A FACTOR ANALYTIC INVESTIGATION OF THE CONSTRUCT OF SUPPLY CHAIN DECISIONS SUPPORT SYSTEM IN EXPRESS SHIPPING COMPANIES AT JORDAN

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Abstract

The Decision Support System provides correct information at the right time so the managers can make timely and more accurate decisions. Therefore, proper design of decision support systems help decision maker to extract useful information from various sources to identifying and solving problems, and making decisions. This study focuses on optimizing the effectiveness and efficiency of Supply Chain performance by investigation of the construct of Supply Chain Decisions Support System in Express Shipping Companies in Jordan.

The study was carried a sample of 61 respondents through the distribution of structured questionnaires to Express Shipping Companies at Jordan within the area of Amman, Jordan. The data were factor analyzed to determine the key dimensions of Supply Chain Decisions Support System measurement scale. Results confirm that the four dimensions scale (Availability of the system-oriented data to support decision and perceive their benefits, sharing ideas and information with customers, suppliers and perceive its benefits, exchanging data electronically with customers and suppliers and perceive its benefits and cooperation and coordination with customers and perceive their benefits) possess adequate reliability and internal consistency as well as convergent validity.

Results of analysis show that the four dimensions of the Supply Chain Decisions Support System scale may serve training needs for Express Shipping Company's staff to develop appropriate training programs that can help to improve their understanding of the activities involved in developing Supply Chain Decisions Support System.

Keywords - Supply Chain, Decisions Support System, Internal Consistency, Convergent Validity, Express Shipping Companies and Jordan.

1 INTRODUCTION

Due to global competition and increasing customer demand for value, the supply chain concept becomes a concern. Thus, the information must be available in real time across the supply chain partners and this can't be achieved without an integrated software system for supply chain. This integration helps in cooperation and sharing information in order to achieve customer satisfaction. This enables companies to achieve competitiveness and their profit (Mrincas, 2008). Moreover, companies try to improve the performance of their work through knowing more about its customers and suppliers and therefore organizations need new system architecture which provides an integrated environment for decision making that will help managers take smart decisions. The term supply chain management is used internationally to include every effort involved in producing and delivering a final product and service. It has focus on costs, efficiencies of supply, and the flow of materials from their various sources to their final destinations [19]. Decision support system gives an organization's employees, partners, and suppliers easy access to the information they need to do their jobs effectively, and the ability to analyze and easily share this information [23].

1.1 SUPPLY CHAIN

Initiative definition of the term supply chain would include the linkage of stages in a process from the initial raw material sourcing through various stages of manufacture, processing, storage, transportation to the final delivery and consumption by the end customer [27]. From Chopra & Meindl in their book Supply Chain Management: Strategy, Planning, and Operations said that supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request [5]. The supply chain does not only include the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves.

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished Products to customers [12]. Ivanov & Sokolov look to supply chain (SC) as a network of organizations, flows and processes where in a number of various enterprises (suppliers, manufacturers, distributors and retailers) collaborate (cooperate and coordinate) along the entire value chain to obtain raw materials, to convert it into specified final products, and to deliver these final products to customers [13]. Through the previous definitions for supply chain, the researchers concludes that the supply chain includes a range of activities, facilities and functions that work together for delivering products and services to the end-user. Starting from acquiring raw material, through manufacturing processes and storage to distribution and reaching the final customers.

According to Chopra & Meindl the objective of every supply chain should be maximize the overall value generated by the supply chain, this value is represent the difference between what the final product is worth to the customer and the costs the supply chain need to fill customers request [5].This value associated with supply chain profitability that contains the difference between revenue generated from the customer and the overall cost across the supply chain. Doing this requires the supply chain to achieve appropriate levels of the five operations performance objectives [25]:

1. ***Quality:*** focus on delivering products and services to the target customers, which means product reliability and increase customer satisfaction so each stage in the supply chain should take responsibility for its own and its suppliers' performance, therefore a supply chain can achieve high end customer quality.
2. ***Speed:*** this has two meanings in a supply chain context. The first is how to response to customers on time (the time between placement order by customer and receiving it in full) this is will be achieved by over stocking within the supply chain this can reduce the chances of stock-out and reducing customer waiting time. The second is the time needed to convert raw material into final product and time need to deliver it to the end customer.
3. ***Dependability:*** it is a more desirable aim because it reduces uncertainty within the chain by keeping overmuch resource. It's essential to deliver order on time.

4. ***Flexibility:*** chain's ability to deal with changes and troubles, and ability to customize and modify the product depending on customer preferences.
5. ***Cost:*** the transaction costs incurred within each operation to transform its inputs into outputs, it may include such things as the costs of finding appropriate suppliers, contractual agreements, monitoring supply performance, transporting products between operations and holding inventories.

