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# The Moderating Effects of Eco-Friendliness between Logistics Service Quality and Customer Satisfaction in Cross-Border e-Commerce: Evidence from Overseas Direct Purchasers in Korea

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**Abstract:** The present study attempted to investigate whether the logistics service quality influences customer status and intention to reuse in the context of cross-border e-commerce. In addition, we explored whether the eco-friendly logistics service plays a moderating role in each quality variable during the logistics service process. By classifying logistics service quality into delivery service quality, return logistics service, delivery stability, and delivery information service, we conducted a survey and obtained a total of 781 responses in Korea, a semi-developed country. The responses were statistically analyzed. Based on this analysis, we concluded that the logistics service quality positively influences customer satisfaction and intention to reuse in the context of overseas direct purchases. Among the dimensions of logistics service quality, the most significant factor was delivery stability. Second, delivery service quality, delivery stability, and delivery information service positively influence the intention to reuse in cross-border e-commerce. Third, the satisfaction of products and/or services of a cross-border e-commerce firm has a high impact on repurchase. Finally, we found that the eco-friendly logistics service positively moderates the relationship between return logistics and satisfaction and the relationship between delivery quality and customer satiation. We concluded this manuscript with a discussion of managerial implications and academic contributions.

**Keywords:** cross-border e-commerce; eco-friendliness; overseas direct purchase



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## 1. Introduction

In recent years, cross-border e-commerce has developed rapidly due to the rapid development and spread of the Internet and mobile. In particular, the rapid increase in online shopping malls around the world has led consumers to act as trade agents. Interest in logistics services increased due to the increase in cross-border e-commerce. Since cross-border e-commerce is purchased online without physical contact with the seller, the logistics service can be seen as a substitute for the seller. If an incomplete logistics service is executed, the customer recognizes it as a seller's mistake, which may not eventually lead to a repurchase of the site. Logistics service is recognized as an important factor that determines user satisfaction in the entire e-commerce process, not just the physical process of delivering products [1].

Among the factors that inhibit the activation of overseas direct purchases is the poor efficiency of the logistics service. In particular, difficulties in post-service such as return treatment, the accuracy of information and tracking of product delivery when ordering, and inaccuracy of information can negatively affect the satisfaction of logistics service and ultimately the continuous purchase of e-commerce sites.

In addition, as environmental problems have recently emerged, due to the nature of cross-border e-commerce, excessive packaging to protect products during long-distance delivery and delivery can cause environmental problems. Porter and Linde (1995) argued

that the creation of new businesses through eco-friendly management should be sought, and the environment should be used as a source of competitive advantage [2]. Shrivastava (1995) argued that environmental management creates new values for customers and has a positive influence on innovation and process improvement [3]. In addition, Sinkovics and Roath (2004) argued that it should be evaluated by the economy, society, and environment as a major factor in sustainability development. In particular, management considering environmental factors is a direct problem for both companies and consumers, so companies considering the environment can maintain a long-term relationship with customers [4].

Although there is no short-term achievement in establishing economic benefits or relationships with consumers, the provision of eco-friendly services in logistics services is recognized as a sustainable company along with improving the company's image in the long run, which can have a positive impact on future customer relationships. Nonetheless, previous studies have little focused on information quality or logistics service in international e-commerce. In addition, it is rare to find studies considering eco-friendly management together with marketing performance in this industry.

Against the background, we aimed to identify what factors of logistics service satisfy buyers' usage of an e-commerce site and what mechanism leads to repurchase. To fill this research gap. We also attempted to find out whether the recently emerging eco-friendly logistics service plays a moderating role between the logistics service quality factor and satisfaction.

Our study may provide academic implications in presenting research models and research results through empirical analysis of the quality factors of logistics service and the role of echo-friendly logistics service for the sustainable development of increasing cross-border e-commerce. In addition, in practice, I would like to present implications related to what parts of the cross-border e-commerce business model should be further considered.

The remainder of our manuscript is structured as follows. In the next chapter, we presented theoretical foundations and hypotheses. The following chapter described our research design. Next, we provided the results of the analysis. Finally, we presented a discussion on theoretical and practical implications, indicated the limitations of our paper, and suggested further research.

## 2. Theoretical Foundations and Hypotheses

### *2.1. Logistics Service and Eco-Friendliness*

Logistics service quality is defined as an activity to identify and satisfy consumer needs [5]. High-quality delivery services strengthen the company's brand and contribute positively to customer satisfaction [6]. In the past, logistics has been studied in terms of cost in corporate activities [7]. As technologies and management methods possessed by companies became more standardized, logistics services began to be recognized as one of the differentiation strategies in the competitive advantage of firms [8,9]. Accordingly, studies have been conducted in various countries and fields that the quality level of logistics service has a positive effect on customer satisfaction and corporate performance [10].

First, Mentzer et al. (1999), which influenced a considerable number of studies, classified and presented nine components that evaluate logistics service quality, including service timeliness, information quality, order quality, order conditions, order accuracy, order procedure, order discharge volume, and order inconsistency processing [5]. In the late 1990s, research was actively conducted to investigate the relationship between the quality of the logistics service of Internet shopping malls and customer satisfaction.

