Relationships among ERP practices, supply chain orientation and operational performance: An analysis of structural equation modeling

Abstract

Purpose- The principal aim of this study is to investigate the interactions among enterprise resource planning (ERP) practices, supply chain orientation (SCO), and operational performance (OPER) by forming a macro perspective based on a scientific foundation powered by a Resource-Based View (RBV).

Design/methodology/approach- Exploratory and confirmatory factor analyses verified the underlying dimensions of SCO and ERP practices. The covariance-based structural equation modeling was employed to test the direct and indirect effects of SCO and ERP practices constructs on OPER.

Findings- Results revealed that SCO has significant and positive effects on OPER whereas ERP practices has not. Moreover, the indirect effect of ERP practices with the mediating effects of SCO is stronger than their direct effects. In addition, the origin of the ERP practices is found to be an important critical success factor.

Originality/value- Although much research has investigated the direct effect of ERP practices on performance, this study points out the importance of SCO in observing the stronger impacts of ERP practices.

Keywords Supply chain orientation, Enterprise resource planning, Operational performance, Resource-based view

1. Introduction

Full, effective, and integrated execution of a management system becomes obligatory to meet criteria, such as speed, production with high capacity, high quality, low cost, and holding minimum inventory. In this context, competing without information technologies that contribute to the efficiency of enterprises by helping retailers with management of material, funds, and information flow throughout the whole production and distribution processes within supply chain management became nearly impossible for enterprises. In the previous years, companies had begun improving their supply chain skills to gain competitive advantage by utilizing the information technology tools, as the present market conditions show that real competition is among supply chains rather than among firms (Christopher, 1992). As an inevitable result of this, information technologies became an inseparable part of competitive business strategies. Being one of the information technologies, Enterprise Resource Planning (ERP) offers a structure that reconstructs processes of enterprises.

The ERP is a crucial tool for corporations to manage the flow of both inside and outside processes of the firm. To satisfy coordination among departments and contractors, the ERP provides control of material and information flow by utilizing different modules, including supply chain, manufacturing, warehouse management, and

quality (Parry and Graves, 2008). What is expected as an outcome of the ERP implementation is an improvement in the operational performance that leads to financial gains. However, studies have revealed that only some of the firms can gain satisfactorily benefit from ERP practices. The question then arises as to what are the factors that triggered the success of ERP implementation in operational performance. Among them, Supply Chain Orientation (SCO), which can be defined as the motivation of organizations to manage supply chain relations with their contractors, is selected.

This study fulfils an important gap in the literature by focusing on the effects of ERP practices mediated by SCO on operational performance by comparing their direct effects, especially in terms of supply chain capabilities for the case of manufacturing companies. Although much research has investigated the direct effects of SCO and ERP practices on performance, to the best of our knowledge, no study exists that deals with the interrelations of tangible (ERP) intangible (SCO) concepts mentioned earlier in conjunction with the mediating effects mentioned.

According to the Resource-Based View (RBV), resource bundling along with combining tangible and intangible resources provides more advantages than the single use of a resource (Hult et al., 2008). This opinion will be discussed in this research, especially with regard to supply chain performance, where the question is whether there is a positive synergy between SCO and ERP practices. The following questions are addressed in this study:

- Is there any positive relationship between SCO and operational performance?
- Do ERP practices have a directly positive impact on operational performance?
- With a mediating effect of SCO, do ERP practices have a stronger impact on operational performance?
- Do the moderating effects of firm size and origin of ERP package (local and foreign) have an impact on operational performance?

The remaining part of this article is organized as follows: Section 2 provides a review of the coherent literature and points out the hypotheses of the study. The research methodology (including data procedure and measurement of variables) is presented in Section 3. Consequently, results are given in Section 4 followed by conclusion and implications.

2. Literature review and hypothesis

The RBV is used to construct the theoretical background of the model, which includes ERP practices, SCO, and OPER. In this section, each of the constructs is explained in a detailed way in order to clarify the structured model.

2.1. RBV and Theoretical Model

According to RBV, a company should develop, acquire, and use its strategic resources to become one of the best performing firms (Barney, 1991; Wernerfelt, 1984; Chae et al., 2014), and corporations can gain competitive advantage by using their resources effectively. In the literature, there are two types of resources: tangible and intangible

(Annamalai and Ramayah, 2011). Tangible resources refer to physical items and they can be transferred inside the firm. However, intangible resources are tacit and therefore difficult to transfer (Kogut and Zander, 1992; Villalonga, 2004). Therewith, intangible resources should be seen as critical elements to gain a competitive advantage (Itami and Roehl, 1991; Villalonga, 2004).

RBV deals with resource bundling (i.e. Hult et al., 2008); this means that with the integration of both tangible and intangible resources rather than focusing on a single resource, organizations can acquire more advantages against their competitors. The other definition is integration of resources of firms to form new capabilities (Yang et al., 2012). Therefore, in this research it is expected that for supply chain-oriented firms, the ERP practices has stronger positive effects on operational performance rather than just implementing ERP solely.

In this study, two resources are considered simultaneously: ERP and SCO. ERP is considered as a tangible resource and in addition to this, SCO can be seen as an intangible resource due to its characteristics. From the perspective of RBV mentioned earlier, combining both tangible and intangible resources is better than using a single resource, so it is asserted that combining all aforementioned resources has a stronger effect on business operational performance rather than simply the direct effect of each resource individually.

