The Impact of Components of IT in SCM on the Company's Performance (Case study: Pars Khodro Company)

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ABSTRACT

In the business environment, Information Technology can play an important role in success of Companies performance. It provides information flow which makes the Supply Chains of companies more robust and resilient and Follow it to improve their performance in global competitive markets. This study attempts to identify the components of information technology in supply chain management and components of company performance evaluation and to determine of their roles in the improvement of the company performance. Thus, the components identified according to review of literature with library study and by means of experts questionnaire was conducted toward validity, reliability, and selection of components. Seven components were selected for information technology in supply chain management. And eight components were selected for company performance evaluation. eventually the Fuzzy DEMATEL method was applied to determine the relationships amongst all components. the result showed that customer relationship management (CRM) is the most important component amongst the components of information technology in supply chain management. On the other hand, advanced planning system (APS) is the most effective component, and return of investment (ROI) as one of the indicators of financial performance the most impressible component.

*Keywords***:** supply chain management; information technology; performance evaluation; fuzzy set theory; DEMATEL method

1. INTRODUCTION

The spread of high speed data communications networks and computer technology has made it possible to manage the supply chain with a level of precision that was not feasible as recently as the Mid 1980s. Those companies that learn to use the techniques and technologies that are now available can build supply chains that have a competitive advantage in their markets. Information technology can support internal operations and also collaboration between companies in a supply chain. Using high speed data networks and databases, companies can share data to better manage the supply chain as a whole and their own individual positions within the supply chain. The effective use of this technology is a key aspect of a company's success.

In the business environment, Information Technology can play an important role in success of Companies performance. It provides information flow which makes the Supply Chains of companies more robust and resilient and Follow it to improve their performance in global competitive markets. Companies must have access to a different information about suppliers, customers, and their productions and services for to perform their affairs. They must organize the activities that this information to use for improvement the overall performance of their company, information systems is made possible for companies until manage all of their information, and make a better decision and improve the implementation of processes of their business. Using of information technology systems for taking and analyze data can be have a great positive effects on better performance of firms. Lack of access to information technology has adverse effects on achieving the competitive priority on environment dynamics, and also companies can't give an appropriate response to market changes, and will increase production costs and so that gradually lost competitiveness in their industry (Tseng et al., 2011).

As a result this study attempts to identify the components of information technology in supply chain management and components of company performance evaluation and to determine of their roles in the improvement of the company performance.

There are many researches about the role of supply chain management in companies, but few researches has been done about the impact of Information Technology applications in Supply Chain Management, and Its role in improvement of company performance in automotive companies. With the increasing use of an integrated information systems and enabling technologies, the supply chain can build which to eliminate poor performance of suppliers, unpredictable customer demands, and uncertain business environment.

In a review of research literature, in a research was conducted with title of information technology in supply chain management attempts to prove the impact of information technology in supply chain management. The results finds that advanced IT is the cause criteria leading to marketing performance and customer satisfaction (Tseng et al., 2011). In another research with title of Information Systems in supply chain integration and management, the literature available on IT in SCM have been classified and then develop a framework for studying the applications of IT in SCM. Based on this review and analysis, recommendations have been made regarding the application of IT in SCM (A. Gunasekaram, E. W. T Ngai, 2004).

In a research with title of the impact of Information Technology on the development of Supply Chain Competitive Advantage, explores the impact of information technology practices on building competitive advantage throughout the supply chain.

The empirical findings from a survey of 76 manufacturing firms in Greece confirmed companies must exploit IT including enterprise applications such as ERP and CRM, as well as e-procurement and e-commerce, and the crucial role of IT practices and techniques on the establishment of a sustainable competitive advantage based on Supply Chain Management (C.Marinagi, P.Terivellas, D. P. Sakas, 2014). In a research with title of the effects of process development and information technology on time-based supply chain performance, purpose of the study is to reveal the individual and cumulative effects of information technology and process development activities on time-based supply chain performance which is a key strategic component of the business competitiveness. According to findings of the research firms mostly consider the importance of information sharing by IT, while using intranet applications takes second place. These finding still don't operate in a SC integrated by IT applications, or don't recognize the value to operate in SCM (Acar et al., 2014). In research with title of the impact of information technology on supply chain capabilities and firm performance proposes that IT-enabled supply chain capabilities are firm-specific, and hard-to-copy across organizations. These capabilities can serve as a catalyst in transforming IT-related resources into higher value for firm. Based on data collected from surveying supply chain and logistics managers in various industries, the findings of this study provide a new perspective in evaluating IT investment in the supply chain process (Wu et al., 2009).