First, Jarvenpaaa and Todd (1997) argued that logistics service quality is important as one of the success factors of Internet shopping malls [11]. According to a study on the relationship between customer satisfaction and logistics service quality in Internet shopping malls, Kim et. al. (2011) developed the logistics service quality factors in the relationship between customer satisfaction and loyalty to information quality, timeliness, order quality, customer service, and delivery quality [12]. In this study, information quality, customer service, and delivery quality among each variable were found to have a significant effect on

customer satisfaction, and furthermore, it was found that trust and attachment to Internet shopping malls increased when satisfied with Internet shopping malls.

Kim and Ha (2018) analyzed the relationship between logistics service quality and customer satisfaction and customer reliability in China's B2C e-commerce platform, consisting of delivery service, return service, after-sales service, and customer satisfaction [13]. As a result, it was said that the logistics service quality has a positive effect on customer satisfaction and customer trust, and customer satisfaction has a positive effect on repurchase intention and word-of-mouth intention. Akil & Ungan (2022) set logistics service quality as order accuracy, order condition, timeliness, and order discrepancy handling in a study that analyzed the relationship between the quality of e-commerce logistics services in cross-border e-commerce and customer satisfaction and loyalty. Among the presented variables, order accuracy has the greatest effect on customer satisfaction, and customer satisfaction has a positive effect on customer loyalty [6].

In a study that analyzed the relationship between fresh food e-commerce logistics services and customer satisfaction, Hong et al. (2019) indicated that convenience, communication, reliability, and responsiveness as elements of logistics service have an important influence on customer satisfaction [14]. Hua and Jing (2015) analyzed the relationship between logistics service quality and customer satisfaction in e-commerce, and stated that delivery service quality, after-sales service quality, and employee service quality had a positive effect on customer satisfaction [15].

In a study on the importance of logistics services in customer satisfaction, Uvet (2020) presented the quality of logistics service as personal contact quality, timeliness, order status, order failure processing method, and information sharing among these variables has a positive effect on customer satisfaction, and information sharing plays a role between personal contact quality and customer satisfaction [1]. Chen and Lee (2019) stated that in a study on the effect of cross-border B2CE e-Commerce information systems and logistics service quality on satisfaction and continuous use intention, delivery services have a positive effect on satisfaction [16]. Kang and Hyun (2021) said that although return-service satisfaction and shopping mall loyalty were positively affected in the core factors of the delivery service quality of Korea's same-day delivery online mall, factors such as delivery information and quick accuracy were now recognized as the basis of delivery service and did not have statistical significance [17].

Logistics services help build customer relationships within the supply chain and help companies maintain a sustainable competitive advantage [18]. Considering the eco-friendly factor in logistics does not provide a company's short-term economic performance, but it has a positive effect from a long-term perspective, such as building a relationship with the company's image customers. Eco-friendly logistics is studied at the corporate and consumer levels, and at the corporate level, it analyzes the relationship between the application of the eco-friendly system in the process of performing the company's work such as using eco-friendly packaging or joint delivery [19]. Eco-Friendly Logistics requires an eco-friendly logistics system in a company's logistics system as consumers have recently become more interested in the environment. Menguc and Ozanne (2005) said that global consumers exert normative pressure on companies for environmental innovation strategies through a preference for eco-friendly products or green consumerism. In addition, environmental innovation strategies have a positive effect on improving the image of the company and its products or relationship with customers [20]. Ali et al. (2022) analyzed the relationship between sustainable logistics service quality (hereafter referred to as SLSQ) on customer satisfaction in the Egyptian market and the relationship between such customer satisfaction and relationship quality. In this study, it was argued that SLSQ consists of personal contact quality, sustainable information quality, and order condition timeless, which have a positive effect on customer satisfaction [18]. You and Kim (2021) verified the effect of motivation, environmental orientation, and eco-friendly supply chain construction on corporate performance for Chinese exporters. As a result of the study, it was said that the establishment of an eco-friendly supply chain of companies

was accelerated according to the needs of the government, regulations, customers, and overseas consumers [19]. Furthermore, the establishment of an eco-friendly supply chain does not affect corporate performance in the short term, but in the long run, companies that implement eco-friendly supply chain management can have a competitive advantage over companies that do not implement eco-friendly supply chain management in the long run. Abbasi and Nilsson (2016) presented customer priorities, management complexity, network impact, and technological evidence as the main themes of future eco-friendly logistics activities in a study exploring the classification and attempts of eco-friendly logistics activities. They suggested that it is necessary to enhance the relationship between customers and logistics service companies as an area to be studied in the future [21].

### *2.2. Hypothesis Development*

Mentzer et al. (1999) defined logistics service quality as satisfying consumer needs and stated logistics service quality by dividing it into solid delivery service and customer relationship service [5]. Richey et al. (2007) and Frio and Bezerra (2021) proposed that the quality of the logistics service has a positive effect on customer satisfaction [8,22]. In particular, due to the characteristics of e-commerce in which goods are sold non-face-to-face without a contact point between consumers and salespeople, the quality of logistics service can be understood as the role of sales staff in the past. Accordingly, we may argue that the quality of logistics service affects customer satisfaction and future repurchase.