2.2. Constructs

SCO refers to the management philosophy that reflects the motivation level of a firm to provide efficiency in supply chain operations (Diniz and Coster, 2007). Hult et al. (2008) defined SCO as "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way." If this view is operationalized with specific activities and businesses, it is expected to affect supply chain performance positively (Omar et al., 2012). Adoption of the SCO requires integrative and collaborative supply chain management activities (Lengnick-Hall et al., 2013) in order to generate value in all members of the supply chain by investing their resources, capabilities, and know-how.
In the literature, several studies indicate that the SCO has a positive impact on business operational performance (Hult et al., 2008; Min and Mentzer, 2004; Min et al., 2007). Similarly, Miocevic and Karanovic (2011) showed that the SCO has a positive impact on organizational buying effectiveness (OBE). In addition to this, they specified that key supplier relationship management (KSRM) was a strong mediator in the SCO-OBE relationship. Min and Mentzer (2004) pointed out that the SCO and supply chain management (SCM) were positively associated. The SCO–SCM path also affects business performance in a favorable way. Furthermore, they presented factors to manage and continue supply chain relations for supply chain-oriented firms. These are trust, commitment, benevolence, cooperative norms, organizational compatibility, and top management support. These can be seen antecedents of cooperation among organizations and crucial elements to assure efficiency, productivity, effectiveness, and long-term relationships (Morgan and Hunt, 1994; Yurt, 2007).

Moreover, Min et al. (2007) suggested the model that included Market Orientation (MO), SCO, and SCM searched the effects of these three factors on operational performance. The analysis showed that MO and SCO are also positively associated. In addition to this, there is a positive relationship between SCO and SCM for the success. Finally, they emphasized that SCO has a positive effect on operational performance and SCO is a strong antecedent of SCM operations. Another study presented by Hult et al. (2008) defined six different indicators for SCO: customer, operations, logistics, competitor orientation, value-chain coordination, and supplier orientation. They suggested that these orientations are first-order indicators of SCO and are positively related to performance. Thus, it is asserted that SCO has a positive impact on operational performance, meaning that firms who focus on supply chain operations more have a competitive advantage compared with others that do not utilize SCO.

H1: SCO is positively related with operational performance.

In the literature, some benefits of ERP are discussed, such as providing high transaction time, decrease in cycle time, and high management in finance, improving information flow, and rapid formation of financial information (Davenport (1998); Muscatello et al., 2003; Bendoly and Jacobs, 2004; Su and Yang, 2010). In addition to the advantages mentioned earlier, according to Holland and Light (1999), ERP facilitates higher managerial control, rapid decision making, and reduction in costs resulting from operations. Bendoly and Schoenherr (2005) showed that ERP practices decreased the material procurement costs, because it satisfied advanced material requirements, advanced production planning, and had little bottleneck/waste in production. One of the most important benefits of ERP is collecting data in a single and shared database. Especially in big companies, many data can be stored in different computers, departments or files. Collecting and analyzing data at the same time is a difficult task. Therefore, ERP can help the management of information flow inside organizations. It can also provide becoming faster in operations comparing to pre-ERP situation. For instance, Autodesk, a company of computer aided software, could reach its customer within 2 weeks, however after ERP it sends 98% of orders in 24 h. IBM could re-price of its products in 5 min, old one was 5 days and could finish the checking of credit in 3 s against 20 min in past, Fujitsu decreased the cycle time for orders to 1 day from 18 days (Davenport, 1998).

Furthermore, in the research of Su and Yang (2010), a positive relationship between ERP and SCM competences was shown. In addition, spending of money and time for ERP also triggers the greater concentration level on supply chain operations, because firms can reorganize and improve their systems during implementation of the ERP within their organizations. Therefore, it is supported that the direct effect of ERP practices on SCO and operational performance is positive. Moreover, according to resource bundling view, with a mediating effect of the SCO, the ERP practices have a positively stronger effect on operational performance. Based on the arguments gathered from the literature, we hypothesize the following:

H2: ERP practices are positively related to operational performance.

H3: ERP practices are positively related to supply chain orientation.

H4: The impact of ERP practices mediated by SCO is stronger than the direct effect of ERPs on operational performance.

Insert Figure 1 about here

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3. Research Methodology

3.1 Sample and data procedure

Survey data were gathered via cross-sectional mail and e-mail survey using a questionnaire. The questionnaire was developed to measure the underlying determinants of the implementation level of SCO and ERP practices relying on 5-point Likert scale with anchors ranging from 1 = strongly disagree to 5 = strongly agree. Moreover, only manufacturing companies were considered in the research. Firms were mostly selected from the members of Industrial Organized Zones and Chambers of Commerce in important industrialized cities of Turkey, such as İstanbul, Ankara, İzmir, Kocaeli, Bursa, Sakarya, and Konya and the reference lists of ERP brands that published their web pages. In addition to these, the social network was also used to reach the managers of organizations. Companies were warned about respondents, because this survey was arranged according to managers related to supply chain operations, including production planning engineers, warehouse managers, the individuals authorized to purchase, and so on.

Approximately 2500 surveys were sent to different firms, and nearly 250 firms responded to our questionnaire. After eliminating several surveys because of largely missing and recurrent values, the sample had 200 observations. Companies are from different sectors such as the automotive, chemical, construction, and food industries. Twenty-four surveys were completed from the automotive industry, 25 of them were from the food sector, 25 were from the construction sector, 17 surveys were from the chemical industry, 12 surveys were from the machine industry, and the remaining were from different sectors, such as iron-steel, furniture, and mining.

Twenty-eight respondents were production managers, 36 respondents were information technology (IT) managers, 24 of them were CEOs or assistants of CEOs, and the remaining respondents were in different positions, such as engineers, supply chain managers, and quality managers. In addition, the corporations were of different sizes. Five companies were micro-sized organizations, 31 of them were small-sized companies (having less than 50 employees), 86 of them were medium-sized companies (having less than 250 employees), 72 of them were big companies, and, consequently, six firms did not specify their number of employees.

