

## Performance Evaluation of the Supply Chain in Persian Gulf Petrochemical Holding Company

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### Abstract

Holding, is a company which is obtained from acquisition of companies. In Holding, a larger company buys the shares of smaller companies and the smaller company, without losing its independence, performs under the policies and strategies of the larger company. This study aims to evaluate the performance of supply chain in the Holding company of Persian Gulf Petrochemical. The SCOR model has been used in this study in order to evaluate the performance of the supply chain. SCOR is a process-based model in which the five main areas of supply chain processes (planning, resources, establishing, sending, and returning) are defined and determined. Each one of these areas contains processes and the accurate implementation of activities associated with each one, and ensures the efficiency and effectiveness of the given supply chain. The data analysis results confirm both of the research hypotheses. Therefore, it can be said with 95% confidence that there is a significant difference between the current situation of the supply chain in the Holding company of Persian Gulf Petrochemical, and its favorable situation. The second research hypothesis is also confirmed. In other words, the most important drawback in the supply chain, from the standpoint of SCOR model, is related to the planning process.

**Keywords:** Performance Evaluation; Supply Chain; Holding; SCOR Model.

### Introduction

In today's markets, technological and competitive factors grow at such increasing rate that makes it difficult and economically cost ineffective for companies to generate what they need. Instead, outsourcing has become one of the main strategies of the companies. Also, the rising trend toward globalization and focus on customers has led to the sensitivity of the logistic issue in the organization planning. Supply chain management, is the approach that has emerged from the heart of this issues (Gunasekaran & Tirtiroglu, 2001). Supply chain management, as one of the paradigms of twenty-first century manufacturing, has attracted more attention in order to enhance organizational competitiveness (Gunasekaran, 2004). Therefore, we are witnessing a rapid growth in theory and practice of this field (Schneeweiss, Zimmer, & Zimmermann, 2004). Supply chain management, faces with some challenges; such as establishing trust and cooperation between supply chain partners, determining the best measures that can facilitate the alignment and integration of the supply chain process, successful implementation of the latest information systems; both computer and internet technologies which enhance the efficiency, performance, and quality in the supply chain (Robinson & Malhotra, 2005). Considering the successful cases, the more companies move toward supply chain management, the more important performance evaluation of supply chains become. Traditional evaluation methods, however, are not as related to supply chain management, because their relevant area is very limited and they cannot assess a wide range of activities. In the last decade, supply chain management has witnessed impressive growth in the publication of theories and practices in this area. However, it should be noted that the topic of evaluation of supply chain

performance has not received sufficient attention by researchers and experts (Theeranuphattana & Tang, 2008). Despite many studies that have been conducted on various aspects of supply chain management, findings of other studies also reveal that little attention has been given by researchers to evaluate the performance of the supply chain (Gunasekaran et al., 2001).

#### ***History and the Concept of Supply Chain***

In the 90s, along with improvements in manufacturing processes and application of reengineering patterns, many industry executives found that improving internal processes and flexibility in the capabilities of the company are not enough for continued market participation, but also suppliers of parts and materials should produce products with best quality and lowest cost and distributors of the products should also have close links with the manufacturer market development policies (Tummala, 2006). With such a view, approaches to supply chain management emerged. On the other hand with the rapid development of information technology in recent years and its widespread use in supply chain management, many major supply chain management activities are being conducted with new methods (Cox, 1999).

According to Loddon (2002), supply chain is chain that contains all activities associated with the flow of goods and conversion of the raw material, from raw material preparation to the final delivery to the consumer. There are two other flows parallel to the flow of goods; information flow and the flow of funds and credit (Ganeshan & Harrison, 1995). On this basis, supply chain management focuses on integration of supply chain activities and also related information flows through improvements in the supply chain relations in order to obtain reliable and sustainable competitive advantage (Lummus, 1999).

