



The prospect of using concurrent engineering for enhancing supply chain efficiency and reducing costs in the hospitality sector

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Abstract

The research aims to show the role of concurrent engineering in enhancing supply chain efficiency and reducing its costs. The Baghdad Tourism hotel suffers from many problems, including inappropriate pricing and poor quality of services that is rendered to customers. There are many tourist services provided efficiently by competitors in the hospitality sector to the customer. This factor has led customers to go to other rival companies, decreasing the revenues and leading to the loss of any competitive advantage. Supply chain costs rises lead to higher total tourism service costs. The research uses a statistical questionnaire on (60) respondents in the company leading to hypothesis testing by a statistical program (SPSS). Findings significantly showed that costs of supply chain activities can be reduced if services rendered are carried out concurrently by eliminating similar activities. Concurrent engineering is a tool which enhances supply chain capabilities by reducing the costs and increasing the revenues. The statistical analysis showed that the general average of research variables in which the calculated value of (T) amounted to (6.786) which is greater than the tabled value of (T) amounted to (1.671) with a degree of freedom (59) and a significant level (5%). This led the researchers to accept the research hypothesis. This study shows the concepts of concurrent engineering and supply chain can be integrated. Many of the previous studies refer to the study of concurrent engineering or supply chain separately, thus this is somewhat unique. The research presents important recommendations represented by the need to use the technique of concurrent engineering to reduce the supply chain costs such as purchasing, transportation, storage and quality costs. These recommendations may enhance the company's future performance.

Keywords: Concurrent engineering, supply chain, cost, efficiency, performance.

Introduction

Some tourism companies suffer from deterioration and failure in their work practices. There is a set of continuous changes in the supply chain and increases in their costs, and also increased inventory levels. Provision of services that do not meet the customer's needs and desires in addition to orders by the suppliers being late is problematic. Transport costs, inventory retention costs and other supply chain costs require the use of concurrent engineering to develop the services, rationalize the costs and increase the supply chain efficiency. The importance of this study stems from the showing of concepts of the concurrent engineering and the supply chain as integrated. Most of the previous studies refer to the study of concurrent engineering or supply chain separately. The study shows role of concurrent engineering in supporting the

supply chain efficiency and reducing its costs. Studying and analyzing the forces of competition, threats and opportunities that attain company goals. The Iraq companies suffer from many problems represented by the lack of services to attain reaching customers' desires. The local markets faces competitors' services with the appropriate specifications that serve the customers' desires. This factor leads to a decrease in company services revenues and the loss of any competitive advantage in addition to rising supply chain costs. The research aims to demonstrate the role of concurrent engineering in enhancing the supply chain efficiency and reducing the costs for a hotel operation. Six sigma is an option of course, because it is a method that provides organizations tools to expand the ability of their business processes. This increase in performance and reduction in process discrepancy helps lead to defect reduction and improvement in profits, greater employee morale, and superior quality of products or services.

In all organizations there needs to be a steady commitment to doing the best job possible and making the best decisions. Six Sigma requires that the hotel guest be prioritized as the first step to effectively restore an issue of defective service that has been created by a service provider. Six Sigma then is a process of reducing defects by analyzing the methods and business processes of hotels, which are defective in terms of efficacy, and then crafting high quality ideal products and services. Where there are defective processes and services, strategies for change and improvement [including the supply chain] should be introduced and endorsed, so as to meet and exceed customer needs towards excellence. (Ramphal & Nicolaidis, 2018)

Literature Review

The part shows some related studies which provide a theoretical base. Bogus, Molenaar and Diekmann (2005), studied the "Approach of Concurrent Engineering to Reduce Design Delivery Time". The aim of the study was to reduce the delivery time of the mechanical industry design. The implementation of the design was based on simultaneous instead of sequencing to achieve time savings and the minimum possible errors. The determination of the steps required for the concurrent engineering application in the field of mechanical industries and the submission of proposals that would improve the performance is important. Kowang and Rasli (2011) examined "New Product Development in multi-location R&D organization: A Concurrent Engineering Approach". Their study aimed to demonstrate the role of concurrent engineering in developing new products by focusing on research, development and design to achieve customer needs in order to improve the functional advantages of the product or service and reduce its cost. Mani, Manikandan and Manikandan (2015) Studied "design of Manufacturing Based on Concurrent Engineering". The study aims to demonstrate role of the technique of concurrent engineering in the design process. It activates the design for multiple purposes through the integration of modern manufacturing techniques by using computers, expert systems and advanced communication networks. Varoutsas and Scapens, (2015) examined "The governance of inter-organizational relationships during different supply chain maturity phases".

