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Identifying Affective Factors on Supply Chain Performance in Persian Gulf Petrochemical Industries

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Abstract

In today's markets, technological and competitive factors are rapidly increasing, which have made it difficult for the companies to provide what they need. Instead, handing out has become one of the main strategies of the companies. The objective of this research is to investigate factors affecting the performance of supply chains in petrochemical industries of Persian Gulf which based on experts' opinion; different indicators were identified in order to measure the performance of supply chains. This research is a descriptive, surveying study based on correlation and regression analysis. In order to conduct the research, first, affective factors on performance of the supply chain based on experts' opinion were presented through using Delphi technique. Then, the elicited factors were investigated through using factor analysis technique and finally the conceptual model of supply chain performance measurement were obtained. In this model, the impact of factors such as clients, process, cost, flexibility, and time on the performance of this industry were introduced, respectively and finally some indicators were provided and evaluated in measurement.

Keywords: performance measurement, supply chain management, effective factors on supply chain

Introduction

Nowadays, companies need to make integration in all processes of production from raw materials to consumer goods. Supply chain management as an integrated event is capable of being accountable for appropriate management of materials and goods flow, information and money flow Angerhofer (2000). Customers' demands for various goods and materials cannot be certainly predicted at all times. Hence if the supply chain departments don't keep enough merchandise in their warehouses, there would be a possibility of losing their customers and the complications which may happen by the lack of inventory. On the other hand, with all the benefits that the inventory and maintenance of them have, if they are not reviewed and analyzed well, it will lead to the losses of the chain; in other words, the price that chain pays for customers' satisfaction may end with destruction of the whole chain (Akkermans, 1995).

In the modern business environment, the producers are facing with an increasing pressure in customers' sides in privatizing the product, quality improvement, and accountability for demands. In order to maintain the business within these pressures, most of the companies seek long-term strategic development and cooperation with a few producers. Increasing requirements of being competitive in the field of efficiency cost as well as being responsive to the customers through using their capabilities and creating customer a new value has made companies to strategically partner up with suppliers, customers, logistics service providers, that this would lead to the formation of the concept of supply chain management. In the 90′s, many industry executives not only found that improving internal processes and the flexibility in the ability of a company is not enough in a market world, but also suppliers and distributors must have close relationship with market development

policies (Ross, 1997). With such a view, the approaches of the supply chain and its management were developed.

Supply Chain Management

Supply chain management is a significant sample of the present age which is to improve the competitive situation of organizations and to consolidate activities and institutions in a chain in order to achieve reliable and sustainable competitive position. The supply chain management is generally dealing with both internal and external sectors. The duty of the internal part is to receive raw materials and transform them into a suitable output as well as delivering it to the distribution network, but the external part is related to the external upper hand members or the external lower hand ones.

Supply chain is a chain which includes all activities associated with the flow of goods and transformation of materials from the preparation phase of raw materials till the final stage of the delivery of the goods to the consumers. Parallel to the flow of goods, there are other two flows which one is the flow of financial resources and the other is the flow of information and funds (Ganeshan et al, 1995). Overviewing the formation history of supply chain management's concept, there are three major stages, production period for warehouses (1975-1960), customers attracting period (1975-1990) and the period of supply chain management which started in the 1980's. In this period administrators through using re-engineering patterns and production processes reformation came to understand that they have to pay their attention to customer relationship management, information and providing flexible material in order to survive in global markets as well as controlling process and setting sustainable improvement. In this era the supply chain management began to develop and was quickly formed. In recent years with the progress of technology, especially with the rapid development of information technology and its broad application in supply chain management, many of the basic activities of chain management with the new method is in progress (Anderson et al, 1997).

Supply chain management includes a target based on equal share, organizing beyond institutional business activities in order to provide a common attitude about the market opportunity. So this is a comprehensive management that can be continued from supplying of raw materials to final customer (fergusen,2000 p 64)

An integrated, coherent and process based approach in preparation, Procurement, production and distribution of products and giving services to the customers (saeedi Kia and e tal, 1379).

Planning, organizing and control of activities in supply chain are known as supply chain management. (Chan, Qi, Chan, Lau, & Li, 2003; APICS, 1998). In other words, the supply chain management is the integration of activities associated with transfer and the flow of goods and services, including their information flow from source of raw materials to the final consumer (Ballou, Gilbert, & Mukherjee, 2000; Handfield & Nichols, 1999).

According to the Simchi-Levi, Kaminsky, & Simchi-Levi (2000) the supply chain management is a set of methods which are used for effective consolidating of suppliers, producers, warehouses and stores. In a way that goods in the right size, place and time are produced and distributed in order to minimize the total cost of the system and meet the requirements of the service level. The supply chain management as a business philosophy has revolutionized business through increasing business skills and the performance of all members in the supply chain (Cooper, Lambert, & Pagh, 1997; Ferguson, 2000).

