ISSN 2409-2665
Journal of Logistics, Informatics and Service Science
Vol. 9 (2022) No.4, pp.91-104
DOI:10.33168/LISS.2022.0407

A Study on the Supply Chain Structure of Air Transport Service Industry

Yong-Jeong Kim [1] , Yun-Jin Kim [2]

[1] Business Research Institute, Sogang University, Seoul, Korea
[2] Graduate School of Business, Sogang University, Seoul, Korea

vision-2020@nate.com (Corresponding Author)

Abstract. This study aimed to specifically identify the service supply chain architecture of the air transport industry, which is difficult to be explained in the form of the traditional manufacturing supply chain. Research methodology used in this study is inter-industry analysis. That is, this study used IO-SDA (input-output structural decomposition analysis) to compute input coefficients and production inducement coefficients to analyze the forward and backward linkage effects of the air transport industry. This research uses data in the world input-output tables for analysis. This study utilizes the National IO Tables released in 2016 by WIOD to conduct the analysis. This study investigated the forward and backward industrial architecture of the air transport industry, and the results indicate that the service and manufacturing industries are involved in both the service supply line and the service delivery line. Such findings confirmed that the nature of the manufacturing-oriented supply chain architecture and that of the service supply chain are different from the perspective of industrial architecture. As a result of the analysis, we can recognize that the service industry and the manufacturing industry are situated as both the forward and backward industries of the air transport service industry in stage 1, 2, and 3.

Keywords: Air Transport, Service Industry, Supply Chain, Inter-industry Analysis

1. Introduction

Across all industries, the share of service industry has surpassed that of the manufacturing industry. Service is no longer supplementary to economic activities, but is focal to both the economy and society (Spohrer & Maglio, 2008; Larson, 2008; Vargo & Lusch, 2008; Maglio & Spohrer, 2008).

Considering that the service industry accounts for more than 70% in developed countries, the share of Korea's service industry is expected to continue to increase in the future. As the share of the service industry in national economies increases, the industrial structures of developed countries such of the U.S, Japan, and EU are shifting to service (Larson, 2008).

The air transport industry is essential for improving the quality of relationships between entities in a supply chain, such as suppliers, manufacturers, distributors, and consumers, and improving the competitiveness of the entire supply chain. Besides, the air transport industry is an industry with high value-added and employment inducement effects, and the establishment of a transport system helps reduce cost and gain competitive advantages in the manufacturing and distribution industries. In particular, the impact of air transport on the economy and industry is strong in an export-oriented economy like South Korea. Accordingly, there is an increasing need to promote the air transport industry, which exerts great ripple effects on the economy and industry.

In the process of Korea's industrialization, the roles of the transport industry have extended from functions of land transportation to various transport types, and its spatial extent is also expanding. In terms of the spatial extent, transport networks are expanding as a consequence of globalization and transportation development. Furthermore, the air transport industry is attaining increased strategic significance because the diverse demand for industrial goods recently has intensified competition. The air transport industry is becoming more important not only in differentiating itself from its competitors, but also in assessing industry and company values and determining the relationships with consumers.

This study aimed to specifically identify the service supply chain architecture of the air transport industry, which is difficult to be explained in the form of the traditional manufacturing supply chain. Namely, this study intended to investigate the architecture of supply chain, the core of the service industry that still remains on a conceptual level. This study targeted the air transport industry, which plays a subsidiary role in strengthening the relationship management of entities in the existing manufacturing-oriented global supply chain. This research methodology used in this study is inter-industry analysis. That is, this study used IO-SDA (input-output structural decomposition analysis) to compute input coefficients and production inducement coefficients to analyze the forward and backward linkage effects of the air transport industry.

