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Service Supply Chain Risk Management: Distinctions from Manufacturing

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Thi Huong Tran and Sebastian Kummer

Service Supply Chain Risk Management: Distinctions from Manufacturing



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In recent decades, service sector has become a main driver of most economies. This sector has unique characteristics entailing many distinctions in operations management and supply chain management compared with manufacturing. However, from academic and practical standpoints, the focus in supply chain management has been strongly leaned toward the goods-dominant logic. So far, the conceptual as well as empirical research on service supply chain risk management (SSCRM) has been scarce. This paper, therefore, attempts to investigate SSCRM with focus on its distinctions from manufacturing through two steps. At the first step, authors review prior research to explore the distinctive features of service supply chain and identify typical supply chain risk management (SCRM) strategies which are effectively applied to manufacturing industry. As a second step, we conduct a case study research of four service providers in telecom and logistics industry in Austria in order to investigate influences of these different features on SSCRM. Findings present distinctive risks arising in service supply chain, features of SSCRM, and efficiency extent of implementing manufacturing SCRM strategies to SSCRM.

Keywords: Risk Management, Service Supply Chain, Manufacturing Supply Chain, Distinctive Attributes

1 Introduction

In line with the increase of global dangers, SCRM plays an increasingly important role in contemporary enterprises and becomes an essential part of a holistic supply chain design (Christopher and Lee, 2004; Ghadge, Dani and Kalawsky, 2012). As a result, SCRM has been a salient topic in recent supply chain management research (Wieland, 2013) with a significant growth in number of published scientific papers and books.

In discipline of operations management, distinction of services from manufacturing/goods began to be considered the first time in the book "The wealth of nations" of Adam Smith in 1776 and has been intensively researched since 1970s (Nie and Kellogg, 1999; Moeller, 2010; Parry, Newnes and Huang, 2011). Services has unique characteristics including high level of customer's involvement and influence, simultaneity of production and consumption, intangibility, non-storability, perishability, and labor intensity (Nie and Kellogg, 1999). These distinctions result in differences in operations management as well as supply chain risk management between manufacturing and service supply chain. For instance, while finished goods inventory can be seen as a buffer against demand fluctuation in manufacturing supply chain (Anderson and Morrice, 2000), it is impossible to put services in storage.

However, from academic and practical standpoints, the emphasis in supply chain management, including SCRM, has been strongly leaned toward the manufacturing sector (Boonitt and Chanida, 2011; Ellram, Tate and Billington, 2004). So far, research about the special features of SSCRM has been scarce (Vilko and Ritala, 2014).

Therefore, this paper attempts to investigate unique characteristics of services and service supply chain, then identify their influence to SSCRM and point out lessons which service providers can learn from manufacturers in term of SCRM.

To this end, the following research questions are proposed:

1. What are unique characteristics of services and service supply chain?
2. How do these characteristics lead to distinctive risks which affect service supply chain in comparison with manufacturing?
3. What are the similarities and differences between service and manufacturing supply chain in term of risk and risk management?
4. In what extend lessons/original risk management strategies in traditional/manufacturing supply chain can be directly extrapolated to service supply chain?

These questions are answered through two steps. Firstly, authors conduct a literature review to explore the distinctive features of service supply chain and identify typical SCRM strategies which are effectively applied to manufacturing industry. Secondly, we conduct a case study research of four service companies in Austria in order to investigate influences of these different features on SSCRM

The rest of this paper is organized as follows. Section 2 presents literature review on service, service supply chain, and SSCRM. Section 3 describes case study research methodology. Findings from empirical research are presented in section 4. Finally, we provides discussion, conclusion, and an outlook on future work in section 5.

2 Literature Review

2.1 Service Supply Chain

Service supply chain is defined as a network of interactive service processes (Sampson and Spring, 2012a). Baltacioglu et al., (2007, p.112) clarified more detail that “service supply chain is a network of suppliers, service providers, consumers and other supporting units that performs the functions of transaction of resources required to produce services; transformation of these resources into supporting and core services; and the delivery of these services to customers”.

In a service supply chain, there are six major processes, namely plan, source, develop, adapt, operate, and recover (Giannakis, 2011). Based on “product” of supply chain, Wang, Wallace, Shen and Choi (2015) categorized service supply chain into Service Only Supply Chains (SOSCs) and Product Service Supply Chains (PSSCs). They defined that in SOSCs, the “products” are pure services and physical products do not play a role. Whereas, PSSCs manage physical products together with significant service considerations.