The aim of this study is to implement the supply chain to show the evolution of the supply chain concept and the importance of the supply chain. It manages the relationships among the chain in recent years. The literature indicates that concurrent engineering is a summary of the best applications developed in the production to solve various problems encountered during product development (Makinen, 2011). The concurrent engineering represents a business strategy that replaces the part of traditional product or service with one of the tasks that works in parallel to develop the product or service. It is a systematic method of integrating the products, service and

process designs simultaneously in the production. It supports the product life cycle in the company as well as the quality, cost and consumer requirements. Tenkorang refers to a multi-functional disciplined activity that starts from the pre-design to the end-of product life (Tenkorang, 2011).

The term concurrent engineering began to emerge in 1980 because the threats from the growing Japanese companies forced many USA and Western companies to look for practices and activities that develop production processes. The USA, Japanese and German companies use concurrent engineering in the automotive, aircraft, machinery, computer production to improve the quality and reduce the costs. It requires simultaneous thinking of product, service and work requirements by a group called the team of multi-functional concurrent engineering (Waller, 2004). The basic idea of concurrent engineering is responsible workers focused on design and manufacture of the product or service work together to achieve the same goals (Slack, Chambers & John, 2004). The concurrent engineering maximizes the value of the company and their competitive advantage grows. It develops their services and rationalizes their supply chain costs to making profits. On the other hand, the concept of the supply chain is relatively recent. Many studies confirm that supply chain management has become more important to meet the challenges of competition. Supply chain members have been able to follow the production processes for the product or service. The processes begin from obtaining the initial resources to market the product (Mouritsen, Larsen & Kotzab, 2003). The business community is now talking about supply chain management whether in large or small companies which gives great importance to the supply chain notion at the global level (Wei & Xiag, 2013).

Concurrent Engineering: The concept of concurrent engineering is the administrative method to develop and improve the product or service at an early stage of its life cycle to reduce the time and costs associated with it (Rush & Roy, 2016). While Ramana defines it as a strategy focused on optimizing and distributing the company's resources in the development and design processes. It ensures development of product efficiently and effectively, enhancing productivity and improving design quality (Ramana, 2012: 1). Groover (2004) sees it as an integration process of the design, manufacturing and other functions to reduce the time spent of delivering the new product or service to the market. The researchers believe that concurrent engineering is a technique which develops and improves all the stages of product or service life cycle. It leads to the reduction of time by integrating the processes of product or service design, production and others. The importance of concurrent engineering is illustrated by the following:

- The company's commitment to adjust its services and conduct development and courses in order to complete the tasks simultaneously.
- Investigate and cover the market needs to render services that can meet customer needs.
- Achieves the necessary quality, so that services comply with customers' expectations and needs and wants.
- Simplicity of resources and manufacturing methods necessary to facilitate and standardize procedures.
- Achieve the services required to ensure customer satisfaction at all stages of the product or service life cycle.

Supply Chain: Seuring and Goldbach define supply chain as an integration of activities related to the flow and conversion services from the raw material to the end-

user and improve supply chain relationships to achieve a sustainable competitive advantage (Seuring & Goldbach, 2002). While Awad and Asser define it as a system that works in the operation of companies through the cooperation between suppliers, customers and companies. It achieves benefits for all the parties and creates a competitive advantages (Awad & Asser, 2010). Schroeder defines it as a sequencing of the company's operations and information systems that provide the products or services from the suppliers to producers then to the final customer (Schroeder, 2007). While Pinor and Fender (2008) define it a successive steps of particular product manufacture or services rendered and distribute from the upstream to downstream or from suppliers to customers. Nezamoddini and others define it as an extensive network of suppliers, producers, distribution centers, retailers and warehouses. The supply chain can obtain raw material, transport and and deliver it to customers (Nezamoddini, Kianfar & Hosseini, 2011). The researchers believe that the supply chain is the common and integrated relations between the companies and its customers to achieve a competitive advantages. The supply chain starts from the suppliers , then moves to to the company and ends with the customers. The importance of supply chain management can be determined as follows according to some authors' (Wei & Xiag, 2013; Abdullah & Kadhim, 2019; Christopher & Gattorna, 2005; Kadhim, 2019):