2. Literature Review

2.1. Previous Studies

With regards to the definition and architecture of the traditional supply chain, Lambert et al. (1998a) defined that supply chain is “the alignment of firms that bring products or services to market,” and consumer was seen as part of supply chain. Christopher (1992), Giunipero & Brand (1996), Ellram & Cooper (1990) perceived the supply chain as a network of firms with upstream and downstream transactional linkages that produces value for the ultimate consumer. They also argued that competition is no longer between companies, but between supply chains. Mentzer et al. (2001) defined a supply chain as “a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.” Lambert et al., (1998a) and Lambert et al. (1998b) also made contributions to a better understanding of the structure of supply chain. The scope of supply chain refers to a network structure consisting of the different entities of supply chain. The entities of a supply chain include all firms that directly or indirectly interact with each other through its suppliers or customers.

Service supply chain is a network of suppliers, service providers, customers, and other service partners that turns resources services or servitised products to deliver them to customers. Accordingly, suppliers, service providers, customers, and other partners are the key entities in a service supply chain. Service providers play similar role as the focal companies (mainly manufacturers) in a traditional supply chain. During the service delivery process from companies to customers, product supplier is involved in the service supply chain to provide part of the service to be delivered to customers (Lin et al., 2010).

Service management and service supply chain management have captured great attention from both academia and industry due to the rise of the service economy, the process of globalization, and the introduction of the concept of service science by IBM in 2004. However, comparing to manufacturers and suppliers that have successfully implemented supply chain management (SCM), the implementation of supply chain management for the service industry is still at the initial stage (Kwon, 2010). Because the service industry does not have any systematic model like the manufacturing industry due to its various characteristics, lack of studies applied the concepts and theories of supply chain to the service industry.

Armistead & Clark (1993) was the first to apply supply chain to the service industry, in which the concept called value chain was applied to the service industry. Zhang et al. (2009) stated that research on supply chain should shift the focus from manufacturing supply chain that emphasizes transport of tangible goods to the service industry.

The majority of previous studies on service supply chain gave their attention to the role of service in the traditional manufacturing-oriented supply chain and the ways to improve the effectiveness of the service. Ellam et al. (2004), Baltacioglu et al. (2007), Zhang et al. (2009), and Lin et al. (2010) are representative studies on service supply chain architecture. These studies attempted to distinguish service supply chain models from manufacturing. Nevertheless, they all remained at the conceptual level as they adopted the concept of flow and relationship management of the existing manufacturing-oriented supply chain to the service industry. Therefore, there is a limit to identifying the concrete form of service architecture of service supply chain, in which the service industry is focal.

The manufacturing supply chain uncertainty resulted from customer needs can be resolved by stock. However, in the case of service supply chain, quick and active integration is required to ensure effective service flow according to customer needs. Consequently, service operators must perform the role that focal firms in the logistics industry have played in the traditional supply chain (Moon et al., 2012).

Therefore, instead of the conceptual model of service supply chain management that has been presented in prior studies, this study aimed to identify and systematically modelize the forward and backward industrial architecture of service supply chain. For this purpose, this study targets the air transport industry, which plays a role in strengthening the relationship management of entities in the traditional supply chain that emphasizes the manufacturing industry. That is to say, this study investigates service supply chain architecture by prioritizing air transport industry, a subsidiary entity in the traditional supply chain.

2.2. Results of Literature Review

The current supply chain is traditionally a field of OM (operation management), concerning the movement of products and information from a supplier to a consumer. Despite the rising importance of the service industry in the global economy in recent times, the concept of supply chain is mostly applied to the manufacturing industry, seldom to the service industry. Most of the prior studies concentrated on the manufacturing industry, while limited studies took service supply chain into consideration.

Most research on service supply chain focused on the service functions in terms of relationship management between entities within a manufacturing-oriented supply chain. Studies have also been conducted on a particular service industry, by applying the concept of manufacturing supply chain to the service process. Few research suggested the types and models of supply chains correspond with the characteristics of the service industry without considering the traditional manufacturing industry-oriented supply chain. The reason may be that it was difficult to generalize the types of service supply chains due to the diversity of the service industry and the characteristics of services that are different from tangible products. It was also difficult to apply the methodology to scientifically distinguish service supply chain to the traditional supply chain.

