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ARTICLE

# Evaluation of Logistics Service for Multimodal Transport via the Trans-Siberian Railway: A Perspective of Shippers in South Korea

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**Abstract** The role of logistics service provider (LSP) is essential for efficient logistics service quality (LSQ) and supply chain management, especially in multimodal transport. Multimodal transport routes that use the Trans-Siberian Railway (TSR) play an important role in the supply chains of Northeast Asia. This paper aims to identify current conditions of TSR LSQ and propose improvements to enhance the competitiveness of traditional routes. Therefore, this study sheds light on and provides recommendations for various managerial strategies to LSPs in the context of the TSR. This study utilizes Importance-Performance Analysis (IPA) to measure levels of importance and performance of the logistics service of LSPs that provide multimodal transport services via the TSR from South Korea to Europe. This study identifies capabilities on the basis of five criteria (price, timeliness, reliability, equipment systems, and customer service) from a customers' perspective. The results of the research indicate that operational improvements should be considered to activate TSR multimodal transport for northern logistics routes from the perspective of Korean shippers. Specific findings show that balanced development strategies are needed for logistics routes that have not yet been significantly activated, while implying that logistics costs could be reduced initially to satisfy shippers. This study presents an operational strategy for LSPs using the TSR in northern logistics through IPA methods. Furthermore, this research can help policymakers propose specific policies to revitalize the northern logistics of Korean logistics companies and to provide incentive supports for shippers.

**Keywords** Multimodal transport, Northern logistics, Trans-Siberian Railway, SCM, Service quality, Logistics service

## 1. Introduction

As global offshoring and global supply chains spread across industries, manufacturers tend to rely on logistics outsourcing or third-party logistics firms (3PL) to focus on their core competencies for the production of their products. Third-party logistics firms provide general transport and value-added service such as storage, labelling, assembly, pick and pack, packaging, filling, order taking, invoicing, continuous stock management, distribution processing, warehousing, and integrated supply chains management. Shippers may differentiate themselves from competitors by adopting 3PL while also securing existing clients by providing enhanced-quality transport services. South Korean companies, such as Hyundai Glovis, Pantos, and SJ Logistics Group, are attempting to secure diverse logistics routes by way of the Eurasian logistics market. Among them, northern logistics via the Trans-Siberian Railway (TSR) is considered an efficient alternative to the traditional Suez Canal route for Korean shippers due to its short distance and transit time.

There are discussions in various countries on the multimodal transport of the TSR, Trans-China Railway (TCR), Trans-Korean Railway (TKR), and Trans-Asian Railway (TAR) in the flow of northern logistics. The northern logistics market includes the Russian Far East, Northeast China, North Korea, and the area known as the Commonwealth of Independent States, which is called "northern logistics" from the perspective of South Korea (Hong et al. 2014; Kim et al. 2019). Along with its geopolitical importance, the northern region can be established as an alternative route to Northeast China, Central Asia and even Europe in terms of transportation and logistics (Ministry of Oceans and Fisheries, 2017). South Korea established a

"National Logistics Fundamental Plan 2016–2025" to add a global expandable logistics paradigm designed to prepare for the Eurasian era. Russia is in the midst of carrying out its "Primorye-1" and "Primorye-2" projects, which are intended to link the international transport corridor of Northeast Asia to boost development in the Far East. The main goals of these projects are economic growth in the Promorsky region, improvement of competitiveness with respect to logistics in the Far East, and the strengthening of international cooperation (KMI 2018). In this scheme, the governments of Korea and Russia agree to provide political support to activate logistics services that businesses in the northern region may utilize.

As of 2017, TSR container volume between South Korea and Russia was expected to be about 83,400 TEU. To vitalize the Eurasian logistics network, South Korea took the "Northeast Asia Plus Community of Responsibility" into its primary considerations and established a Northern Economic Cooperation Committee to support the development of various routes for northern logistics. The northern logistics market can encourage the logistics networks of Korea and Eurasian regional countries (Figure 1), enabling job creation and innovative growth. Container throughput using the TSR is expected to increase from 83,400 TEU per year to 142,668 TEU by 2049 and, assuming that it is connected to the Korean Peninsula railway system, the freight of the TKR-TSR will be further increased to 176,000 TEU by 2049 (Presidential Committee on Northern Economic Cooperation 2018). Thus, it is necessary for Korean shippers and 3PLs to diversify their global supply chains and ensure national competitiveness through TSR multimodal transport.