By briefly investigating the history of the concept of supply chain management, three major periods can be seen (Anderson et al., 1997); the period of production for warehouse (1960-1975), customer attraction period (1975-1990), and supply chain management period which began in 1980. In this period, through using reengineering patterns and modification of manufacturing processes, managers found out that they have to focus their policy and attention on customer relationship management, information, and supply of materials and they also have to bring the processes under control and generate continuous improvement in order to survive and continue their presence in global markets. In this period the supply chain begins to form and rapidly develop. With the advancement of technology, especially the rapid development of information technology in recent years and its widespread use in supply chain management, nowadays many major chain management activities are being performed using the new approaches (Azar et al., 2011).

Montezeka & Morgan (1997) argue that: "the integrated supply chain management tries to look from the perspective of an external customer and then manage all processes to horizontally provide value to him/her". To this purpose, these authors believe that chains compete with each other, not companies, and the key to victory is creating a complete management and leadership strategy for a totally integrated supply chain, including external customers, suppliers, and their suppliers and etc. (Lummus, 1999).

Cox (1993), defines the supply chain as follows: "First, processes that connect the customer to the suppliers from the beginning of raw materials to final consumption of the finished good, and second, set of tasks inside and outside the organization that activates the value chain in order to create products and customer service".

Alam & Cooper (1993), regarding supply chain management, state that: "... an integrated philosophy to manage all flows over distribution channels, from the supplier to the final customer".

#### ***Performance Evaluation System***

Performance evaluation is one of the key activities of management and selecting an evaluation system to achieve these strategic objectives is placed at the heart of this issue. For this

reason, designing a performance evaluation system is very important. This leads to a very important question: "How can we design a performance evaluation system and keep it up to date?". The real challenge in answering this question is achieving an overall picture and realizing that a suitable solution cannot be applied to every situation. Principally, these relationships indicate the formation of a coherent and united collection. Strategy is defined by considering restrictions that are imposed by operational standards which constitute the main indicators of quality for competitiveness; market and economic activities which determine the nature of the competitive advantage they need to succeed; shareholder and beneficiaries expectations regarding financial performance; macro environment, which indicates boundaries of acceptable measures for organizations from the viewpoint of knowledge, skill, resources and manpower. Although the performance evaluation system is an integrated and coherent system, but it is made up of five major elements and components. Balance of system comes from the application of the Balanced Scorecards, or other assessment tools. The structure of this system arises from the knowledge and understanding of that complex of issues which make up the organization's competitive advantage. This structure should be strongly affected by the operational inputs to ensure that the performance evaluation system is not very isolated and unaware of the capabilities and operational practices. The design of the evaluation system should be determined and shaped by the strategy (which points the favorable condition toward the organization in terms of direction) and system administrators and employees (which are directly and practically associated with the system). Another one of the inputs of design system is related to the reflection data obtained from assessment systems and proper feedbacks to eliminate distortions and implementation of the necessary modifications. The element of focus in performance evaluation is related to the determined evaluation indices. This focus is regulated based on the strategy and also scientific and actual results and finally, reflection of the actual functionality of the operational system is necessary. Accordingly, it is possible to momentarily and permanently redefine the competitive objectives and to continuously improve the capabilities of the organization and principal guidelines.

Performance evaluation activities maintain the strategic and operational aspects of the organization and must provide key data for vital aspect of knowledge management, planning information, controlling and monitoring progress. Also, these activities must adapt themselves and be closely associated with the changes in the market and operation environment in order to be leading the way for active management (Shepherd, 2006).

### **Research Background**

Kumar & Yamaga (2007), investigated the dynamic modeling of a supply chain in the Environmental Friendly Automotive Industry in Japan. This investigation has used Dynamics of Systems and the ARIMA method to present a hybrid approach to modeling, performance measurement, and stability of supply chain.

Sachan & Sahay (2005), conducted an investigation entitled "Modeling of grain supply chain total costs in a supply chain of grains in India" with the aim of understanding and predicting future earnings on the chain in different situations and also providing policies to reduce the total cost.

Campuzano (2010), investigated the supplier-buyer relationships and the impact of information technology on it, reduction of bullwhip effect in medical and health services, generation of a model for evaluating supply chain performance for pharmacies, and demand modeling in supply chain using fuzzy estimations.