In recent years, researchers have conducted studies to gain insight into: understanding, concepts, and characteristics of service supply chain (Ellram, Tate and Billington, 2004; Voudouris, Owusu, Dorne and Lesaint, 2008; Voudouris, 2008); amplification in service supply chain (Akkermans and Vos, 2003); differences between service and manufacturing supply chain performance (Sengupta, Heiser and Cook, 2006); customer roles (Sampson and Spring, 2012a); process and operational models (Maull, Smart and Liang, 2014; Wang et al., 2015); contract and risk sharing in service supply chain

(Selviaridis and Norrman, 2014). However, according to Breidbach, Reefke and Lincoln (2015), service supply chain formation and governance, which provide a strategic advantage to service providers, still remain an unfamiliar challenge to many practitioners.

2.2 Distinctions between Service and Manufacturing Supply Chain

2.2.1 Distinctive Characteristics of Services

Two hundred years ago, services started to be distinguished from goods by Adam Smith. It is a product which perishes in the very instant of its performance, a result of unproductive labor (Smith, 1776) or an "immaterial" product (Say, 1836).

Through reviewing of research papers from 1963 to 1983, Zeithaml, Parasuraman and Berry (1985) found that the most frequently cited characteristics of services are IHIP, including Intangibility, Heterogeneity (or non-standardization), Inseparability (of production and consumption), and Perishability (or exclusion from the inventory). This IHIP framework has become a sound foundation in most of the marketing research (Parry, Newnes and Huang, 2011) and other fields such as service marketing, service quality, service management, service factory, and service value chain. Lovelock and Gummesson (2004) argued against the IHIP characteristics and tentatively proposed a "rental/access paradigm" instead. However, this paradigm has not been widely accepted (Edvardsson, Gustafsson and Roos, 2005).

According to Edvardsson, Gustafsson and Roos (2005), the IHIP characteristics have most often been discussed through the view of the service provider, instead of the view of the customers. The Unified Service Theory (UST) of Sampson and Froehle (2006), refined prior service perspectives and proposed five characteristics of service, including intangibility, heterogeneity, inseparability, perishability, and customer participation.

In the SCRM context, we adapted UST framework which views service characteristics under both lens of service providers and customers. Furthermore, labor intensity is also one common distinctive feature of service supply chain (Nie and Kellogg, 1999; Akkermans and Vos, 2003).

In brief, this paper proposes a research plan according to six salient distinctive characteristics: Intangibility, Heterogeneity, Inseparability, Perishability, Customer participation, and Labor intensity.

2.2.2 Differences in Supply Chain Structure

The differences in structure of a service supply chain derive from the unique characteristics of services, which distinguish them from goods (Baltacioglu et al., 2007).

Mauil, Smart and Liang (2014) asserted that most traditional manufacturing supply chains are represented linearly, like “one-way traffic”, with products flowing from “upstream” entities to “downstream” entities. However, service supply chains are different with a bidirectional traffic, in which products/services flows go both directions (Sampson, 2000, 2012). For instance, as described in figure 1, service providers receive inputs from service

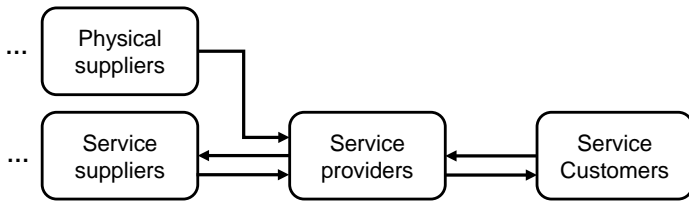


Figure 1 Service supply chain structure

customers then continue to provide inputs to their downstream service suppliers who in turn provide outputs to the initial service providers and subsequently back to customers (Maul, Smart and Liang, 2014).

The figure 1 shows that there are both physical goods suppliers and service suppliers in service supply chain. This feature leads to mixture and complexity of service supply chain structure. This issues will be discussed in the next sections.

2.2.3 Role of Customer in Supply Chain

One of the most distinctive features of service supply chains is the breadth of customer involvement (Nie and Kellogg, 1999). In the bidirectional service supply chain, customers play many roles including co-suppliers and co-producers through providing process components and labors, helping design and deliver services, and monitoring quality service (Sampson and Spring, 2012b; Selviaridis and Norrman, 2014).