The concept of Porter (1985) value chain was modified to supply chain, and has since then been generalized to the manufacturing industry oriented supply chain. Research on service supply chain was not enough compared to the growth of the service industry and its share in the entire economy. Besides, prior studies on service supply chain architecture only provided a conceptual framework of it. Therefore, for the purpose of identifying the supply chain architecture of the service industry, which can be hardly explained by the nature of the traditional supply chain, this study takes the air transport industry as the application case to identify the air transport service supply chain architecture.

This study extents the concept of manufacturing-oriented supply chain to service, and identifies the forward and backward industry architecture of the air transport service supply chain. Thus, it can provide the foundation for more generalized research on service supply chain architecture.

3. Research Design and Methodology

3.1. Research Design and Analysis Model

This study uses inter-industry analysis to identify the industrial architecture of air transport service supply chain, and computes the input coefficients and production inducement coefficients to analyze the forward and backward linkage effects. Inter-industry analysis, which is also called IO-SDA (Input-Output Structural Decomposition Analysis), is useful for examining specific economic and industrial architectures since it can analyze the inter-industry relations that cannot be figured out through macroscopic analysis. It is also a useful analysis for drawing up and adjusting policy directions on industrial architecture, because the ripple effect of final demand on the economy can be analyzed by industrial sector. The focus of the analysis is to compute the input coefficients and Production Inducement Coefficients, and then use the results to derive the Industrial Linkage Effect. Excel, which is useful for processing functions, is used as the tool for analysis.

This study used the industrial linkage effects for identifying the industrial architecture of air transport service supply chain. Using inter-industry analysis in economics to achieve the research objectives enables the analysis of linkages of the air transport service industry to other industries from the industrial structure perspective, and is useful for concretely analyzing the linkage architectures of forward and backward industries. This research is conducted as an extended study of the logistics service supply chain model proposed in the study of Kim & Ha (2022). Data analysis uses the results of input-output analysis of the first stage calculated for the air logistics industry in the study of Park et al. (2020). In order to identify the industrial linkage architecture of the air transport service supply chain, additional analysis is conducted by expanding it to three stages. The overall research framework and analysis procedure are illustrated in Fig. 1.

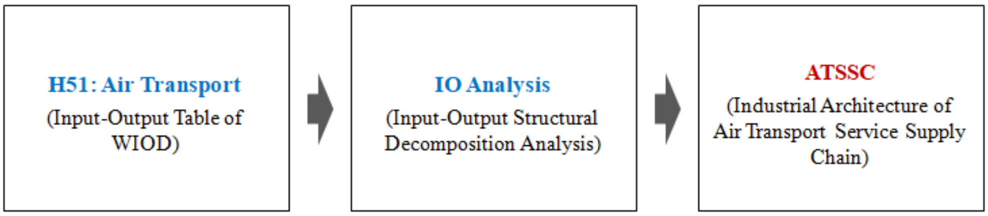


Fig. 1: Research Framework and Analysis Procedure

This study uses production inducement coefficients to evaluate industrial linkage effects, identifies the linkage architectures of forward and backward industries, and combines with air transport service supply chain to derive results. n industries, products are used both as final goods and as intermediate goods for the production in other industries. Intermediate good is noted with z_{ij}, meaning the amount of intermediate goods in sector i supplied to sector j.

Intermediate demand (z_{ij}), final demand (Y_i), import (M_i) and total output (X_i) of sector i are displayed in the input-output table to show the output structure of sector i. The model of output structure is expressed in Formula (1).

$$X_i = \sum_{j=1}^{n} z_{ij} + Y_i - M_i = \sum_{j=1}^{n} a_{ij} X_j + Y_i - M_i \qquad (1)$$

The input coefficient a_{ij} corresponds to the aggregate intermediate good i used by sector j $(a_{ij} = z_{ij}/X_j)$. This ratio indicates the relationship between input and output, meaning the outputs in sector i that are used as intermediate inputs to generate one unit of production in sector j. The total outputs of a particular industry equals to the total required inputs in sector i due to the production of outputs, consumption expenditures, exports, investments, and government expenditures in order to generate one unit of production in entire industries.