3.2. Measurement of variables

3.2.1. Main constructs

The scale related to SCO is cited from the study of Min et al. (2007). According to this research, questions were presented regarding credibility, benevolence, commitment, cooperative norms, organizational compatibility, and top management support. Trust, or in other words, credibility and benevolence, refers to reliability and helpfulness among companies, and it is positively related with performance (Petersen et al., 2005; Spekman et al., 2002; Terpend and Ashenbaum, 2012). Commitment is *an implicit or explicit pledge of relational continuity between exchange partners* (Dwyer et al., 1987). Furthermore, cooperative norms are defined as *the perception of the joint efforts of both the supplier and distributor to achieve mutual and individual goals successfully while refraining from opportunistic actions* (Siguaw et al., 1998). Organizational compatibility means fitness or suitability of cultural norms and management techniques to the SCM. Last, but not least, top management support refers to be open to changes and leadership means suitability and fitness of management techniques and cultural norms to SCM processes.

For ERP scale, different ERP modules were considered to generate arguments, and three basic ERP modules about operations, supply chain, production planning, and quality, were taken into account. In addition, some statements were modified by using the questions of Sternad et al. (2011). Originally, the statement of "*ERP system provides sufficient information to our organizational needs*" was changed to the ERP production/quality/supply chain module provides sufficient information to our organizational needs. Moreover, these statements were checked by two ERP experts, and they confirmed suitability of arguments. The respondents were asked to check their opinion about statements with scaling from 1 (strongly disagree) to 5 (strongly agree).

Performance criteria were decided by reviewing literature (e.g. Kroes and Ghosh, 2010; Zaim et al., 2007). Statements were designed primarily according to supply chain performance. Non-financial criteria common to supply chain operations are as follows: delivery on time, forecasting accuracy, lead time, service after sale, and average inventory level. It can be thought that there is a direct relationship between operational performance and financial performance because operational performance refers to efficiency in the activities of firm. This includes: reduced cycle time, fast response to customers, delivery on time, increased customer satisfaction, and these can increase sales and revenue. In addition to these, some operational performance criteria, such as, lower inventory levels and forecasting accuracy are also related to cost reduction. Improvement in these type of criteria can increase revenue and profits. Therefore, higher efficiency means higher operational performance, and this cause better financial performance. The respondents were asked to check their opinion about performance on a scale from 1 (very bad) to 5 (very good).

3.2.2. Moderator variables

In this study, two different perspectives are taken as moderating variables: the former is related to the ERP package, and the latter is related to firm characteristics. As mentioned earlier, although numerous studies exist regarding the effect of ERP on competitive performance (Ho, 2007; HassabElnarby et al., 1999), the combined effect of ERP and SCO has not been investigated yet. Soh and Sia (2004) accentuate that insufficient attention has been paid to the consistency of the ERP package and organization. Ram et al. (2014) points out the necessity to study the influence of some processors, including competence of ERP package. Haddara (2014) and Law and Ngai (2007) emphasize that the consistency of ERP packages and organizational structure strongly affect the success of the implementation process. In addition, inadequate ERP package selection creates a primary obstacle on adoption. Kilic et al. (2015) placed emphasis on the importance of right ERP package selection, as it creates a competitive advantage.

Since to the best of our knowledge, the effect of ERP package (as a qualification of ERP package) on implementation success has not been observed, in this study it is taken as the critical success factors associated with ERP. Two options are investigated, local and foreign ERP packages were assessed to determine whether statistically significant differences exist between two groups.

The necessity and the expectations from ERP package diversify according to the operation structure that has a strong connection with firm size. Although firm size has been considered by some researchers as a critical success factor in the implementation of ERP (Bradford and Florin, 2003; Mabert et al., 2003; Schniederjans and Yadav, 2013, Van Der Vorst, 2012; Nettsträter et al., 2015), in Turkey, no study exists regarding the effect of the firm size on ERP. As a result, in this study, moderator variables are also taken into consideration.

4. Analysis and results

By taking the theory-driven approach as a guide, the analytical framework is tested by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) in structural equation modeling (SEM) in order to assess the consistency among scale items (Jöreskog and Sörbom, 1993; Vinodh and Joy, 2012; Chan and Chong, 2013). In this study, the EFA and CFA are used to test the measurement model of the SCO and ERP practices.

In the remaining sections, unidimensionality, convergent and discriminant validity, reliability, and common method bias in the model are given to validate the constructed model. Consequently, inter-relationships among ERP practices, SCO, and operational performance constructs, and the mediating impact of SCO on the relationship between ERP practices and operational performance within the context of the manufacturing sector using covariance-based structural equation modeling are investigated. These steps are further discussed in detail in the following sections.

4.1. Exploratory factor analysis (unidimensionality and reliability)

In this study, we tested the unidimensionality of SCO and ERP practices constructs by analysing the results of a principal component analysis in the EFA. The EFA with varimax rotation was performed for both constructs: SCO and ERP practices. First, this analysis was applied for SCO. There were 20 items related to SCO, and at the end of the steps 16 items were loaded on four different factors as in Table 1. These explain the 68.9% total variance. Based on the loadings, these factors were named credibility (CRE), benevolence (BENV), commitment (COM), and top management support (TMS). All these factors were also previously mentioned (Min and Mentzer, 2004; Min et al., 2007), so the analysis overlaps with the literature. The Cronbach α values are 0.71, 0.87, 0.63, and 0.90, respectively. These values are closer to or greater than the threshold value 0.7 (Nunnally and Bernstein, 1994), therefore all of them are used in this study.