The effective supply chain management is considered as key for creating a stable competitive environment through improving internal and external relationships from the company (Ellinger, 2000). Astionz (1999) defines the supply chain management as " A system which its

components are the suppliers, production, distribution services and customers who have been linked to each other by forward flow of the material and backward flow of the information " (Gunasekaran et al, 2001). There are some other definitions for supply chain management such as, consolidating key processes of business from the final consumer to the main supplier which offers products, services and information and as a result creates added value for the stakeholders (Remko & van Hoek, 1998). According to the above given definition about supply chain management, it can be concluded that the supply chain management is the management of all activities associated with transfer of goods from raw materials to the final user which includes choosing a source and supply, production scheduling, order processing, inventory management, transport, warehousing and the customer services as well as the required information systems for monitoring and coordination (Quinn, 1997).

Performance measurements of supply chain

Performance measurement is one of the key management activities and the selection of system evaluation in order to achieve the strategic objectives of the organization is placed in the center of this issue. That's why the design of a performance evaluation system is of a high importance. Performance measurement is vital for the organizational success as it makes it easy to understand any behavior as well as shaping it and improving competitiveness (Fawcett & Cooper, 1998). Performance measurement as a necessary tool of management provides the necessary assistance for the performance improvement in line with the supply chain. Although the supply chain management has become a common action at the level of industries and flow of articles related to the theory of supply chain management measures have been published, the measurement of supply chain performance was not the center of the attention (Chan et al, 2003)

Neely, Gregory, & Platts (1995) have defined performance measurement as quantifying the effectiveness and measures efficiency. The effectiveness is proving customers with what they need and the efficiency is the economical use of the company's' resources in the predetermined levels of the customers' satisfaction. Hence, we can say that the performance measurement systems are set of metric data (metrics) which are quantifying the effectiveness and efficiency of the measures. Lebas (1995) explains performance measurement as the transfer of performance into restricted symptoms which can be transferred and reported under the same conditions. It is said that performance measurement of supply chain can provide a better understanding of the supply chain, have a positive impact on the behavior of agents and improve the overall performance. (Chen & Paulraj, 2004).

The results of studies done by Kaynak (2003) and Kaynak . Hartley (2008). (2008) showed that the performance of optimal quality is followed by high financial and commercial performance. The quality can increase the satisfaction of the customers as well as making companies being capable of asking for higher prices or reducing the costs. It increases the profit margin of the companies as well as increasing the ability of the supply chain in simultaneous coordination and integration of upper hand and lower hand flows, and the amount of the supply chain flexibility in fulfilling customer needs.

Gunasekaran et al (2001) have developed a framework in order to measure the performance in strategic, technical and operational levels in supply chain. This framework is basically in touch with supplier, delivery, customer service, and inventory costs and logistic. Fan Amstel and D hurt have shown that particular type of the parameters which are used for logistic activities are different with each other based on the level of measurement (scope of activity, performance, between sectors or the Organization) and the operational field (Cooper Lambert, & Pagh, 1998).

In Lehmann and e tal studies (2002) industrial products are first categorized into 4 groups, and then for each group of products the measurement indicators have been suggested.

Govrin in his studies in 1993 has provided performance indicators in detailed. In these studies 5 indicators have been suggested that are: quality, cost, on time delivery, services, flexibility which each of them has different dimensions. So the frequency of the proposed indicators on the one hand and the need to have an access to the information of indicators , the relative credit of resources, relevant reference of time and the purpose of using indicators such as an overall assessment or evaluation are set of factors effective in indicators choice .

Chan and e tal (2003) have identified six key processes (supplier, internal logistics, production, external logistic, marketing & sales, and the final customers) and have provided the input, output and mixed (combined) criteria for each. They have also categorized performance criteria into qualitative and quantitative classification. Based on their comments some examples of the qualitative criteria include: customer satisfaction, flexibility, integrity of information and material flow, effective risk management and supplying performance.

Some quantitative criteria include:

1- Cost based criteria such as minimizing the costs and investments in inventories as well as maximizing profit and return rate of capital (ROI).

2- Customer based criteria such as maximizing fulfillment percentage of orders (supply rate), minimizing the delay in the delivery of products and time of responding to the customer, minimizing LT (the time between receiving the order and delivery of it) and redoing the tasks.

3- Competency based criteria such as maximizing the use of capacities and utilization of resources (Chan et al, 2003). Overall a few efforts have been done in systematic arrangement in performance measurement criteria. In addition there is no consistent agreement about the most suitable method of classification among the researchers and scientists (Shepherd & Gunter, 2006). Biman (1999) has identified three criteria in supply chain performance measurement: resources, output and flexibility.