One the other hand, the input structure of sector j, which includes intermediate input (z_{ij}), value-added (w_j), and total input (X_j), is shown in a row in the input-output table, as presented in Formula (2).

$$X_j = \sum_{i=1}^{n} z_{ij} + W_j = \sum_{i=1}^{n} r_{ij} X_i + W_j \qquad (2)$$

The output coefficient r_{ij} is obtained by dividing intermediate input (row vector) by total input $(r_{ij} = z_{ij}/X_i)$. It means that the total output of a particular sector equals the sum of the sector's basic input factors/value-added and payments for purchases from other industries and for imports.

3.2. Research Methodology

This study conducts inter-industry analysis that applies industrial linkage effects as the main methodology to achieve the research aim, and focuses on computing forward and backward linkage effects of the airport transport service industry.

All industries are interconnected to each other in two aspects. On the one hand, a sector purchases products from other industries for use as inputs in producing its own output, and on the other hand, it sells its outputs to other industries. The purchases and sales reflect the industry's backward and forward linkage effects, respectively. Again, an industrial sector may directly sell raw materials to or buy raw materials from other sectors. Forward and backward linkage effects can be identified through such direct transactions between sectors, or they can be examined by production inducement coefficients to take indirect relationships into account.

The following is the estimation through direction relationships. Input coefficients can be used to estimate backward linkage effects. Input coefficients represent the proportion of input structure, which indicates the use of intermediate goods and value-added to generate outputs in each sector. Therefore, industries with high input coefficients (demand a large portion of intermediate goods) are termed "intermediate input industry," and have high backward linkage effects. Distribution coefficients can be used to estimate forward linkage effects. Distribution coefficients represent the proportion of distribution structure, which indicates the use of a sector's products as intermediate goods in other sectors and the sales of them as finished goods for consumption, investments, and exports. Therefore, industries with high intermediate distribution coefficient (supply a large portion of intermediate goods) are termed "intermediate demand industry," and have high forward linkage effects.

An industry may not directly link to certain other industries, but is indirectly related to them through a third industry. If a sector has lower intermediate input rate than other sectors but uses mostly domestic intermediate goods in its production process, it is indirectly related to many domestic industries. Thus, it may be a different case than the above-mentioned one that can be identified through only direct relationships. Use production inducement coefficients to calculate forward and backward linkage effects, so-called power of influence and sensitivity of dispersion, is a method to estimate both direct and indirect interrelated relationships among sectors.

3.3. Analytical Data

This study uses data in the world input-output tables for analysis. In general, input-output tables are created for individual countries, or for multiple regions within a country. Input-output tables have been regularized to evaluate the interrelationships among countries since 1980, so-called the world input-output table. World input-output tables published by WIOD (world input-output database) and ICIO (inter-country input output) are the most generally accepted.

The construction of WIOD was funded by the European Commission and was carried out by international organizations including major research institutes and academic organizations in Europe and OECD, for the purpose of analyzing the influence of globalization on international trade, environmental problems, and socio-economic development. The creation of WIOT (world input-output table) was a part of the construction of WIOD. WIOD was first released in 2012, and became more effective when the annual time-series data till 2014 was released in November 2016.

WIOD (Released November 2016) contains input-output tables, International SUTs, National SUTs, and Socio-Economic Accounts. WIOTs are available for the years 2000 till 2014 in current US dollars. The data covers a total of 43 countries, which include 30 EU countries and 13 other major countries like Korea, and all other countries in the word are aggregated as ROW (Rest of the World). Data are classified into 56 sectors and recorded in a 2,464×2,464 matrix.

The air transport industry is examined in this study. This study analyzes data in National IO Tables (Released November 2016) from WIOD. This study analyzes the time-series data of the air transport industry in the input-output tables of the Korea economy for the period 2000-2014, which includes sectors H51. This study used world input-output table instead of regional input-output table to raise public trust, and to allow future research to expand the research scope to inter-country comparison.