There have been studies that show that consumers are most satisfied with the provision of return logistics service among the quality of logistics service and have a significant effect on customer situation [17]. Kim and Ha (2018) suggested that delivery service, return service, and after-sales service play an important role in satisfaction in a study on the logistics service quality of China's B2C e-commerce platform [13].

Kang and Hyun (2021) indicated that return treatment has a positive effect on the delivery status and loyalty to a shopping mall in Korea's same-day delivery online mall [17]. Information quality is the same as overseas direct purchase shopping mall consumers. Customers' concentration to reuse is the degree to which they continue to purchase their preferred products or services based on their past positive experiences, and the concentration on recommendation is the degree to which they want to inform others after purchasing overseas direct purchase products [21].

Peng, Gu, and Lee (2019) analyzed the factors affecting customer satisfaction in the overseas direct purchase logistics service for Chinese people and found that information quality and delivery quality have a positive effect on customer status and re-purchase and engagement commitment. In this study, information quality is defined as the degree to which overseas direct purchase malls provide various logistics information such as product delivery location information to consumers, and delivery quality is defined as the degree to which consumers perceive the speed of delivery, safety, and identity of delivery products [23]. Lanhe, Oh, and Park (2021) measured variables such as rapid delivery, punctuality of promised delivery time, and delivery at the desired time in a study that analyzed the effect of logistics service on customer situations in cross-border e-commerce [24]. Accordingly, the speed of delivery had a positive effect on satisfaction for customers. Sun (2018) analyzed the effect of logistics service quality on customer situations and entry to reuse of Chinese agricultural products in online shopping malls, and included return services, such as rapid delivery or safe delivery in logistics service quality, and said that both delivery service and return service have a positive effect [25]. Joo and Choi (2012) analyzed the path of overall logistics service quality on customer status, attention of word-of-mouth, and attention to research in B2C Internet shopping mall environments in Korea, China, and Japan. It is said that overall logistics service quality has a positive effect on customer satiation, and customer satiation plays a mediating role between logistics service and repurchase intention [26]. Dai and Lee (2016) defined the delivery quality of Chinese delivery agencies as a logistics service regarding the delivery quality of the product, and said that such delivery quality has a positive effect on consumer satisfaction [27].

Research considering eco-friendliness in the logistics service cannot immediately exert a direct influence on a company's economic interests or relationships with consumers, but it will have a positive effect on the company's image and future relationships with customers. In this regard, You and Kim (2021) argued that the production of eco-friendly products and services is an essential factor in improving corporate performance. They said that among the motives for participating in the eco-friendly supply chain, government regulations and customer demands had a significant positive effect on the execution of eco-friendly supply-chain management [19]. Nonetheless, the implementation of the eco-friendly supply chain does not affect economic performance in the short term, but it will help secure a competitive advantage for companies from a long-term perspective. Based on the above research results, we developed the following research hypotheses:

**Hypothesis 1**. *Logistics service quality positively influences customer satisfaction.*

**Hypothesis 1-1**. *Delivery service quality positively influences customer satisfaction.*

**Hypothesis 1-2**. *Return logistics service positively influences customer satisfaction.*

**Hypothesis 1-3**. *Delivery stability positively influences customer satisfaction.*

**Hypothesis 1-4**. *Delivery information service positively influences customer satisfaction.*

**Hypothesis 2**. *Logistics service quality positively influences intention to reuse.*

**Hypothesis 2-1**. *Delivery service quality positively influences intention to reuse.*

**Hypothesis 2-2**. *Return logistics service positively influences intention to reuse.*

**Hypothesis 2-3**. *Delivery stability positively influences intention to reuse.*

**Hypothesis 2-4**. *Delivery information service positively influences intention to reuse.*

**Hypothesis 3**. *Customer satisfaction positively influences intention to reuse.*

**Hypothesis 4**. *Eco-friendliness positively moderates the relationship between logistics service quality and customer satisfaction.*

**Hypothesis 4-1**. *Eco-friendliness positively moderates the relationship between delivery service quality and customer satisfaction.*

**Hypothesis 4-2**. *Eco-friendliness positively moderates the relationship between return logistics service and customer satisfaction.*

**Hypothesis 4-3**. *Eco-friendliness positively moderates the relationship between delivery stability quality and customer satisfaction.*

**Hypothesis 4-4**. *Eco-friendliness positively moderates the relationship between delivery information service and customer satisfaction.*

## 3. Research Design

### *3.1. Research Context*

Currently, the amount of overseas direct purchases in Korea was KRW 5.14 trillion in 2021, up 26.4% from 2020. This figure is the highest level since related statistics began to appear in 2014. Looking at Korea and the major countries where cross-border e-commerce takes place, it is in the order of China (63.6%), the United States (15%), and the European

Union (10.9%). By product line, purchases increased in all product groups, including clothing and fashion (27.7%), household goods and automobile goods (33%), and food and beverage (20.3%). In addition, Korea is a representative country of semi-developed countries. In effect, a semi-developed economy has well-established institutions such as information markets and can offer an effective contrast to an emerging economy that might have comparatively poor institutions functioning for cross-border e-commerce firms or to a developed economy. Therefore, investigating overseas direct purchasers in Korea can be an ideal research context.