Service quality is an important distinguishing factor among competitors, in that it ties in directly to customer satisfaction and company self-evaluation. Specifically, different criteria of service attributes should be taken into account relative to the characteristics of an industry (Babakus and Boller 1992). Thai (2008) proposed a new conceptual model for service quality of maritime transport to propose some implications for the maritime industry. That study is distinct from previous studies in that it takes into account the unique dimensions and concepts of maritime transport service quality. Yuen and Thai (2015) examined the relationship between service quality and customer satisfaction for liner shipping companies to present marketing strategies. Although prior studies examined maritime transport in relation to logistics service quality (LSQ), research exploring the service quality of multimodal transport is scarce.

Logistics outsourcing is a critical factor in transport cost reduction, the improvement of customer satisfaction, and the enhancement of competitiveness resulting from the selection of proper supply chain management via 3PL (Liu and Wang 2009; Thai 2013). Previous studies extracted criteria and evaluated logistics transport services (Aguezzoul 2014; Chen 2008; Franceschini and Rafele 2000; Lai and Cheng 2003; Thai 2013) while also exploring selection issues relating to optimal 3PLs (Huang et al. 2009; Jharkharia and Shankar 2007; Liu and Wang 2009; Vijayvargiya and Dey 2010). The role of freight forwarders and 3PLs is essential for efficient LSQ and supply chain management, especially in multimodal transport operated via multiple transportation modes. Generally, a high level of LSQ has a positive impact on customer satisfaction, and several related studies have been conducted to corroborate this notion. In particular, Yeo et al. (2015) highlighted the relationship between port service quality and customer satisfaction. By investigating user satisfaction as a means of maintaining customer loyalty and attracting new customers, their study provided implications for identifying an operator's future plans. Furthermore, Chen (2008) applied an evaluation of the performance record model to measure the performance of a customer-centric logistics service provider (LSP) in Taiwan's electronics manufacturing industry.


**Figure 1. Trans-Siberian railway.**
Source: Authors' own elaboration.

Notwithstanding the previous studies regarding LSQ, little research investigates LSQ from the service user's perspective. Therefore, this study aims to identify and evaluate the service quality of TSR multimodal transport with Importance-Performance Analysis (IPA) methods that are used primarily for service provider selection and evaluation. Although previous studies have used IPA methods in logistics and port service (Huang et al. 2009; Lai and Cheng 2003; Lee and Hu 2012; Oh et al. 2018), and northern logistics has proven vital for Korean shippers and 3PL, there is no study of multimodal transport service in the TSR. This paper aims to identify the criteria for evaluation of Korean LSPs when Korean import/export companies use the Northern Logistics System. Therefore, this study may produce an operational strategy for multimodal transport service providers with a specific focus on the TSR. The study also has ramifications for service users, as it suggests a direction for operational improvement.

The rest of this paper is organized as follows: Section 1 reviews prior literature regarding LSQ and the importance of northern logistics. Section 2 outlines the methodology. Based on the survey, Section 3 of this paper presents the results of a comparative analysis regarding what customers deem important relative to actual performance. Finally, Section 4 proposes managerial implications from the perspective of Korean logistics companies.

## 2. Literature Review

Logistics service accounts for a significant portion of product flow, from the manufacture of goods to their delivery to consumers. Import-export companies have attempted to achieve cost reduction, enhancement of service quality, and customer satisfaction for supply chain competitiveness through improvements to logistics services (Kwak et al. 2018; Liu and Wang 2009; Seo et al. 2014; Thai 2013). Therefore, the appropriate selection and evaluation of logistics outsourcing or 3PL providers is important for manufacturers. Aguezzoul (2014) investigated the main criteria and methodologies on the basis of comprehensive prior studies related to 3PL. The study findings stressed the importance of companies employing specialized 3PL as a fundamental differentiation strategy.

The definition and scope of LSQ were discussed in various prior studies. The quality of logistics services aims at improving overall efficiency and achieving customer satisfaction with two approaches: physical and user aspects. The majority of studies defined and classified LSQ in terms of physical distribution service quality (PDSQ) of the first approach (Bienstock et al. 1997; Giovanis et al. 2013; Mentzer et al. 1999). Giovanis et al. (2013) proposed a reliable definition of LSQ by combining both process and outcome quality. This LSQ model consisted of 10 measures including Procedural Quality (PQ), Contact Quality (CQ), Word-of-Mouth (WOM), Repurchase Intentions (RI), Information Quality (IQ), Discrepancy Handling (DH), Order Condition (OC), Timeliness (T), Product Availability (PA), Order Accuracy (OA). A comprehensive LSQ is possible if an assessment that reflects the customer's characteristics is added to the PDSQ. Thai (2013) proposed a systematic conceptual model of LSQ, taking into account an interaction between customer-centered service and service provider. The model was tested on Singaporean companies and found that customers were critical to improve LSQ. This proposed model is consisted of five factors: Customer focus quality, Order fulfilment quality, Timeliness, IQ, and Corporate image.

