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The Impact of ERP Systems and Supply Chain Management Practices on Firm Performance: Case of Turkish Companies

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Abstract

Enterprise Resource Planning (ERP) system is an important tool for business processes planning, information flowing, executing and controlling, regarding the sources of the companies' (financial, material, equipment, labor) deployed premises in different places. Supply Chain Management (SCM) practices are extroverted doors of the companies in order to ensure mutual advantages in their own processes. Successfully implemented and integrated ERP system and SCM practices provide advantages in planning, decision-making, execution and increases the performance of firms. This study examines the dimensions of SCM practices and ERP systems and tests the relationship between competitive advantage and firm performance. The research was carried out for 138 Turkish Companies' executives. Path analysis was used to test the research hypotheses. SCM and ERP system implementations had revealed that the SCM practices and ERP system have positive effects on firm performance and competitive advantages.

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1. Introduction

Supply Chain Management (SCM) is an effective approach to sustain the competitive advantage and firm performance (Li et al., 2006). In order to obtain a better competitive position, SCM is a strategy that aims to reduce the costs and provide better integration of production and distribution systems and to enhance the customer satisfaction. SCM is a process to control the information flow, goods (property) and

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services amongst and within the firms and also develops strong ties between suppliers and customers. According to Mzoughi et al. (2008), SCM literature focuses on strategic management, partnership, logistics and marketing. Resource management comprehension extends to all distribution and transport services that cover the entire logistics concepts and exceeds the supply unit (Su and Yang, 2010). SCM deals with all processes of the firms' produced raw materials and resources until their final step. When all strategic organizations act as a single unified entity, suppliers' system performance will be also improved. The success of SCM and information technology advances requires integration of ERP systems. This will provide competitive advantage and enable sales managers to meet customer expectation. They are increasingly adopted by companies of all sizes (Chang et al., 2008).

Several researchers investigate the relationship between SCM practices and firm performance (Mzoughi et al., 2008; Li et al., 2006). In order to increase the flexibility and efficiency of a firm, it needs to implement the SCM strategies. SCM practices have a positive impact on organizational performance and competitive advantage. SCM and ERP system act as an effective tool that enhances firm performance and provide a continuous competitive advantage (Li et al., 2006). ERP systems lead to the improvement in the work conditions and ease the use of information (Mzoughi et al., 2008). This technology effects the information process, workflow and the interaction effect between the employees of the firm. Firms have some marketing and financial objectives. They try to reach these objectives. Also, companies can reach the competitive advantage by developing strategic relationship orientation of mutual gains, maintaining the relationships with limited number of suppliers (Chen and Paulraj, 2004). The objective of this study is to investigate the relationships among SCM practices, ERP systems, firm performance and competitive advantage. It examines the relationship between the variables are presented within the framework of the Turkish market. This research provides managers with a tool for SCM practices and the development of ERP system, for the managers.

2. Theoretical Framework

2.1. SCM Practices

Logistics chain management is the way companies use suppliers' processes, technology and competence to improve their competitive advantage (Mzoughi et al., 2008). SCM is the external logistics part of a company including customers and suppliers. SCM relates the management of materials and information flows through logistic chain. The most of the definitions of SCM focus on the external environment. However, in some management areas (especially in the modernization of business and operational management) studies focus on the internal part. Without taking into account the global market supply chains realities, it is no longer seems possible to achieve success for the companies. It's not enough for the firms to capture the entire success, by only integrating; the design, procurement, manufacturing and distribution processes within the new methods and also the management, in accordance with the implementation of advanced technology. The implementation of the supply chain networks to cover this form of management is one the main factors of the success. In various research activities, SCM implementations were described as; supplier partnership, customer relationship, customer service management, foreign procurement, purchasing, information sharing, information technologies sharing, etc. Li et al. (2006) has set-up their works on five activities; strategic supplier partnership, customer relationship, level of information sharing, information sharing quality and delay (postponement). According to Mzoughi et al. (2008), SCM applications such as; strategic supplier

partnership, customer relationship, information sharing and information quality level, provide significant competitive advantages for the companies.