Insert Table 1 about here

Furthermore, nine indicators of ERP practices were loaded on two different factors as in Table 2. These explain the 68.2% of total variance and further to loadings; these factors are named modules of ERP (MO) and utility of ERP (UTIL). The Cronbach α values are 0.89 and 0.78, respectively. These values are greater than the threshold value 0.7 (Nunnally and Bernstein, 1994), so they could be used in the analysis.

Insert Table 1 about here

4.2. Confirmatory factor analysis (construct and convergent validity)

CFA tests the measurement model of variables. Therefore, SCO and ERP practices were tested with a first-order confirmatory factor model to evaluate the construct validity. Based on the results, it can be said that factor structures for SCO and ERP practices obtained from EFA were supported. The measurement model for SCO and ERP practices is summarized. The standardized regression weights for all variables constituting each dimension were also found to be significant ($p < 0.05$), as shown in Tables 3 and 4.

Insert Table 3 about here

Insert Table 4 about here

The goodness-of-fit indices for SCO, ERP practices and OPER reveal that the values of X^2 statistic are 187.21, 75.71, 4.93 and values of X^2/df are 1.88, 3.60, and 1.64, respectively. This ratio should be between 1 and 5 or less, where lower value implies a better fit (Hair et al., 1995). Moreover, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Tucker–Lewis coefficient (TLI), and comparative fit index (CFI) values and root mean square error of approximation (RMSEA) for SCO, ERP practices, and OPER are highly satisfactory, because these indices should be close to 1 to show a perfect fit, which are given in Table 5 (Hair et al., 1995).

Insert Table 5 about here

Therefore, it can be said that each model showed a good fit when considered with related factors. The model parameters were calculated with the maximum likelihood method. For each variable, most of the indices are at an acceptable level (Cheung and Rensvold, 2009; Hair et al., 1995; Hooper et al., 2008). In addition, the significance levels of the factor loadings that belong to each component are investigated and, consequently, each of them is found to be statistically significant (Anderson and Gerbing, 1988). Moreover, the composite reliability (which can be calculated by dividing the sum of standardized loading squared by the sum of standardized loading plus the sum of measurement error) and average variance extracted (AVE) values are computed (Hair et al., 1995). As shown in Table 6, composite reliability diversifies from 0.751 to 0.902, which reveals that construct reliability is in an acceptable range. In addition to this, convergent validity of scales that are also given in Table 6 are strong, since the AVE values were greater than the suggested level (0.50).

Insert Table 6 about here

4.3. Discriminant validity

Discriminant validity explains the degree to which measures of different dimensions of SCO and ERP practices constructs are unique from each other. Table 7 indicates the results of 15 pairwise tests for discriminant validity. These findings indicate strong support for the discriminant validity criterion, so it can be concluded that the discriminant validity criterion is satisfied by these values.

Insert Table 7 about here

4.4. Common method bias

When data are collected from a single source for both the independent and dependent variables, common method bias tends to provide higher estimates of the relationships between the variables (Podsakoff and Organ, 1986). Since the gathering data from multiple data sources for each of the entities (namely organizations) bring a high cost, as a result of this, in this study, data are collected from single respondents while simultaneously aiming at minimizing common method variance by utilizing surveys. In addition, some questions were evaluated by top manager themselves, therefore one-factor test was utilized to check the potential bias recommended by Podsakoff and Organ (1986).

As Harmans test recommended, a principal components factor analysis was utilized to group the variables as well as a resulting factor analysis of all items. Detailed information will be given in the next sections. Six factors with eigenvalues greater than one are able to explain 47.36% of the total variance. According to the test results mentioned earlier, the common method bias is not considered statistically significant. The results from the Harman's single factor test show a minimal impact on the reported findings due to common method bias.

4.5. Structural analysis

The final step in the analysis is the testing path model as shown in Figure 2. The hypothesized structural equation model is tested with the AMOS software package.

Insert Figure 2 about here

The goodness-of-fit indices for this model are at an acceptable level, and these mean a good fit for data (Satorra-BentlerX^2=89.555 with df=55; X^2/df=1,6; GFI=0.905; AGFI=0.848; NFI=0.829;CFI=0.881;RMR=0.048; RMSEA=0.094). Results of four hypotheses and related coefficients are shown in Figure 2. As can be seen, the first hypothesis, that SCO is positively related with OPER, is supported and the standardized regression weight for this relationship is significant ($\beta = 0.921$; $p < 0.05$). This finding tends to confirm the earlier research results that show a positive relationship between SCO and OPER (Hult et al., 2008; Min and Mentzer, 2004; Min et al., 2007).

Figure 2 also exhibits the relationship between ERP practices and OPER. However, the hypothesis that ERP practices had a positive impact on OPER is not accepted ($p = 0.341 > 0.05$). This result is similar with some research in the literature that asserts no direct positive impacts of ERP practices on operational performance (Etezady, 2011; Hendricks et al., 2007; Li et al., 2009); however, it is contrasted with some research that supports the positive effects of ERP practices on performance (Bendoly and Jacobs, 2004; Muscatello et al., 2003; Su and Yang, 2010).

The third hypothesis, positive relationship between ERP practices and SCO, is also supported with the standardized regression weight that is $\beta = 0.648$ ($p < 0.05$). It means that ERP practices triggers the development of concentration level on supply chain operations. Furthermore, the hypothesis that mediating by SCO, ERP practices has a stronger effect than the direct effect of ERP practices on OPER is also accepted ($Y_{ERP\text{-}SCO} * \beta_{SCO\text{-}OPER}$=0.65*0.92 =0.598). There is a complete mediation between ERP practices and OPER when considering the SCO as mediator that is also supported with Sobel test (test statistic= 4.25).

