Measuring Service Supply Chain Management Processes: The Application of the Q-Sort Technique

Sakun Boon-itt and Chanida Pongpanarat

Abstract—**The emphasis in supply chain and operations management is still strongly skewed toward the manufacturing sector. Thus, there has been little research to date on service supply chain related to the development of sound measurement constructs. The aim of this study is to develop a meaningful scale to measure service supply chain management processes. The finding of Q-Sort technique is a set of scales corresponding to a target dimension. However, four dimensions, including Demand Management, Capacity and Resource Management, Order Process Management, Service Performance Management have limited numbers of qualifying scales, indicating that the scales need to be reviewed, and another round of Q-Sort should be run to give a second chance. As the implication, the results indicate that the Q-Sort technique is a useful approach in eliminating the validity and reliability problem particularly in the early scale development stages for defining the constructs of supply chain management processes in the service context.**

Index Terms—**Service supply chain; Q-sort; scale development**

I. Introduction

In the highly competitive environment of today, service industries are facing the challenge of improving operational efficiencies and reducing costs, without negatively impacting customer service. Further, challenges come up due to technology revolution, increasing customer expectations, frequently changing customer needs and a dynamic market situation. As a result, service firm has to reduce cost, turning into an innovative player and differentiate itself in the market to achieve sustainable growth. To meet these challenges, service providers are beginning to implement the supply chain management practices (SCM), that create a balance between customer requirements and supply chain capabilities [1]. Supply chain management can bring reliability, responsiveness, consistency, flexibility, cost reduction and process efficiency.

From academic and practical standpoints, the emphasis in supply chain and operations management is still strongly skewed toward the manufacturing sector. Although, it is believed that service can benefit applying some best practices from manufacturing, the indifferences between service and manufacturing businesses could create a need for specific constructs or scales reflecting a service supply chain practices. Thus, there has been little research to date on service supply chain related to the development of sound measurement constructs or scales. For this reason, it is necessary for researchers to operationalize and validate empirically sound scales to measure the service supply chain processes. The aim of this study is to develop a meaningful scale to measure service supply chain management processes. For this reason, it is necessary to find appropriate methodologies to develop robust empirical scales to measure supply chain integration. In other words, there is a need for researchers to operationalize and validate scales to measure the supply chain management practices in service industry. The Q-sort technique could be beneficial in this regard [2].

In this study, the basic procedure is to have 12 practitioners working in the service business acting as respondents. The scales were sorted into several groups, with each group corresponding to a specific dimension (process), based on the similarities and differences among them. According to [3], there are seven theoretical processes of service supply chain including: (1) Demand Management, (2) Capacity and Resource Management, (3) Customer Relationship Management, (4) Supplier Relationship Management, (5) Order Process Management, (6) Service Performance Management, and (7) Information and Technology Management.

This paper applies the Q-sort technique to the scale development process in order to address the reliability and validity problems caused by subjectivity of the supply chain management in service. In other words, this study provides an overview of Q-sort technique to test whether these constructs could be described and differentiated at the preliminary stage of scale development. Indeed, the main contribution in this paper is not related much on theoretical concepts; rather, it focuses on the methodological aspects in terms of how to use Q-sort as a tool to pre-validate and measure supply chain management in Thai service context. This paper is set out in three sections. The first section provides a review of the theoretical background of service supply chain management. This is followed by explanations of the Q-sort technique. Section three discusses the major findings and how to analyze these results and certain conclusions are drawn in the last section on the suitability of the Q-sort technique for scale development for service supply chain management construct.

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II. Theoretical Background of Service supply Chain Management

Service supply chain management is a tool for

forecasting, planning, implementing, and controlling the process of the supply chain with the objective to satisfy customer requirements in an efficient manner. It involves coordinating, integrating and controlling the product, information and finance flows both within the organization and among the partners. In the past, firms were implementing SCM with the purpose of achieving operational efficiency and cost reduction. In today's business, however, firms are looking for leveraging competitive advantage to deliver better customer service. In fact, the integrated supply chain management fulfils the firm's requirement. The purpose of the supply chain in a manufacturing industry is reducing cycle time, inventory, and logistics costs. In the service industry, most of this purpose is irrelevant as the service provided is intangible or intransferable [4]. The service industries are keen to increase supplier responsiveness and better customer service delivery since most of the service industries deliver the service directly to the customer without the distributor and logistics partners. The traditional supply chain deals only with the flow of materials from suppliers to end users whereas service chains deal with the flow of resources which require managing processes.