- Implementing supply chain management is an inevitable and necessary choice for businessmen.
- It helps to gain competitive advantage by reducing costs and improving quality.
- it facilitates information exchange and maintains a high degree of market sensitivity.
- Helps quickly respond to market uncertainty requirements.
- It is an indispensable requirement for the social responsibility of the company.
- Providing knowledge through a variety of methods, processes, techniques and systems used to improve supply chain performance.
- Identify potential areas for improvement by studying the supply chain.
- Evaluating the required changes and modifications, reviewing the periodic performance and analyzing the value.
- Optimal use of resources leads to improved the profits and revenues within the company.

Integration of concurrent engineering and supply chain to enhance their efficiency and reduce their costs

The supply chain is one of the dimensions the concurrent engineering after the product or service design and the process design simultaneously. This is called the three dimensional concurrent engineering. The strategic nature of the supply chain design must be recognized in order to integrate with the product or service development processes. The integration of the supply chain with the concurrent engineering requires an integrated team, including the inside and outside members of the company (suppliers and others). This integration in business and activities achieves the following according to Cooper and Slagmulder (1997):

- Helping companies to find early opportunities before designing the product or service at the lowest possible cost.

- Contributing to obtaining new strategic information that enables companies to discover new generations of products or services.
- Providing products or services developed to the market at the lowest possible time and product or service development processes being implemented at the same time.

The companies seek to reach competitive advantage and develop their value. Cost reduction is one of the main factors to achieve competitive advantage. Costs must be low along the supply chain without neglecting any of their activities. This integration plays an important role in reducing the total costs of the final product or service, improving the selling price and increasing the company's profits. This requires attention to manage the cost, strategically. as an essential part of the cost control on all activities of the company. This includes the supply chain activities and reduce the costs of this chain as follows according to Adebisi and Rafiu (2013):

- **Purchasing costs:** The cost of raw material or supplies paid to suppliers including shipping costs and it consists of more than one category. The discounts vary with levels, volumes and credit terms of suppliers that affect the cost of purchase.
- **Cost of orders:** It includes costs related to preparing and issuing purchase orders. Then receiving and checking items that match incoming invoices, purchase orders, receipt records and the cost of obtaining purchase permits.
- **Storage and transportation costs:** The storage and transportation costs of goods available for sale and include the costs to be added to related inventory such as amongst others insurance, obsolescence, damage.
- **Quality costs:** The non-conformance costs with specifications and characteristics of the product or service to predetermined criteria.

The integration of concurrent engineering and supply chain requires the following according to Knipper (2010):

- The Supply Chain Cost Analysis for all the activities, functions and tasks directly related to flow the information about the product or service.
- Evaluating the level of positive cooperation based on cost data volume from the supply chain associated with the stakeholders in the chain.
- Identifying accounting techniques that can be applied in cost analysis and her study such as activity –based costing, target cost, concurrent engineeringetc. Dealing with suppliers to show the mutual costs and benefits of stakeholders in the supply chain.
- Identifying the significant supply chain costs that contribute in making decision by stakeholders in the supply chain such as the cost of transportation that depends on the means of transport used and the distance of the source of supply.
- Diagnosing the unit characteristics that are affected by the supply chain costs when making decisions.

Search hypothesis

This search depends on the following hypothesis: Concurrent engineering enhances the efficiency of the company's supply chain in the tourism sector, reducing product or service costs, increasing profits and gaining a competitive advantage.

