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An Analysis of the Relationship Between Supply Chain Agility and Leanness and Supply Chain Performance in the Industrial Plants of Hormozgan Province

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Abstract: The present research aims to analyze the relationship between supply chain agility and leanness and supply chain performance. Agile supply chain and lean supply chain have been regarded in this research as factors that affect the performance of supply chain. For this purpose, a questionnaire was prepared with the aim of assessing the relationship between the research variables and was distributed among the research sample. In this research, the middle managers and the operational managers of Hormozgan industrial companies were regarded as the research population and 104 managers among them were selected as the research sample.

Key words: Supply chain agility, leanness, supply chain performance, industrial plants, structural equation model

INTRODUCTION

With the increasing globalization of economy, efficient supply chain is one way to survive the competition. A big challenge for any company is a response to uncertainty due to the growing demand (Hassler, 2004). Acceleration of technological changes has shortened the products' life cycle. These challenges have led to the increased competition among the local companies as well as among domestic ones. As a result, a focus on supply chain management should move from cost to a response to the external stimuli of the market (Christopher, 1992).

Not very long ago, many organizations had chosen lean thinking to manage and improve their competitive position, after which the idea of agile production was focused on as an alternative to lean thinking. Agility has been introduced as the next step after leanness in some phasing (Tabriz and Rahimi, 2009). Rapid reaction to customers' needs, the very hard competition in the market and the increased environmental changes are problems nowadays faced by organizations (Power *et al*., 2001). In such an environment it is impossible to manage and control organizations using the traditional methods. An effective reaction to these changes and achievement of competitive advantage involves access to organizational agility (Jafarnejad and Shahaei, 2007). Since, supply chain plays an important part in organizations' success, the importance of the entrance of the agility concept into supply chain increases because such a chain can react to the changes of the market rapidly and more effectively (Teece *et al*., 2007). Therefore, it is believed that agility will be needed for the coming competitive pressures of organizations and for achievement of competitive advantage.

An agile supply chain can properly react to the changes that occur in the environment (Tizro *et al*., 2011). Agility in supply chain can be defined in this way: "the ability of a supply chain to react rapidly to the changes of the market and the customers' needs" (Jafarnejad and Shahaei, 2007). Agile supply chain can be defined as a structure with the goal of customer and employee satisfaction in which any organization can design its own business strategies, processes and information structure and systems (Shahaei, 2006).

The supply chain agility of any organization is an important factor that affects the general competitiveness of the organization (Swafford *et al*., 2006). Obviously, supply chain agility will enable a manufacturing factory to reach a higher level of agility in the organization. Supply chain agility will enable an organization to react effectively and rapidly to market turmoil and other cases of uncertainty and will consequently allow the organization to achieve a special higher competitive position (Jafarnejad *et al*., 2013). Moreover with the agile processes of supply chain, an organization will have more sensitivity to match supply and demand and will be able to achieve a shorter cycle to present its products. Agility of the supply chain of an organization will directly affect its ability to make new products and deliver them to customers (Jafarnejad *et al*., 2013).

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Considering the points mentioned above, the questions raised here are about the relationship between supply chain agility and supply chain performance and the relationship between supply chain leanness and supply chain performance. The main concern of the present research is to find an answer to these questions. Actually, the main concern of this research is to analyze the relationship between agile supply chain, lean supply chain and supply chain performance.

Literature review

Supply chain: The term "Supply Chain Management" (SCM) was first introduced to the literature by Keith and Webber. These two researchers believe that the goal of a supply chain is that logistics becomes the main concern of management. Since, only senior management can solve and create a balance between the conflicting objectives throughout the supply chain, the systems integration strategy which reduces the risk level has been developed and implemented. They believe that it is a difficult and challenging job to coordinate the mudas, information and cash flows in a big multinational company. Supply chain is a complicated system which like an organization has a large number of simple components that interact with one another as well as with the environment and share information with one another and correct their internal structure through these interactions. In terms of interaction with the environment, supply chain can be regarded as an open system. Like any other organism, supply chain continuously gets inputs from and gives outputs to the environment (Chandra and Grabis, 2007).

The goal of a supply chain is to have the right output at the right time. When the customers' needs change, the supply chain managers respond by changing the price that customers pay to use the resources. Therefore, supply chains are primarily managed with negative feedback cycles. Since, supply chains include time delays, they move toward fluctuation and the production and the assets become either more or less than the right level. However, there is much more fluctuation in parts and raw mudas than in the final products. Three features of supply chain are phase fluctuation, acceleration and delay. When fluctuation spreads from a customer to the supplier, this fluctuation is accelerated along with time delay. Acceleration and fluctuation is different from consumption to production in specific industries (Sterman, 2000).