By examining conducted studies on the subject of current study which is the impact of components of information technology in supply chain management on the company performance, There are many researches about the role of supply chain management in companies, but few researches has been done about the impact of Information Technology applications in Supply Chain Management, and Its role in improvement of company performance in automotive companies.

Therefore, in this current study firstly, with the study of these investigations, and related books with the research topic, components of information technology in supply chain management, and the components of company performance evaluation were identified, and by means of the experts questionnaire was conducted toward validity, reliability, and selection of components. Secondly, seven components were selected for information technology in supply chain management, and eight components were selected for company performance evaluation eventually, the Fuzzy DEMATEL method was applied to determine the relationships amongst all components.

2. INFORMATION TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

Obtained information from supply chain management helps companies to make a decision that what products what time produce, store, and transform, Orders transfer to the entire company rapidly, tracking the situation of orders, examining and monitoring of inventory level, reduction of inventory costs, transformation and warehousing, planning based on customer demands, transferring of conducted changes in production design. These supply chain management systems are inter-organizational systems that automates circulation of information in the organizations (Laudon, 2013).

In this research, first by means of research literature review, components was considered for information technology in supply chain management and company performance evaluation, secondly by means of expert opinions was conducted toward validity

and reliability of components, eventually the following components are considered for information technology in supply chain management and company performance evaluation. Material requirements planning (MRP) (C1) is an appropriate tool for detailed planning of material supply in the manufacturing and assembly of parts into finished products. The aim of this system is to provide the right parts in the right place and time in order to be conducted on time production and delivery. To achieve this aim MRP provides a formal and specific program for every part of production, raw material, semi-finished parts and final production (Koh, 2004).

Enterprise resource planning (ERP) (C2), enterprise resource planning systems are a software packages that allows to organizations to integrate their components and having more control on their activities. Manufacturing organizations have been main groups of users of this software. In among of these organizations automotive companies because of having numerous processes and significant financial potential have the largest share in the implementation of these softwares. ERP systems are very complex and integrated systems that thousands of organizations in the world need it for success in their business (Koch, 1996). Advanced planning system (APS) (C3) is a kind of production management process that within resources and production capacities are allocated optimally. In fact, advanced planning systems are systems that plan the real production based on volume of forecasts and actual orders. This approach used in the environments that simple planning can't respond to complex conditions (Chen, Lin, 2008).

Supplier relationship management (SRM) (C4) supplier relationship management systems can have a benefits for the both sides (seller and buyer). Buyers obtains a reliable resources of goods that need with reasonable prices and reliable results. Also they do not have to for buying the products be looking for sellers repeatedly, and also sellers obtains stable resource of trade and benefit. Further collaboration between suppliers and buyers can create more benefits such as constant monitoring of inventories and real and on time information (Kaske, 2002). Customer relationship management (CRM) (C5) customer relationship management systems helps to companies in order to manage the communications with customers. These systems provides Required information for the harmonization of all the processes of business related to customers in the field of sale and marketing and required service to optimize of revenue, customer satisfying, and keeping of customers. These information help to companies in order to profitable customer identified, attracted, and keep, better services give to customers, and finally, increase their sale (Laudon, 2006). RFID, GPS, mobile and wireless (C6) coordination of the different units is a very complex and difficult act in supply chain. Information technology was identified as a solution for this problem through the information sharing, automating processes, and integration of supply chain management. The advance in information technology, internet security improvement, and bandwidth has caused spreading use of mobile and wireless technologies.

These technologies have many advantages for organizations for example GPS technology is used in order to providing service to customers in the moment. Applications and softwares of information technology enables the organizations until be connected to the central computer by means of GPS, GIS, Wimax, and Wi Fi technologies and allows the users to share their information throughout the supply chain. For example RFID technology along with a short message service and mobile portals allows to users access to on time information in throughout the supply chain (Eng, 2005). Data electronic interchange (DEI) (C7) this technology are used to automate the office interchanges such as sending and receiving of

orders, invoices, sheets transport and delayed of orders. Members of supply chain can share the demand data at creation time by means of DEI, and have the prediction of demand. This affair can reduce the unclear that is increasing in upstream loops of supply chain (Bort and Bielfeldt, 1994).