Sharifi et al., (2007), analyzed the key topics of strategic supply chain management, one of which is the long-term capacity planning, and investigated the capacity planning policy for the management of food chain with unsteady flows of overdue and parameters of market constrains.

### **Performance Evaluation Indicators in Supply Chain**

Numerous attempts have been done to explain the performance evaluation indicators in supply chains, each of which involve different view and approach regarding the classifying and grouping of the mentioned indicators. Some examples of these include:

- Focus on the quality or quantity of indicators, which is considered in the studies of Beamon (Beamon, 1999).
- What they measure: Gunasekaran and also Tony (2001), focused on the issue of relationship between indicators and expenses; Schneeweiss (2004), focused on quality, cost, flexibility, and delivery; Chan (2003), focused on cost, quality, resource utilization, flexibility, transparency, trust, and innovation; Beamon (1999), focused on resources, output, and flexibility; Hiber focused on the form of efficiency in supply chain, combination, and efficiency of coordination; Chan (2003), focused on input, output, and process (Beamon, 1999).
- Attention to strategic, operational, or technical focus which studies of Gunasekaran (2001) have been focused upon (Beamon, 1999).
- Process in the chain which these indicators are related to and have been the focus of investigation conducted by Chan & Key (2003), Hong et al. (2004), Lakamy & Mac Carmac (2004), and Stephens (2001). (Beamon, 1999).

### **SCOR Model**

Supply Chain Operations Reference Model is expanded by the Supply Chain Association. This association is an independent and non-profit organization which created this model as an inter-industry standard. The three main levels of SCOR model have been expressed by the Supply Chain Association as follows:

– The first level of SCOR model: The first level of SCOR model, which is also called the Perfect Level, defines the scope and content of supply chain management processes at the highest level, namely the Strategic Level. Processes at this level are:

1. Planning: Local resource assessment and sources of supply chain, collection and prioritization of demand and requirements of demand, planning for supply chain, planning for sourcing, production planning, distribution and delivery planning, and finally planning for the provision of after-sales services and return.

2. Sourcing: implementation of sourcing programs, receiving the raw materials, inspection of incoming materials, attempts to pay for the raw materials or the finished good which have been received from the upstream supplier.

3. Manufacturing: implementation of manufacturing program, requesting and receiving the raw materials, designing, manufacturing, assembly, and testing and packaging of goods.

4. Delivery: implementation of delivery program, order management processes, selecting carriers, delivery, and processing invoices.

5. Return: implementation of return program, return of faulty goods, warranty services, the return of extra deliveries.

– The second level of SCOR model: the second level of SCOR model which is also called the configuration level, classifies the supply chain processes into three main categories:

Planning processes, implementation processes, and empowerment processes. Planning processes contain of all the necessary processes for implementing supply chain which consist of: the entire chain planning, sourcing, manufacturing, delivery, and return. Implementation processes, cover all processes that change the state of materials received from the source towards finished

good. These processes fall into four categories which can be classified into three general types in the SCOR model: manufacturing goods to the store at the warehouse, manufacturing goods to deliver, engineering goods to order (Fayez, 2005).

– The third level of SCOR model: This level, which is also called the breakdown level, separates the processes of the second level into equivalent micro-processes. Each process in this level is generally defined and each input and output is determined. The supply chain forms at this level and process elements are demonstrated in terms of planning and capability in a logical sequence (SCC, 2004).

### **Research Tools**

In addition to library documentations and some interviews with experts of Holding Company of Persian Gulf Petrochemical, questionnaires have been used as the most important data collection and analysis tools. Therefore, the internal consistency and Cronbach's alpha methods have been used in order to assess the reliability of the questionnaires. Cronbach's alpha value was 0.866 for the questionnaire related to the experts.

### **Statistical Population**

60 questionnaires have been distributed among experts and specialists of Holding Company of Persian Gulf Petrochemical in order to conduct the statistical analysis in this study.