2.2.4 Focus of Supply Chain Management

Beside some similarities in general demand management, customer relationship management, and supplier relationship management which are critical factors in both manufacturing and service supply chain, there does exist different aspects required to examination of service supply chain (Sengupta, Heiser and Cook, 2006). For instance, 'delivery' is central to service, whereas 'make' is central to manufacturing (Maull, Smart and Liang, 2014). Furthermore, in service supply chains, human labor is the most significant component of the value delivery process while physical handling of a product plays the most centralized role in manufacturing supply chains (Sengupta, Heiser and Cook, 2006; Breidbach, Reefke and Lincoln, 2015).

2.3 Service and Manufacturing Supply Chain Risk Management

2.3.1 Supply Chain Risk Management

SCRM is the implementing strategies to manage both daily and exceptional risks along the supply chain based on continuous risk assessment in order to reduce vulnerability and ensure business continuity (Wieland and Marcus Wallenburg, 2012). A variety of SCRM frameworks have been developed in both of proactive as well as reactive approach and focused on upstream or downstream. So far, SCRM methodologies have been diversified from conceptual framework, modelling, and simulation to empirical research through case study, survey or expert interview.

Supply chain risk is like an iceberg. Many attempts in defining supply chain risk are often too broad or too narrow. Therefore, risk identification is the

first and the most important task in SCRM process. In risk identification stage, characteristics of supply chain must be deeply investigated and considered from different aspects to obtain insights into uncertainties, vulnerabilities, risk sources, and risk drivers. The following steps, risk evaluation and risk mitigation, also depend on features of supply chain and the focal company.

2.3.2 Supply Chain Risk Management Strategies

Through a review of 140 quality papers in SCRM literature, Ghadge, Dani and Kalawsky (2012) presented a list of supply chain risk management strategies classified into two approaches as proactive and reactive (cf. table 1).

Table 1 SCRM strategies (Ghadge, Dani and Kalawsky, 2012)

Proactive SCRM strategy	Reactive SCRM strategy
<p>Supplier management: risk sharing by contract manufacturing, contractual governance, dual/multi-sourcing.</p> <p>VMI/buffer stock.</p> <p>Product/process management: product diversification, postponement, product design and delivery management.</p> <p>Supplier collaboration through improved confidence, cultural adaptation, information sharing.</p>	<p>Contingency planning: strategic event management plan, enhanced flexibility in options.</p> <p>Disaster management: robust recovery, rebuilding of supply chain, resource utilization/management, scenario analysis for future disruptions.</p> <p>Demand management: operational rerouting, shifting customer demand, dynamic pricing.</p>

These strategies have been effective for typical/manufacturing supply chain risk management. In this research, through semi-structure interview with service supply chain managers, we will exam adoption of the identified strategies in SSCRM.

2.3.3 Supply Chain Risk Management in Service Sector in Comparison with Manufacturing

Researchers asserted that service supply chains should be managed differently from manufacturing due to their distinctive characteristics (Akkermans and Vos, 2003; Sampson, 2012; Sampson and Spring, 2012b; Sengupta et al., 2006; Kathawala and Abdou, 2003; Baltacioglu et al., 2007). SSCRM is no exception. However, the understanding of risk management in service supply chains is still in its infancy (Vilko and Ritala, 2014). So far, there has been quite few of research about service supply chain risk management. Research of Vilko and Ritala (2014) mostly is one of the first studies in generating a framework in service supply chain risk management. Their research described distinctive IHIP attributes of service, demonstrated the contrasting traditional supply chain and service supply chain (table 2), and proposed a conceptual framework of service supply chain in terms of risk management at different levels (process, offering, and system).

However, supply chain risk management in service sector in compared with manufacturing still lacks of empirical studies (Vilko and Ritala, 2014). Therefore, this paper conducts to do a step further in order to capture instances of the practitioners' views on service supply chain risk management through an empirical case study research.

Table 2 Contrast between traditional supply chain and service supply-chains (Vilko and Ritala, 2014)

	Traditional supply chain	Service supply chain
Risk management emphasis	Tangible, potentially separable supply chains; emphasis on pre-risk-event activities	Intangible, high inter-dependent, multi-actor supply chains; emphasis on real-time and activities
Key risk management inputs	Information; systematic process understanding	Knowledge; systemic process understanding
Key risk management activities	Hierarchical, statistical approach to risk identification, analysis and control	Intuitive and proactive approach to risk identification, analysis and control

3 Empirical Research Methodology

3.1 Case Study Research

Case study research is widely used in organizational studies and across the social sciences (Kohlbacher, 2006). This method enables researchers to answer “how” and “why” questions, while taking into account how a phenomenon is influenced by the context within which it is situated. Stuart et al. (2002) suggested that case study is an appropriate research methodology to map the field of supply chain management. According to Halldórsson and Arlbjörn (2005), the actual use of the case study methodology may facilitate current research on supply chain management, in particular for building theories, providing detailed explanations of best practices, and making more understanding of collected data. In supply chain management literature, conceptual framework and empirical research along with the case study approach are commonly used (Ghadge et al., 2013).