Table 1. Proposed components.

The symbol	Components of Information Technology in Supply Chain Management
C1	Material Requirement Planning (MRP)
C2	Enterprise Resource Planning (ERP)
C3	Advanced Planning Systems (APS)
C4	Supplier Relationship Management (SRM)
C5	Customer Relationship Management (CRM)
C6	RFID, GPS, mobile and wireless
C7	Data Electronic Interchange (DEI)

3. THE COMPONENTS OF COMPANY'S PERFORMANCE

The information technology in supply chain management can impact on company performance in various ways. First, an integrated system helps to achieve benefits through allowing a firm to respond better to customer problem and requests (Rogers et al., 1993). Second, information flows facilitated by the IT can potentially increase the sales volume by reaching customers directly and promptly whenever a new product is introduced, and by tapping into markets that were inaccessible on account of distribution or other infrastructure constraints (Wu, Mahajan, Balasubramanian, 2003).

Information technology in supply chain management can also potentially improve a firm's financial performance through a cost advantage over competitors. Using of IT in SCM reduce demand uncertainty, and the cost of inventories in the process of matching supply with demand in supply chain network (frohlich, 2002) it can help a firm produce and deliver products or services to customers at lower cost and higher speed through the improvement in coordination between supply chain partners (Ling, Huangs, & Lin, 2002).

Therefore, we believe the using of information technology in supply chain management can have a direct impact on a firm's performance. In this study, we examine three performance variables-marketing performance, financial performance and customer satisfaction. Marketing performance includes sales growth (C8), market share (C9), product development (C10), and market development (C11). Financial performance includes profitability (C12), ROI (C13), and cash flow from operations (C14) (Wu et al., 2006) (Tseng, 2011). And another component is Customer satisfaction (C15) (Kim, 2009).

Table 2. Proposed components.

| The symbol	Components of company performance evaluation
	Marketing performance
C8	Sales growth
C9	Market share
C10	Product development
C11	Market development
	Financial performance
C12	Profitability
C13	ROI
C14	Cash flow from operations
C15	**Customer satisfaction**

4. DEMATEL METHOD

Decision Making Trail and Evaluation Laboratory (DEMATEL) method was first conceived by the Battelle memorial institute through its research in the Geneva Research Centre in 1973. DEMATEL method is used to analyze the relations among different criteria. The DEMATEL method based on diagraphs. A diagraph or directional graph classifies factors into cause and effect groups. It depicts a relation between these groups. DEMATEL converts this relationship into an effective structural model (Baruahe.S, Raj.S, Ray.A, Chacravorty.S, 2012).

4. 1. Fuzzy set theory

Fuzzy theory was released by Lotfi Zadeh professor, Iranian scientist and professor of the Berkeley campus America. This theory of the releasing time so far has earned expanding and a great deepen, and various uses has found in different fields. fuzzy theory, a theory is for action in uncertain situation. This theory is able to transform many concepts, variables, and ambiguous and unclear systems in the real world to the mathematical, and thus, provide the filed for argument, inference, control and decision making in uncertain situation (Momeni, 2006).

