

A Development of Supply Chain Intergration Construct: Using the Q-sort Technique

Sakun Boon-itt

Thammasat Business School, Thailand

E-mail : sboonitt@tu.ac.th

Abstract

Supply chain integration is an important topic for researchers and practitioners. However, the major concerns constraining the full and complete use of this concept in supply chain management research has been that the construct takes on its own meaning depending on individual subjectivity and different points of view. There is a need for researchers to operationalize and measure what it means by supply chain integration. The basic research question is whether a meaningful measure of supply chain integration can be developed. Exploratory study where subjective judgments of an indescribable object are involved could be conducted using the Q-sort technique because it captures an entity by finding stimuli which can be clustered to form a description of the construct. This paper describes the use of the Q-sort technique in the scale development process and applies it to the context of evaluating supply chain integration. The results indicate that the Q-sort technique is a useful methodological approach in eliminating the validity and reliability problems particularly in the early scale development stages for defining the construct of supply chain integration.

Introduction

In an increasingly competitive global marketplace, most firms are competing with a high level of market pressure worldwide. To be successful, they need to develop a better way to ensure that customers are satisfied with high service levels at acceptable prices. Therefore, it is necessary for them to develop supply chain networks of activities involved in producing and delivering a final product from suppliers to end customers. Based on this strategy, the focus now is shifting towards effective supply chain management. Instead of doing business with other organizations one by one, firms need to manage a whole network of relationships to include logistics and other business processes, from suppliers to end users.

It is important to recognize that one of the most important prerequisites for successful supply chain management is the integration of information flow, material flow, and all the business processes within a supply chain network (Lambert et al, 1998). Effective and efficient management of the supply chain requires the integration of all processes that go beyond purchasing and logistics activities. In the literature, one can find considerable numbers of research areas related to the benefits of supply chain integration in various ways: maximized the supply chain performance (Frohlich & Westbrook, 2001); reduced ordering cost (Scannell et al, 2000); reduced cycle time and inventory level (Stank et al, 1999); and reduced business uncertainties (Childerhouse et al, 2003).

However, a major obstacle to the full and complete use of this concept in supply chain management research has been that the supply chain integration is a construct that takes on its own meaning at a level of individual subjectivity and different points of view. 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 integration construct. The Q-sort technique could be beneficial in this regard (Ekinici & Riley, 1999).

This paper applies the Q-sort technique to the scale development process to address the reliability and validity problems caused by subjectivity of the supply chain integration concept. 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 integration in Thai context. This paper is set out in three sections. The first section provides a review of the theoretical background of supply chain integration. 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 supply chain integration.

Theoretical Background of Supply Chain Integration

In a competitive environment, an increase in the level of partnership among businesses is required. Spekman et al (1998) summarize the development of partnership into three stages, starting from cooperation, to coordination, and then to collaboration. Cooperation, whereby firms exchange essential information and engage some suppliers into a long-term contract, has become the threshold level of interaction. In other words, cooperation is a starting point for supply chain management and it has become a necessity for business. However, it is not a sufficient condition. The next stage is coordination whereby specified material and information are exchanged among partners to make seamless linkage among trading partners. Again, this process is important, but it is not a sufficient condition for integration due to the lack of integrated information flow.

At the highest level, collaboration, also known as supply chain integration, requires that all trading partners throughout the supply chain become integrated into their suppliers'/customers' processes. For example, supply chain partners cannot only plan the future production scheduling together, but they also share technology as well as future design, product requirement, and long-term strategic intention. The movement from coordination to collaboration or integration requires high levels of trust and information sharing among partners.

An increasing ability to compete in the global market expands the domain of business practice to include the notion of integration into supply chain strategy. Consequently, there has been a great deal of attention revealing that supply chain integration is increasingly an important topic for researchers and practitioners (Morash & Clinton, 1998; Frohlich & Westbrook, 2001; Frohlich, 2002; Chandra & Kumar, 2001). There is realization that the basic concept of supply chain management is to integrate production and information flow across the supply chain processes (Lambert et al, 1998). In the supply chain context, integration is defined as the extent to which all activities within an organization, and the activities of its suppliers, customers, and other supply chain members, are integrated together (Narasimhan & Jayaram, 1998). An integrated supply chain is linked organizationally and coordinated with information flow, from raw materials to on-time delivery of finished products to customers. The

entire supply chain is linked by information on anticipated and actual demand (Sabath, 1995).