Multiple case studies provide a more rigorous and complete approach than single case study research because of the triangulation of evidence (Bonoma, 1985). Therefore, our selection of four cases falls within the mentioned recommendations.

3.2 Case Selection

Authors selected one telecom company (named as company A) and three logistics service providers (named as company B, C, and D) to implement this empirical research. These four service providers in Austria range from medium to large size; cover both B2B and B2C services; and include SOSC (telecom) and PSSC (logistics service providers). All four service companies

are doing business in global environment and seriously pay attention to supply chain risk management.

The logistics service provider was proved as an appropriate empirical example to study research in SSCRM (Selviaridis and Norrman, 2014). Telecom industry also is a proper sample in research of Akkermans and Vos (2003) about amplification in service supply chain.

3.3 Data Collection

The data were collected through semi-structured interviews and published documents.

Interviewees are senior managers of supply chain and risk management departments of four service companies. Questionnaires were sent to the respondents in advance. We conducted personal interviews with notes taken in February and March, 2015. Each interview lasted about 45 to 90 minutes. Complementary documents includes company website, company profile, risk management report, and annual reports. These materials are used to cross-check for triangulation purpose together with cross case analysis.

The content of questionnaire is as follows:

Question 1:

Do the distinctive features of services (intangibility, heterogeneity, inseparability, perishability, labor intensity, and customer participation) result in distinctive risks of service supply chain in compared with manufacturing?
How does your supply chain deal with these risks?

Question 2:

In what extent the SCRM strategies in table 1 in traditional supply chain have efficiency to service supply chain risk management?

Question 3:

What are the most significant risks in your service supply chain from the following points of view: process, resources, and environment?

Question 4:

How differently does your company manage the relationships with your physical goods and service suppliers?

Question 5:

Is there any problem arising in SCRM (Risk identification, assessment and mitigation) of your service supply chain?

3.4 Data Analysis

Data analysis is the process of categorizing, tabulating, testing, recombining both quantitative and qualitative evidence to address the initial propositions from literature review (Yin, 2003). In this phase, evidences including transcripts from expert interviews and complementary documents, were analyzed, synthesized, and combined to answer research questions.

4 Case Study Analysis

4.1 Research Context

This research investigated four service providers in two service supply chains (telecom and logistics) which are described as follows:

4.1.1 Supply Chain of Telecom Service Provider (Company A)

Company A is a large size corporation in telecom industry. As a leading telecom provider, this company serves almost 20 million customers in seven countries across Central and Eastern Europe and earned about €4 billion in 2014. Figure 2 represents services and service supply chain of this company.

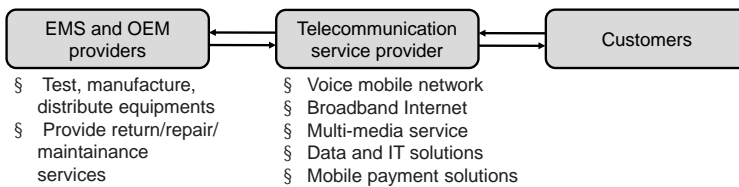


Figure 2 Telecom service supply chain

4.1.2 Supply Chain of Logistics Service Providers - LSPs (Company B, C, and D)

Company B is a large size logistics company with turnover more than one billion euros in 2014. This company employs over 5000 staffs, and operates over 3000 trucks on road per day in about 30 countries in Europe and Asia.

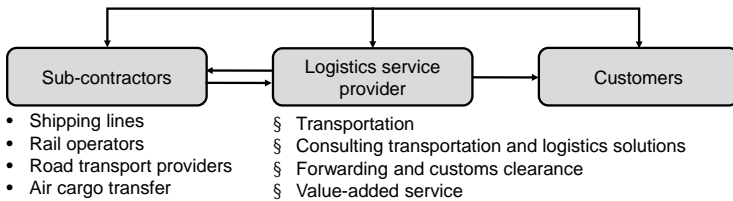


Figure 3 Logistics service supply chain

Company C is a medium size logistics company, with turnover approximately €500 million euros in 2014, having more than 2000 staffs, and doing business in about 90 locations in 20 countries. Company D is a subsidiary company in Austria of a worldwide logistics group. Last year, this company earned more than 1.5 billion euros in revenue figure which created by over 5000 employees. Figure 3 illustrates supply chain of these companies.