4. Results

4.1. Calculation of Production Inducement Coefficients

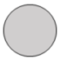
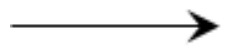
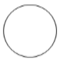
Input coefficients were obtained by dividing the intermediate inputs utilized in airport transport sector's production activities by total inputs. Because input coefficients are calculated by dividing a certain sector's input structure by output, the output in each sector is defined as the normalized component ratio 1. Production inducement coefficients are expressed in a inverse matrix, which can be obtained by subtracting the input coefficients matrix from the unit matrix. Input coefficients are considered the parameter to measure the production inducement effect on each sector when there is a change in final demand of goods or services. If production inducement coefficients are calculated by using input coefficients, the change in final demand can be measured independently to estimate the corresponding change in production. However, since it is hard to measure the successive production ripple effects by using only input coefficients in case there is a large number of sectors, a mathematical method called inverse matrix is used to derive production inducement coefficients. Production inducement coefficients, defined as the cumulated multiplier, indicate the direct and indirect ripple effects on the productions of each industry when the final demand occurs by one unit. The element (i, j) of the production inducement coefficients matrix $(I - A)^{-1}$ that is in the -th row and j-th column means the growth in production of sector i induced directly or indirectly when final demand in sector j increases by one unit. The sum of a column of the production inducement coefficients matrix shows the increase in production in all industries induced by a final demand increase of one unit in sector j (Kim & Sheng, 2022).

4.2. Industrial Linkage Architecture of Air Transport Industry

This study identified stage 1 of the industrial linkage architecture of the air transport industry by figuring out the 10% of its backward and forward industries with the highest production inducement coefficients. Based on the selected backward and forward industries in stage 1, this study then analyzed the stage 2 of the industrial linkage architecture. This study eventually analyzed stage 3 of the industrial linkage architecture on the basis of the selected backward and forward industries in stage 2. The two industries with the highest production inducement coefficients over the study period (2000-2014) as the forward and backward industries of the second and their stages. By this method, this study examined and visualized the industrial linkage architectures of a total of three stages.

The description of the results focused on the industries in stage 1, which directly link with air transport sector. Among the linkage industries in stage 1, one is connected with the air transport sector with a solid line if its production inducement coefficients stayed within top 10% highest throughout the study period (2000-2014). Furthermore, among the forward and backward industries in stage 2 and 3, a * is marked on the right side of the industrial code in case the industry has production inducement effect on two or more industries. The symbols being used in the result diagrams are shown in Table 1.

Table 1: Diagram Legend of Industrial Linkage Architecture

Legend	Description	Legend	Description
	Focal industry		Linkage industry of stage 3
	Linkage industry of stage 1		Line of connection for industries with high production inducement coefficient continuously
	Linkage industry of stage 2	*	Industries with production inducement effects on two or more industries

Stage 1 of the forward and backward industrial architecture of H51 (air transport) was analyzed. The backward industries of H51 (air transport), which provide outputs to be used as intermediate goods in the production of H51 (air transport), include C19 (petroleum products), H52 (warehousing), C30 (transport equipment), and N (administrative and support). The backward industrial architecture of H51 (air transport) is similar to that of H50 (water transport). In particular, in the field of manufacturing, it is closely related to C19 (petroleum products) and C30 (transport equipment), because of the high production inducement effects of aircraft manufacturing and fuel manufacturing industries. The distribution industry H52 (warehousing) also has production inducement effects, meaning that the transportations functions of H51 (air transport) is connected to the warehousing and handling functions as a necessity in order to complete the service process. Thus, air transport services are tightly connected with logistics facilities like air cargo terminal. Besides, N (administrative and support) has high production inducement effects, indicating that H51 (air transport) is tightly related to businesses like transportation equipment rental business, packaging and charging business, and security system.

This study identified the industries with higher forward linkage effects, which use the final output of H51 (air transport) as intermediate goods in their production process. The forward industries of H51 (air transport) that has production inducement effects throughout the study period include wholesale and retail (G45, G46, G47) and H53 (courier activities). The results reveal that air transport service is closely related to the distribution and delivery of goods. Many wholesale and retail businesses are related to distribution and are using air transport services. Especially, air transport plays an important role in international distribution along with the process of globalization. Moreover, it is common to use air transport services to distribute products of the technology-and capital-intensive industries to the overseas market. H51 (air transport) is involved in the Door-to-Door courier activities, as it provides final delivery services for retail trades like the rapidly growing direct overseas purchase in the recent past. Air transport service is the optimal transport mode for quick and accurate international parcel delivery. Table 2 presents the forward and backward industrial architecture of H51 (air transport). It is extended to stage 3 and modelized into a supply chain, as illustrated in Fig. 2.