4.6. Moderating effect

Multiple-group analysis with covariance-based SEM enables us to examine the variation in the proposed model with respect to the moderator variables. Two moderator variables are addressed in this section. The moderating effects of firm size and origin of ERP package (local and foreign) on the proposed model were assessed to determine any significant differences between the two groups. If the goodness of fit of the constraint model is worse than that for the corresponding unconstraint model, then the model has different results for each group (Hair et. al, 1995). Table 8 presents model fits of both unconstraint and constraint models, and also values of model differences of origin of ERP package and firm size as a moderator. A specific discussion is provided next.

Insert Table 8 about here

Table 8 shows that the X^2 value for the unconstrained and the constrained models for firm size were 190.849 (df = 82) and 203.416 (df = 93). The difference between the two X^2 values was 11.592 with 11 df, which was not statistically significant at the level of $\alpha = 0.1$ ($p > 0.1$), indicating that firm size does not have any significant moderating effect on the structural model. In contrast, the origin of the ERP package type was noted to have a significant moderating effect ($p < 0.05$) on the structural model. Table 9 shows the mean and standard deviations of the individual variables of each construct and the appropriate test statistics for comparing difference in mean scores.

Insert Table 9 about here

Table 9 indicates some significant variation in the ERP practices, SCO, and operational performance constructs with respect to the origin of the ERP package type. The independent *t*-value was employed to compare two groups. The relationship between SCO and credibility, and lead time and operational performance were found to be significantly ($p < 0.05$) different with respect to the ERP package type.

Table 10 shows the comparison of the path coefficient between the two groups. The independent *t*-value was employed to compare two path coefficients within the Amos program. Table 10 indicates that the relationship between credibility and SCO, and the relationship between lead time and operational performance is significantly different according to local- and foreign-based ERP users.

Insert Table 10 about here

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5. Discussion and Managerial Implications

SCO is the motivation of organizations to manage supply chain relations with their contractors, with concentration on supply chain activities inside a firm or willingness to be efficient and successful in supply chain operations throughout the firms' activities. To design an efficient supply chain, thus, firms should be supply chain oriented. The SCO is a strategic capability, and it is one of the required factors to achieve a

competitive advantage (Hult et al. 2008; Jüttner and Christopher 2013; Hervani et al., 1999). However, SCO and SCM are not independent from each other rather they are different from each other. The SCO is managed by an organization, whereas the SCM is shared in relationships between supply chain partners (Min et al. 2007).

In this research, the scale of SCO was adapted from the study of Min et al. (2007). According to the EFA, four factors were found. These were credibility, commitment, benevolence, and top management support. Credibility refers to trust, and benevolence implies helpfulness among companies. It can be seen that the SCO is very important for manufacturers to become successful in supply chain operations, because, in the model, the positive impacts of ERP practices on OPER with a mediating effect of SCO are stronger than the direct effect of ERP practices on it. This is compatible with the literature, because many authors emphasized the importance of SCO (Hult et al. 2008; Min and Mentzer 2004; Min et al. 2007). To sum up, managers should be supply chain oriented, because in today's market environment, the SCO brings competitive advantages to firms, including being credible and benevolent, which provide closer and sustainable relationships between contractors.

In this study, the scale for ERP practices was first developed. According to EFA, two factors were found: modules of ERP and the utility of ERP practices. The first factor refers to the functions of different ERP modules. In this research, when the scale was developed, three operational ERP modules were considered: production planning, quality, and the supply chain. In addition to the first factor, the second one illustrates the importance of ERP modules for corporations.

When results are considered, it can be easily observed that the ERP practices have no direct effect on OPER. It means that ERP brings no advantages directly. In fact, this solution is surprising, but in the literature, there are some opinions about this issue. Brynjolfsson (1993) explained this problem as the productivity paradox of information technology. Corporations face this type of problem for several reasons. The most important ones are time lags and mismanagement (Brynjolfsson, 1993). Time lags mean that to observe the positive effects of investment in information technology requires a long lead time. Therefore, in the short and medium term, firms cannot get any positive impact from information technologies on operational performance. Second, mismanagement is a serious problem for organizations, especially if there is a lack of expert managers. Many firms have ERP or different information technologies, but if there are not enough experts to use these types of systems, getting the complete benefit or utility from them is not possible. Therefore, firms should hire qualified managers to utilize the information systems. Furthermore, management's failure to leverage the full potential of IT is another significant problem (Dos Santos and Sussman, 2000). Since IT occurs from different parts and software, the lack of any section or part may cause a loss in the utilization. For instance, if any SME uses ERP with only few modules, it cannot take full advantages of using ERP. Therefore, firms should struggle to implement ERP fully in their organizations.

In addition, when using ERP in its simplest form, it may not bring competitive advantages for organizations. Since ERP is applied in existing systems, inefficiencies or problems may not be eliminated during and after ERP implementation. Bill Gates

pointed out this situation and said the first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency. Data are received from the ERP and used to generate knowledge or define and eliminate problems; then, the improvement efficiency in organizations can be provided.

According to results, SCO plays an important role for organizations to get benefit from ERP systems. Firms should give importance to SCO because it brings competitive advantages to firms, including being credible and benevolent, which provides closer and sustainable relationships among contractors. This causes sharing of data between suppliers and customers, and it leads the effective utilization of ERP systems because, with lack or wrong data, organizations cannot use software programs efficiently. In addition to this, the level of top management support to SCOs is an important point to get benefit completely from the ERP. The qualified people and technical infrastructure are needed for this type of software, so top management support can affect the success of ERP implementation.