4.2 Characteristics of Services- Source of Distinctive Risks Exposed to Service Supply Chain

Figure 4 presents cross-case analysis findings on distinctive risks of service supply chain, which stem from the six identified characteristics. The next sub-sections will detail these findings.

4.2.1 Intangibility

As described in figure 4, this attribute results in five typical distinctive risks appearing in service supply chain as follows:

Unique characteristics of service	Distinctive risks in Service supply chain		
	Service suppliers	Service providers	Service customers
Intangibility	§ Traceability risk	§ Design risk § Quality risk § Traceability risk	§ Vague demand § Subjective quality assessment
Heterogeneity	§ Punctuality risk	§ Punctuality risk § Reliability risk § Reputation risk	<i>No findings</i>
Inseparability	§ Just-in- time risk	§ Just-in- time risk	§ High customization risk
Perishability	<i>No findings</i>	§ Capacity risk § Real-time risk § Loss of defect	<i>No findings</i>
Labor intensity	<i>No findings</i>	§ Standardizing risk § Knowledge, skill and cultural risk	<i>No findings</i>
Customer participation	<i>No findings</i>	§ Traceability risks § Information sharing risk	§Co-producer & co-supplier complexity §High customization

Figure 4 Distinctive risks exposed to service supply chain

Vague demand and design risk: Intangibility refers to the ambiguous specifications of stakeholders in general and customers in particular. This feature hinders service providers from perceiving clearly and exactly their customers' expectation. This issue results in risks in design stage and entails ineffective service control.

Quality control risk: In addition, service managers also cannot directly observe and control quality of process. For instance, whereas manufacturing managers can supervise their production line, the managers of LSPs said that it is really hard to follow truck drivers and see how they behave with customers, and how they handle goods. Company C asserted that the most

vulnerable problems happen “on the road”. The quality control risk in service supply chain is typically much more significant in compared with manufacturing industry.

Traceability risk: Service supply chains relate to the sourcing and delivery of intangibles. This fact results in traceability risks happening in both supply side and focal service company. As LSPs' key informants described about their logistics consulting service that in order to give advices and solutions to business partners, the consultants have gained knowledge, skill and information from various sources, both of tangibles and intangibles. That leads to the difficulty to identify suppliers of intangibles' failures.

Risk arising from subjective service quality assessment: Due to the vague nature of services, this risk arises in qualifying of service quality and performance because of the bias and subjective attitude of customers. For example, in manufacturing sector, products can be physical evidence to proof quality and performance, but in service sector, managers “apply standards, try to provide the best service in the best manner and by the best people, however the final judgement belongs to customer experience” (interviewee of company B).

4.2.2 Heterogeneity

Services is not consistent like physical products. It tends to be heterogeneous because customers and service suppliers present heterogeneous inputs. According to key informant of company A, “Rules can apply to machine but it is difficult to totally apply to people”.

In fact, it is very difficult to standardize entire of service process and implement a mass service production. As a result, punctuality rate of service fluctuates continuously at the stages of pre-hold, loading, unloading, and delivery (as company C's informant said). In addition, company D also asserted that punctuality is a significant worry when they make use of service sub-contractors. Consequently, punctuality risk entails reliability risk when customers cannot receive services as their expectations, previous experience, or as other customers' receiving. More importantly, service providers can lose their loyal customers and even their reputation due to consistence break.

4.2.3 Inseparability

Due to simultaneity in production and consumption feature, service supply chains have to face with two significant risks: Just-in-time and high customization risks.

Logistics companies cannot transport goods until order from customer arrives; telecom firm also will not consult or install service to consumers who do not have demand. Therefore, in service, just-in-time (JIT) delivery is a requirement, not a choice. Consequently, a service provider may take the double JIT risk when they need participation of other service suppliers to fulfil customer's demand.

Furthermore, when consumption and service process take place in the same time, customers have more opportunity to customize their requirements. On the one hand, high customization can lead to higher satisfaction of customer. However, on the other hand, this customization is not easy to

“modify routing schedules which are optimized in advance” (company C) as in logistics company.

4.2.4 Perishability

Perishability feature entails risks of real time management, loss of defect, and capacity management in service supply chain.

In services, any unutilized time or services cannot be stored or reused to later customers. Therefore, perishability characteristic creates real-time management risk and enormous loss when failures happen since “loss of time is loss of revenue, even loss of customer” company B’s respondent emphasized.