### *3.2. Measurement*

The indicators constituting the independent variable, the dependent variable, and the moderating variable were measured as a reflective scale. Each questionnaire was measured on a Likert 5-point scale. Table 1 shows a summary of the literature referenced when developing operational definitions and measurement questions of the constituent concept.

**Table 1.** Operational Definitions and References of Constructs.

| Constructs | Operational Definitions | N of Items | References |
|---|---|---|---|
| Delivery Service Quality | The degree to which the delivery is delivered to the desired level after ordering the product, which means that it is delivered quickly from the order to the delivery | 4 | Kang & Hyun (2021) [17] |
| Delivery Information Service | The degree to which the customer can view the process from order to delivery | 4 | Uvet (2020) [1] |
| Return Logistics Service | The speed and ease of processing of return, incorrect delivery, or incorrect product after delivery | 5 | Kim & Ha (2018) [13] |
| Delivery Stability | The degree to which goods are delivered without misdelivery, damage, or omission | 4 | Akil & Ungan (2022) [6] |
| Eco-friendliness | The degree of consideration of echo-friendly elements in the exploration of the optimal path and the logistics service process in the logistics service | 4 | Menguc & Ozanne (2005) [20] |
| Customer Satisfaction | Customers' experience and quality of service and satisfaction with overall service | 4 | Mentzer et al. (2001) [10] |
| Intention to reuse | Revisit the site again, make repeated purchases, and recommend them to the people around you | 5 | Mentzer et al. (2001) [10] |

### *3.3. Data Collection*

We study distributed a questionnaire online in March 2022 to Korean consumers who have experience in purchasing products through overseas direct purchases. If there was a missing value of the respondents, a total of 781 copies were recovered and used for analysis.

## 4. Analysis and Results

### *4.1. Sample Characteristics*

In the present research, the gender ratio of respondents accounted for 36.9% with 383 men and 62.9% with 225 women, 62.4% with 373 in their 20s, and 220 in their 30s, accounting for 36.1%. Four-year college graduates account for the largest portion of the respondents, with 212 high school graduates, 52 professional college graduates, 8.5 percent four-year college graduates, 52.7 percent four-year college graduates, and 24 graduate graduates or higher, accounting for the largest portion. In addition, looking at the number of uses of overseas direct purchases, 1.5% were used once/week with 9 people, 10.7% were used once/month with 65 people, and 41.9% were used once/quarter with 255 people.

The amount used for overseas direct purchases is 47.9% with 292 people less than 100,000 won and 36.6% with 223 people less than 100,000 won, and the most frequently purchased items are clothing and fashion-related products, 37.3% with 227 people, followed by health functional foods with 139 people, accounting for 22.8%. In line with Armstrong and Overton (1977), we checked nonresponse bias and concluded that there is an insignificant bias between early respondents and late ones [28]. Table 2 summarizes the characteristics of the sample.

**Table 2.** Sample Characteristics.

| Category | | N of Respondents | % |
|---|---|---|---|
| Gender | Male | 383 | 62.9 |
| | Female | 225 | 36.9 |
| Age | 20s | 373 | 61.2 |
| | 30s | 220 | 36.1 |
| | 40s | 16 | 2.6 |
| Education | High school | 212 | 34.8 |
| | Community college | 52 | 8.5 |
| | College | 321 | 52.7 |
| | Graduate school | 24 | 3.9 |
| Site Visit Frequency | 1 per week | 9 | 1.5 |
| | 1 per month | 65 | 10.7 |
| | 1 per quarter | 255 | 41.9 |
| | 1 per year | 280 | 46.0 |
| Purchase Volume (Thousand Won) | Under 100 | 292 | 47.9 |
| | 100–200 | 223 | 36.6 |
| | 200–300 | 56 | 9.2 |
| | 300–400 | 13 | 2.1 |
| | Over 400 | 26 | 4.1 |
| Purchase Item | Cosmetics | 32 | 5.3 |
| | Foods | 34 | 5.6 |
| | Electronics | 50 | 8.2 |
| | Clothing & Fashion | 227 | 37.3 |
| | Daily supplies | 34 | 5.6 |
| | Exercises | 72 | 11.8 |
| | Health-functional | 139 | 22.8 |
| | Others | 21 | 3.4 |

### *4.2. Reliability and Validity Tests*

We conducted a reliability analysis with variables such as delivery quality, delivery information, return logistics, and delivery stability of cross-border e-Commerce companies, along with variables and reliability analysis such as eco-friendliness, customer satisfaction, and focus to reuse. The analysis results are shown in Table 3.

To examine common method variance, we conducted Harman's single-factor test in line with Podsakoff et al. (2003) [29]. According to this test, the explanatory powers of each construct are approximately 41.63%, 14.82%, 7.22%, 6.24%, and 4.27%, respectively. Therefore, we confirmed that the distortion due to the bias of the same method was insignificant in the sense that the first and most explanatory power did not account for more than half of the total explanatory one.