Finally, moderator effect shows that the relationship between credibility and SCO, and the relationship between lead time and operational performance is significantly different according to local and foreign-based ERP users. It can be thought that foreign-based ERP packages are more expensive than the local ones; therefore, foreign software programs are generally used by institutionalized and big companies. So, these types of organizations can give importance more to lead time and credibility than small- and medium-sized enterprises in their SCOs.

6. Conclusion

The aim of this research is to investigate the direct and indirect effects of ERP usage with the mediating effect of SCO on operational performance. The study is based on survey and data collected from manufacturing companies. First, factors of latent variables were determined according to EFA, and then reliability and validity of these variables were evaluated with CFA. In the next step, unidimensionality was tested for three variables, and hypotheses were evaluated with the AMOS method. Since all of the three constructs get a higher value than 0.7 for both Cronbach's α and Dillon-Goldstein's ρ, they are considered unidimensional.

According to the RBV, with resource bundling along with combining of both tangible and intangible resources instead of focusing on a single resource, corporations can develop an advantage against their competitors (Hult et al. 2008). This opinion was discussed in this research, especially with regard to supply chain performance. Therefore, ERP should have a stronger positive effect on performance in supply chain-oriented firms, because according to the resource-bundling perspective, combining ERP practices and SCO brings many benefits to organizations rather than implementing solely.

The path analysis showed that SCO has a significant and positive effect on operational performance, while ERP practices do not. The issue that ERP practices had

no significant impact on operational performance has been named the productivity paradox of information technology (Lim et al. 2004).

Furthermore, the indirect effect of ERP practices with the mediating effect of SCO is significant and stronger than its direct impact. Although much research has been interested in the effect of ERP practices on performance, this study indicated the importance of SCO to observe the stronger impact on operational performance.

Although it is an intensive study, this research has some limitations. Since only manufacturing companies were considered, in future research, the service sector may also be added and results can be compared with those of the manufacturing sector. Similar to manufacturing companies, organizations in the service sector also play an important role in trade and business, and many supply chains need to buy service from these corporations. However, to do this comparison, a different ERP scale should be developed, because statements about ERP variables were arranged according to manufacturing operations such as quality management and production planning. So, further indicators related with different modules, such as customer relationship management, accounting, and finance, need to be added to the scale.

Furthermore, as data can be collected from different countries, the results of hypotheses can be compared. Cultures or technological infrastructures can differ from country to country. Therefore, comparisons of different countries firms provide a wider perspective for researchers regarding the importance of having a supply chain orientation. By using the international business theory, the impact of ERP practices and KM on performance changes in different geographical regions can also be investigated.

Similar to quantitative analysis, qualitative research methods are also important for studies in social sciences. Therefore, researchers can interview managers from the private sector. They can give extra information about the importance of SCO and explain how it contributes to operational and financial performance. They can also clarify further reasons of why ERP practices has no direct effect on operational performance.