Suppliers' performance has a significant impact on the product quality, production costs, delivery time, technology, innovation and the development of the firm and also strongly affects the competitiveness and profitability of the organization. Resource utilization quality can be only improved by the strategic partnerships of the main suppliers. The development of management capacity depends on the long-term cooperation, to ensure excellent product quality, availability and co-operation for the requested goods' quality and selection of the supplier (Vonderembse et al., 1999). Strategic partnerships do not have special form; they can be changed according to the aims of the partners. Selection and development of suppliers' activities, improved communication between the institutions will promote mutual trust, making the sharing of information and provide long-term partnerships, establish a balanced partnership and also provide an understanding of the strategic orientations for the partners' expectations (Mzoughi et al., 2008). At the end of a long-term relationship, a company can understand the motivations of the suppliers and the way of establishing institutional communication. Suppliers should be aware of the customers' systems and procedures to integrate them to their activities. The concept of partnership with suppliers is developed by; especially determining the type and sort of the stock. Partnerships reduce the transaction costs and provide advantages for the suppliers and firms and also allow technology transfer (Ramsay, 1996).

Customer relationship management (CRM) is an important element for SCM practices. It includes all relationship management practices, the creation long-term relationships and development of customers' satisfaction. In order to ensure satisfaction of customers, companies designate suitable suppliers for each customer needs (Choy et al., 2002). By means of obtaining information about the customers' data base, companies increase their performance by destruction of the useless knowledge stage of the chain level, increasing the flow of material and information and the establishment of long-term relationships with clients. Cooperation between suppliers and customers enables firms to have real-time information about demand and customer needs. According to Mzoughi et al. (2008), network concept completes the traditional relationship management patterns between suppliers and buyers. Thus understanding the framework of the customers' relationships network is necessary.

Information sharing and information quality level defines the information exchange efficiency in a partnership. These elements (information sharing and information quality level) are crucial in the development of successful partnerships with suppliers. Information sharing among the partners means the reporting of critical information and industrial property. Suppliers and customers can collaborate to improve and develop the various elements of the supply chain, such as quality and cost (Jones, 1998). Information quality is related with accurate, timely, sufficient and the credibility of the information. All elements of the supply chain can help to reduce the supply and demand uncertainty by information sharing. In order to obtain the best management result for the supply chain and guarantee a certain level of flexibility, the shared information must be correct. The effect of the mutual exchange of information depends on how information is shared, time and the partner who will benefit from this information. Companies must consider the information as a strategic resource and provide the notification by minimum delay and disruption (Holmberg, 2000).

2.2. ERP Systems

The major purpose of ERP is to integrate a wide range of information regarding organizational resources to create synergies with business partners, meet customer requirements, and enhance

operational performance. ERP system can be defined as the solutions that are integrated to the business processes and firms' functions (Al-Mashari et al., 2003). ERP system is standard adaptable software. It is an information system that manages production planning, supplies, production, sales, distribution, accounting and customer service by integrating them all together. ERP system is defined as a part of a firm's global management information system that integrates all the business functions (Chen, 2001). ERP system deals with better integration of different departments' information systems. ERP system enables the information linking a set of suppliers, distributors and customers without geographical restrictions. Information about customers and suppliers are shared instantaneously and in an accurate and homogeneous manner (Chen and Popvich, 2003).

The purpose of implementing an ERP system varies among the companies and with this reason the perceived advantages of ERP are different and difficult to be defined. It can be tangible or intangible. An ERP system has several advantages. These are normalization of firm procedures, integration of facilities and data, computerization of trading processes, increasing the flexibility, reduction of the number of the employees, strengthening the globalization system and solving the problems. Information system that integrates the ERP system to logistics chain provides a competitive advantage (Akkermans et al., 2003). ERP systems and SCM practices are the basis for organizational performance and ongoing competitive advantage. SCM provides effective tools for institutions and helps to meet the needs of suppliers and customers, and competitors.