In addition, this characteristics cause capacity risks at seasonal peak. Service providers must face to trade off problem between redundant cost for back-up capacity and satisfaction customer demand. Like a respondent said, they have to back-up staffs, trucks, containers, and sub-contractors to fulfil orders at Christmas time in Europe and Lunar New Year in Asia market. The similar phenomenon is also seen in telecom company at the time of Christmas and new school years.

4.2.5 Labor Intensity

In service sector, human factor is the most significant component. The direct workers as truck drivers, telecom installer, telecom service consultant, and customer service staff are the most important representative of service companies. Their skills, knowledge, attitude, and behaviors are the key to assess service performance. Only a small mistake happens, the reputation of service providers can be damaged. Therefore, all informants asserted

that risk in knowledge, skills, and cultural of labor is the most challenge with them.

Besides that, the implementation of standards to service operations also contains risks. It is necessary to cite again the saying of company A, "Rules can apply to machine but it is difficult to totally apply to people".

4.2.6 Customer Participation

Customers may have many roles in the bidirectional service supply chain. For instance, LSPs' customers can provide products and order logistics companies to pack, transport to their customers. In this case, customers are also suppliers. In another example, as companies B and D explained about their logistics consulting service, customers describe their problems and requirements, then discuss as well as brainstorm with consultants to find out the best solution. In brief, customers can be co-supplier, co-producer in service supply chain.

Multiple roles of customers lead to risks in traceability when problem raises from customer side. This feature, furthermore, results in the complexity in information sharing and operations management with co-producers and co-suppliers, and high specifications' customization.

4.3 The Most Vulnerability in Service Supply Chain

4.3.1 Process Point of View

As defined in figure 4, most distinctive risks arising from service providers due to nature of services. Specifically, LSPs stated that, "on the road"- operation stage is the most significant risk in process point of view. Similarly,

the customer-contact moment in telecom service supply chain is the most vulnerable process.

4.3.2 Resource Point of View

People are the most vulnerable resource in service supply chain. Because production lines can operate automatically and produce massively. However, labor in service system varies in skills, knowledge, behavior, attitude, and even cost (LSPs' key informants).

4.4 Supplier Risk Management in Service Supply Chain

In service supply chain, a service provider may include physical goods suppliers and other service suppliers. Supplier risk management strategies in traditional supply chain have been explored and widely applied. There is a question arising that is there any differences in supplier risk management strategies between service suppliers and physical goods suppliers?

4.4.1 Physical Goods Suppliers

To manage physical goods providers, a service company can apply supplier risk management strategies as in manufacturing supply chain such as incoming inspection, dual/multi sourcing, VMI, buffer stock, collaboration, and risk sharing contracts. As company A responded, the original equipment manufacturers supply one of the most important physical inputs to provide telecom service. In order to manage these suppliers, company A applied strategies such as incoming inspection and collaboration in storage, inventory, and capacity adjustments.

4.4.2 Service Suppliers

Service suppliers need to be managed differently because they have unique characteristics and distinctive risks to the focal service providers. As companies B, C, and D described the management to their freight forwarding sub-contractors that they have to share the same understanding of quality, work with uniform systems, and live in a similar corporate culture. In this way they can ensure that the customers are provided with homogeneous services.

4.5 Efficiency of Traditional Supply Chain Risk Management Strategies in Service Sector

Both of traditional manufacturing and service supply chains operate in the same business environment and base on the general supply chain principles. Therefore, service and manufacturing supply chains have to face quite a few similar risks from external environment and deal with problems from suppliers, outsource partners, competitors, and customers. However, there are also many different risks as mentioned in the above sections. This section investigates whether typical risk management strategies in traditional supply chains (table 1) can be directly extrapolated to service supply chains.

Resulting from the need of uniform services, strategies such as collaboration and information sharing show high effectiveness in service supply chain. All experts asserted that, when internal members are too familiar with business activities and environment, it is the difficulties to identify potential risks. As a result, collaboration and sharing information with supply

chain partners can help service providers detect supply chain risks more comprehensively.

Product/service diversification strategy is also highly appreciated by all experts, especially in telecom company with various value added-services. In fact, customers can join service production process and order their requirements. Therefore, service supply chain should proactively give customers opportunities in customizing service although this action can bring risks to service providers.

Dual/multi sourcing in physical goods or service suppliers are taken advance in service supply chain. For example, logistics company B assesses and selects their trust sub-contractors to face capacity shortages in seasonal peaks.