**Table 3.** Results of Reliability and Validity.

| Construct | Indicators | Components | | | | |
|---|---|---|---|---|---|---|
| | | Factor Loadings | Communality | Eigen Value | Variance (%) | Cronbach's α |
| Delivery Information Service | Delivery status informing level | 0.799 | 0.713 | 7.911 | 41.639 | 0.888 |
| | Deliver a message to offered | 0.759 | 0.770 | | | |
| | Overview of overall delivery | 0.754 | 0.709 | | | |
| | Checking delivery completion | 0.680 | 0.691 | | | |
| | Addressing delivery issues | 0.665 | 0.595 | | | |
| Return Logistics Service | Fast return processing | 0.876 | 0.788 | 2.815 | 14.818 | 0.894 |
| | Convenient return process | 0.854 | 0.825 | | | |
| | Fast refund and exchange | 0.847 | 0.800 | | | |
| | Reflecting customer feedback | 0.787 | 0.707 | | | |
| | Providing return information | 0.584 | 0.566 | | | |
| Delivery Stability | Undamaged delivery | 0.879 | 0.765 | 1.371 | 7.218 | 0.919 |
| | Delivery without lossless | 0.836 | 0.802 | | | |
| | Safe packing | 0.826 | 0.802 | | | |
| Delivery Service Quality | Precautionary delivery | 0.811 | 0.846 | 1.186 | 6.241 | 0.811 |
| | Easy to grasp delivery info. | 0.740 | 0.689 | | | |
| | Easy to grasp transaction info. | 0.716 | 0.704 | | | |
| | Rapid delivery | 0.691 | 0.616 | | | |
| | Delivery within time frame | 0.595 | 0.519 | | | |
| Eco-friendliness | Reducing logistics waste | 0.939 | 0.739 | 3.331 | 83.278 | 0.933 |
| | Use eco-friendly materials | 0.936 | 0.881 | | | |
| | Environmental awareness | 0.914 | 0.876 | | | |
| | Optimal transportation | 0.859 | 0.835 | | | |
| Intention to reuse | Intention to revisit | 0.866 | 0.870 | 6.265 | 69.614 | 0.943 |
| | Will purchase frequently | 0.833 | 0.890 | | | |
| | Recommendation to others | 0.832 | 0.874 | | | |
| | Willingness to reuse | 0.804 | 0.848 | | | |
| | Word-of-mouth of purchase | 0.769 | 0.837 | | | |
| Customer Satisfaction | With service provided | 0.887 | 0.805 | 1.179 | 13.097 | 0.950 |
| | With the results of logistics | 0.869 | 0.884 | | | |
| | With the purchase experience | 0.864 | 0.806 | | | |
| | With the site | 0.860 | 0.630 | | | |

In another factor analysis, the Kaiser-Meyer-Olkin test for sampling adequacy was 0.806. The factor loading of each factor was found to be 0.7 or more. Therefore, it can be interpreted that there is a degree of concentration between factors, and is appropriate as a measurement item. In addition, Cronbach's alpha of each variable was also found to be 0.811 to 0.919 and its reliability was verified. In addition, as a result of exploratory factor

analysis to find out the impact of the logistics service quality of cross-border e-Commerce companies, satisfaction, and repurchase as dependent variables, the total variance explanatory power was 82.711%. Since factor loading was 0.7 or more and commonality was 0.6 or more, we judged that it was appropriate as a measurement item for each constituent concept. Furthermore, to verify the reliability, reliability verification was performed using Cronbach's alpha. The Cronbach's alpha of each factor was higher than 0.9. Accordingly, the reliability was verified [30].

### *4.3. Descriptive Analysis*

Correlation analysis was conducted to find out the degree of relevance between each factor. Table 4 summarizes the results of the descriptive analysis of the constructs.

**Table 4.** Results of Descriptive Analysis.

| Construct | Mean | S.D. | Correlations | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Delivery Quality** | **Return Logistics** | **Delivery Stability** | **Delivery Info** | **Eco-Friend** | **Customer Satis.** | **Intent to Reuse** |
| Delivery quality | 3.3767 | 0.79210 | 1 | | | | | | |
| Return logistics | 2.5856 | 0.79069 | 0.418 ** | 1 | | | | | |
| Delivery stability | 3.7336 | 0.83812 | 0.613 ** | 0.266 ** | 1 | | | | |
| Delivery information | 3.0267 | 0.80065 | 0.592 ** | 0.503 ** | 0.449 ** | 1 | | | |
| Eco-friendliness | 3.8329 | 0.85245 | 0.354 ** | 0.075 | 0.482 ** | 0.250 ** | 1 | | |
| Satisfaction | 3.4836 | 0.84045 | 0.701 ** | 0.432 ** | 0.727 ** | 0.609 ** | 0.374 ** | 1 | |
| Intention to reuse | 3.3655 | 0.77777 | 0.536 ** | 0.320 ** | 0.503 ** | 0.508 ** | 0.376 ** | 0.682 ** | 1 |

Note: 1. ** $p < 0.01$.

### *4.4. Results of Hypothesis Tests*

We conducted multiple regression analyses for testing hypotheses. The *t*-value of Hypothesis 1-1 that the delivery service quality of cross-border e-Commerce companies has a positive effect on customer saturation was 7.979, which was significant at the significance level of 1%. Delivery quality was measured by the ease, speed, and time-to-time delivery of delivery information and transaction information. It can be seen that providing high-quality content related to such delivery to consumers increases customer satisfaction with cross-border e-Commerce.