4. 2. The triangular fuzzy numbers

One of the most used fuzzy numbers is triangular fuzzy number and is showed in this form $M = (m, a, \beta)$. (m = facade, a = distance of facade to the lower bound, β = distance of facade to the upper bound)
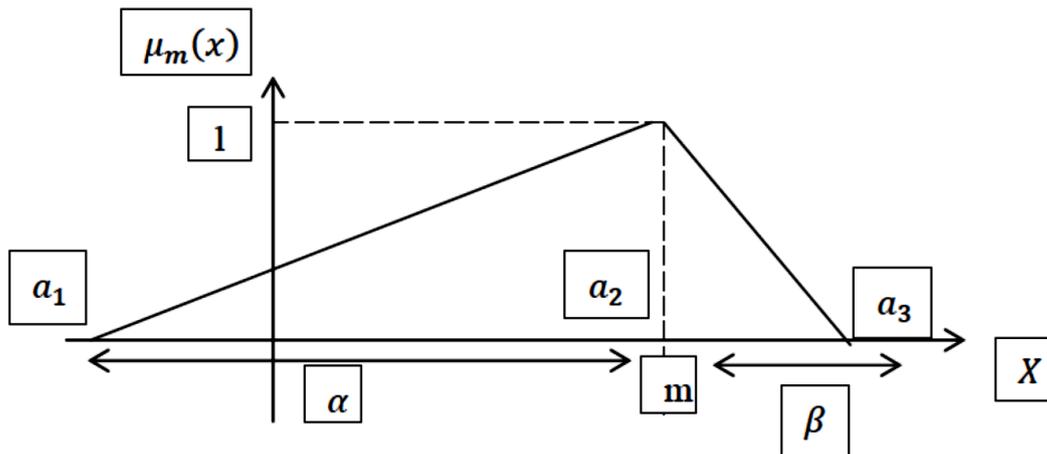
In this study, has used the proposed triangular fuzzy numbers by Lin and Wu. The following table show verbal phrases and their triangular fuzzy numbers.

Table 3. Verbal phrases and their triangular fuzzy numbers.

Five point scale	Verbal phrases	Fuzzy numbers
0	No influence	(0, 0, 0.25)
1	Very low influence	(0,0.25, 0.50)
2	Low influence	(0.25, 0.50, 0.75)
3	High influence	(0.50, 0.75, 1)
4	Very high influence	(0.75, 1, 1)

5. METHODOLOGY

The Fuzzy DEMATEL research method in uncertainty, the analysis procedures are explained as follows:

Step 1: Distribution of paired comparisons questionnaire (questionnaire of dematel) in amongst of the company experts. And rate on a scale of 0 to 4 where, 0: no influence, 1: very low influence, 2: low influence, 3: high influence, and 4: very high influence. After collecting all of the questionnaires following steps done in order to determination of the relationships of components:

Step 2: Conversion verbal phrases into triangular fuzzy numbers. Generate a direct relation matrix depicting these relationships. Based on the above components, a matrix X is generated,

which is an n×n matrix. The matrix obtained is the direct relation matrix. In this step, has used the proposed triangular fuzzy numbers by Lin and Wu. And, average of the gathered data in the form of fuzzy from paired comparison matrix, to consider all of the expert opinions, arithmetic mean is taken according to the following formula:

$$z = \frac{z_1 + z_2 + \cdots \ldots \ldots .. + z_n}{n}$$

Step 3: Fuzzy aggregation normalized matrix. In this step average of paired comparisons matrix in form of fuzzy numbers are normalized by means of the related formulas. Normalize the direct relation matrix X and form a fuzzy aggregation normalized matrix E. from the fuzzy direct relation matrix X, the fuzzy aggregation normalized matrix E is obtained as:

$$E = S \times X$$

$$S = \frac{1}{\left(\text{MAX}1 \leq j \leq n \sum_{j=1}^{n} x_{ij}\right)}$$

i, j = 1, 2…n

Step 4: Finding the total relation matrix T. After calculating the normalized matrix E, the total relation matrix T can be achieved by using the formula: (where I is identifying matrix, which is also an n×n matrix)

$$T = E \times (I - E)^{-1}$$

Step 5: Depicting the causal diagram. The sum of rows and columns, within the total relation matrix T separately denoted as D and R, using the formulae:

$$D = \left[\sum_{j=1}^{n} [t_{ij}] n \times 1\right]$$

$$R = \left[\sum_{j=1}^{n} [t_{ij}] 1 \times n\right]$$

where D and R denote the sum of rows and columns respectively. The causal diagram is found by mapping (D + R; D - R). D + R, obtained by adding D to R, and gives us the weights and D-R, obtained by subtracting D from R, give us relations of components.

Step 6: Defuzzification. In this step, obtained fuzzy numbers (D + R, D - R) from the previous step are defuzzied according to the following formul:

$$B = \frac{(a_1 + a_3 + 2 \times a_2)}{4}$$

6. RESULTS

The following table shows the importance and the relation axis for cause and effect groups all the components of Information Technology in supply chain management and company performance evaluation:

Table 4. The prominence and relation axis for cause and effect groups (definitive numbers).