In contrast, risk sharing contract is mostly not applied in service supply chain except for the long-term contract which helps service providers to hedge out the risk of price changes. To control the severity of risk, stocking an excess buffer and safety stocks are also a common measures in manufacturing. However, these strategies mostly do not work in service supply chain except for tangibles resources.

5 Discussion and Conclusion

In this paper, we investigated distinctions of service, service supply chain, and service supply chain risk management. Through reviewing SCRM and service field literature, authors proposed six unique characteristics which distinguish service and manufacturing supply chain, including intangibility, heterogeneity, inseparability, perishability, labor intensity, and customer

participation. We furthermore investigated influences of these features in service supply chain in term of risks, supply risk management and SCRM strategies. Findings also showed some typical SCRM strategies in traditional supply chain can be extrapolated to service supply chain.

When it comes to managerial insight, the responses from expert interviews suggested that establishing a quality cultural throughout supply chain is a sustainable risk management strategy in order to supply a uniform service to customers. The higher intangible level requires the more efforts in collaboration with supply chain partners. The more customer involvement, the more information sharing needed.

In this study, authors attempted to ensure a reliable and valid research design through coherent literature review and multi-case together with multi-evidence investigation. However, there are several limitations. Firstly, four selected cases in telecom and logistics industry did not cover a various range of service sector although these cases can have all six unique characteristics of a service supply chain. Secondly, supply chain partners of service providers were not interviewed in this empirical study. Finally, measuring efficiency of traditional SCRM strategies in service supply chain was conducted qualitatively with a small sample size containing four cases.

To overcome these shortcomings, in future research, researchers can conduct empirical investigations in other service sectors, or quantitative examinations of the analyzed distinctions, as well as establishment specific SCRM framework in service supply chain.

References

- Akkermans, H. and Vos, B., 2003. Amplification in Service Supply Chains: an Exploratory Case Study from the Telecom Industry. *Production and Operations Management*, 12(2), pp.204–223.
- Anderson, E.G. and Morrice, D.J., 2000. A simulation game for teaching service-oriented supply chain management: Does information sharing help managers with service capacity decisions? *Production and Operations*, 9(1), pp.40–55.
- Baltacioglu, T., Ada, E., Kaplan, M.D., Yurt And, O. and Cem Kaplan, Y., 2007. A New Framework for Service Supply Chains. *The Service Industries Journal*, 27(2), pp.105–124.
- Bonoma, T. V., 1985. Case research in marketing: opportunities, problems, and a process. *Journal of marketing research*, 22(2), pp.199–208.
- Boonitt, S. and Chanida, P., 2011. Measuring service supply chain management processes: The application of the Q-sort technique. *International Journal of Innovation, Management and Technology*, 2(3), pp.217–221.
- Breidbach, C.F., Reefke, H. and Lincoln, C. W., 2015. Investigating the formation of service supply chains. *The Service Industries Journal*, 35(1-2), pp.5–23.
- Christopher, M. and Lee, H., 2004. Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, 34(5), pp.388–396.
- Edvardsson, B., Gustafsson, A. and Roos, I., 2005. Service portraits in service research: a critical review. *International Journal of Service Industry Management*, 16(1), pp.107–121.
- Ellram, L.M., Tate, W.L. and Billington, C., 2004. Understanding and Managing the Services Supply chain. *The Journal of Supply Chain Management*, 40(3), pp.17–32.
- Ghadge, A., Dani, S., Chester, M. and Kalawsky, R., 2013. A systems approach for modelling supply chain risks. *Supply Chain Management: An International Journal*, 18(3), pp.523–538.
- Ghadge, A., Dani, S. and Kalawsky, R., 2012. Supply chain risk management: present and future scope. *International Journal of Logistics Management*, 23(3), pp.313–339.
- Giannakis, M., 2011. Conceptualizing and managing service supply chains. *The Service Industries Journal*, 31(11), pp.1809–1823.