Baghdad tourism hotel in Iraq

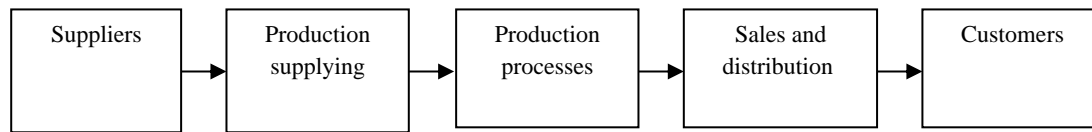
The 160 hotel rooms are air-conditioned and have private balconies. The hotel contains more than ten luxurious presidential suites in addition to two private wedding rooms. It also includes the Al-Baghdadi Restaurant and Café. It provides special conference and meeting rooms for various purposes with a maximum of 350 people and a minimum of 50 people. In addition it provides other services such as a wedding hall, health club and swimming pool. The company suffers from a lack of demand for its products or services due to competitors products or services in the tourism sector. The company also suffers from inefficiency of the supply chain as well as delivery time of the raw materials which are usually late. Recently, the Customers' desire for competitors' products or services has increased and has led to lower revenue, lower production levels, and declining market share in addition to a weaker competitive position. The company's market share is declining. In 2014 (5%), 2015 (4.5%), 2016 (3.5%), 2017 (2%) and 2018 (1.5%). Thus, it is noticed that the market share of the Baghdad tourism hotel has been continuously decreasing for 5 years. Customers tendency towards competitors' products or services due to different quality, price and specifications of the product or service between the preferences of the Iraqi customer and the viewpoint of the Iraqi company.

Study of the supply chain in the company

The supply chain design is important for achieving the success of the company. It affects the stages of preparation and production of the product or service for customers. It includes all internal and external suppliers to improve the quality of raw materials purchased at the lowest possible cost. It also includes finished products or services produced to customers with high efficiency and effectiveness that lead to achieving customer satisfaction and improving the company's profitability and value. It works to interconnection between raw materials, finished goods or final services, information and transactions. The suppliers are selected by the research and development department in the company. The study and analysis of the production situation of the company helps determine the requirements of production inputs to instruct the purchases committee to conduct studies and research of the market. Agents identify who provides the products or services with the specifications determined within the appropriate quality and cost standards and then instruct the finance department to buy them. Before the start of the production process, the idea of the product must be shaped by the design department.

The company conducts studies and research to develop or redesign existing products or services in order to determine customer needs and the ability of the company to meet those needs. After studying the available physical, financial and human capabilities, the technological path will be developed for the purpose of achieving the company's goals. The test process is carried out to determine the compatibility of the designs of the products or services and determine the operating methods of all production stages. Taking the necessary procedures to solve technical problems until the final product or final service is reached is vital. The company plans for providing its products or services at the prices determined by market research and according to the prices of similar products or services in the local market. The hotel includes several types of guests: Permanent guests of the employees of local and foreign companies, guests coming for travel and tourism purposes, guests coming for parties and weddings, guests coming without prior booking and others. The following figure shows the supply chain activities of this company:

Figure 1. Supply chain activities of the company



The problems facing the current supply chain in the company

Suppliers: The high cost of raw materials and the difficulty in obtaining them because the company did not care about the supply chain. The company is having difficulty providing raw materials for products or services. This requires the company to search for new and efficient suppliers. This factor leads to lower costs and avoid the product or service that does not meet specifications. Other competitors use good suppliers who are able to provide raw materials at the right quality and price. This has a major impact on the cost of the product or service and its quality. Another problem with the supply is the distance between the raw materials stores and the workplace, making this factor difficult to deliver these materials in time. In addition to the lack of transportation means that leads to a delay in the production process and the lack of sufficient warehouses within which to store the materials caused the high cost of spoilage and damage.

The production process: Failure to observe technical errors in the work within the study of research and development and the absence of immediate solutions that led to the provision of products or services that do not meet specifications. This also resulted in increased waste and incurred additional costs represented in the costs of re-operating the product or service to ensure its safety. Irregular power outages greatly affect work resulting in customer satisfaction not being achieved.