### **Research Hypotheses**

– According to the SCOR model, there is a significant difference between the current situation and the favorable condition of supply chain of Holding Company of Persian Gulf Petrochemical.

– The planning process is the primary weakness of supply chain of Holding Company of Persian Gulf Petrochemical.

### **Data Analysis**

#### ***First hypothesis testing***

The first level indicators of SCOR model based on the table 1, have been used to test the first hypothesis in order to evaluate the overall condition of the supply chain in the Holding Company of Persian Gulf Petrochemical.

Wilcoxon's Signed Rank Test has been used to test the hypothesis and the results, using SPSS software, are expressed in the following table. T\_V\_C symbol represents all the variables of interest in current situation and T\_V\_I symbol indicates all variables in favorable condition.

Accordingly, at the error level of 95%, critical point based on the normal distribution table is equal to 1.96. Thus, it can be said with 95% confidence, that there is a significant difference between the present supply chain conditions in the Holding Company of Persian Gulf Petrochemical and its favorable condition. Therefore, the first research hypothesis is confirmed.

**Table 1. Performance indicators of SCOR model**

Delivery reliability in the supply chain	Delivery Performance
	Rates of completed orders
	Correct completion rate

Accountability of supply chain	Specified time of delivery
Flexibility of supply chain	Chain response time
	Manufacturing flexibility
Supply chain cost	Cost of goods
	The total cost of supply chain management
	Added-value efficiency
	Cost of Warranty / return of goods
Efficiency of asset management in the supply chain	Cash to cash cycle time
	Inventory save time
	Gains from assets

**Table 2. Wilcoxon's Signed Rank Test**

Sum of Ranks	Mean Rank	N	Rank	
12968.00	147.05	74a	Negative Ranks	T_V_I-T_V_C
37464.00	160.86	246b	Positive Ranks	a T_V_I < T_V_C
		427c	Ties	b T_V_I > T_V_C
		564	Total	c T_V_C = T_V_I

**Table 3. The test statistic and area under the curve based on the Wilcoxon's Signed Rank Test**

Statistic	Comparing the current and favorable situation
Z	-6.213
0.000	Asymp.sig.(2-tailed)

***Second hypothesis testing***

The second hypothesis of this research introduces the planning process as the most important filed for improvement among the five different processes of SCOR model. In order to test this hypothesis, Friedman's method is used and the results are shown in the table below.

**Table 4. Mean ranks of model processes base on the Friedman's test**

SCOR Processes	Mean Rank
Planning Processes	2.64
Delivery Processes	.74
Sourcing Processes	2.3
Manufacturing Processes	3.63
Return Processes	3.85

**Table 5. Determining the Friedman's test statistic**

N	60
Chi-Square	27.236
Df	4
Asymp.sig.	0.000

According to table 5,  $\chi^2$ , critical value with 4 degrees of freedom, 5% confidence level, and 9.487 can be extracted. Because the value of the test statistic is greater than the table value, it can be said that the viewpoint of experts regarding condition of the five processes of Holding Company of Persian Gulf Petrochemical are different and ranking them is essentially impossible. Therefore, the

second research hypothesis is also confirmed. In other words, based on the SCOR model the primary weakness of supply chain of Holding Company of Persian Gulf Petrochemical is related to the planning process.

### Conclusion

Development of Holdings and improving its efficiently, face numerous difficulties and obstacles and the Holding Company of Persian Gulf Petrochemical is no exception. The obtained results from analysis of data from experts and specialists show a significant difference between the current and favorable situations of supply chain of Holding Company of Persian Gulf Petrochemical. Generally, there is no strategic plan regarding the elements in this category as a supply chain and therefore, the decision makers of this organization are not concerned with organized efforts to coordinate the elements of the chain. In this respect, each of the companies involved in this chain, act completely separate and independent and Holding, as the major shareholder in most of these companies, focuses solely to financial issues. Surely, if the authorities in this organization act towards the harmonization of processes and operations in a manner fully integrated and interconnected, this chain shall provide suitable profitability for every circle within in.

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