As a result of analyzing the relationship between return logistics and customer situation in Hypothesis 1-2, a *t*-value of 3.703 was significant at the significance level of 1%. This can be seen as a high concern of customers about misdelivery or damage to products ordered from cross-border e-commerce companies. Therefore, it can be seen that the stable supply of the return logistics service has a positive effect on the satisfaction of site use. As a result of analyzing the relationship between delivery stability and customer saturation, Hypothesis 1-3 showed a high *t*-value of 15.111, and H1-4 had a positive effect on the satisfaction of the site for high-quality delivery information service, and the *t*-value of this hypothesis was statistically significant at 6.494.

Hypothesis 1-1, Hypothesis 1-2, Hypothesis1-3, and H1-4 were all accepted in investigating the relationship between logistics service quality and customer satiation. The highest delivery stability is that trading transactions made at cross-border e-commerce have a long delivery time, so anxiety about exchange and post-service and concerns about damage to the product can act as obstacles. Therefore, it can be interpreted that the safe delivery status has a high impact on the satisfaction of the site. Table 5 shows the results of examining the effects of logistics service quality on customer satisfaction.

**Table 5.** Effects of Logistics Service Quality on Customer Satisfaction [a].

| | Unstandardized Coefficients | | β | *t* | *p*-Value | Results of Hypothesis Tests |
|---|---|---|---|---|---|---|
| | B | S.E. | | | | |
| Constant | −0.056 | 0.102 | | 0.544 | 0.587 | |
| Delivery quality | 0.282 | 0.035 | 0.265 | 7.979 | 0.000 | Accepted |
| Return logistics | 0.107 | 0.029 | 0.101 | 3.703 | 0.000 | Accepted |
| Delivery stability | 0.448 | 0.030 | 0.447 | 15.111 | 0.000 | Accepted |
| Delivery information | 0.211 | 0.032 | 0.201 | 6.494 | 0.000 | Accepted |

Notes: [a] Dependent variable: Customer satisfaction. R = 0.823; $R^2$ = 0.677; Adj-$R^2$ = 0.675; F = 316.005.

As a result of multiple regression analysis related to the causal relationship between the logistics service quality and the reuse pattern for the site, $R^2$ was 0.677 and revised $R^2$ was 0.675, and the explanatory power of the model was verified. Hypothesis 2-1 is a hypothesis that delivery quality affects the repurchase of international e-commerce sites, and the *t*-value was 4.884, which was statistically significant, and Hypothesis 2-2 was not statistically significant. H2-3 verified the relationship between delivery stability and attention to reuse, the *t*-value was 5.965, and the *t*-value between delivery information and repurchase was 5.766, indicating that both had a statistically significant effect. It was found that the fact that only the return logistics service factor did not have statistical significance does not lead to future repurchase because the performed return action has poor product satisfaction. Table 6 shows the results of examining the effects of logistics service quality on intention to reuse.

**Table 6.** Effects of Logistics Service Quality on Intention to Reuse [a].

| | Unstandardized Coefficients | | β | t | *p*-Value | Results of Hypothesis Tests |
|---|---|---|---|---|---|---|
| | B | S.E. | | | | |
| Constant | 0.955 | 0.131 | | 7.283 | 0.000 | |
| Delivery quality | 0.221 | 0.045 | 0.225 | 4.884 | 0.000 | Accepted |
| Return logistics | 0.036 | 0.037 | 0.036 | 0.966 | 0.335 | Rejected |
| Delivery stability | 0.227 | 0.038 | 0.244 | 5.965 | 0.000 | Accepted |
| Delivery information | 0.240 | 0.042 | 0.247 | 5.766 | 0.000 | Accepted |

Notes: [a] Dependent variable: Intention to reuse. R = 0.617; $R^2$ = 0.380; Adj-$R^2$ = 0.675; F = 92.688.

Hypothesis 3 identified the relationship between satisfaction and repurchase, and the *t*-value was high at 22.976. In other words, it was confirmed that if the experience or service of the site was satisfactory, it would lead to future repurchases. Table 7 shows the results of examining the effects of customer satisfaction on the intention to reuse.

**Table 7.** Effects of Customer Satisfaction on Intention to Reuse [a].

| | Unstandardized Coefficients | | β | *t* | *p*-Value | Results of Hypothesis Tests |
|---|---|---|---|---|---|---|
| | B | S.E. | | | | |
| Constant | 1.167 | 0.098 | | 11.854 | 0.000 | |
| Customer Satisfaction | 0.631 | 0.027 | 0.682 | 22.976 | 0.000 | Accepted |

Notes: [a] Dependent variable: Intention to reuse. R = 0.682; $R^2$ = 0.465; Adj-$R^2$ = 0.527; F = 527.879.

We investigated whether the eco-friendly logistics service plays a moderating role between the logistics service quality and customer satisfaction of cross-border e-Commerce companies. First, it was verified whether it plays a moderating role in the eco-friendly logistics service between delivery service quality and customer saturation. As a result

of the regression analysis, it was found that $R^2$ in the first stage was increasing to 0.491, $R^2$ = 0.507 in the second stage, and $R^2$ = 0.512 in the third stage, but the moderating role between delivery information and satisfaction was not significant. Therefore, Hypothesis 4-1 was rejected. Table 8 shows the summary of the results of the Hypothesis 4-1 test. Table 8 shows the results of examining the moderating effects of eco-friendliness on the relationship between delivery information and customer satisfaction.