Agility in supply chain: Agility can be described as a management concept for response to the turbulent and dynamic markets and customers' demands. Actually, agility is involved not only with responding the customers but also with utilizing and achieving advantages from these changes. In order to be able to provide responsiveness, companies should have congruous capabilities in several areas such as product development, construction and logistics. Certain competencies are needed for these capabilities in each one of these areas (Jafarnejad and Darvish, 2009).

Agility in a supply chain refers to the ability of supply chain and its members to cooperate rapidly with the networks and to adapt themselves with customers' changing requirements. Tolon regards supply chain agility as the effective merge of supply chain and emphasis on very close and long-term relations with consumers and suppliers (Tolone, 2000). Supply chain agility should be defined in the following way: supply chain agility refers to the ability of a supply chain to respond rapidly to the changes of the market and to customers' wants (Sharp *et al*., 1999).

Obviously, supply chain agility will enable a manufacturing factory to reach a higher level of agility in the organization. Supply chain agility will enable an organization to react effectively and rapidly to market turmoil and other cases of uncertainty and will consequently allow the organization to achieve a special higher competitive position. Moreover with the agile processes of supply chain, an organization will have more sensitivity to match supply and demand and will be able to achieve a shorter cycle to present its products. Agility of the supply chain of an organization will directly affect its ability to make new products and deliver them to customers. However, Swafford *et al*. (2006) believe that thesupply chain agility of an organization is a vital factor that influences the general competitiveness of that organization (ZandHesami *et al*., 2009).

The dimensions of agile supply chain: Venkatraman and Henderson believe that agility in competition or responsiveness of supply chain is examined in terms of the stage of maturity of the supply chain. The main challenge of supply chain is supplying, improving, modifying and ensuring the balance among the following three dimensions.

The first dimension (interaction with customers): The first stage includes remote customer experience of the products, during which attempts are made do display the product to customers. For this purpose, it is useless to use sales catalogs, display the products on TV on the web and internet shopping in order to make the products accessible to customers who are geographically dispersed. In other words, the company recognizes the

customers' priorities through virtual tools in order to produce the goods based on their orders which is the second stage of evolution. In the third stage, the order-based production will lead to consumers' recognition (Jafarnejad *et al*., 2013).

The second dimension (configuration of the assets): Due to interaction with customers, the form of the assets is evolved from the outsourcing of mudas and parts into the interdependence of commercial processes. This means that the vital commercial processes are delegated to the supply chain parts instead of external outsourcing. Finally, these commercial processes which are interdependent and may have been dispersed in terms of place and time progress toward coalitions for resources. At this stage, companies cooperate with one another and share their knowledge and capabilities of the resources in the World Wide Web (Keihan, 2015).

The third dimension (leveraging the use of knowledge): Agility in supply chain involves that team work and the free flow of information among the business units, rather than individuals'competencies should be emphasized. At this stage, the company tends to penetrate not only in the employees and the working teams of the competing companies but also in the companies themselves. This is done by establishing global communication and making a community of professional experts (Venkatraman and Henderson, 1998).

Lean supply chain: Lean production is done based on five principles of lean thinking with the aim of creating value stream, removing the mudas and wastes of the company, maximizing the value stream process and creating flexibility in operations. Supply chain management has deficits or shortcomings despite its numerous advantages. Lean supply chain management is suggested for optimization of supply chain management and for removal of the shortcomings. Lean supply chain management is formed by removing the extra production, extra transportation and other extra things and also by improving the product distribution network.

The lean production principles beyond the production borders enable companies to be flexible and profitable more than they were before. Therefore, it is very important nowadays to merge leanness and supply chain management and experts find the goals of supply chain such as reduction of the mudas and enhancement of profitability and flexibility as goals common with the leanness fundamentals and try to find and remove the factors that put the leanness of supply chain under question. Merging these two categories leads to lean supply chain with the aim of supplying the product with the lowest price and the highest value added (from the customers' perspective). Recognizing mudas in the chain, presenting appropriate strategies to remove them and raising the assessment indicators all will help reach a lean supply chain.

In order to make a supply chain lean, the first step is to specify the area for examining the value stream, then the mudas in the area should be recognized and strategies should then be provided in order to remove the mudas. Finally, after implementation of these strategies in the supply chain, their effect on the performance evaluation indicators should be assessed.