Table 2: Linkage Industry of Air Transport Service

Section	Linkage Industry of Stage 1	Linkage Industry of Stage 2	Linkage Industry of Stage 3
Backward Industry	C19, H52, C30, N	B, C20, K64, N, C24, C28, I	H49, C19, D35, C20, N, L68, I, C24, C25, C10-C12, A01
Forward Industry	G47, H53, G46, G45	J61, C21, G47, K64	G47, G46, Q, M72, J61, C21, L68, H52

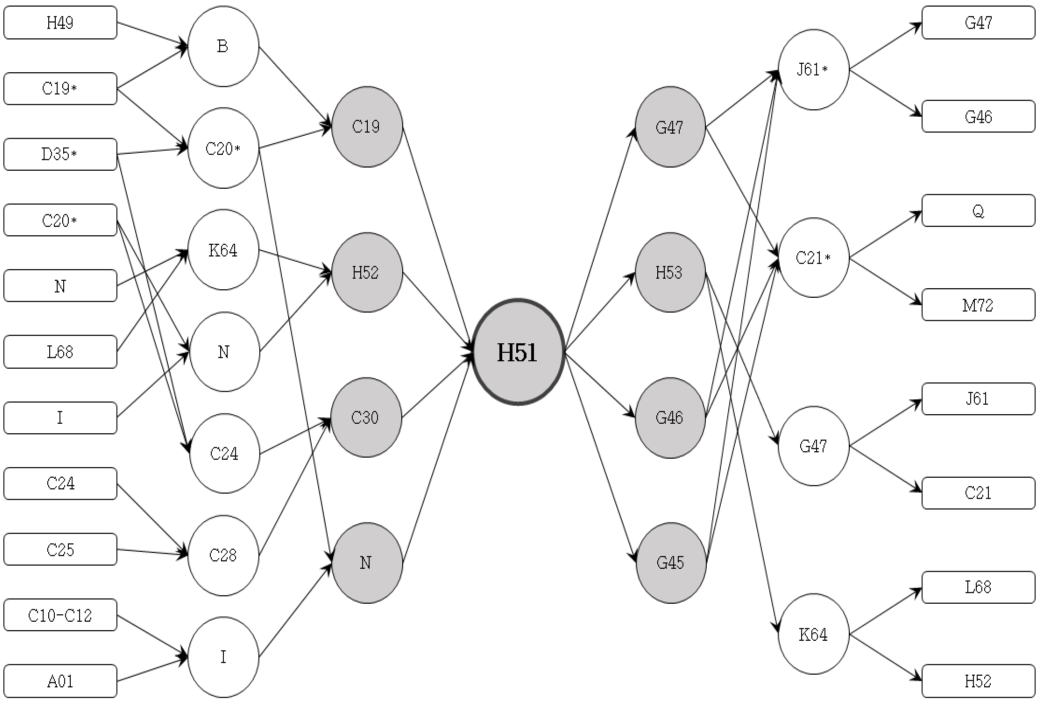


Fig. 2: Industrial Linkage Architecture of Air Transport Industry

4.3. ATSSC (Air Transport Service Supply Chain)

This study investigated the forward and backward industrial architecture of the air transport industry, and the results indicate that the service and manufacturing industries are involved in both the service supply line and the service delivery line. Such findings confirmed that the nature of the manufacturing-oriented supply chain architecture and that of the service supply chain are different from the perspective of industrial architecture. According to Lin et al. (2010), the distinct attribute of service is that the service supply chain is basically a two-level bidirectional supply chain. While the two directions indicate physical product and information in a traditional supply chain, they indicate service delivery and customer participation in a service supply chain. Thus, the bidirectional architecture is reinforced by customer participation.