TABLE 1: DEFINITION OF SERVICE SUPPLY CHAIN PROCESSES

Construct	Definition
Demand Management	Managing and balancing customer demand by keeping up-to-date demand information.
Capacity and resource Management	Management capacity and resources of service, these resources are organized effectively and efficiently operate at optimum capacity.
Customer Relationship Management	Maintaining and developing long-term customer relationships by developing customer information continuously and trying to understand what customers want.
Supplier Relationship Management	A process where customers and suppliers develop and maintain a close and long-term relationship as partners. SRM composes of five key components, including coordination, cooperation, commitment, information-sharing and feedback.
Order Process Management	Organizing response for orders processed from customers. The scope of order process management includes getting orders until delivering service to customers.
Service Performance Management	Management services systems, all of which should be taken into account when managing, measuring, modifying and rewarding service performance to improve organizational performance in order to achieve corporate strategic aims and promote its mission and values.
Information and technology Management	Adoption of technologies to support and collaborate within supply chain to improve service supply chain operations for achieving competitive advantage in their businesses.

SCM concepts have been implemented successfully in the service industry like retail, financial services, transportation services and courier service, logistics providers [3]. The classical example in retail industry is Wal-Mart. It has provided better service to its customer by collaborating the entire operating using SCM. P&G also implemented the SCM concept which has provided the company competitive advantage in the market. In general, SCM offers huge benefits to the service industry. This will enable the firm to achieve greater customer satisfaction and loyalty. Using SCM in service firm carries greater competitive advantage in the marketplace and increases the bottom line growth. It also enables the firm to reduce the cost, help in a better delivery system, forecasts the customer demand.

[3] defined service supply chain management as the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer. In addition, service supply chain could be defined as a network of suppliers, service providers, customers and other service partners that transfer resources into services delivered to and received by the customers [5]. According to [3], there are seven theoretical processes of service supply chain including: (1) Demand Management, (2) Capacity and resource Management, (3) Customer Relationship Management, (4) Supplier Relationship Management, (5) Order Process Management, (6) Service Performance Management, and (7) Information and technology Management. Table 1 provides the definition for each process.

III. Q-SORT TECHNIQUE

The Q-sort technique was originally developed by psychologists as a way to examine personal traits. Its ability to uncover a person's underlying values also makes it ideal for identifying the basic factors that drive purchasing behavior [6]. This technique is very versatile. Although it is often directed at priorities and suspected rank orders [7], the technique is especially suited to cases where the very existence of concepts has not been established.

The Q-sort technique has been widely used for pre-assessing initial construct validity and reliability. The basic concept of the Q-sort technique is to have experts act as judges and sort the items into several groups, with each group corresponding to a dimension based on agreement between judges [8]. In the Q-sort technique, the main evaluation index is a measurement of *inter-judge agreement* levels. If none or very few of the statements qualify, it may be that the definitions are wrong or the construct does not exist. It is also important to state two defining rules in order to judge the final result in Q-sort technique. First, a definition only exists if at least two items legitimately describe it. Second, for a item to be legitimate 70 percent of the sample must have allocated it to the same definition. In other words, a factor exists if 70 percent of the sample agrees that the two items describe it. In addition, at least four to six items per scale should be obtained in order to get the internal consistency (reliability) of a scale [9].

A. An Application of Q-Sort Technique

This technique assumes that there is a theoretical multidimensional concept (Factor) of supply chain management in service industry. To illustrate the usefulness of this Q-sort technique, seven dimensions (Factors) of service supply chain management were developed by [3] including:

- Demand Management,
- Capacity and resource Management
- Customer Relationship Management
- Supplier Relationship Management
- Order Process Management
- Service Performance Management

- Information and technology Management

The objective of this study is to illustrate whether the seven dimensions (Factors) of service supply chain integration mentioned above could be verified. This Q-sort technique consisting of seven definitions and a "Not Applicable (N/A)" category and 45 items representing seven dimensions (Factors) were also written on separate cards. The set of cards for each construct were shuffled and given to the respondents. The respondents were then asked to put each card under one of the dimensions (Factors) to the best of their knowledge. A "Not Applicable" category was also included to ensure that the respondents did not force any item into a particular category. Prior to sorting the cards, the respondents were briefed with a set of instructions.