- Halldórsson, Á. and Arlbjørn, J.S., 2005. Research Methodologies in Supply Chain Management—What Do We Know? In: H. Kotzab, S. Seuring, M. Müller and G. Reiner, eds. 2005. Research methodologies in supply chain management. Physica-Verlag HD, pp.107–122.
- Kohlbacher, F., 2006. The Use of Qualitative Content Analysis in Case Study Research. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 7(1).
- Lovelock, C. and Gummesson, E., 2004. Whither Services Marketing? In Search of a New Paradigm and Fresh Perspectives. *Journal of Service Research*, 7(1), pp.20–41.
- Mauil, R., Smart, A. and Liang, L., 2014. A process model of product service supply chains. *Production Planning & Control*, 25(13-14), pp.1091–1106.
- Moeller, S., 2010. Characteristics of services – a new approach uncovers their value. *Journal of Services Marketing*, 24(5), pp.359–368.
- Nie, W. and Kellogg, D.L., 1999. How Professors of Operations Management View Service Operations? *Production and Operations Management*, 8(3), pp.339–355.
- Parry, G., Newnes, L. and Huang, X., 2011. Goods, products and Services. In: M. Macintyre, G. Parry and J. Angelis, eds. 2011. *Service Design and Delivery*. [online] Springer US, pp.19–39. Available at: <<http://www.springer.com/computer/swe/book/978-1-4419-8320-6>>.
- Sampson, S.E., 2000. Customer-supplier duality and bidirectional supply chains in service organizations. *International Journal of Service Industry Management*, 11(4), pp.348–364.
- Sampson, S.E., 2012. Visualizing Service Operations. *Journal of Service Research*.
- Sampson, S.E. and Froehle, C.M., 2006. Foundations and Implications of a Proposed Unified Services Theory. *Production and Operations Management*, 15(2), pp.329–343.
- Sampson, S.E. and Spring, M., 2012a. Customer Roles in Service Supply Chains and Opportunities for Innovation. *Journal of Supply Chain Management*, 48(4), pp.30–50.
- Sampson, S.E. and Spring, M., 2012b. Special Topic Forum on Service Supply Chains. *Journal of Supply Chain Management*, 48(4), pp.3–7.

- Say, J.B., 1836. A treatise on political economy: or the production, distribution, and consumption of wealth. [online] Grigg & Elliot. Available at: <https://books.google.com/books?hl=vi&lr=&id=qnsPAAAAAYAAJ&oi=fnd&pg=PR1&dq=A+Treatise+on+Political+Economy+1836&ots=qldj3Hw8jl&sig=lz_1aeHIMEa_9JW3RYQ0uNHBCjA> [Accessed 16 Jun. 2015].
- Selviaridis, K. and Norrman, A., 2014. Performance-based contracting in service supply chains: a service provider risk perspective. *Supply Chain Management: An International Journal*, 19(2), pp.153–172.
- Sengupta, K., Heiser, D.R. and Cook, L.S., 2006. Manufacturing and Service Supply Chain Performance: A Comparative Analysis. *The Journal of Supply Chain Management*, 42(4), pp.4–15.
- Smith, A., 1776. The wealth of nations. [online] Penguin Books, London. Available at: <<http://ir.nmu.org.ua/handle/123456789/121392>> [Accessed 16 Jun. 2015].
- Stuart, I., McCutcheon, D., Handfield, R., McLachlin, R. and Samson, D., 2002. Effective case research in operations management: a process perspective. *Journal of Operations Management*, 20(5), pp.419–433.
- Wilko, J. and Ritala, P., 2014. Service supply chain risk management. *Operations and supply chain management*, 7(3), pp.114–120.
- Voudouris, C., 2008. Defining and Understanding Service Chain Management. In: C. Voudouris, D. Lesaint and G. Owusu, eds. 2008. *Service Chain Management*. Springer Berlin Heidelberg, pp.1–17.
- Voudouris, C., Owusu, G., Dorne, R. and Lesaint, D., 2008. *Service chain management: technology innovation for the service business*. Springer Berlin Heidelberg.
- Wang, Y., Wallace, S.W., Shen, B. and Choi, T.-M., 2015. Service supply chain management: A review of operational models. *European Journal of Operational Research*, [online] (In Press). Available at: <<http://linkinghub.elsevier.com/retrieve/pii/S0377221715004646>>.
- Wieland, A., 2013. Selecting the right supply chain based on risks. *Journal of Manufacturing Technology Management*, 24(5), pp.652–668.
- Wieland, A. and Marcus Wallenburg, C., 2012. Dealing with supply chain risks: Linking risk management practices and strategies to performance. *International Journal of Physical Distribution & Logistics Management*, 42(10), pp.887–905.
- Yin, R.K., 2003. *Case Study Research: Design and Methods*. Sage Publications.

Zeithaml, V.A., Parasuraman, A. and Berry, L.L., 1985. Problems and strategies in services marketing. *The Journal of Marketing*, [online] 49, pp.33–46. Available at: <<http://www.jstor.org/stable/1251563>> [Accessed 24 Jun. 2015].