To understand the classification of supply chain integration, Frohlich and Westbrook (2001) describe that there are two interrelated forms of integration that manufacturers regularly employ. The first type of integration involves integrating the forward physical flow of delivery between suppliers, manufacturers, and customers. Studies on the forward physical flow include topics such as Just-in-Time (Richeson et al, 1995; Claycomb et al, 1999; Dong et al., 2001) and delivery integration or postponement strategy (van Hoek et al, 1999). The second type of integration involves backward integration of information technologies and flow of data from customers to suppliers. This means that the information systems used must be integrated and capable of pushing demand from one level to the next, and that communication among all levels must be both effective and timely (Turner, 1993).

Bowersox, et al (2000) and Stank et al (2001) further discuss the supply chain integration framework by extending the scope of production and information flows. In their study, six critical areas used in the framework to achieve supply chain logistics integration include: 1) customer integration, 2) internal integration, 3) supplier integration, 4) technology and planning integration, 5) measurement integration, and 6) relationship integration.

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 (Brown, 1986). This technique is very versatile. Although it is often directed at priorities and suspected rank orders (Tractinsky & Jarvenpaa, 1995), the technique is especially suited to cases where the very existence of concepts has not been established.

However, although the Q-sort addresses problems of this nature, it is not a technique from which result could be generalized to a population without confirmatory factor analysis. This preliminary technique will be followed by more empirical approaches (McKeown & Thomas, 1988). In general, the output of Q-sort could be seen as a proof of reliability or a cognitive pattern (Thomas & Baas, 1992). Essentially, Q-sort is about finding concepts and it categorizes scales assigning the most appropriate statement to the measured construct and eliminates the meaningless one (content validity) in order to avoid an unambiguous variable definition. By requiring respondents to sort statements into different groups, many problems associated with questionnaire could be avoided (Kendall & Kendall, 1993).

Based on Ekinici and Rilley (1999)'s study to measure service quality in hotel industry, there are three stages in the initial application including:

- 1) To create a set of construct definitions by inductive (literature review) or deductive (expert opinion) methods (Hinkin & Schriesheim, 1989)
- 2) To create sets of statements which nominally represent those definitions; and
- 3) To test, in order to avoid forced choice that would run the risk of a false conclusion, whether subjects are asked to combine the statements with the definitions on a "free sort" basis with the option of "not applicable".

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 statements legitimately describe it. Second, for a statement to be legitimate 70 percent of the sample must have allocated it to the same definition. In other words, an entity exists if 70 percent of the sample agrees that the two statements describe it. In addition, at least four to six statements per scale should be obtained in order to get the internal consistency (reliability) of a scale (Hinkin et al., 1997).

An Application of Q-Sort Technique

This technique assumes that there is a theoretical multidimensional concept of supply chain integration. To illustrate the usefulness of this Q-sort methodology, six dimension of supply chain integration were developed by Bowersox, et al (2000) and Stank et al (2001) including:

- Customer integration,
- Internal integration,
- Supplier integration,
- Technology and planning integration,
- Measurement integration, and
- Relationship integration.

The objective of this study is to illustrate whether the six dimensions of supply chain integration mentioned above could be verified. Based on the studies of Bowersox, et al (2000) and Stank et al (2001), this Q-sort technique consisting of six definitions and a “Not Applicable (N/A)” category and 29 statements representing six dimensions 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 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.

Samples

Although it is possible to use Q-sort technique with one individual, Kerlinger (1986) 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 (McKeown and Thomas, 1988). Brown (1986) notes that 30 to 50 samples are usually more than adequate for the study using Q-sort technique. Therefore, in this study, the basic procedure was to have 30 purchasing/production managers and academics acting as respondents and sorted the items into several groups; each group corresponding to a factor or dimension, based on similarities and differences among them.

Findings

Due to space limitation in this paper, an example of the results for only one dimension (*Relationship Integration*) is illustrated. Table 1 shows the performance of the statements corresponding to this dimension. The percentage represents the degree of consensus between the samples on how far the statement describes the definition. There are five statements which mean that only two statements were consigned to the acceptable level of Relationship Integration. In other words, the first two statements in

the table pass the qualifying criteria of over 70 percent of the sample consensus. After the analysis, it is evident that such a dimension as Relationship Integration exists.

