and consistency ratio (CR)

Criterion	n	RI	λ_{max}	CI	CR (%)
GOV	2	0	2.00	0.00	0
SCR	2	0	2.00	0.00	0
ORG	3	0.58	3.21	0.105	0.181
FIN	4	0.9	4.30	0.100	0.111
INF	3	0.58	3.00	0.002	0.004

Table 10. Final ranking of sub-barriers

Criterion code	**CR**	**Wj**		**Rank**
GOV1	0	0.185	**0.53**	**1**
GOV2			0.47	2
SCR1	0	0.151	**0.62**	**1**
SCR2			0.38	2
ORG1	0.181	**0.238**	0.12	3
ORG2			**0.53**	**1**
ORG3			0.35	2
FIN1	0.111	0.236	0.25	3
FIN2			**0.29**	**1**
FIN3			0.27	2
FIN4			0.19	4
INF1	0.004	0.191	0.26	3
INF2			**0.40**	**1**
INF3			0.34	2

(Source: Calculated by authors)

The results in Table 9 show that the consistency ratio (CR) for all five criteria is below 10%, satisfying the consistency requirement for pairwise comparisons.

Following the creation of pairwise comparison matrices for each barrier group, consistency ratio (CR) calculation, and weight determination for all barriers, Table 10 presents the rankings of subsidiary barriers within each main barrier group. The CR values for all comparisons fall below 10%, indicating good consistency among the judgments of the five experts. These local rankings are established based on the descending order of the weights assigned to each subsidiary barrier within its respective group.

To determine the overall weights and rankings of the subsidiary barriers, we multiply the weight of each sub-barrier by the weight of its corresponding main barrier group. The aggregated results of these overall barrier weights are visualized in Fig. 2.

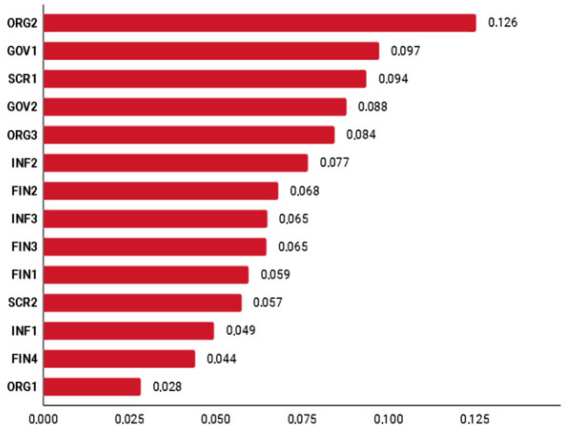

Fig. 2. Overall Impact Ranking of Sub-barriers

Table 10 and Fig. 2 show that "poor organizational structure" emerges as the most significant barrier, with a score of 0.126. Following closely behind are "lack of mechanisms and support for recovery and recycling activities" (0.097 points) and "lack of coordination with customers" (0.094 points).

4.4. Solutions to Overcome Barriers of Reverse Logistics System for E-Commerce in Vietnam

In this section, we propose solutions to overcome barriers to reverse logistics systems for e-commerce in Vietnam. These solutions are taken from the literature review and then verified and amended by expert interviews.

Regarding government policies, it is crucial for the government to issue regulations and incentives regarding reverse logistics activities. Good policies can protect the rights of online consumers and reduce pressure on sellers, then boost the development of e-commerce and contribute to developing economies and societies. In line with proactive activities in recent years, E-commerce Department, Ministry of Industry and Trade can contribute positively to the development of reverse logistics system for e-commerce in Vietnam through guidelines and regulations relating to organizing flows of returned goods and requirements to returning policies as well as the responsibility of third party logistics service providers in reverse logistics systems.

Regarding supply chain coordination, e-commerce sellers may improve the quality of reverse logistics systems by enhancing customer relationships and providing customers with comprehensive

guidelines about good return processes to ensure as well as detailed visualizations of actual products on e-commerce platforms to avoid unnecessary returns. In addition, enterprises can develop good relationships with third-party logistics service providers who are collecting, sorting, storing, and transporting returned goods. One other solution is to build and operate digital platforms to manage, track, and trace reverse logistics processes, promote information sharing, and establish electronic collaboration among supply chain members. The wide application of technologies 4.0 and increasing awareness about coordination in supply chain are supporting to the potentiality of these solutions.

Regarding organizational barriers, senior management support, awareness, and knowledge with clear policies and standardized organizing procedures and returned goods should be the top internal priority to manage for reverse logistics flows. For example, top management can create, document, train, and widely communicate to related staff about importance and procedures of reverse logistics activities.

Finally, regarding to infrastructure barrier, internal infrastructure (such as cameras, alert systems, smart warehouses, management software/ platforms) and external infrastructure (roads, hubs, ...) are crucial for an effective reverse logistics system.

5. Conclusion

The development of e-commerce and the necessity of a reverse logistics system are inevitable trends in the digital era. This study has shed light on key barriers when deploying reverse logistics activities in e-commerce. Besides the challenges in terms of costs, policies, services, management, and infrastructure, the unclear organizational structure for recovery logistics activities, and lack of mechanisms and support for recovery and recycling activities from the government, lack of coordination with customers and third-party logistics service providers, are the top three significant barriers. The study proposed specific solutions to overcome those barriers. Among them, strengthening cooperation and coordination within the supply chain to facilitate the exchange of information, improve operational capabilities, and lead to overall cost reductions is the most important solution.

The AHP method proved to be a valuable tool throughout this research to identify the most influential barriers hindering reverse logistics in e-commerce. However, it is important to acknowledge a potential drawback of AHP in terms of subjectivity. The objectivity and reliability of the analysis results can be significantly influenced by the expert's judgment. Future research could fix this limitation with a larger number of experts and the application of the Delphi method or focus group. In addition, researchers should investigate deeper into specific product lines for example in fashion or electronics goods. Besides that, enablers and specific solutions are also necessary to be delved into to bring significant implications to practitioners.

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