Number	The symbol	Components	D + R	D - R
1	C11	Market development	10.556	0.035
2	C8	Sales growth	10.478	0.208
3	C10	Product development	10.459	0.245
4	C12	Profitability	10.363	-0.421
5	C9	Market share	10.274	0.075
6	C15	Customer satisfaction	10.128	-0.202
7	C14	Cash flow from operations	10.06	-0.644
8	C13	ROI	9.881	-0.668
9	C5	Customer Relationship Management (CRM)	9.869	0.105
10	C4	Supplier Relationship Management (SRM)	9.812	0.138
11	C2	Enterprise Resource Planning (ERP)	9.682	0.209
12	C7	Data Electronic Interchange (DEI)	9.615	0.376
13	C3	Advanced Planning Systems (APS)	9.61	0.499
14	C1	Material Requirement Planning (MRP)	9.479	-0.017
15	C6	RFID, GPS, mobile and wireless	9.081	0.06

The DEMATEL analysis produced two categories of results. According to this table, it prioritized the components based on their degree of importance in the decision making context consideration. As explained earlier the importance of components is assessed by (D + R) values. The degree of influence of components is shown in this Table 4. The higher value, the more important the components is Based on (D + R) values, the importance of components can be prioritized as C11 > C8 > C10 > C12 > C9 > C15 > C14 > C13 > C5 > C4 > C2 > C7 > C3 > C1 > C6.

The result shows that the three most important components of information technology in supply chain management are: C5: Customer Relationship Management (CRM) (weight: 9.869), C4: Supplier Relationship Management (SRM) (weight: 9.812), and C2: Enterprise Resource Planning (ERP) (weight: 9.682). And the three most important components of company performance evaluation are: Market development (weight: 10.556), Sales growth (weight: 10.478), and Product development (weight: 10.459).

Secondly, DEMATEL analysis classified components either as net drivers or net receivers depend on the net influence to the context. If (D - R) is positive, the component is cause component, and (D-R) is negative, the component is effect component. The results are shown in table 3. The results indicate that the two most influential components are: C3: Advanced Planning Systems (APS) ((D-R) = 0.499), and C7: Data Electronic Interchange (DEI) ((D - R) = 0.376). and the impressible components are: C13: ROI ((D - R) = -0.668), C14: Cash flow from operations ((D - R) = -0.644), Profitability ((D - R) = -0.421), C15: Customer satisfcation ((D - R) = -0.202), and C1: Material Requirement Planning (MRP) ((D - R) = -0.017).

6. 1. Cause and effects diagram

The results of the analysis can also be used to develop a causal diagram or cognition map.