Securing an effective and efficient transport service has become an increasingly vital means of ensuring customer satisfaction and facilitating corporate management. As mentioned previously, the main research topics relating to logistics services are evaluation, criteria, and selection (Aguezzoul 2014; Chen 2008; Franceschini and Rafele 2000; Huang et al. 2009; Jharkharia and Shankar 2007; Lai and Cheng 2003; Liu and Wang 2009; Thai 2013; Vijayvargiya and Dey 2010). Liu and Wang (2009) applied three different methodologies to a case involving Taiwan's mid-size semiconductor-related companies to identify the most favored LSP. In the case study of this paper, price, customer service, and corporate reputation were presented as the most influential criteria. Vijayvargiya and Dey (2010) considered cost, transportation, and value-added service to select effective logistics providers among Indian auto parts companies. According to the results, cost criteria was calculated at the highest weighting value followed by delivery and value-added and inland transportation, and other costs were evaluated as sub-factors. Liu (2011) assessed operating practices to improve competitiveness from the perspective of LSPs through a comparative study of China and the UK. His findings indicated that LSPs with different cultural, political, and developmental stages should establish their operational strategies in line with their respective business environments and national characteristics. Irrespective of location, the competitive strategies, customer service actions, use of service quality criteria, relationship, and Information Technology (IT) applications, innovation sources, and cost calculation tool applications all indicated similar importance to both China and the UK. Greater Tumen Initiative (2014) conducted assessment of Sea-Land multimodal transport using ferries to vitalize logistics in Northeast Asia. This study evaluated problems of mutual access restriction of trailer chassis, empty

containers, procedural complexity, and lack of new business models. The results of this paper suggested ways to enhance the competitiveness of multimodal transport through multilateral measures such as support of local government, logistics information platform, and support for business expansion.

Jharkharia and Shankar (2007) derived the choice of a suitable LSP for mid-size businesses and Fast-Moving Consumer Goods companies by seeking IT through the analytic network process (ANP) method. As a result of the analysis, interchangeability was identified as the most important factor between LSPs and companies seeking IT, due to the connectivity of a flexible supply chain and the fundamental capabilities of IT. Based on the SERVQUAL model, literature related to service quality was produced mainly on the basis of tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al. 1988). However, given the unique characteristics of the shipping and logistics industry, the customized model needs to be used rather than the SERVQUAL model to adequately assess service quality (Yuen and Thai 2015).

Franceschini and Rafele (2000) analyzed the consistency between the evaluation criteria of U.S. courier service providers and the factors associated with the Parasuraman model. The standard for Federal Express has eight dimensions, namely: lead time, regularity, reliability, completeness, flexibility, correctness, harmfulness, and productivity. The comparison results showed that empathy was removed as a factor because there was no match for the above criteria. With that being said, it could serve as an inevitable factor in other situations. Lim et al. (2017) analysed the key factors of transit trade corridors in northern Asia through expert survey and factor analysis. This study revealed that there were eight factors affecting transit trade corridors: policy implications, safety and political issues, environment, finance, infrastructure, geography, and corridor performance. This research is of significance as an early study exploring factors to consider in developing transit trade corridors.

Thai (2013) explored related characteristics to enhance the quality of logistics services based on customers and LSPs in Singapore. By conducting a factor analysis, this study derived five classification systems and 20 sub-factors. Specifically, the five classifications consisted of customer focus quality, order fulfillment quality, corporate image, timeliness, and IQ. Jung et al. (2019) investigated the competitiveness of low-cost carriers compared to car ferry services by exploring the factors important in the context of a shipper's transport options. They adopted the fuzzy-AHP method along with four mid-level criteria: validation of additional costs, availability, reliability, and convenience of transport service. Among sub-factors, cargo penalty was the most influential.

In light of the service quality evaluation, referring to the summary of Table 1, five criteria and 20 sub-factors for evaluating