The researcher summarizes the main objectives of supply chain management according to Jespersen & Larson as follows [14]:

1. Increased flexibility to satisfy customer's preferences.
2. Quicker and more precise delivery time.
3. Increase customer loyalty and resulting increase in sales.
4. Fewer backorders sold out.
5. Minimize total cost.

1.2 SUPPLY CHAIN DECISIONS SUPPORT SYSTEM

Decision support systems are gaining an increased popularity in various domains, including business, engineering, military, and medicine. They are especially valuable in situations in which the amount of available information is elusive from decision maker and in which accuracy is importance. Decision support systems can help decision maker by providing various sources of information, providing intelligent access to relevant knowledge, and support the process of structuring decisions. They can also provide well defined alternatives to support decision. Also, they can employ artificial intelligence methods to solve complex problems. Appropriate application of decision making tools increases productivity, efficiency, effectiveness and gives many businesses a competitive advantage over their competitors, allowing them to make optimal choices for technological processes, planning business operations, logistics, or investments [8].

However Laudon & Laudon presented a definition for decision support system by viewing system's capabilities that "DSS Provide simulation, analytical, and data modeling tools to optimize decision making [17]. This system addresses problems where the procedure for producing the information aids is not fully predefined in advance .Therefore, decision support system has more analytical power than other information systems".

2 RESEARCH METHOD

Based on a review of the contemporary information system & supply chain management, a list of key variables that affected Supply Chain Decisions Support System was drawn up. During the initial phase of the study, (61) middle and top management managers in express companies in Jordan were invited to collect primary data about the factors affected Supply Chain Decisions Support System.

The researchers depends on the availability of the system-oriented data to support decision and perceive their benefits suggested by Kimball [11,16], sharing ideas and information with customers, suppliers and perceive its benefits [15], exchanging data electronically with customers and suppliers and perceive its benefits and the cooperation and coordination with customers and perceive their benefits [21,26].

The questionnaire comprised 37 questions divided into four sections. The first section consisted of 7 questions covering Availability of the system-oriented data to support decision and perceive their benefits. The second section of the questionnaire consisted of 14 questions designed to seek information about sharing ideas and information with customers, suppliers and perceive its benefits. The third sections consisted of 8 questions covering Exchanging data electronically with customers and suppliers and perceive its benefits. The fourth sections consisted of 8 questions covering Cooperation and coordination with customers and perceive their benefits.

To measure reliably for each section should be measured with a multi-item scale using a five point likert scale (1 = strongly disagree" and 5 = strongly agree") for the 37 statement/ items of the four dimensions of the scale.

2.1 MEASURE RELIABILITY

The first stage focused on the specification of dimensions for the verification of the 37 - items scale, its reliability and validity, analyzing the elements and dimensions which determine the Supply Chain Decisions Support System construct in express companies at Jordan. Anderson and Gerbing's two-step procedure was followed [1]. First, different analyses of the correlations between the initial scale items were carried out for this purpose, as well as examinations of scale reliability. The correlation matrix contained many high correlations. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was 0.861 (comfortability above the 0.60 benchmark) and the Bartlett's test of sphericity was significant at $p<0.001$ [22].

According to Bagozzi and Philips and Bagozzi and Youjae [2,3], in order to purify the measurement scale for Supply Chain Decisions Support System, items that correlate negatively with one another or do not correlate strongly with the sum of the remaining items were removed. Therefore five items were dropped. The next step was an exploratory factor analysis to initially assess the psychometric properties of the scale. Factor analysis was used to allow the grouping of variables and therefore, simplify data for possible interpretation. The statistical purpose of factor analysis was to determine whether there were linear combinations of variables that will assist in summarizing the data and identifying underlying relationships [10].

Exploratory factoring was based upon a principal components analysis as the extraction method using Varimax rotation with Kaiser Normalization of the thirty remaining items that described the relationship marketing orientation suggested by literature. The scale items were purified through an iterative process. Items that did not load heavily on the primary factor (i.e., 0.4) and items that had significant cross loadings were removed. This resulted in a removal of three more items. The remaining twenty seven items were factor analyzed again. The analysis produced a four -factor solution, which accounts for 61.561 % of the variation in the data, according to the criteria developed by Kaiser (1958). As can be seen in Table 1, these factors are: Availability of the system-oriented data to support decision and perceive their benefit, sharing ideas and information with customers, suppliers and perceive its benefits, exchanging data electronically with customers and suppliers and perceive its benefits and Cooperation and coordination with customers and perceive their benefits.