B. Samples

Although it is possible to use Q-sort technique with one individual, [9] states that the Q-sort should have as many subjects as possible. Q-sort could have some biased toward small sample size and single case study [10]. [6] notes that 10 to 30 samples are usually more than adequate for the study using Q-sort technique. Therefore, in this study, the basic procedure was to have 12 managers in service firms as respondents and sorted the items into several groups; each group corresponding to a factor or dimension, based on similarities and differences among them.

IV. Findings

Due to space limitation in this paper, an example of the results for only one dimension *(Supplier Relationships Management)* is discussed in details. The result based on Q-Sort techniques is shown in the Appendix. Table 2 shows the performance of the items corresponding to this dimension. The percentage represents the degree of consensus between the samples on how far the item describes the definition. There are six items which only one item *(The ability to share common resources with suppliers*) was not consigned because the degree of consensus is less than 70%. After the analysis, it is evident that such a dimension as Supplier Relationships Management exists.

The overall result illustrated in Table 3 explains the frequency of qualifying to non-qualifying items for the sample. The output of Q-sort technique is a set of 26 qualifying items that correspond to the target dimensions as shown in Table 3. However, three dimensions (Factors), including *Demand Management, Capacity and Resource Management, and Order Process Management* have limited number of qualifying items (See Appendix A). Especially, a definition of Service Performance Management does not exist since only one item legitimately describes it. Therefore, this result does not support the concept that all dimensions (Factors) used in this study are valid based on Q-Sort analysis. In this case, the current items need to be rephrased and another Q-sort technique should be run to give a second chance, especially for Service Performance Management. After completing a sufficient number of items the next stage of scale development is to transfer the acceptable items to a questionnaire and for them to be tested using a range of scale types.

TABLE 2: The Result and Frequency of Supplier Relationships Management Dimension

Supplier Relationship Management	Q-sort study (N=12)
The ability to develop long-term relationships with suppliers.	80% (0.8)*
The ability to maintain close relationship with a limited pool of suppliers.	90% (0.9)*
The ability to evaluate supplier performance.	80% (0.8)*
The ability to focus on key supplier to improve the service chain quality.	80% (0.8)*
The ability to develop a partnership program with suppliers for the benefit of the whole service supply chain	80% (0.8)*
The ability to share common resources with suppliers	*30% (0.3)*

TABLE 3: The Overall Result from Q-sort Technique

Final statistics	Number of items
Items placed on dimensions (Total)	45
Qualifying items (Agreement ≥ 0.70)	26
Rejected items (Agreement < 0.70)	19

V. Conclusions

The case study has shown that determining an appropriate construct in the service context is a crucial issue in describing the items to measure service supply chain processes as suggested by [11]. However, this case study aims to validate the items or concepts of service supply chain management by other means before using questionnaire as a tool to collect the data. It is important to note that the scale development process is very crucial at the beginning to ensure that the researchers are able to get the best information they need from the respondent [12]. Therefore, this Q-sort technique plays a role to apply a theoretical framework combined with considerations of expert opinion in scale development. In this case, the service supply chain management assessment studies encourage a tendency for eliminating the items that contain misunderstanding or mixed worded items among *Demand Management, Capacity and* Resource *Management, Order Process Management, and Service Performance Management*, especially in service supply chain context. As a result, researchers have to be careful when they need to measure concept of service supply chain practices if they need to measure them.