**Table 1. Summary of evaluation dimensions of logistics services**

| Authors | Research objective | Dimensions |
|---|---|---|
| Vijayvargiya and Dey (2010) | To propose a common logistics provider to optimize the international logistics systems | Cost (inland transport and other, ocean & air freight), delivery (port licensing & presence, schedule flexibility), value added services (clearing & forwarding, warehousing, IT-track & trace) |
| Liu (2011) | To identify the operational practices in order to enhance the competitiveness from the LSP's point of view | Strategic management, customer service, service quality, operations management, customer relationship management, IT, inventory management, innovation, human resource management, cost management |
| Franceschini and Rafele (2000) | To analyze the consistency between the evaluation criteria of logistics service sector and the factors associated with the Parasuraman model | Lead time, regulatory, reliability, completeness, flexibility, correctness, harmfulness, productivity |
| Lim (2017) | To investigate the key factors of transit trade corridors in Northern Asia | Development and policy implications, safety, security and political concerns, environment protection, financing and investment, soft infrastructure, hard infrastructure, geography and landscape, corridor performance |
| Thai (2013) | To explore the definition of LSP and related characteristics of the quality of logistics services based on customers and LSPs | Customer focus quality, order fulfilment quality, timeliness, information quality, corporate image |
| Jung et al. (2019) | To identify the factors important in the context of a shipper's transport option | Validation of additional cost factors, availability of transportation service, reliability of transportation service, convenience of transportation service |

LSP, logistics service provider.
Source: Authors.

TSR multimodal transport were extracted through literature and expert interviews (Jharkharia and Shankar 2007; Jung et al. 2019; Thai 2013; Vijayvargiya and Dey 2010). The role of LSPs, including logistics outsourcing and 3PL, is critical in multimodal transport. In particular, the TSR connecting the Russian Far East and Europe is generally used as multimodal transportation for Korean logistics companies and manufacturers. In this regard, it is essential to assess the quality of TSR multimodal transport logistics service with respect to seamless connections in the northern logistics market.

## 3. Methodology

### 3.1 Importance-Performance Analysis (IPA)

IPA was first developed by Martilla and James (1977) along with an executive method for establishing a company's management and marketing plans by investigating user opinions on products and services. The idea of the method is that based on the importance and performance of the customer's assessment of the service attributes provided by the firm, it can determine in which areas the firm is adequately allocating key resources as well as where the firm should re-evaluate resource distribution. The IPA method has been generally adopted in a large number of fields such as education (O′Neill and Palmer 2004), public management, and tourism destination choice (Lai and To 2010), hotel selection and operation (Chu and Choi 2000), and port management due to its ease of analysis and useful results (Lee and Hu 2012; Lee et al. 2017; Oh et al. 2018).

There are also cases of IPA methodology being used in the study of logistics services. Lai and Cheng (2003) assessed supply chain performance (SCP) of Hong Kong's LSPs by using IPA analysis. To render a reasonable analysis, shippers, LSPs, and consignees were considered for efficiency and effectiveness. As Hong Kong's LSPs had a high aware of SCP, both importance and performance scores for each of the three criterion noted above were higher than the mean value "3". The primary focus of LSPs is service effectiveness for shippers. Lai and Cheng's study stressed the importance of communicating with supply chain members as a means of enhancing LSQ.

Huang et al. (2009), for their part, conducted a comprehensive analysis of Taiwan's e-commerce retail transportation services using the structural equation model and IPA method. Research showed that retail delivery providers should invest resources in the correctness and speed of information, as well as in the easy-to-use order process portion, so as to operationalize strategies. This study also attempted an IPA analysis of logistics and transportation services. More specifically, the study identified capabilities on the basis of five criteria (price, timeliness, reliability, equipment systems, and customer service) that TSR's multimodal transport service providers ought to have from the perspective of customers. Research on LSPs in multimodal transport has been insufficient, especially considering the fact that logistics evaluations using TSR are more valuable for Korean import-export shippers. The expectations and performance of logistics service attributes encountered by transport users can be diagrammed using the importance-performance matrix (IPM). The IPM constructs a two-dimensional plot by displaying the mean value of importance on the vertical axis and the mean value of performance on the horizontal axis, shown in Figure 2 (Chen 2014; Martilla and James 1977).

The matrix is divided into four quadrants labeled "A," "B," "C," and "D," which possess different strategic implications. For example, the upper left-hand part of the quadrant is "Concentrate here," which means that the customers are aware of the higher importance, while the perceived performance is lower. In the upper right-hand part, quadrant B, we find: "Keep up the good work," which shows high levels of user-recognized importance and actual performance. Quadrant C, the lower left area, is labelled "Low priority," wherein both importance and performance recognized by the user are low. Finally, the lower right part, quadrant D, is "Possible overkill," which denotes a high performance level with a comparatively low importance level (Martilla and James 1977; Oh et al. 2018).