As a result of the analysis, we can recognize that the service industry and the manufacturing industry are situated as both the forward and backward industries of the air transport service industry in stage 1, 2, and 3. The industrial linkage architecture of the air transport service supply chain is presented in Fig. 3. Finally, Fig. 3 comprehensively presents the basic industrial linkage architecture of air transport service supply chain. The results proved that the nature of the manufacturing-oriented supply chain architecture and that of the service supply chain are different from the perspective of industrial architecture.

5. Conclusion

This study aimed to examine the concrete type of service supply chain, which has been remaining on a conceptual level in previous studies. For this purpose, this study analyzed and modelized the supply chain architecture of air transport service, which could be hardly explained by the traditional manufacturing supply chain architecture. The research on service supply chain attended to prioritize air transport services, which plays a subsidiary part by strengthening the relationships among entities in the traditional manufacturing-oriented supply chain. In terms of research methodology, this study adopted the inter-industry analysis in economics to examine the concrete industrial architecture of air transport service supply chain. Based on the analysis, this study identified the forward and backward industries of the air transport industry, and calculated the production inducement coefficients of the air transport service industry on other industries to check the existence and degree of the forward and backward linkage effects.

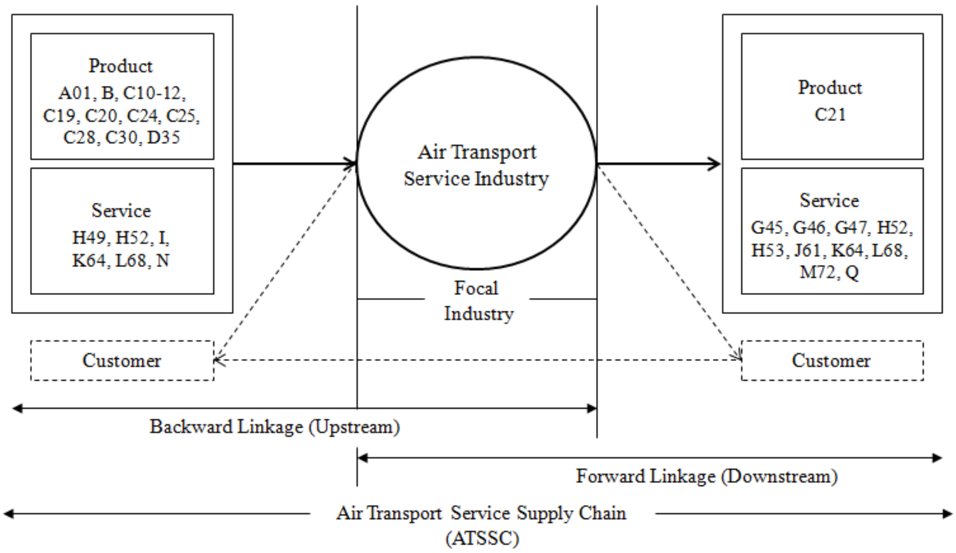


Fig. 3: ATSSC (Air Transport Service Supply Chain)

The results of this study demonstrate that the types of the supply chain entities and the direction of the relationships in the traditional manufacturing-oriented supply chain architecture are different than those in the air transport service supply chain architecture. And a air transport service supply chain (ATSSC) structure could be proposed within the framework based on the results. Considering air transport services as the center of air transport service supply chain, both the service supply line (backward industry; upstream) and service delivery line (forward industry; downstream) are composed of manufacturing an service. Applying the air transport service supply chain architecture proposed in this study to a variety of transport service industries would be useful in identifying the concrete service supply chain architecture of each transport service industry.

Based on the findings of this study, the research contributions and implications were summarized in the academic and practical aspects. The academic contributions of this study are as follows. First, this study expanded the concept of the traditional manufacturing supply chain to a service perspective to modelize the air transport service supply chain architecture. Second, originality is shown in this study as it applies inter-industry analysis as research methodology to the air transport service supply chain architecture. Finally, the multi-disciplinary nature of the study makes it meaningful from the perspective of service science, as the study approaches the research questions with the service dominant logic to apply economic methodology. The practical contributions of this study are as follows. First, as in the manufacturing industry, this study provided the foundation for the service industry to shape supply chain management into the business strategy of service companies from the perspective of business management. Second, in the matter of national economic policy, this study provided the groundwork for understanding the forward and backward industrial architecture of the air transport industry. Specifically, it will be possible to establish efficient and effective industrial policies for the industries which are influenced significantly by the ripple effects of the air transport industry.