APPENDIX A: The Results and Frequency of All Factors (* Indicated Qualifying Item)

Demand Management	Q-Sort Study (N=12)
The ability to simulate different of demand needs.	100% (1.0)*
Demand resources needs reliability.	70% (0.7)*
The ability to improve the accurate demand	*40% (0.4)*

forecasting and delivery by reconciling up-to-date information.	
The ability to focus on forecasting, planning, and target-setting functions.	*30% (0.3)*
The ability to match service capacity with demand through operations.	*20% (0.2)*
Capacity and resource Management	
The ability to manage intangible resources (e.g. skills, experiences, and knowledge) to operate at optimum service capacity.	80% (0.8)*
The ability to manage tangible resources (e.g. facilities, labor, and capital) to operate at optimum service capacity.	70% (0.7)*
The ability to define service capacity in the firm.	*50% (0.5)*
Have the tracking system in order to find the problems of unused service capacity.	*50% (0.5)*
Service capacity utilization is low enough to provide near instant service or least waiting time.	*40% (0.4)*
The ability to match service capacity with uncertain demand.	*30% (0.3)*
The ability to adjust service capacity during high and low demand.	*30% (0.3)*
The ability to deal with excess and/or idle service capacity	*30% (0.3)*
Customer Relationship Management	
The ability to develop long-term relationships with customers.	90% (0.9)*
Focus on customer satisfactions as the center of corporate activities.	90% (0.9)*
The ability to communicate optimistic information to customers.	90% (0.9)*
The ability to establish effective relationships with customers to the benefit of the brand loyalty.	90% (0.9)*
The ability to classify and prioritize key customers.	80% (0.8)*
The ability to manage relationship with customer to create the impression before and after service.	80% (0.8)*
The ability to focus on customer needs and customer service to improve the service chain.	80% (0.8)*
Order Process Management	
The ability to process order communication correctly steps by step.	90% (0.9)*
Process orders or reservation systems are efficient.	80% (0.8)*
The process of order taking is polite, fast and accurate.	*60% (0.6)*
The ability to simplify order process by using information technology system.	*30% (0.3)*
The ability to provide service delivery to right customer, right place and right time.	*20% (0.2)*

Service Performance Management	**Q-Sort Study (N=12)**
Management team emphasize on service performance management.	70% (0.7)*
Employees in organizations recognize the benefits of service performance management.	*60% (0.6)*
Have a commitment to ensure accurate and reliable service performance.	*50% (0.5)*
Employees have knowledge and skills in working with integrity and confidence.	*40% (0.4)*
Employees are able to develop their personality and refine their service performance.	*40% (0.4)*
Employees are willingness to serve customers immediately.	*30% (0.3)*
Have customer satisfaction index (CSI) such as speed of service, number of complaints, number of recommendations.	*30% (0.3)*
Information and technology Management	
Using new technology for increase channel to customers to contact the organization.	100% (1.0)*
The ability to access information quickly any time via information technology.	90% (0.9)*
The ability to create effective networks management to share information among internal functions, suppliers and customers.	80% (0.8)*
Firm has an information technology system to share information with customers.	80% (0.8)*
Firm has an information technology system to share information with suppliers.	80% (0.8)*
Firm use up-to-date information to make a decision via information and technology management.	80% (0.8)*
The ability to track accurate information and/or data within the supply chain by using information technology.	70% (0.7)*

The purpose here in this paper has been to illustrate the value and procedures of Q-sort technique as a preliminary process in scale development. We have attempted to establish a set of items which have a degree of pre-validation by using the scientific method known as Q-sort technique. The goal of Q-sort technique is to match the proposed items with the appropriate constructs and contexts. By using the concept of service supply chain, a scaled questionnaire could be used to check the reliability and validity of the dimension and constructs. The case study through this Q-sort application has shown that determining a qualified item is an important issue in explaining the dimensions of service supply chain management. However, it is noted that this technique should be used as a preliminary approach in scale development rather than a complete process. This process should be viewed as the process to only improve internal consistency reliability in scale development processes.

In conclusion, the objective in this study was to address not only the procedures but also the benefit of Q-sort technique as a preliminary process in scale development. Besides, it may be useful if researchers will use this technique instead of employing an expert opinion or piloted questionnaire to probe validity to the final questionnaire.

This study opens up several directions in future research. First, how do results from this study compare with other previous related literature? Second, how can we avoid issues or statements which are too subjective caused by the theoretical framework in service supply chain? Third, how should we go from this point to develop and assess measurement scales in service supply chain management.

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