### 3.2 Measurement development

This study identified capabilities on the basis of five criteria that TSR's multimodal transport service providers ought to have from the perspective of customers. All variables in this research were devised from prior literature related in LSP and service quality evaluation in order to ensure reliability and validity as depicted in Table 2. The dimensions deployed to evaluate logistic service were referenced in Aguezzoul (2014), and divided into five scales of price, timeliness, reliability, equipment systems, and customer service in the LSP context. The measurements were slightly converted and modified in the context of TSR multimodal transport service. This research conducted an evaluation of logistics service using the degree of price consisting of 5 sub-factors (Aguezzoul, 2014; Jharkharia and Shankar, 2007; Jung et al. 2019), timeliness containing 4 items (Jharkharia and Shankar, 2007; Jung et al. 2019; Thai, 2013; Vijayvargiya and Dey 2010), reliability consisting of 3 sub-factors (Jung et al.

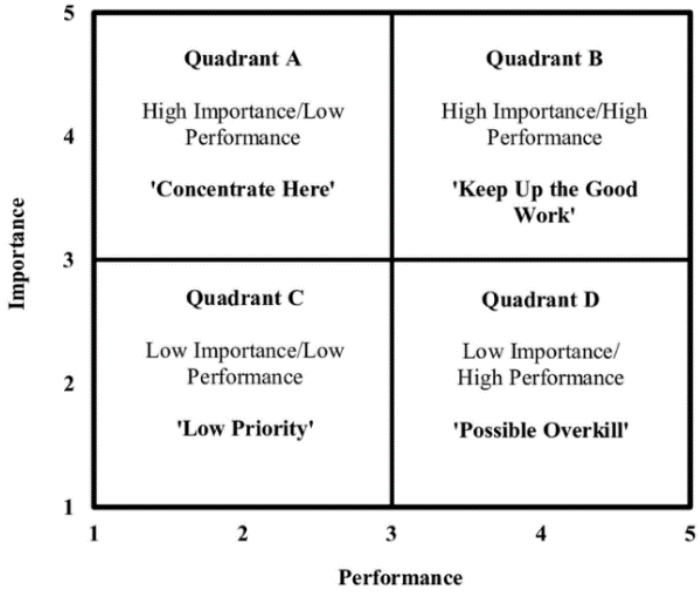


**Figure 2. Importance-performance matrix.**
Source: Martilla and James (1977).

**Table 2. Measurement items**

| Construct | Measurements | References |
|---|---|---|
| Price | 1. Flexibility in billing and payment<br>2. Competitive logistics prices<br>3. Cargo incentive<br>4. Penalty or commission for cancellation of cargo reservation<br>5. Reasonable fare rate according to circumstances | Aguezzoul (2014); Jharkharia and Shankar (2007); Jung et al. (2019) |
| Timeliness | 6. Seamless connectivity between different modes of transportation<br>7. Ability to connect to various ports in Korea<br>8. Schedule flexibility<br>9. On-time of delivery | Jharkharia and Shankar (2007); Jung et al. (2019); Thai (2013); Vijayvargiya and Dey (2010) |
| Reliability | 10. Safe and secure delivery<br>11. Proper handling of Russian customs clearance<br>12. Appropriate packing capacity to minimize cargo damage | Jung et al. (2019); Kim et al. (2020); Thai (2013); Vijayvargiya and Dey (2010) |
| Equipment system | 13. Ability to supply and secure train wagons<br>14. Possible use of Block Trains<br>15. Cargo loading space capacity during peak season<br>16. IT-Tracking for freight location | Jharkharia and Shankar (2007); Jung et al. (2019); Thai (2013); Vijayvargiya and Dey (2010) |
| Customer service | 17. Prompt and appropriate response to customers' needs and requirements<br>18. Easy complaint/claims procedure<br>19. Easy and convenient cargo booking and contracting service<br>20. Various transportation plans and consulting | Jharkharia and Shankar (2007); Jung et al. (2019); Thai (2013) |

Source: Authors.

2019; Thai, 2013; Vijayvargiya and Dey 2010), equipment system with 4 sub-factors (Jharkharia and Shankar, 2007; Jung et al. 2019; Thai, 2013; Vijayvargiya and Dey 2010), and customer service including 4 items (Jung et al. 2019; Jharkharia and Shankar, 2007; Thai, 2013). The study adopted a five-point Likert scale for the scope of the measurement for evaluation. The survey questionnaire was designed for level of importance/performance, ranging from 1 (= very unimportant) to 5 (= very important) for items relating to "importance," and from 1 (= performing really badly) to 5 (= performing really well) for items relating to "performance," as recognized by logistics service users.

### 3.3 Data collection

A self-administered evaluation questionnaire was constructed for the users (e.g., shippers) of TSR multimodal transport. To

ensure objectivity, its sections were separated so that respondents were asked to rate the importance assessments in the first part and then performance assessments in the next part. This was done because the questionnaire's capacity to evaluate importance and performance could have an impact on other evaluation items, which could skew the data (Martilla and James 1977).