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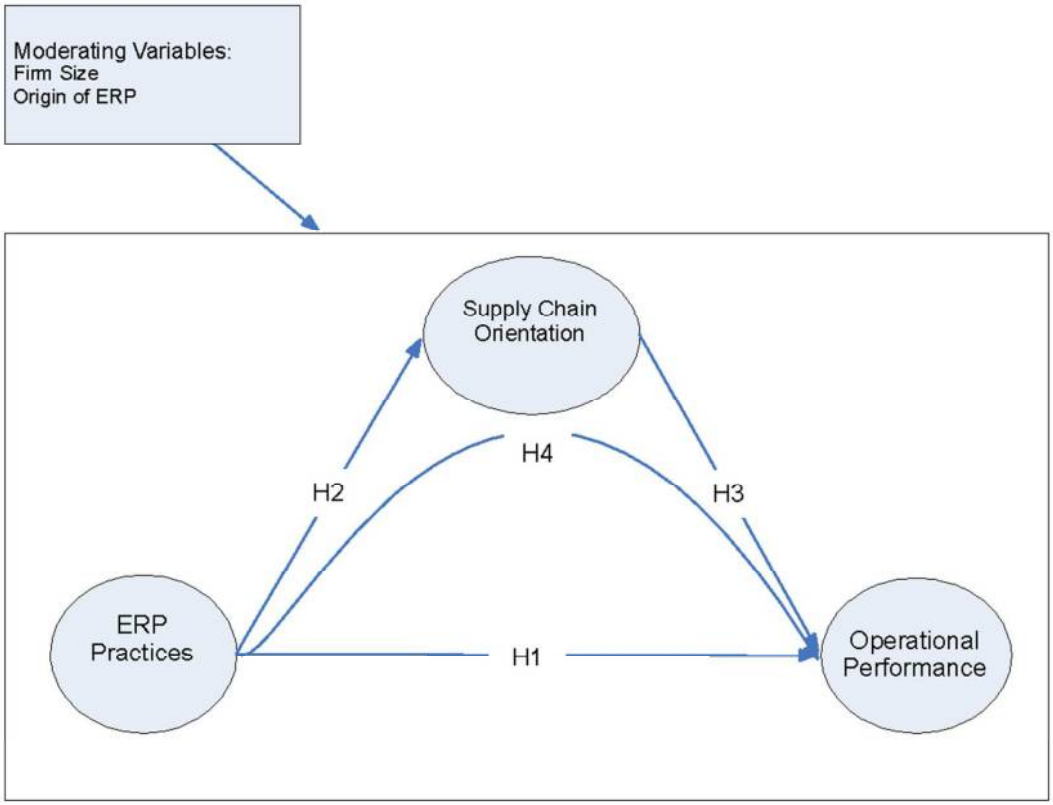
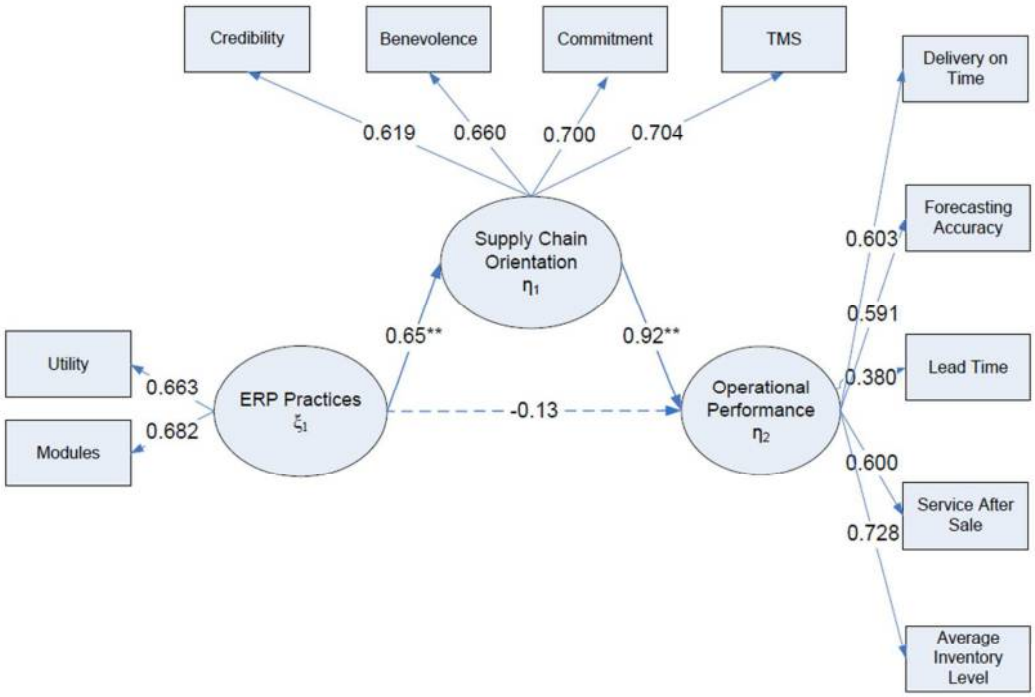


Figure 1. Proposed Model



**significant for $p < 0.01$

Figure 2. Results of proposed model

Table I. EFA for SCO

Symbol	Variables	CRE	BEN	COM	TMS
SCO1	Promises made to our supply chain members by our business unit are reliable.	0.76			
SCO2	Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.	0.68			
SCO3	Our business unit does not make false claims to our supply chain members.	0.81			
SCO4	Our business unit is not open in dealing with our supply chain members.	0.59			
SCO5	When making important decisions, our supply chain members are concerned about our welfare.		0.78		
SCO6	When we share our problems with our supply chain members, we know they will respond with understanding.		0.73		
SCO7	In the future we can count on our supply chain members to consider how their decisions and actions will affect us.		0.86		
SCO8	When it comes to things that are important to us, we can depend on our supply chain members' support.		0.79		
SCO9	We defend our supply chain members when outsiders criticize them, if we trust them.			0.73	
SCO10	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.			0.87	
SCO11	Our business unit is willing to make cooperative changes with our supply chain members.			0.75	
SCO12	Top managers repeatedly tell employees that this business units' survival depends on its adapting to supply chain management.				0.84
SCO13	Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business units' success.				0.74
SCO14	Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business units' success.				0.77
SCO15	Top management repeatedly tell employees that sharing risk and rewards is critical to this business units success				0.85
SCO16	Top management offers various education opportunities about supply chain management.				0.79

Table II. EFA for ERP

Symbol	Variables	MO	UTIL
ERP1	We effectively use the ERP Production module.	0.87	
ERP2	ERP Production module gives necessary information about production processes.	0.85	
ERP4	We effectively use the ERP Supply Chain module.	0.87	
ERP5	ERP Supply Chain module gives necessary information about production processes.	0.74	
ERP7	We effectively use the ERP Quality module.	0.76	
ERP8	ERP Quality module gives necessary information about production processes.	0.64	
ERP3	The lack of ERP Production module is a serious loss for us.		0.78
ERP6	The lack of ERP Supply Chain module is a serious loss for us.		0.86
ERP9	The lack of ERP Quality module is a serious loss for us.		0.80

Table III. CFA for SCO

Symbol	Variables	Regression weights
Credibility		
SCO1	Promises made to our supply chain members by our business unit are reliable	0.85***
SCO2	Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.	0.81***
SCO3	Our business unit does not make false claims to our supply chain members.	0.73***
SCO4	Our business unit is not open in dealing with our supply chain members.	0.57***
Benevolence		
SCO5	When making important decisions, our supply chain members are concerned about our welfare.	0.78***
SCO6	When we share our problems with our supply chain members, we know they will respond with understanding.	0.79***
SCO7	In the future we can count on our supply chain members to consider how their decisions and actions will affect us.	0.83***
SCO8	When it comes to things that are important to us, we can depend on our supply chain members' support.	0.80***
Commitment		
SCO9	We defend our supply chain members when outsiders criticize them, if we trust them.	0.71***
SCO10	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	0.68***
SCO11	Our business unit is willing to make cooperative changes with our supply chain members.	0.72***
Top Management Support		
SCO12	Top managers repeatedly tell employees that this business units survival depends on its adapting to supply chain management.	0.78***
SCO13	Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business units success.	0.89***
SCO14	Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business units success.	0.89***
SCO15	Top management repeatedly tell employees that sharing risk and rewards is critical to this business units success.	0.74***
SCO16	Top management offers various education opportunities about supply chain management.	0.61***