A reliability analysis was conducted on the summated scale of these constructs using reliability coefficients. The internal consistency was assessed by means of the Cronbach's alpha coefficient [7]. Tables 1 and 2 report the reliability of the multi-item scale which using Cronbach's coefficient alpha. The overall coefficient alpha for the scale is 0.916 which is greater than the recommended cut-off level of 0.70 and of 0.60 according to Sekaran and Melewar and Saunders [18, 20, 24]. With regard to individual subscales, the reliability coefficient of all the four components: Availability of the system-oriented data to support decision and perceive their benefit (0.802), sharing ideas and information with customers, suppliers and perceive its benefits (0.894), exchanging data electronically with customers and suppliers and perceive its benefits (0.827) and Cooperation and coordination with customers and perceive their benefits (0.835) met the standard. Therefore, these indicated high reliability estimates since reliability figures less than 0.60 are generally considered to be poor, those in the range of 0.70 to be acceptable, while those above 0.80 to be good [10,18,24]. Acceptable, suggesting that scale is a reliable for the instrument used for measuring Supply Chain Decisions Support System. We will discuss briefly each component (factor) later. Table 1 provides the descriptive output for each factor.

Table 1. Result of exploratory factor analysis Supply Chain Decisions Support System (Scale Reliability)

Constructs	Factor Loadings	Variance Explained	Reliability Cronbach alpha
Factor 1: Availability of the system-oriented data to support decision and perceive their benefit		19.738	0.802
1. Decision support system used in a company included quantitative models dealing with one problem	0.533		
2. Decision support system used in a company included quantitative models related to the time for package delivery	0.502		
3. Decision support system used in a company included quantitative models with one objective	0.652		
4. Decision support system used in a company contribute to improve the accuracy for customer order forecasting	0.747		
5. Decision support system used in a company contribute to Minimize Costs	0.563		
6. Decision support system used in a company contribute to maximize profits	0.707		
Factor 2: sharing ideas and information with customers, suppliers and perceive its benefits		16.529	0.894
7. Information to predict future requests	0.749		
8. Information about capacity distribution	0.789		
9. Ideas and suggestions for provided services quality	0.618		
10. Information about competitors companies	0.500		
11. Ideas and suggestions to maximize profits	0.582		
12. Information about the political, economic or technological changes	0.811		
13. Reduce bottlenecks	0.770		
14. Improve the operations performance	0.652		
15. Exclude activities that do not add value	0.772		
16. Improve the accuracy of suppliers forecasting for the company's requires	0.634		
Factor 3: Exchanging data electronically with customers and suppliers and perceive its benefits		14.241	0.827
17. The company exchange data electronically by using intranet and extranet	0.790		
18. There is a connection between the computers networks within the company	0.706		
19. The company service buying & selling through website	0.583		
20. The electronic exchange of company data lead to increase accuracy	0.553		
21. The electronic exchange of company data lead to update data rapidly	0.707		
22. The electronic exchange of company data lead to improve the accuracy of customer orders forecasting	0.811		
23. The electronic exchange of company data lead to responsiveness on time to customer orders	0.617		
24. The electronic exchange of company data lead to increase customer satisfaction	0.713		
Factor 4: Cooperation and coordination with customers and perceive their benefits		11.053	0.835
25. Cooperation & Coordination with customer lead to agree with them on the basic rules of trading	0.759		
26. Cooperation & Coordination with customer lead to agree with them on the list of transactions and delivery dates	0.589		
27. Cooperation & Coordination with customer lead to develop action plan	0.722		
28. Cooperation & Coordination with customer lead to improve the accuracy of customer orders forecasting	0.654		
29. Cooperation & Coordination with customer lead to deliver their needs on time	0.521		
30. Cooperation & Coordination with customer lead to increase customer satisfaction	0.546		
31. Cooperation & Coordination with customer lead to maximize profits	0.533		
32. Cooperation & Coordination with customer lead to increase the achieving objectives set in the plan	0.519		
Supply Chain Decisions Support System (Scale Reliability)		61.561	0.916

As can be seen in Table 2, these Cronbach alphas indicate that the scales used in the questionnaire satisfactorily measured the constructs.

Table 2. Correlations, Reliabilities and Descriptive Statistics (N=61)

Constructs	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.00			
Factor 2	0.469	1.00		
Factor 3	0.642	0.483	1.00	
Factor 4	0.425	0.571	0.515	1.00
Mean	4.10	3.83	3.85	4.15
Standard Deviation	0.72	0.76	0.79	0.71
Cronbach alpha	0.802	0.894	0.827	0.835

Note: All Correlations are significant at the 0.01% level ($p<0.01$).