This study employed non-probability sampling (convenience, purposive and snowball sampling), because it is not possible to identify the shippers' population who have experience to use northern logistics route. In purposive sampling, it is assumed that a researcher's knowledge about the population can be used to select cases to be included in the sample, and, in snowball sampling, a researcher makes initial contact with a small group and then uses these to establish contacts with others. Stank et al. (2003) applied this sampling method in logistics outsourcing research where it is difficult to find a wide range of objects. Under these circumstances, it is appropriate to find a clear object and conduct additional object obtained from referrals by the initial respondents (Goodman 1961).

Among executives of shipping companies who have experience using multimodal transport via the TSR to transport their products from South Korea to Europe, a total of 50 questionnaires were distributed to gain perspective on TSR multimodal transportation in the Russian Far East. The survey was conducted via e-mail, and a total of 20 valid responses were received (response rate = 40%). Companies utilizing multimodal transport in the Russian Far East via the TSR are concentrated in Busan and Daegu.

## 4. Results

Table 3 summarizes the mean values of user importance and performance ratings as they relate to TSR multimodal transport under the categories of price, timeliness, reliability, equipment systems, and customer service. The results indicate that the mean

**Table 3. Mean value of importance and performance in TSR multimodal transport from logistics service users' perspectives**

| Dimension | Measurement items | Summary of mean | | |
|---|---|---|---|---|
| | | Importance | Performance | Gap |
| **Price** | | | | |
| **1** | Flexibility in billing and payment | 3.80 | 3.25 | −0.55 |
| **2** | Competitive logistics prices | 3.45 | 2.80 | −0.65 |
| **3** | Cargo incentive | 4.05 | 2.80 | −1.25 |
| **4** | Penalty or commission for cancellation of cargo reservation | 2.65 | 2.55 | −0.10 |
| **5** | Reasonable fare rate according to circumstances | 3.95 | 2.80 | −1.15 |
| **Timeliness** | | | | |
| **6** | Seamless connectivity between different modes of transportation | 3.65 | 3.00 | −0.65 |
| **7** | Ability to connect to various ports in Korea | 2.70 | 3.15 | 0.45 |
| **8** | Schedule flexibility | 2.85 | 2.70 | −0.15 |
| **9** | On-time of delivery | 3.40 | 3.00 | −0.40 |
| **Reliability** | | | | |
| **10** | Safe and secure delivery | 2.70 | 3.20 | 0.50 |
| **11** | Proper handling of Russian customs clearance | 3.65 | 2.60 | −1.05 |
| **12** | Appropriate packing capacity to minimize cargo damage | 3.60 | 2.75 | −0.85 |
| **Equipment system** | | | | |
| **13** | Ability to supply and secure train wagons | 3.50 | 2.80 | −0.70 |
| **14** | Possible use of block trains | 4.05 | 2.65 | −1.40 |
| **15** | Cargo loading space capacity during peak season | 3.15 | 3.25 | 0.10 |
| **16** | IT-tracking for freight location | 3.70 | 2.85 | −0.85 |
| **Customer service** | | | | |
| **17** | Prompt and appropriate response to customers' needs and requirements | 3.65 | 3.15 | −0.50 |
| **18** | Easy complaint/claims procedure | 3.10 | 3.10 | 0.00 |
| **19** | Easy and convenient cargo booking and contracting service | 3.80 | 3.05 | −0.75 |
| **20** | Various transportation plans and consulting | 3.65 | 2.65 | −1.00 |
| | **Average value** | 3.453 | 2.905 | −0.548 |

TSR, Trans-Siberian Railway.
Note: Gap = performance minus importance.
Source: Authors

value of importance recognized by shipping companies that use the TSR tend to be high. The actual average of all importance measurement items was 3.453, which was higher than the median (= 3.0) of the Likert scale. This suggests that users of the TSR place great importance on all 20 assessment items. Although the importance value was high, the actual mean value (= 2.905) of all performance items is relatively low and below the median (= 3.0) of the Likert scale. This finding suggests that companies using TSR multimodal transport appreciate the importance of a variety of attributes, but indicates that actual performance recognized by firms is not sufficiently achieved. Specifically, the perceived performance of "Ability to connect to various ports in Korea," "Safe and secure delivery," and "Cargo loading space capacity during peak season" was shown to be higher than the importance rate, while "Easy complaint/claims procedure" appeared to be the same with respect to its importance and performance. The importance rating of all attributes except for the previous four factors was higher than the corresponding performance values.