***significant for $p < 0.001$

Table IV. CFA for ERP practices

Symbol	Variables	Regression weights
Module		
ERP1	We effectively use the ERP Production module.	0.79***
ERP2	ERP Production module gives necessary information about production processes.	0.80***
ERP4	We effectively use the ERP Supply Chain module.	0.88***
ERP5	ERP Supply Chain module gives necessary information about production processes.	0.79***
ERP7	We effectively use the ERP Quality module.	0.63***
ERP8	ERP Quality module gives necessary information about production processes.	0.59***
Utility		
ERP3	The lack of ERP Production module is a serious loss for us.	0.70***
ERP6	The lack of ERP Supply Chain module is a serious loss for us.	0.81***
ERP9	The lack of ERP Quality module is a serious loss for us.	0.72***

***significant for $p < 0.001$

Table V. Goodness of fit statistics

Construct	x^2	Df	x^2/df	GFI	AGFI	CFI	TLI	RMSEA
SCO	187.21	83	2.25	0.88	0.83	0.93	0.92	0,06
ERP Practices	75.71	21	3.6	0.92	0.84	0.95	0.91	0,7
OPER	4.93	3	1.64	0.98	0.95	0.99	0.97	0,05

Table VI. Validity statistics

Factors	CR	AVE	ASV
Module	0.895	0.594	0.148
Credibility	0.838	0.568	0.256
Benevolence	0.878	0.644	0.261
Commitment	0.751	0.502	0.316
Top management	0.902	0.650	0.267
Utility	0.790	0.557	0.156

Table VII. Assessment of discriminant validity

Test	Description	Unconstrained model X^2	Constrained model X^2	Difference
1	Credibility- Commitment	82,72	14,67	68,05***
2	Commitment- Benevolence	106,57	44,05	62,52***
3	Commitment-Top Management Support	153,9	94,34	59,56***
4	Commitment- Utility	86,17	17,09	69,08***
5	Commitment-Module	258,11	205,36	52,75***
6	Credibility-Benevolence	124,18	65,38	58,8***
7	Credibility-Top Management Support	157,93	104,42	53,51***
8	Credibility-Module	824,06	770,96	53,1***
9	Credibility-Utility	608,91	555,64	53,27***
10	Benevolence-Top Management Support	157,83	112,27	45,56***
11	Benevolence-Module	264,49	222,2	42,29***
12	Benevolence-Utility	79,91	35,29	44,62***
13	Top Management Support-Utility	120,6	79,23	41,37***
14	Top Management Support-Module	340,59	299,33	41,26***
15	Module-Utility	274,57	258,25	16,32***

***significant for $p < 0.01$

Table VIII. Moderating effects

Model Characteristics	Model Fit	Size	Origin of ERP Package
Unconstraint Model	x^2	190.849	183.234
	DF	82	82
	CFI	0.84	0.85
	RMSEA	0.082	0.079
Constraint Model	x^2	202.441	203.416
	DF	93	93
	CFI	0.83	0.84
	RMSEA	0.077	0.077
Model Differences	Δx^2	11.592 (df=11)	20.182 (df=11)
	p - Value	0.395	0.043

Table IX. Comparison results of variables and t-value

	Local		Foreign		
Variables	Mean	Standard Deviation	Mean	Standard Deviation	P Value
Generation	3,721	0,833	3,753	0,773	0,780
Storage	3,955	0,928	4,124	0,915	0,200
Usage	3,964	0,808	3,933	0,823	0,787
Credibility	4,266	0,755	4,503	0,557	0.014
Benevolence	3,730	0,837	3,663	0,717	0,551
Commitment	3,817	0,654	3,757	0,664	0,515
TMS	3,800	0,864	3,802	0,853	0,985
MODULES	3,713	0,927	3,672	0,097	0,768
Utility	3,721	0,913	3,985	0,999	0.086
Delivery on time	4,198	0,872	4,169	0,757	0,800
Forecasting accuracy	3,937	0,917	3,742	0,613	0.086
Lead time	3,613	0,912	3,562	0,878	0,727
Service after sale	3,685	0,894	3,730	0,850	0,714
Average inventory level	4,153	0,907	4,079	0,895	0,562

Table X. Multiple group analysis results

Relationship	Local		Foreigner		
	Estimate	P Value	Estimate	P Value	z-stat
SCO – ERP	0.415	0.000	0.736	0.000	1.292
OPER – SCO	0.829	0.000	0.709	0.000	-0.421
OPER – ERP	-0.037	0.715	-0.099	0.577	-0.306
Commitment – SCO	0.887	0.000	0.651	0.000	-1.289
Benevolence – SCO	0.892	0.000	0.832	0.000	-0.282
Lead Time – OPER	0.881	0.000	0.486	0.024	-1.219
Forecasting Accuracy – OPER	1.181	0.000	0.533	0.000	-2.368**
MODULES – ERP	0.686	0.000	1.405	0.002	1.505
Credibility – SCO	0.919	0.000	0.481	0.000	-2.35**
Delivery on Time – OPER	1.073	0.000	0.774	0.000	-1.029
Avg. Inv. Level – OPER	1.284	0.000	1.261	0.000	-0.065

**significant for $p < 0.05$