DeLone and McLean (2004) collect the factors that may affect the success of the ERP system under six main categories; system quality, information quality, system usage, user satisfaction, individual effect and organizational impact. However, Sedera and Gable (2004) have determined; information quality, system quality, organizational impact, individual effect and institutional system success items as the main factors that may affect the ERP success. As claimed by the others that the service quality is the sub-component system quality. DeLone and McLean (2004) have added the service quality as a new and separate criteria, benchmark to their models. Because the importance of the service quality offered by data processing (support) department or external service provider has great importance not to lose the customers and causing a failure (since the users are clients and lack of user support causes sales volume decreases). These determined criteria are expanded by other researchers. For instance, during ERP implementations, correct software/software vendor and/or selection of the consultant will directly affect the success of the ERP and long term association of seller and the firm (Tsai et al. 2011). ERP vendors and consultants help for quality of the application, ensuring participation and to informing the users. Therefore, selection of the correct system affects the system quality, selection of the correct software vendor and consultant affects the service quality.

According to Ifinedo (2007), individual impact and organizational impact are unrelated in the context of ERP systems. However, there is a direct link, through the action of the individual impact and organizational impact workgroup (workgroup: organizational sub-units and/or functional departments). Also, the socio-economic risk management is part of every successful business management in the event of changes (Tsai et al. 2011). The protection of the moral and business information resources plays an important role in reducing the risks. Therefore, risk management and security control factors are important for evaluating the quality of the system. Tsai et al. (2011) investigated impact of the internal (firm project management team) and external (vendors and implementation consultants) factors on the service quality. They argued that, there are three key factors to achieve the success in ERP implementations; system vendors, implementation consultants and firm's project management team. Without the external support (vendors and implementation consultants), ERP implementations can rarely be successful in the organizations. ERP implementation can reduce the risk of failure in the resolution of

disputes, drawing the right frames for changes, defining the objectives of the project management team and also the process of a change/transformation.

3. Hypotheses Development

The framework proposes that ERP systems will have an impact on competitive advantage and firm performance. Also, SCM practices effect the ERP systems and have an impact on competitive advantage and firm performance. SCM practice is conceptualized as a four-dimensional construct. The four dimensions are strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing. The ERP system is conceptualized as a five-dimensional construct. These are system quality, information quality, system use, individual impact and organizational impact. Competitive advantage and organizational performance are concepts that have been operationalized in the existing literature (Ellinger et al., 2008). Using literature support, the expected relationships among ERP systems, SCM practices, competitive advantage, and firm performance are discussed, and hypotheses relating these variables are developed.

SCM practices are expected to improve an organization's competitive advantage through price/cost, quality, delivery dependability, time to market, and product innovation. Prior studies have indicated that the various components of SCM practices (such as strategic supplier partnership) have an impact on various aspects of competitive advantage. According to Li et al. (2006), strategic supplier partnership can improve supplier performance, reduce time to market and increase the customer satisfaction. Information sharing have an impact to levels of supply chain integration by enabling organizations to make dependable delivery and introduce products to the market quickly. Information sharing and information quality are positively associated with customer satisfaction and partnership quality. SCM is the key factor for delivering the competitive advantage. For achieving the strategic objectives and competitive advantages, firms use the suppliers' participations (Wagner, 2006). Partnerships with external organizations are the main source of a competitive advantage. Competitive advantage is obtained through these strategies; low price, better quality, innovation, marketing time and delivery safety. The above arguments lead to

H1: The SCM practices have a positive impact on competitive advantage.

There are two types of criteria used to measure the performance of the firms; financial criteria and market criteria. Return on investment (ROI), sales profit margin and ROI growth are included in the financial performance. The market performance share is related with the sales growth, market share growth and overall competitiveness concerns. Several researchers argued that SCM practices increase an organization's market share, return on investment and improve overall competitive position (Li et al., 2006; Mzoughi et al., 2008). For instance, strategic supplier partnership has been reported to yield organization-specific benefits in terms of financial performance. Customer relationship management leads to significant improvement in organizational performance. Furthermore, information sharing has a positive impact on organizational performance (Li et al., 2006). The adoption of SCM practices will result better firm performance in highly a competitive environment. Based on the above, it is hypothesized that:

H2: The SCM practices have a positive impact on firm performance.