Based on the results of the IPA, a two-dimensional model of the IPM was constructed by displaying the performance on the x-axis and importance on the y-axis. It is essential to adopt the actual mean value as opposed to the midpoint of the Likert scale to more accurately interpret the real data. Given that the mean value evaluated by users is generally high, if the midpoint (= 3.0) is adopted, all measurement items will correspond to quadrant B, which is "keep up the good work" (Lai and Cheng 2003; Oh et al. 2018). Therefore, the IPM was divided using the actual mean value in this study, as shown in Figure 3. The four plots schematized in the IPM are able to evaluate current logistics services from the perspective of TSR users, which might help with future management strategies for LSPs. The multimodal transport service users regarded "Cargo incentive" and "Possible use of Block Trains" as the most important factors for evaluating the TSR. On the contrary, companies deemed "Penalty or commission for cancellation of cargo reservation" as the least significant criteria, followed by "Ability to connect to various ports in Korea," and "Safe and secure delivery." The location within the IPM for all 20 assessment factors is described in Table 4.

## 5. Conclusion

This study first evaluated the LSQ of TSR multimodal transport from the perspective of shipping companies. The criteria for assessing logistics service in this study were reconstructed to suit the TSR multimodal transport in the Russian Far East, through factors mentioned in the service quality literature and opinions of northern logistics experts. This study identifies the status of TSR logistics service and presents a benchmarking model to new market entrants by providing efficient operational insight to LSPs. Moreover, it not only fills research gaps by assessing the respective levels of importance and performance as recognized by logistics users in the context of TSR multimodal transport, but also identifies their competency as a means of allocating resources efficiently.

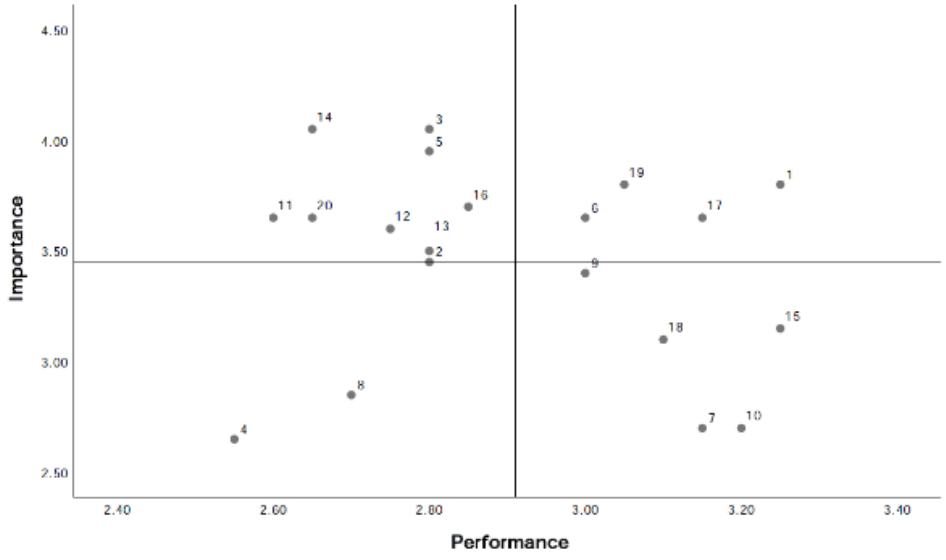


**Figure 3. Importance-performance matrix in TSR multimodal transport.**
TSR, Trans-Siberian Railway.
Source: Authors.

**Table 4. Location of assessment factors in IPM**

| Location in IPM | Number of items | Measurement items |
|---|---|---|
| **Concentrate here (A)** | 3 | Cargo incentive |
| | 5 | Reasonable fare rate according to circumstances |
| | 11 | Proper handling of Russian customs clearance |
| | 12 | Appropriate packing capacity to minimize cargo damage |
| | 13 | Ability to supply and secure train wagons |
| | 14 | Possible use of Block Trains |
| | 16 | IT-Tracking for freight location |
| | 20 | Various transportation plans and consulting |
| **Keep up the good work (B)** | 1 | Flexibility in billing and payment |
| | 6 | Seamless connectivity between different modes of transportation |
| | 17 | Prompt and appropriate response to customers' needs and requirements |
| | 19 | Easy and convenient cargo booking and contracting service |
| **Low priority (C)** | 2 | Competitive logistics prices |
| | 4 | Penalty or commission for cancellation of cargo reservation |
| | 8 | Schedule flexibility |
| **Possible overkill (D)** | 7 | Ability to connect to various ports in Korea |
| | 9 | On-time of delivery |
| | 10 | Safe and secure delivery |
| | 15 | Cargo loading space capacity during peak season |
| | 18 | Easy complaint/claims procedure |

Source: Authors.
IPM, importance-performance matrix.