Sales and distribution agents: The failure of the company to adopt a distinct price policy resulted in the loss of some customers. The distribution ports are also inefficient because they do not depend on the cost and quality of the product or service in the pricing process. Customers resort to alternative products or services provided by competitors in the hospitality sector with appropriate price and quality. Also, the lack of ad campaigns discourages customers from obtaining company products or services.

After sales service: Represents the services that the company provides to its customers such as guarantees that win the customer's confidence in this product or service. These additional services help in discovering the errors in providing the product or service, the failure to use and non-conformity with set specifications. All of the services mentioned above are lacking in the company.

The role of concurrent engineering in improving the value of supply chain activities and reducing their costs in the company

- The R&D department takes the necessary action to replace the raw materials needed to produce the product or service in a manner similar to the raw materials involved in the production of the competing product. By finding efficient suppliers, this leads to a decrease in the costs of purchasing the supplied materials.
- Establishing raw materials warehouses near the company's departments. Providing suitable storage conditions to increase their resistance to the surrounding conditions, which leads to lower storage and transportation costs.
- Providing electric power generators associated with production departments to ensure continuous production and protection of different materials and products and increase the efficiency of services provided to the clients. This increases productivity and improves energy usage as well.

- Working on designing the product or service and conducting a comprehensive study of all stages of production to avoid obstacles and problems before starting production according to standards and restrictions.
- Encouraging people to avoid these obstacles leads to the smooth running of operations. This leads to the execution of orders quickly and avoids incurring additional costs for the product or service provided.
- Working properly at first sight leads to the provision of appropriate production and a reduction in quality costs related to internal and external failure.
- Implementing advertising and promotional campaigns that contribute significantly to increasing the company's profits and achieving customer satisfaction.
- Providing after-sales services such as warranty, maintenance and other additional services, which contributes significantly to increasing customer confidence in the company's products or services.

Sample of study

The sample consisted of n=60 individuals distributed among managers, technicians, accountants and other employees in the company. The period of the questionnaire application extended from 10/9/2019 to 15/11/2019. The Company ii in Baghdad and is affiliated to the Ministry of Tourism and Antiquities.

Materials

The opinions and responses of individuals to the research sample of the student community were analyzed and worked to describe and diagnose most important research questions related to the hypothesis in order to identify the difference in their opinions and test the validity of this hypothesis or not. For this purpose, the researchers used a five-point level Likert scale to conduct the statistical analysis of individual responses of the research sample about testing the hypothesis of the research: Concurrent engineering enhances the efficiency of the company's supply chain, reducing product costs, increasing profits and gaining a competitive advantage.

Table 1. Statistical indicators N = 60

#.	Items	Statistical Indicators			
		weighted arithmetic mean	Standard Deviation	Coefficient of variation	Weight Percent
1	Concurrent engineering enhances the efficiency of the supply chain by reducing the time to obtain raw materials and providing them in a timely manner to prevent any abnormal stops.	4.600	0.494	10.740%	92.000%
2	The supply chain works to provide raw materials with high quality specifications and thus helps in providing products or services that meet the needs and desires of customers.	4.286	1.242	28.990%	85.714%
3	Concurrent engineering contributes to reducing the costs of supply chain activities without compromising the quality of the raw materials purchased from the suppliers.	4.429	1.080	24.389%	88.571%
4	The existence of a common database for the company, suppliers and customers contributes to the application success of concurrent engineering.	4.357	1.150	26.404%	87.143%
5	It contributes to obtaining strategic information that enables companies to discover new generations of their products.	3.375	1.366	40.486%	67.500%