Thor (1994) has claimed that there should exist a family of parameters. A balanced set of four to six criteria which usually includes productivity, quality and customer satisfaction offer a thorough viewpoint about the results of the performance. To emphasize on the importance of performance measurement Gong and e tal refer to the to Boston Consulting Group's study which says: Few companies achieve their objectives in technological innovation field and get satisfactory results for which performance measurement is required (Gong, 2008). Performance measurement based on reliable data is one of the factors which seems necessary in full use of the company from its investment's value (Luo gzarish, Wu, Rosenberg, & Barnes, 2008)

Methodology

The present study has been conducted to Identify the affective factors on performance of supply chain in petrochemical industries of Persian Gulf which is a descriptive, survey research based on correlation analysis and regression. In order to conduct the research first we tried to identify the effective factors on performance of supply chain from elites' opinions in this industry through using Delphi technique. Later on the obtained factors have been investigated through using the factor analysis technique and conceptual model of performance measurement of supply chain and finally, the results have been tested through using factor analysis. For performing factor analysis, a questionnaire was designed for the extracted factors and was viewed in terms of validity and reliability and then was collected between experts through using the sampling distribution. Random sampling was simple and the data analysis in this study was carried out through using the SPSS software.

Participants

For the statistical analysis in this study 100 questionnaires were distributed among experts and specialists of the petrochemical industries of Persian Gulf.

The results of factor-exploration analysis

Based on sampling and data analysis the results are shown in table 1.

Table 1. The results of factor analysis for the variables

Factors						Variables
Supplier	**Costs**	**Flexibility**	**Customer**	**Process**	**Time**	
					0.743	Cycle Time
					0.375	LT time (Lead Time)
					0.628	(Order Cycle Time)
				0.488		Ordering methods
				0.694		Effective scheduling of distribution plan
				0.798		Amount of sharing information
			0.890			The way and quality of delivery
			0.777			Customer satisfaction
		0.865				Product and service variety
		0.688				Response to quick orders
		0.928				supply Rate
	0.382					Return capital
	0.848					Amount of circulating cash
	0.658					Warehousing costs
0.674						Suppliers level of cooperation
0.832						Assistance in solving technical problems
0.317						Quality capabilities of the supplier
0.459						Increased delivery
13.86%	12.68%	13.96%	9.75%	8.12%	8.37 %	Set variance
13.86%	22.58%	43.37%	52.23%	58.36%	72.65%	Set variance (collective)
2.191	2.68	2.63	3.036	1.98	1.64	Special amount

The analysis of data in main factors analysis method was with a rotation of the total variance and the optimal variance is equal to 72.65 percent. In other words, the obtained model in this study explains 72.65 percent of effective factors on supply chain performance. The explained total

variance is used as the total validity criterion. Based on table 1 the amount of each factor variable can be viewed in each structure which by that we mean the regression coefficient. The amount of this should be more than 0.3. Regressions coefficients are weighed mixture of variable which best explain the variance of that factor or in other words the amount which variables can affect the behavior of that factor. X factors of the variances show any percentage of that variance which is explained by that factor (Kline, 1994). It must be mentioned that variables which are closer to zero, get a better outcome. According to the variances of structure, the numbers of the variables in each structures show the higher convergence. And, few numbers of variables in other structures (the few numbers of variables in other structures represent the divergent), explains the validity of the model. The obtained structures include supplier, cost, flexibility, process, customer, and time. Supply chains which are having better performance chain within these factors have higher performance as well; so these six structures provide the performance of supply chain in industry.

In the case of approval of the proposed model we can point out that the amount of RMSEA is equal to 0.028 and is less than 0.05. Two other indicators GFI and AGFI were 0.95 and 0.92 respectively that shows good fitting of the model and the value of K to degree of freedom is 1.68 which is less than 3. So we can conclude that the obtained model is fit and appropriate. And among six identified factors, customer factor 0.89 and then process 0.78 were of high importance respectively and had the highest regression coefficient on the performance of the supply chain. The next factor is cost with 0.64 and then flexibility with 0.48, supplier with0.34 and time with0.28 had the highest impact on performance of supply chain.

Conclusion

The achieved result depicts an overall understanding of the experts' viewpoints about the importance of each factor in performance measurement of supply chain. The most important factor of this chain is its customers. Therefore, it is very clear that their importance in performance measurement was very high. The second factor was process which reflects that the business processes in this industry have many weaknesses and this factor in professionals and experts opinions of the industry may be one of the most important items in improvement of supply chain performance. Variables such as the amount of investment information, ordering methods and distribution are categorized in this factor. Cost is another factor which is considered important in this model. It is very clear that cost efficiency in this industry is not well fulfilled and experts of the industry are looking for some ways in order to create cost efficiency in production of products with low expenses for final customers. Time was introduced as a less effective factor in this model and it is probably because of closed markets and bargaining power of this industry in response to final customers ,time was not considered as a competitive factor .

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