**Table 8.** Moderating Effects of Eco-friendliness on the relationship between Delivery Information and Customer Satisfaction.

| Step | Model Fit | | | | | Regression Coefficient | | |
|---|---|---|---|---|---|---|---|---|
| | R | $R^2$ | F-Value Change Statistics | | F-Value | Variable | Beta | *t*-Value (*p*-Value) |
| | | | $R^2$ Change | F-Value Change | | | | |
| 1 | 0.701 | 0.491 | 0.490 | 585.129 | 585.129 | Delivery Information | 0.701 | 24.189 (0.000) |
| 2 | 0.713 | 0.509 | 0.507 | 225.516 | 314.193 | Delivery Information | 0.649 | 21.343 (0.000) |
| | | | | | | Eco-friendliness | 0.144 | 4.745 (0.000) |
| 3 | 0.714 | 0.510 | 0.512 | 1.001 | 209.796 | Delivery Information | 0.543 | 4.888 (0.000) |
| | | | | | | Eco-friendliness | 0.052 | 0.536 (0.592) |
| | | | | | | Delivery Information × Eco-friendliness | 0.167 | 1.001 (0.317) |

Second, we verified the moderating role of the eco-friendly logistics service between the return logistics service and satisfaction. As a result, the amount of change in $R^2$ in the first to third stages was increasing to 0.186, 0.302, and 0.310. The *t*-value of the third stage was 2.928, which was statistically significant at the significance level of 1%. This result shows that it plays a moderating role between return logistics and customer satiation. In the case of the return logistics service, problems such as distance movement and disposal of the product occur more than in the forward logistics service, so it can be interpreted that satisfaction increases when the return logistics service is performed. Therefore, Hypothesis 4-2 was accepted. Table 9 shows the results of examining the moderating effects of eco-friendliness on the relationship between return logistics quality and customer satisfaction.

Third, we tested the moderating effect of the eco-friendly logistics service between delivery stability and customer satiation. As a result of the regression analysis, the amount of change in $R^2$ in steps 1 to 3 was found to be 0.528, 0.529, and 0.529, respectively, and the *t*-value of the moderating variable in step 3 was 0.681, which was not statistically significant. This result shows that the moderating role between the stability and satisfaction of delivery is not significant delivery. Therefore, Hypothesis 4-3 was rejected. Table 10 shows the results of testing the moderating effects of eco-friendliness on the relationship between delivery stability and customer satisfaction.

**Table 9.** Moderating Effects of Eco-friendliness on the relationship between Return Logistics Quality and Customer Satisfaction.

| Step | Model Fit | | | | | Regression Coefficient | | |
|---|---|---|---|---|---|---|---|---|
| | R | $R^2$ | F-Value Change Statistics | | F-Value | Variable | Beta | *t*-Value (*p*-Value) |
| | | | $R^2$ Change | F-Value Change | | | | |
| 1 | 0.432 | 0.186 | 0.185 | 139.101 | 139.101 | Return Logistics | 0.432 | 11.794 |
| 2 | 0.551 | 0.304 | 0.302 | 102.190 | 132.240 | Return Logistics<br>Eco-friendliness | 0.406<br>0.344 | 11.940<br>10.109 |
| 3 | 0.560 | 0.314 | 0.310 | 8.572 | 92.119 | Return Logistics<br>Eco-friendliness<br>Return Logistics × Eco-friendliness | −0.027<br>0.059<br>0.545 | −0.180<br>0.571<br>2.928 |

**Table 10.** Moderating Effects of Eco-friendliness on the relationship between Delivery Stability and Customer Satisfaction.

| Step | Model Fit | | | | | Regression Coefficient | | |
|---|---|---|---|---|---|---|---|---|
| | R | $R^2$ | F-Value Change Statistics | | F-Value | Variable | Beta | *t*-Value (*p*-Value) |
| | | | $R^2$ Change | F-Value Change | | | | |
| 1 | 0.727 | 0.528 | 0.527 | 679.717 | 679.717 | Delivery stability | 0.727 | 26.071 |
| 2 | 0.727 | 0.529 | 0.527 | 340.286 | 340.286 | Delivery stability<br>Eco-friendliness | 0.712<br>0.031 | 22.369<br>0.965 |
| 3 | 0.728 | 0.529 | 0.527 | 226.811 | 226.811 | Delivery stability<br>Eco-friendliness<br>Delivery Stability × Eco-friendliness | 0.643<br>−0.038<br>0.120 | 6.033<br>−0.357<br>0.681 |

Finally, we examined whether the eco-friendly logistics service regulates the relationship between delivery quality and customer satiation. As a result of the regression analysis, the value of $R^2$ from step 1 to step 3 increased from 0.186 to 0.314. In step 3, the *t*-value of the interaction variable, delivery quality × eco-friendliness, was 2.020, which was statistically significant. This result shows that the echo-friendly logistics service plays a moderating role between delivery speed and satisfaction. Therefore, Hypothesis 4-4 was accepted. Table 11 shows the results of examining the moderating effects of eco-friendliness on the relationship between delivery quality and customer satisfaction.