Table 1: The Result and Frequency of Relationship Integration Construct

<i>Statements</i>	Frequency (%), n = 30
Relationship Integration	
The capability to provide supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risks	0.80*
The capability to provide guidelines for developing, maintaining, and monitoring supply chain relationships	0.70*
<i>The level of strategic planning to shares a common set of expectations with supply chain partners</i>	0.63
<i>The willingness to share strategic information with selected supply chain partners</i>	0.50
<i>The level of joint planning and forecasting with supply chain partners</i>	0.50

*Pass the qualifying criteria that over 70 percent of the sample consensus

The overall result illustrated in Table 2 explains the frequency of qualifying to non-qualifying statements for the sample. The output of Q-sort technique is a set of 21 statements with at least two consigned to each dimension as defined in Table 3. This could support the concept that all dimensions used in this study are valid. However, one dimension (*Relationship Integration*) has a limited number of statements. In this case, the statements need to be rephrased and another Q-sort technique should be run to give a second chance. After completing a sufficient number of statements the next stage of scale development is to transfer the acceptable statements to a questionnaire and for them to be tested using a range of scale types.

Table 2: The Overall Result form Q-sort Technique

Final statistics	Number of items
Statements placed on dimensions	
Qualifying statements (Item \geq 0.70)	21
Rejected statements (Item $<$ 0.70)	8
Total	29

Table 3: The Qualified Statements: Supply Chain Integration Construct

Dimensions of their statements	Q-sort study Result (%), n =30
Internal Integration	
Integration across functional areas under firm control	1.00
Level of information flow within firm between order and inventory management process.	0.87
Level of responsiveness and flexibility to meet internal customers' needs	0.80
Degree of interpersonal, relations, communication activity interaction among functions in firm.	0.77
Customer Integration	
Degree of customer involvement in product development	0.93
Degree of joint planning to anticipate demand visibility with customers	0.73
Level of information sharing about market information and inventory stocking point with customers	0.70
Capability to achieve efficient and rapid delivery for customer ordering	0.70
Supplier Integration	
Degree of supplier involvement in the process of procurement and production.	0.93
Degree of supplier involvement in product development.	0.90
Level of strategic partnership and long-term relationship with suppliers (single / dual sourcing of supply)	0.73
Technology and Planning Integration	
Level of technology designed to facilitate cross-organizational data exchange	0.90
Capability to provide integrated database and access method to facilitate information sharing	0.87
Capability to obtain available, timely, and accurate information to facilitate use	0.73
Degree of information system that reflects more enterprise wide integrated processes (i.e. Enterprise Resources Planning)	0.70
Measurement Integration	
Capability to measure supply chain performance in terms of impact on business profit statements	0.90
Performance measurement data across supply chain partners is available on a more timely basis	0.87
Quality of data available for performance measurement in the firm	0.70
Relationship Integration	
Capability to provide supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risks	0.80
Capability to provide guidelines for developing, maintaining, and monitoring supply chain relationships	0.70

Conclusion

The case study has shown that determining an appropriate construct in the specific context is a crucial issue in describing the statements or items to measure supply chain integration in Thailand. However, this case study does not aim to offend the supply chain integration concept that already proposed in the literature; indeed, this finding seeks to validate the statements or concepts of supply chain integration 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. It is not necessary that the concepts applied in the Western contexts such as The United Kingdom, Europe, and The United State should be appropriate to use in Thailand. Therefore, this Q-sort technique plays a role to apply a theoretical framework combined with considerations of the contextual factors. In this case, the supply chain integration assessment studies encourage a tendency for eliminating the statements that contain misunderstanding or mixed worded items in Thai context (8 items) in relationship integration especially. As a result, researchers have to be careful as not to use the entire statement proposed in the different context if they need to measure relationship integration. Therefore, it is necessary to re-word or eliminate negative statements in order to avoid the respondents' bias in measurement.

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 statements 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 statements with the appropriate constructs and contexts. By using the concept of supply chain integration, 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 statement is an important issue in explaining the dimensions of supply chain integration in Thailand. 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 key issues studies? Second, why the results in scale development processes which conduct in Thai context are different from other studies, especially in relationship integration? Third, how can we avoid issues or statements which are too subjective caused by the theoretical framework?

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