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A Study on International Multimodal Transport Networks from Korea to Central Asia: Focus on Secondhand Vehicles

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ABSTRACT

Currently, high-income countries use multimodal transportation to export large quantities of secondhand vehicles to low-income countries. Secondhand vehicle export has shown its highest growth in recent years, especially in Korea. The problem of transporting secondhand vehicles from Korea to Central Asia is becoming an important issue, but few researchers are interested in it. The objective of this research is to determine the optimal transport network for exporting secondhand vehicles from Korea to Central Asian countries by combining experts' opinions and real data from existing transport networks. The fuzzy Delphi method was applied to obtain factors to evaluate alternative multimodal transport networks for moving secondhand vehicles from Korea to Central Asian countries by judgment from experts. The analysis shows that among the five factors (total cost, total time, reliability, security, and transportation capability), total cost is the most considerable factor, followed by reliability, transportation capability, total time, and security. Additionally, in the mainly three multimodal transport networks, the sea+Trans-China Railway route is ranked first, followed by the sea+Trans-Siberian Railway and sea+truck routes.

1. Introduction

With increasing international trade and rising incomes, low-income countries are using multimodal transportation to import large quantities of secondhand vehicles from high-income countries, and the scope of this market will continue to expand enormously (Hwang and Kang, 2011). Previously, secondhand Japanese vehicles dominated the international market (Consulting Company Yano, 2010). Now, secondhand Korean vehicles, having relatively low purchasing prices and improved conditions than before, have begun to be recognized in the international market (Shin, 2013). The main areas importing secondhand vehicles from Korea are the Middle East, South Africa, Southeast Asia, and Central Asia according to statistical data from Korea's used car export association. All these areas have formed fixed and efficient secondhand vehicle transport networks

except Central Asia.

Central Asia does not have an efficient transport network because of its location in the middle of the Eurasian continent. International multimodal transport suffers various limits, such as customs clearance matters, track gauge differences matters, climate limitations, etc. So far, there are three transport networks from Korea to Central Asia: the sea+Trans-China Railway (TCR) route, the sea+Trans-Siberian Railway (TSR) route, and the sea+truck route (Park, 2011). The cargo transport volume for these networks is about 40%, 40%, and 20%, respectively, because all of these networks have some disadvantages. However, there are few researchers interested in analyzing the multimodal transport networks for secondhand vehicle exports from Korea to Central Asia. Therefore, this research aims to determine the optimal network for secondhand vehicle transport from Korea to Central Asian countries and to suggest the development strategy and priority of alternative networks.

Previous research related to transport network problem mostly used linear programming (Ayar and Yaman, 2012; Xie et al., 2012; Meisel and Kopfer, 2014) or mathematics programs (Chiew and Qin, 2009; Domuta et al., 2011) but did not consider the judgments of experts. Selecting a transport network is a decision-making issue that depends not only on the results from mathematical models but also on the judgment of decision makers because there are some uncertainties in the judgment process, such as the evaluation of service quality or reliability (Tsai et al., 2010). The fuzzy Delphi method is widely employed to resolve uncertainty and imprecision in decision making by comparing judgments of decision makers using fuzzy triangular numbers to more accurately reflect the original opinions of decision makers (Wang et al., 2014). In this research, the fuzzy Delphi method is employed to solve the multimodal transport network selection problem by integrating both the real data from the secondhand vehicle industry and judgments from experts.

2. Literature Review

2.1. *Multimodal Transport Networks for Secondhand Cars*

There are main three transport networks from Korea to Central Asia: the sea+TSR route, the sea+TCR route, and the sea+truck route (Park, 2011) (shown in detail in Figure 1).

The sea+TSR route runs from Korean ports to Vostochny port in Russia and transfers to the TSR until reaching Central Asia. The TSR operates as a block train: In order to fully load, it sometimes waits for several days, and as a result, there is usually a large backlog of goods waiting for transport. The long winter weather makes it difficult to cross the frozen region, which makes the TSR inconvenient for providing transport services. Additionally, Russian customs clearance standards make customs clearance procedures complicated.

The sea+TCR route runs from Korean ports to Lianyungang port in China and transfers to the TCR until reaching Central Asia. The TCR should transfer at the border between China and Kazakhstan due to the track gauge size is different in two countries; but there is a lack of railway wagons in Kazakhstan to connect the cargo transported from China. Sometimes, the Chinese government restricts the use of railways to the transport of strategic cargo (grains, ore, etc.), which limits railway use for other cargoes. Paying informal express fees to gain priority use of the TCR and avoid slow transport times leads to high costs for shippers.

The sea+truck route runs from Korean ports to Bandar Abbas port in Iran and then uses trucks to transport goods to Central Asia (Zhang and

Liu, 2013). Deep-sea transportation takes days longer than the TSR/TCR. The transport cost from Bandar Abbas port to Central Asia is expensive, and trucking related facilities are scarce. Additionally, the unstable political situation in Middle Eastern countries may cause disruptions in the transportation network, leading to irregular service.

Until now, none of these three multimodal transport networks have been economically viable for secondhand vehicle transportation due to unique or shared issues. These three networks are the research target. After evaluating the networks, the optimal network can be chosen for future improvement and development.

Fig. 1. The three main multimodal transport networks

2.2. *Research on Secondhand Vehicles*

The secondhand vehicle industry is rapidly growing. Because of its short development time, this industry has not received much attention. Research in this field is rare, and most research about the secondhand vehicle market presents situation investigations and the import/export volume of the main trading countries.

Some of the research focuses on case studies and benchmarking from countries that have a high volume of secondhand vehicle trading and a better secondhand vehicle market, such as Japan and the US (Li, 2008; Luo, 2009; Consulting Company Yano, 2010; Zhang, 2010; Yan and Huang, 2012). Other research discusses the status quo, characteristics, and problems of the secondhand vehicle market (La and Eom, 2006; Su, 2007; Son et al., 2007; Fu, 2009; Wu et al., 2009; Hwang and Kang, 2011; Zheng et al., 2012; Shin, 2013; Essoh, 2013).

Such research mostly focuses on the market in this industry or case studies of developed secondhand export countries. However, with the growth of the secondhand vehicle, meeting the demands of customers at the right time and for a reasonable price is becoming an important issue (i.e., the secondhand vehicle transport problem). This issue has not been addressed yet, and to fill this gap, this research will analyze the transport network of secondhand vehicles using a case study of exports from Korea to Central Asian countries.

2.3. *Research on Multimodal Transport Network*

With the expansion of worldwide electronic marketing and the development of economic globalization, global services supported by worldwide transportation have become necessary to the business world. Therefore, how to decide and manage transport networks efficiently has become a key issue for reducing costs and enhancing customer service in