**Table 11.** Moderating Effects of Eco-friendliness on the relationship between Delivery Service Quality and Customer Satisfaction.

| Step | Model Fit | | | | | Regression Coefficient | | |
|---|---|---|---|---|---|---|---|---|
| | R | $R^2$ | F-Value Change Statistics | | F-Value | Variable | Beta | *t*-Value (*p*-Value) |
| | | | $R^2$ Change | F-Value Change | | | | |
| 1 | 0.432 | 0.186 | 0.185 | 358.340 | 358.340 | Delivery quality | 0.609 | 18.930 |
| 2 | 0.551 | 0.304 | 0.302 | 55.264 | 222.820 | Delivery quality | 0.550 | 17.273 |
| | | | | | | Eco-friendliness | 0.237 | 7.434 |
| 3 | 0.560 | 0.314 | 0.310 | 4.081 | 150.662 | Delivery quality | 0.296 | 2.276 |
| | | | | | | Eco-friendliness | 0.043 | 0.423 |
| | | | | | | Delivery quality × Eco-friendliness | 0.362 | 2.020 |

## 5. Discussion

We investigated whether the logistics service quality affects customer status and intention to reuse in the recently rapidly increasing cross-border e-commerce, and further explored whether the eco-friendly logistics service plays a moderating role between each quality variable during the logistics service process. To attain this purpose, we collected data from a survey of customers in Korea, a representative country of the semi-developed economy.

The results of this study are summarized as follows. We classified logistics quality service into delivery service quality, return logistics service, delivery stability, and delivery information service. As a result of analyzing whether these factors affect customer satisfaction and attention to reuse for cross-border e-commerce, the following conclusions were drawn. First, the logistics service quality influenced the customer situation. Among these, the most significant factor was delivery stability. This result suggested that cross-border e-commerce firms need to put a lot of resources into areas such as breakage or mistaken delivery because they have to endure long delivery times due to the nature of cross-border e-commerce. Second, as a result of verifying the relationship between logistics service quality and concentration to reuse, the relationship between return logistics and concentration to reuse among delivery quality, return logistics, delivery stability, and delivery information was not significant. The fact that the return was made can be interpreted as not having a significant effect on repurchase because dissatisfaction with the goods purchased from the cross-border e-commerce firm occurred. Third, the satisfaction of services or products of cross-border e-commerce firms has a high impact on the repurchase, which is consistent with existing research results. Fourth, we analyzed whether eco-friendly logistics regulates the relationship between logistics service quality and customer satiation. As a result, we found that the eco-friendly logistics service moderates the relationship between return logistics and satisfaction and the relationship between delivery quality and customer satiation. We could see that it plays a regulatory role. The measurement items of the eco-friendly logistics service were measured by the optimal path and prohibition of the use of unnecessary wrappers. In the case of return logistics, since logistics activities would not occur when a satisfactory product is delivered, it can be interpreted that building an eco-friendly logistics service can lead to satisfaction of the site, and it is necessary to find an optimal distribution path for rapid and timely delivery between delivery quality and satisfaction. Therefore, it can be interpreted that the eco-friendly logistics service plays a moderating role between delivery quality and satisfaction.

Our study presented several implications for theory and practice. For the continuous operation and development of cross-border e-commerce firms, it is necessary to first consider providing information that customers can specifically confirm to increase satisfaction in inducing the repurchase of the site among logistics service quality. In addition, because of the nature of cross-border e-commerce, characterized by long-distance transportation,

we found that providing visible information on delivery status and information also affects attention to reuse. Nonetheless, in the case of the return logistics service, there was significance in satisfaction. Nevertheless, there was insignificance in the repurchase rate. No matter how much the return logistics service meets the customer's needs, the dissatisfaction with the product itself does little to lead to a repurchase. Because the cross-border e-commerce site can be continuously operated only when it is made, a model that considers transparent disclosure of the delivery process and safe delivery; speed is more suitable than return logistics. Moreover, in the case of eco-friendly logistics service, because return logistics service and delivery service quality have been shown to play moderating roles, it is necessary to consider eco-friendly logistics service.

Although our paper provided important contributions, it involves limitations; thus, a natural and crucial step is to conduct further research. The limitations of our paper are as follows. First, we suffered from the lack of innovation in the research method. Even though we conducted a two-stage regression analysis with data collected in a survey, we did not perform a structural equation modeling analysis. Therefore, it is meaningful for future researchers to confirm the results of our paper with a different research method. Second, the gender ratio in our survey was imbalanced. Thus, by collecting more responses from female customers or by making an equal sample size of the two groups, further research should validate the current research results. Third, our study is lacking a personalized investigation of the understanding of logistics services in the sense that we focus on the issue of eco-friendly logistics services. Accordingly, future research should be conducted on an investigation of the difference between traditional logistics services and eco-friendly ones in terms of customer satisfaction and/or competitive advantage in the marketplace.

In conclusion, we analyzed the effects of logistics service quality on customers' satisfaction and repurchase intention in the context of cross-border e-commerce. In addition, we presented academic contributions in the sense that the eco-friendly logistics service has been used as a moderating variable [31]. Specifically, we suggested what factors cross-border e-Commerce firms should consider when they desire to improve their logistics service or to build a business model to achieve competitive advantage in the marketplace and thereby attain superior financial performance.

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