6	Reduce the cost of supply chain activities lead to a reduction in the overall costs of the final product or service and increase the company's profits.	3.821	1.366	35.746%	76.429%
7	Concurrent engineering reduces the product or service life cycle in the shortest possible time because all development processes are done simultaneously.	4.036	1.214	30.085%	80.714%
8	Integrating dimensions of the concurrent engineering from product design, process design, and supply chain design leading to high-quality products or services at a lower cost and provided in a timely manner to achieve customer desires.	4.071	1.251	30.717%	81.429%
9	The concurrent engineering finds early opportunities before designing products or services at the lowest possible cost without compromising on quality.	3.589	1.395	38.875%	71.786%
10	The preparation of studies and researches for developing of raw materials in the supply chain contributes to offering the distinguished products or services compared to competitors.	3.607	1.410	39.099%	72.143%
11	Concepts of concurrent engineering and supply chain are important concepts that are not well known to the company.	3.232	1.347	41.670%	64.643%
12	The difficulty of arriving raw materials affects the production process flow, which leads to increasing of the product or service life cycle.	3.536	1.401	39.621%	70.714%
Overall average		3.912	1.226	32.235%	78.232%

Results and Discussions

The results presented in table (1), which includes (12) questions, indicated that the average overall response of the sample individuals reached (78.232%) with a weighted arithmetic mean of (3.912), a standard deviation of (1.226) and the coefficient of variation (32.235%). The most important item that contributed to enriching this variable was the first item: (Concurrent engineering enhances the efficiency of the supply chain by reducing the time to obtain raw materials and providing them in a timely manner to prevent any abnormal stops). The severity of the response (92.000%) had a weighted arithmetic mean (4.600), a standard deviation 0.494 and the coefficient of variation (10.740%). The following element is the third item: (Concurrent engineering contributes to reducing the costs of supply chain activities without compromising the quality of the raw materials purchased from the suppliers). The severity of the response was (88.571%) and with a weighted arithmetic mean (4.429), a standard deviation of (1.080) and the coefficient of variation (24.389%). While the lowest percentage in this variable is for the item (11): (Concepts of concurrent engineering and supply chain are important concepts that are not well known to the company). The severity of the response (64.643%) with a weighted arithmetic mean (3.232), a standard deviation (1.347) and the coefficient of variation (41.670%). It is thus noted that the weight percentages of all the research items exceeded (70%) and the weighted arithmetic means of the research sample opinions exceeded the default mean of the measurement performed (3) with a significant level (5%) and degree of freedom (59) for all research variables.

Table 2. (T) Test results of the research variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	Overall average
Calculated (T)	25.087	7.744	9.898	8.828	2.054	4.500	6.384	6.411	3.160	3.221	1.290	2.862	6.786
Tabled (T)	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671	1.671

(df=59, significance level 5%)



It shows from the above table that the calculated value of (T) is greater than the tabled value of (T) with the degree of freedom (59) and the level of significance (5%) for the research variables. The overall average of these variables where the calculated value of (T) amounted to (6.786) is greater than the tabled value of (T) which amounted (1.671) with a $df=59$ at a significance level (5%), which leads us to accept the research hypothesis, which states that: Concurrent engineering enhances the efficiency of the company's supply chain, reducing product costs, increasing profits and gaining a competitive advantage.

Conclusions

This research was interested to show the role of concurrent engineering in enhancing the supply chain efficiency and reducing its costs. The importance of this study stems from the showing of the concepts of concurrent engineering and supply chain as being integrated. Most of the previous studies refer to the study of concurrent engineering or supply chain separately. The concurrent engineering achieves many benefits, including reducing the time of product or service delivery to the market. It improves the response to changes in the needs and desires of customers by offering the products or services of high quality, with suitable prices and lower costs. The statistical analysis results of the research showed that the overall average of research hypothesis variables in which the calculated value of (T) amounted to (6.786) is greater than the tabled value of (T) and amounted to (1.671) with a degree of freedom (59) and a significance level (5%). This leads us to accept the research hypothesis. The research hypothesis state that: concurrent engineering enhances the efficiency of the company's supply chain, reducing product costs, increasing profits and leads to the gaining a competitive advantage. The costs of supply chain activities can be reduced if production operations can be carried out concurrently by eliminating similar activities that can be performed at the same time. These techniques require a database shared by team members of concurrent engineering. The database provides sufficient flexibility to respond to the customers' requirements. Successful use of the supply chain requires members of this chain to have a clear understanding of the problems of cost, technology, time, bottlenecks and quality issues. The need to use a technique of concurrent engineering in order to reduce the supply chain costs such as purchase, transportation, storage and quality costs is evident.

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