MATERIALS AND METHODS

This research is a descriptive-survey research in terms of data collection method. In descriptive research, researchers seek to describe the research subject and for this purpose, they collect information to test the research hypotheses or to respond the questions that are related to the current status of the subject (Sarmad *et al*., 1997). The research population includes the middle managers and the operational managers who are active in the industrial plants of Hormozgan Province whose number was 142 and the sample size was determined as 104 managers by use of Cochran formula. We have used a standard questionnaire in order to collect the required data and have used SEM (Structural Equation Model) in order to analyze the collected information and have used Lisrel Software for this purpose. We have also used SPSS Software in order to test the research hypotheses. It is noteworthy that the reliability of the questionnaire used in the research has been measured with Cronbach's alpha and its results have been shown in Table 1. The following results show that the questionnaire items have good reliability.

Analysis of the research data

Fitness test of the conceptual model: The goal of evaluating the fitness of the model is to determine the degree to which the model has compatibility and conformity with the empirical data used in the research. There is a large set of fitness criteria and indexes that can be used for measuring the fitness of the model. The

Table 1: Reliability of the questionnaire

Row	Variables	Cronbach's alpha coefficients
1	Supply chain agility	0.806
2	Supply chain leanness	0.902
3	Supply chain management	0.879

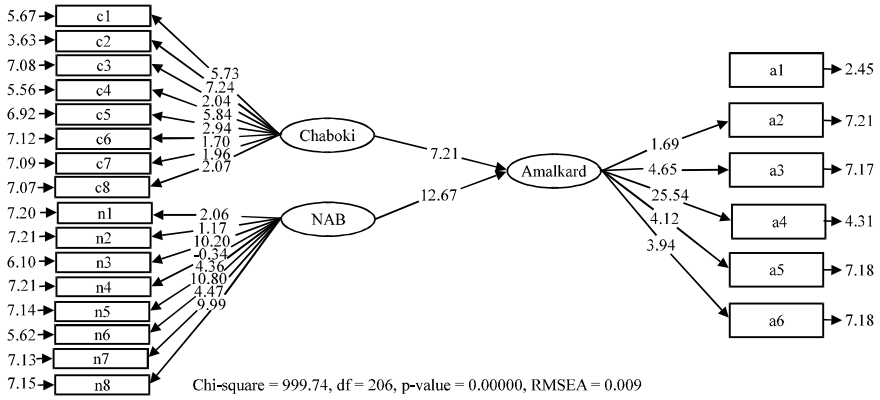

Fig. 1: The significant numbers of the research structural model

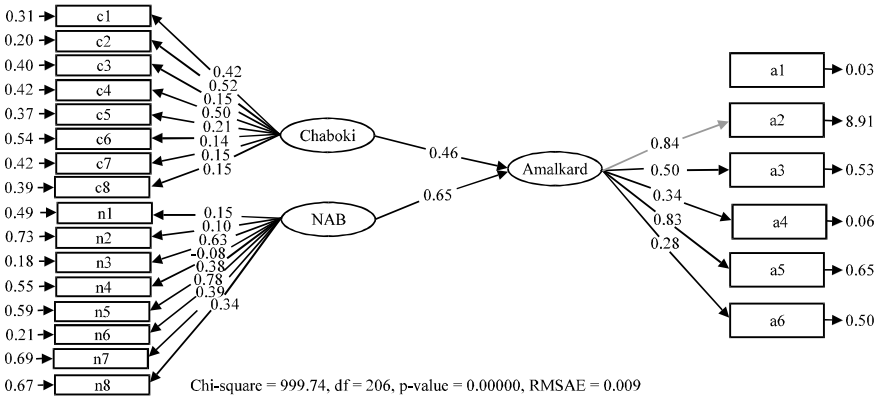

Fig. 2: The standard estimation coefficients of the structural model of the research

conceptual model of the research is displayed in this part by use of a path diagram and its fitness is assessed using different methods. A complete model of structural equation is actually a mix or combination of a path diagram and CFA (Confirmatory Factor Analysis).

Figure 1 shows that the effects of the independent variables (supply chain agility and leanness) on the dependent variable (supply chain performance) is significant (because the values of significance are greater than 1.96). Figure 2 also shows that the rate of influence of supply chain agility on supply chain performance is equal to 46% and the rate of influence of supply chain leanness on supply chain performance is equal to 65%. Based on the model presented in the research, one can come to the conclusion that the relationship among all of the components mentioned in the research model is significant.

Testing the research hypotheses

The first main hypothesis: There is a significant relationship between supply chain agility and the supply chain performance of the company.