Researchers investigating the ERP systems have argued that ERP has an impact on the firm performance (Botta-Genoulaz, 2005). For example, Hunton et al. (2003) has examined the impact of the ERP system adoption on firm performance by comparing companies using ERP systems and others that do not use them. They stated that both ROI and turnover of the ERP system users significantly improved.

However, the results vary according to the size of firms (Hunton et al., 2003). Therefore, a positive relationship between ERP systems and organizational performance can be proposed.

H3: ERP system has a positive effect on firm performance.

ERP systems replace complex and sometimes manual interfaces between different systems with standardized, cross-functional transaction automation. Order cycle times (the time from when an order is placed until the product or service is delivered) can be reduced, resulting in improved throughput, customer response times, and delivery speeds (Cotteleer and Bendoly, 2006). According to Hunton et al. (2003), ERP system provides major changes in culture and behavior models which are the main sources of economic advantages. Based on the above, it is hypothesized that:

H4: ERP system has a positive effect on competitive advantage.

Having a competitive advantage generally suggests that an organization can have one or more of the following capabilities when compared to its competitors: lower prices, higher quality, higher dependability, and shorter delivery time (Li et al., 2006). Competitive advantage provides the opportunity to develop their own economic performance and ability to compete with the company's rivals. A firm can increase the profit margin and ROI values, only by improving the products' quality. Innovative companies can increase their market share and sales by having the ability to drive rapid product launches. Firms reach competitive advantage by with maintaining relationships with a limited number of suppliers, fostering communication between the numbers of the logistics chain, and realize mutual gains by developing strategic relationship orientation (Chen et al., 2004). Therefore, a positive relationship between competitive advantage and organizational performance can be proposed.

H5: Competitive advantage has positive effect on the firm performance.

4. Research Methodology

This study has been conducted to reveal and investigate the relationships among SCM practices, ERP systems, competitive advantage and firm performance. The methodology initially involves the establishment of the construct's domain through a literature review followed by the identification of a pool of items to measure the constructs forming the research model. This pool of items is used to develop an initial survey and was subject to a pilot study for measurement purification prior to the finalization of the questionnaire and the implementation of the main study. The data needed for field search has been collected through survey research method, which is described and analyzed in more detail in the following sections.

4.1. Measures and Sampling

To test the above hypotheses, multi-item scales adopted or developed from prior studies for the measurement of the constructs were used. SCM practices have four dimensions. The four dimensions are strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing. The items are adopted from Li et al. (2006). The ERP system is conceptualized as a five-dimensional construct. These are system quality, information quality, system use, individual impact and organizational impact. These measurement items are adopted from DeLone and McLean (2004). Competitive advantage and organizational performance are concepts that have been operationalized in the existing literature (Ellinger et al., 2008). The methodology consistently entails the adoption of a survey research method. A survey was conducted to validate the proposed relationships ascribed in the hypotheses and to develop a reliable discussion coextending with the findings attained. To test the

hypotheses, well verified measures of multi-item scales adopted from previous studies were used. All the measurement constructs were estimated through respondents’ perceptual evaluation on a five-point Likert scale, which was anchored by the end points of “strongly disagree” (1) to “strongly agree” (5).

The data used to test the hypotheses are drawn from a varied spectrum of Turkey’s industries. The organizations taking part in the survey have both national and international, operational domains. The initial sample consisted of 500 firms in total, residing in the Marmara Region of Turkey which is the most industrial region. The firms were selected and contacted through the database of Istanbul Chamber of Commerce. The use of key informants as sources of data is standard practice in business and management research. Thus, the presumption that “individual views on issues will constitute a function of their organizational roles” directed the survey of the study to be done with individuals who occupy strategic positions in their organizations who would be more knowledgeable about the strategic relationships between the inter-organizational structures. Of the 500 contacted, 175 agreed to answer the survey. Yet, of the 175 returns, 37 were deleted due to incomplete and inconsistent information, leaving 138 usable returns for analysis. Correspondingly, a response rate of 27.6% is obtained.