2.2 CONSTRUCT VALIDITY

According to Cronbach, evidence of construct validity exists when the pattern of correlation among variables conforms to what is predicted by theory [7]. Therefore convergent and nomological validities are examined.

Convergent validity refers to the degree of agreement in two or more measures of the same construct. Evidence of convergent validity was provided by the fact that all measurement items were loaded on the appropriate constructs. Evidence of convergent validity in the Supply Chain Decisions Support System scale was examined through simple correlations among the four components of the Supply Chain Decisions Support System scale. Table 2 show that correlation matrix contained most correlations above 0.30 and all correlations are significant at $p<0.01$; furthermore, each of the components also highly correlated (0.64 and above) with the overall measure of Supply Chain Decisions Support System. The pattern of correlations indicates that components of Supply Chain Decisions Support System scale converge on a common construct, thereby providing evidence of convergent validity. Further,

Table 2 illustrates that the comparison of the alpha coefficients with their correlation coefficients confirmed that discriminant validity was in support of all constructs [4,9].

Nomo logical validity shows the ability of a scale to behave as expected with respect to some other constructs to which it is related [6]. As we mentioned above, Successful Supply Chain Decisions Support System can improve Performance. As stated in Table 2, all correlation coefficients between the components of Supply Chain Decisions Support System are positive and significant (at $p< 0.01$) .Thus nomological validity of the scale is demonstrated.

3 RESULTS

The four factors shown in Table 1 relate to elements of Supply Chain Decisions Support System in existing literature and collectively, these retained factors account for 61.561 percent of the total variance in the 32 variables. Based on the items loading on each factor, the factors were, respectively, labeled as Availability of the system-oriented data to support decision and perceive their benefit, sharing ideas and information with customers, suppliers and perceive its benefits, exchanging data electronically with customers and suppliers and perceive its benefits and Cooperation and coordination with customers and perceive their benefits.

Factor 1 : Availability of the system-oriented data to support decision and perceive their benefit

Six items loading on this factor relates very directly to Availability of the system-oriented data to support decision and perceive their benefit dimension of Supply Chain Decisions Support System. The respondents felt that Availability of the system-oriented data to support decision which include quantitative and quantitative models dealing with one problem, improve the accuracy for customer order forecasting, Minimize Costs and maximize

profits are a very important aspect of Supply Chain Decisions Support System. This factor accounted for 19.738 % of variance and its reliability was 0.802.

Factor 2 : sharing ideas and information with customers, suppliers and perceive its benefits

10 out of 14 items loading on this factor relate to sharing ideas and information with customers, suppliers and perceive its benefits dimension of Supply Chain Decisions Support System. The respondents felt that sharing ideas and information with customers, suppliers and perceive its benefits is a very important aspect of Supply Chain Decisions Support System. Is also significantly loaded on this factor. This factor accounted for 16.529% of variance and its reliability was 0.894.

Factor 3 : Exchanging data electronically with customers and suppliers and perceive its benefits

All the 8 items loading on this factor relate to different aspects of exchanging data electronically with customers and suppliers and perceive its benefits. The respondents felt that if an organization wanted to build and maintain long-term relationship with the customers, it should provide timely and trustworthy information to them. This factor accounted for 14.241 % of variance and its reliability was 0.827.

Factor 4 : Cooperation and coordination with customers and perceive their benefits

All the 8 items loading on this factor relate to different aspects of Cooperation and coordination with customers and perceive their benefits. This factor accounted for 11.053% of variance and its reliability was 0.835.

4 CONCLUSIONS AND IMPLICATIONS

There are several factors management of Express Shipping providers can use to improve their specific service delivery process and Performance. Supply Chain Decisions Support System is one of key strategic issues for managers of Express Shipping companies for establishing and maintaining long-term relationships with their clients.

To remain competitive and obtain competitive advantages, the Express Shipping Company's managers at Jordan can try to increase relationship and thus customer loyalty by managing each dimension of Supply Chain Decisions Support System in the context with the Jordanian Express Shipping company's customers. Cooperation and coordination with customers and perceive their benefits is found to be one of key strategic issues for Express Shipping Company's managers at Jordan for establishing and maintaining long-term relationships with their customers therefore Express Shipping Company's managers need to monitor their behaviors and internal processes.

The four dimensions of the Supply Chain Decisions Support System scale may serve training needs for Express Shipping Company's staff to develop appropriate training programs that can help to improve their understanding of the activities involved in developing Supply Chain Decisions Support System.

This study also opens some additional avenues for future research in the context of Jordanian banking services. Thus further research should focus on the following issues:

First, future research should examine the effect of Supply Chain Decisions Support System on business performance as multidimensional construct.

Second, future research should investigate the antecedents and consequences of the dimensions of Supply Chain Decisions Support System.

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