Table 2: The output of the relationship between supply chain agility and supply chain performance

Path coefficient (β)	Significant number t-value	Path To variable	From variable
0.46	7.21	Supply chain performance	Supply chain agility

The results of the equations of the conceptual model for the relationship between supply chain agility and supply chain performance have been shown in the following Table 2.

As shown in Table 2, the level of significance between supply chain agility and supply chain performance is equal to 7.21 which is greater than 1.96, showing that the relationship betw supply chain agility and supply chain performance is significant at 99% level of confidence. The path coefficient between the two variables is also equal to 0.46, showing the rate of influence of supply chain agility on supply chain performance. Therefore, the first main hypothesis of the research is confirmed. The symbol of path coefficient between the two variables indicate that supply chain agility has a positive effect on supply chain performance.

Table 3: The output of the relationship between supply chain leanness and supply chain performance

Path coefficient (β)	Significant number t-value	Path To variable	Path From variable
0.65	12.67	Supply chain performance	Supply chain leanness

The second main hypothesis: There is a significant relationship between supply chain leanness and the supply chain performance of the company.

The results of the equations of the conceptual model for the relationship between supply chain leanness and supply chain performance have been shown in Table 3.

As shown in Table 3, the level of significance between supply chain leanness and supply chain performance is equal to 12.67 which is greater than 1.96, showing that the relationship between supply chain leanness and supply chain performance is significant at 99% level of confidence. The path coefficient between the two variables is also equal to 0.65, showing the rate of influence of supply chain leanness on supply chain performance. Therefore, the second main hypothesis of the research is confirmed. The symbol of path coefficient between the two variables indicate that supply chain leanness has a positive effect on supply chain performance.

RESULTS AND DISCUSSION

The main goal of this research is to analyze the relationship between supply chain agility and supply chain leanness on supply chain performance in the industrial plants of Hormozgan Province. As it was mentioned earlier, if a company is able to use the concepts of agile supply chain and lean supply chain completely and precisely it can create more competitive advantage than its competitors in today's motarakem market. Therefore, the two variables supply chain agility and supply chain leanness have been regarded in this research as the main variables of the research and their effect on supply chain performance as the dependent variable of the research has been assessed. The variables supply chain agility and supply chain leanness have been shown to affect supply chain performance with the rate of 46.5 and 65%, respectively. Consequently, the two hypotheses of the research are confirmed.

SUGGESTIONS

Suggestions for those who are active in industry:

- Suggestions based on H_1: there is a significant relationship between supply chain agility and supply chain performance of the company

A basic concept in supply chain agility is high flexibility and rapid response to market changes. It was shown in this study that mosst of the industrial capacities of the plants under study do not have enough ability and speed for suitable and timely reaction to the changes of the market. Therefore, recommend that the senior managers of the industrial companies of Hormozgan Province prioritize the most important component of supply chain agility, i.e., flexibility in order to be able to react rapidly to different changes of the market (such as a decrease or increase in market demand, the changes of exchange rate, changes in the suppliers' conditions and so on).

Another main component in supply chain agility is supplying customer satisfaction. Customer satisfaction actually refers to his repurchase from a company due to the values that he has achieved in his past experiences. Today, customers are considered the basis of business and market approach. Therefore, supply chain should have a strategic look at customer satisfaction. One way to achieve customer satisfaction is to use the concepts of agility in supply chain. Accordingly we recommend that the managers of the industrial plants of Hormozgan Province use the concepts of supply chain agility in order to achieve more satisfaction among their customers and create appropriate competitiveadvantage for themselves.

- Suggestions based on H_2: there is a significant relationship between supply chain leanness and supply chain performance of the company

The concept of (Lean) is primarily based on reducing different types of wasteat all stages of production. One of the most important stages of production in any company is the operation related to logistics and supply chain. Lean supply chain also focuses on the reduction of mudas and finally the reduction of the production costs. Therefore, considering the lack of use of lean concepts in the supply chain of the companies under study, we recommend that the managers of the industrial plants of Hormozgan Province make a precise and strategic plan to make their supply chains lean.

One of the very important wastes in supply chain is the wastes that are made during transportation of products. Among these wastes are the waste of energy and fuel that occur during transportation. Supply chain leanness can reduce these wastes and finally reduce the current prices and the costs of industrial companies. It is recommend in this regard that the managers of industrial companies use the concepts of leanness in their own supply chains and thus take practical and effective measures to reduce their production costs.

CONCLUSION

After distributing and collecting the questionnaires, we investigated the results and validity of the research

hypotheses. We used structural equation model in this research to analyze the relationship between the variables and utilized LISREL Software for this purpose. We also used SPSS Software to test the research hypotheses. The statistical tests showed that the research hypotheses are confirmed.

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