References

Armistead, C. G. & Clark, G. (1993). Resource Activity Mapping: the Value Chain in Service Operations Strategy. *The Service Industrial Journal*, 14(4), 221-239.

Baltacioglu, T., Ada, E., Kaplan, M. D., Yurt, O. & Kaplan, Y. C. (2007). A New Framework for Service Supply Chain. *The Service Industries Journal*, 27(2), 105-124.

Christopher, M. L. (1992). *Logistics and Supply Chain Management*. London: Pitman Publishing.

Ellram, L. M. & Cooper, M. C. (1990). Supply Chain Management, Partnerships, and the Shipper-Third-Party Relationship. *The International Journal of Logistics Management*, 1(2), 1-10.

Ellram, L. M., Tate, W. L. & Billington, C. (2004). Understanding and Managing the Service Supply Chain. *Journal of Supply Chain Management*, 40(4), 17-32.

Giunipero, L. C. & Brand, R. R. (1996). Purchasing’s Role in Supply Chain Management. *The International Journal of Logistics Management*, 7(1), 29-37.

Kim, Y. J. & Ha, B. C. (2022). Logistics Service Supply Chain Model. *Journal of Logistics, Informatics and Service Science*, 9(3), 284-300.

Kim, Y. J. & Sheng, Y. P. (2022). Industrial Linkage Structure between Land Transport Industry and Distribution Industry in Korea. *GLOBAL BUSINESS & FINANCE REVIEW*, 27(1), 95-107.

Kwon, O. K. (2010). *Supply Chain Management*. Seoul: Pakyoungsa.

Lambert, D. M., James, R. S. & Lisa, M. E. (1998a). *Fundamentals of Logistics Management*. Boston, MA: Irwin/McGraw-Hill.

Lambert, D. M., Cooper, M. C. & Pagh, J. D. (1998b). Supply Chain Management: Implementation Issues and Research Opportunities. *International Journal of Logistics Management*, 9(2), 1-20.

Larson, R. C. (2008). Service Science: At the Intersection of Management, Social, and Engineering Sciences. *IBM System Journal*, 47(1), 41-51.

Lin, Y., Shi, Y. & Zhou, L. (2010). Service Supply Chain: Nature, Evolution, and Operational Implications. *Proceedings of the 6th CIRP-Sponsored International Conference on Digital Enterprise Technology*, 66, 1189-1204.

Maglio, P. P. & Spohrer, J. (2008). Fundamentals of Service Science. *Journal of the Academy of Marketing Science*, 36(1), 18-20.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D. & Zacharia, Z. D. (2001). Defining Supply Chain Management. *Journal of Business Logistics*, 22(2), 1-25.

Moon, J. H., Lee, Y. H. & Cho, D. W. (2012). Object-oriented Simulation Modeling for Service Supply Chain. *Journal of the Korea Society for Simulation*, 21(1), 55-68.

Park, J. H., Kim, Y. J. & Song, Y. W. (2020). A Study on the Production Inducement Effects of Korean Air Logistics Industry: The Results of a Input-Output Analysis. *Journal of Distribution and Logistics*, 7(3), 55-67.

Porter, M. E. (1985). *Competitive Advantage*. NY: The Free Press.

Spohrer, J. & Maglio, P. P. (2008). The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-creation of Value. *Production and Operations Management*, 17(3), 238-246.

Vargo, S. L. & Lusch, R. F. (2008). Service-dominant Logic: Continuing the Evolution. *The Academy of Marketing Science*, 36(1), 1-10.

Zhang. R., Chen, R. & Zhang, Y. (2009). The Conceptual Model of the Service Supply Chain Research Based on Business Processes. *2009 International Conference on Management and Service Science,* 1-4.