4.2. Measure Validity and Reliability

After data collection, the measures were subjected to a purification process to assess their reliability and validity (Anderson and Gerbing, 1988). An exploratory factor analysis (EFA) was conducted including 64 measured items of 9 variables, using a principal component with a varimax rotation and an eigenvalue of 1 as the cutoff point. The Kaiser-Meyer- Olkin (KMO) measure of sampling adequacy was .92, and the Bartlett test of sphericity was significant at $p < .01$ ($X^2 = 6261.82$), indicating the suitability of these data for factor analytic procedures. During the EFA analysis four factors were extracted from ERP systems construct items (named as system and information quality, system use, individual impact, and organizational impact), three factors were extracted from SCM practices (named as strategic partnership with suppliers, customer relationship, level of information quality and sharing). One factor extracted from performance and competitive advantage. Next, we calculated means and standard deviations for each variable and created a correlation matrix as shown in Table 1.

Table 1. Mean, Standard Deviation and Correlation Coefficients

	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. System and Information Quality	4.00	.74	$\alpha = .85$								
2. System Use	4.14	.89	.65**	$\alpha = .94$							
3. Individual Impact	4.06	.82	.68**	.70**	$\alpha = .93$						
4. Organizational Impact	3.85	.94	.66**	.67**	.79**	$\alpha = .93$					
5. Strategic Partnership with Suppliers	3.84	.86	.26**	.51**	.38**	.44**	$\alpha = .93$				
6. Customer Relationship	4.26	.63	.50**	.59**	.61**	.62**	.54**	$\alpha = .92$			
7. Level and Quality of Information Sharing	3.98	.75	.46**	.55**	.53**	.58**	.71**	.73**	$\alpha = .96$		
8. Firm Performance	3.84	.79	.30**	.46**	.47**	.43**	.55**	.53**	.53**	$\alpha = .83$	
9. Competitive Advantage	3.71	.85	.47**	.59**	.60**	.52**	.56**	.62**	.57**	.63**	$\alpha = .95$

* $p < 0.1$; ** $p < 0.05$

Moreover, Cronbach’s Alpha values representing reliability of each variable are shown on the diagonal of the table. The means and standard deviations are within the expected ranges. It is also seen as a result of the correlation analysis that all of the constructs each differing from each other as a factor, are significantly related to each other when one-to-one correlations are considered; and the relatively low-to-moderate correlations provide further evidence of discriminant validity. Regarding to the results of the above statistical tests for reliability and validity, it is assumed that the factors of the variables are sufficiently valid and reliable to test hypotheses.

4.3. Hypotheses Testing

To test our hypotheses, we performed a structural equation modelling (SEM). Before doing any analysis, because our unit of analysis is the “firm,” we aggregated the composite scores of 9 variables. We performed a Path (SEM) analysis by the use of AMOS 4.0. During the analysis, the parameters representing the covariances across ERP systems and SCM practices constructs were allowed to be free. We found that the covariance between ERP systems and SCM practices were significant, as shown in Fig 1. This indicates ERP systems and SCM practices occur simultaneously and affect each other. Fig 2 demonstrates the relationships among ERP systems, SCM practices, competitive advantage and firm performance. The results indicate that SCM practices ($\beta = .77, p <.01$) affect competitive advantage, supporting H1. Also, SCM practices positively affect the firm performance ($\beta = .50, p <.05$). Therefore, we concluded that H2 is supported.