Figure 1. Cause and effects diagram.
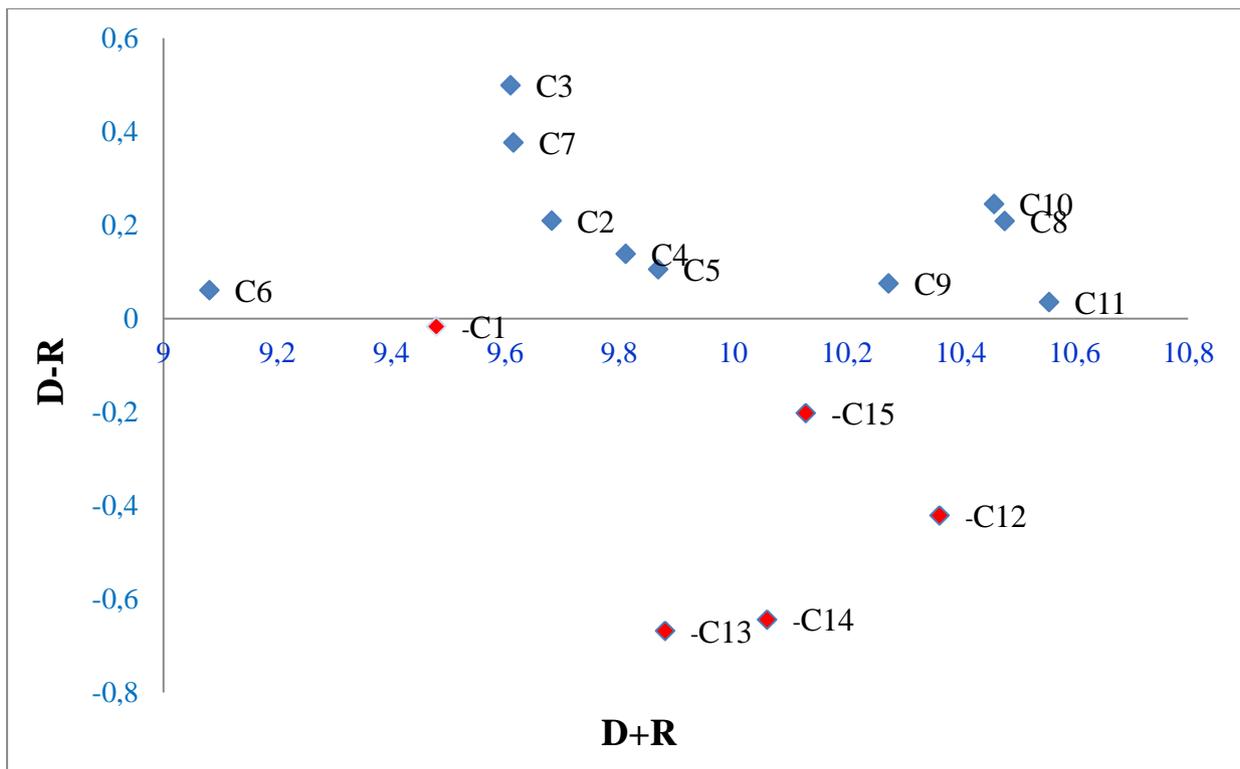
The cause and effects diagram has been constructed using (D + R) as the X-axis and (D - R) as the Y-axis. The locations of the components with respect to X and Y-axis component, the degree of importance that the components play and indicate the net effects that they contribute to the context of the study. The figure indicates that amongst the cause components C3: Advanced Planning Systems (APS) is the main three component followed by C7: Data Electronic Interchange (DEI), C10: Product development, and amongst the impressive components are: C13: ROI, C14: Cash flow from operations, and C12: Profitability.

This study assists us to understand the interrelationships between components more systematically. Understanding of the dynamic nature of the decision-making process through these causal relationships is critical to the implementation strategies of Information Technology in Supply Chain Management.

7. DISCUSSION AND CONCLUSIONS

Overall by comparing the results of this study with the other accomplished studies of related to the subject, in a research was conducted with title of information technology in supply chain management attempts to prove the impact of information technology in supply chain management. The results finds that advanced IT is the cause criteria leading to marketing performance and customer satisfaction (M.L.Tseng, K.J.Wu and T.Nguyen, 2011). Also, this research shows that with investment in components of Information Technology in Supply Chain Management especially, Customer Relationship Management (CRM) can lead to better performance of Supply Chain Management.

In another research with title of Information Systems in supply chain integration and management, the literature available on IT in SCM have been classified and then develop a framework for studying the applications of IT in SCM. Based on this review and analysis, recommendations have been made regarding the application of IT in SCM (A.Gunasekaran,E.W.T.Ngai , 2004). In this current study also, proposes precious component for high firm performance which is the IT impact on SCM.

In a research with title of the impact of Information Technology on the development of Supply Chain Competitive Advantage, explores the impact of information technology practices on building competitive advantage throughout the supply chain. The empirical findings from a survey of 76 manufacturing firms in Greece confirmed companies must exploit IT including enterprise applications such as ERP and CRM, as well as e-procurement and e-commerce, and the crucial role of IT practices and techniques on the establishment of a sustainable competitive advantage based on Supply Chain Management (C.Marinagi, P.Terivellas, D. P. Sakas, 2014). In this study Customer Relationship Management (CRM) was identified as the most important component of information technology in supply chain management and Enterprise Resource Planning (ERP) also as one of the cause component that impacts on the other components.

To successfully adapt the new technology, the managers must pay attention on what kind of technology systems need to be invested and how to aggregate these on their production status. The empirical experimental result will shows out cause and effect components group which gives the guideline for decision-making for managers. Managers should consider what and who to apply information system to get productivity.

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