As a result, the mean value of the importance rating evaluated by shipping companies was high (= 3.453) relative to the midpoint of the Likert scale. This indicated that import-export firms were aware of political and economic projects to activate the northern logistics market with neighboring countries and they garnered significant importance with respect to TSR multimodal transport. However, the performance rating as reported by users (= 2.905) did not correspond with the mean of importance and fell below the midpoint of the Likert scale. This suggests that TSR multimodal transport in the Russian Far East is in the beginning stage and the existing alternative route, i.e., the Suez Canal, is still more active. In addition, the importance-performance rating gap in this study provided positive lessons with respect to operational aspects. The result of the IPA demonstrated the advantages to companies that enhance efficiency, given the larger value of importance, though such findings are moot in some circumstances, such as when the performance rating is higher than its corresponding importance rating. Our findings indicate that in such cases, it is not practical to use this logistics route. Therefore, the gap between importance and performance denoted where a company's resources should or should not be allocated in the interest of sustainable utilization.

The quadrant scatterplot of the IPM could also derive a different operational implication for LSPs. In quadrant B ("Keep up the good work"), four factors were included, accounting for 20% of the total, and maintaining the status quo for high importance-performance. Additionally, in quadrant C ("Low priority"), three factors were included, accounting for 15% of the total. Here it is important for firms to maintain a low level of resource allocation because of the relatively low level of importance attributed by questionnaire respondents. The most notable areas were quadrants A and D for multimodal transport LSPs. Quadrant A, "Concentrate here," was comprised of "Cargo incentive," "Reasonable fare rate according to circumstances," "Proper handling of Russian customs clearance," "Appropriate packing capacity to minimize cargo damage," "Ability to supply and secure train wagons," "Possible use of Block Trains," "IT-Tracking for freight location," and "Various transportation plans and consulting." This area included all main criteria: Price, Reliability, Equipment system, and Customer service excluding "Timeliness," which suggests that it is vital to make multilateral efforts to satisfy logistics service users for the seamless flow of multimodal transport in the Russian Far East. It also indicates that price, reliability, and proper supply of equipment are essential factors in TSR transport from the perspective of shipping companies.

Wang and Yeo (2016) showed that cost-effective logistics networks were recognized as important in the logistics industry while also demonstrating that reliable services were crucial to logistics companies in international multimodal transport. On the other hand, quadrant D ("Possible overkill") was comprised of factors such as "Ability to connect to various ports in Korea," "On-time of delivery," "Safe and secure delivery," "Cargo loading space capacity during peak season," and "Easy complaint/claims procedure." It is interesting to note that two out of five factors within quadrant D belong to the "Timeliness"

criterion, and that all main criteria were included, apart from “Price.” The schematic diagram showed that LSPs might reduce their allocation of resources in quadrant D and concentrate more on other strategies, such as “Price” resources. These findings show that balanced development strategies are needed for logistics routes that have not yet been significantly activated, while also implying that logistics costs could be reduced initially to satisfy shipping companies and attract more customers.

This study has important practical and political ramifications. It proposes a milestone for LSPs using the TSR in northern logistics as a means of securing alternative logistics routes through IPA methods. In addition, this study helps 3PLs to achieve customer satisfaction by improving the quality of logistics services to retain current customers and attract new shippers. The results of the survey were evaluated from the perspective of the users of northern logistics to derive more practical implications. TSR supply chain routes can prove useful for logistics service operators in Northeast Asia, while also facilitating efficient transport for Korean companies due to their short distance and transit time from South Korea to Europe. Furthermore, this research can help policymakers make decisions in exploring alternative logistics routes that can enhance the competitiveness of Korean corporations.

Despite its theoretical and practical implications, this study has some limitations. First, the number of samples was small because only logistics service users, i.e., shipping companies, are subject to the analysis in terms of TSR multimodal transport in the northern logistics market. To broaden the scope of the research, future studies need to obtain various respondents that are supply chain members, such as LSPs, port authorities, and other related researchers. Second, as it was difficult to identify population accurately, the non-probability sampling method was used, which imposed limitation in carrying out reliability and validity testing for this study. Further study may increase the number of samples and incorporate reliability and validity testing. Third, the study was limited to multimodal transport of the northern logistics market with a TSR context. Future research could incorporate comparable intermodal transport routes such as the TCR, TAR, and Trans-Mongolian Railway, as a means of suggesting comprehensive operations strategies for Korean LSPs. Finally, the characteristic of the cargo was not fixed in this study. Future studies could focus more on marketing management as well as the service direction taken by LSPs, depending on whether such providers specialize in bulk freight or container freight.

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