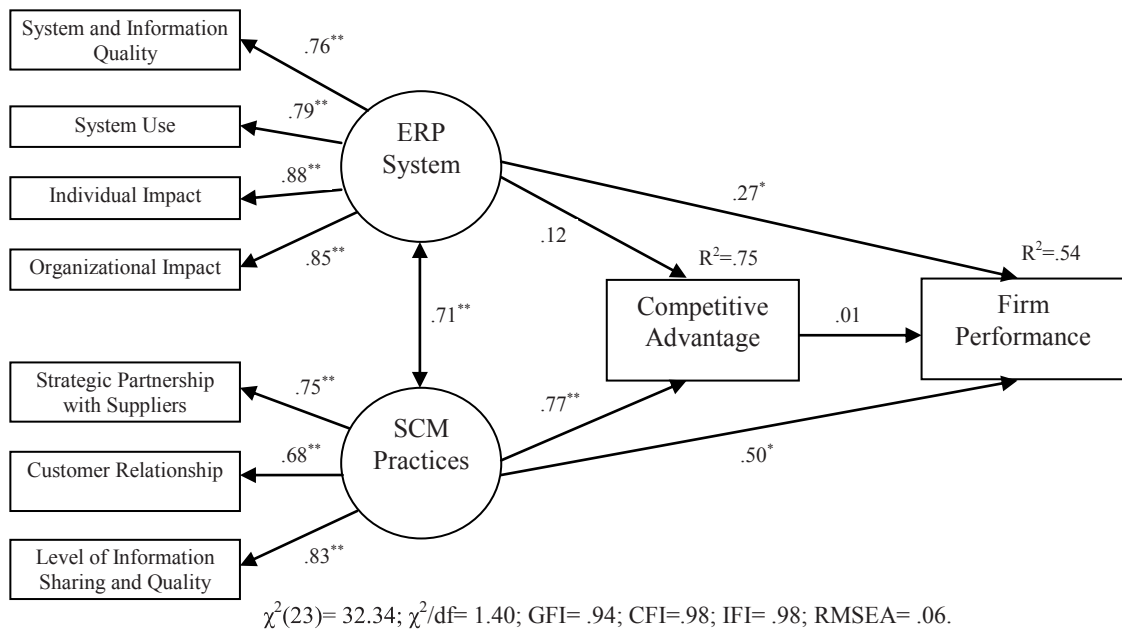


Figure 1. Results of the Path Analysis

Regarding the role of ERP systems on competitive advantage, we found that ERP systems is not positively related to competitive advantage ($\beta = .12, p >.05$). Therefore, research hypothesis H4 is not supported. On the otherhand, ERP systems have a positive effect on firm performance ($\beta = .27, p <.05$),

supporting hypothesis H3. Finally, we found that competitive advantage does not positively affect the firm performance ($\beta = .01$, $p > .05$), not supporting H5. Also, we checked the quality of the SEM analysis. The results exhibit that all the measurements have significant loadings to their corresponding second-order constructs. Overall, model has a satisfactory fit with $\chi^2(23) = 32.34$ and $\chi^2/df = 1.40$, goodness of fit index (GFI) = .94, comparative fit index (CFI) = .98, incremental fit index (IFI) = .98 and root mean square error of approximation (RMSEA) = .06.

5. Discussion and conclusion

This paper has empirically tested a framework identifying the relationships among SCM practices, ERP systems, competitive advantage and firm performance. The primary goal of this research has been investigate the effects of SCM practices and ERP systems on competitive advantage and firm performance. To test the research hypotheses, a path analysis using AMOS 4.0 program was applied. Our results show that most of the hypotheses were supported. For example, SCM practices have a greater positive impact on competitive advantage and firm performance. The standardized path coefficients for SCM practices on competitive advantage and firm performance were 0.77 and 0.50, respectively. ERP practices do not have any effect on competitive advantage but they have a positive impact on firm performance. The standardized path coefficients for SCM practices on competitive advantage and firm performance were 0.12 and 0.27, respectively. Finally, competitive advantage does not have any effect on firm performance.

These findings support our conceptual model and offer a number of managerial implications. First, this study provides a practical tool for managers to evaluate the SCM practices and ERP systems, through the development and the validation of these systems. Also, we showed the effectiveness of SCM practices and ERP success in increasing the performance and competitive advantage. In order to achieve higher competitive advantage, managers should adopt SCM practices. Since the competition is moving from “among organization” to “between supply chains”, organizations are increasingly adopting SCM practices to reduce supply chain costs and secure competitive advantage. The results of this research support that SCM practices can have discernible impact on competitive advantage and firm performance. It should be noted that SCM practices and ERP systems may be influenced by contextual factors, such as the type of the industry, firm size, etc. This study integrates the all the activities of the SCM and ERP systems and links these activities with competitive advantage and firm performance.

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