SUPPLY CHAIN ORIENTATION, ERP USAGE AND KNOWLEDGE MANAGEMENT IN SUPPLY CHAIN

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To my family

APPROVAL

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I certify that this dissertation satisfies all the requirements as a dissertation for the degree of Doctor of Philosophy.

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This is to certify that I have read this dissertation and that in my opinion it is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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AUTHOR DECLARATIONS

1. The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

2. The program of advanced study of which this thesis is part has consisted of:

i) Research Methods course during the undergraduate study

ii) Examination of several thesis guides of particular universities both in Turkey and abroad as well as a professional book on this subject.

Mehmet Fatih ACAR

December, 2013

ABSTRACT

Mehmet Fatih ACAR **DECEMBER 2013**

SUPPLY CHAIN ORIENTATION, ERP USAGE AND KNOWLEDGE MANAGEMENT IN SUPPLY CHAIN

The principal aim of this study is to investigate the direct and indirect impacts of Knowledge Management (KM) and Enterprise Resource Planning (ERP) usage with the mediating effect of Supply Chain Orientation (SCO) on operational performance. The research is based on survey and datacollected from 200 manufacturing companies. Using Exploratory Factor Analysis, dimensions of SCO, KM and ERP Usage were identified and with Confirmatory Factor Analysis, they were validated. In addition to these, the validity and reliability of three variables were also evaluated by testing unidimensionality three ways: Principal component analysis, Cronbach's α and Dillon-Goldstein's ρ. The Partial Least Square Method (PLS) and Universal Structure Modelling (USM) were applied to examine the direct and indirect effects of variables on performance. The path analysis displayed that KM and SCO have significant and positive effects on operational performance, while ERP does not. Moreover, indirect impacts of KM and ERP Usage with a mediating effect of SCO are significant and stronger than their direct effects. Also, operational performance influences financial performance positively. In addition to these, the path analysis was employed for two moderator effects; company size and origin of used ERP brand. Owing to the relatively small sample size, instead of structural equation modelling, the PLS method was applied to model. Furthermore, the service sector was not used in the study, but is available for future research. Although much research have investigated the effects of KM and ERP Usage on performance, this study points out the importance of SCO to observe the stronger impacts of KM and ERP. Moreover, the research indicated that ERP and KM are complementary rather than conflicting.

Keywords: Supply Chain Orientation, Knowledge Management, ERP, performance

KISA ÖZET

Mehmet Fatih ACAR **ARALIK 2013**

TEDARİK ZİNCİRİNDE BİLGİ YÖNETİMİ, KKP KULLANIMI VE TEDARİK ZİNCİRİ ODAKLILIK

Bu çalışmanın amacı Bilgi Yönetimi (BY) ve Kurumsal Kaynak Planlaması (KKP) kullanımının operasyonel performans üzerine olan dolaylı ve direkt etkisinin incelenmesidir.Dolaylı etki ile ima edilen Tedarik Zinciri Odaklılık (TZO) vasıtası ile oluşan etkidir.Bu çalışma ankete dayalı bir araştırmadır ve imalat sektöründeki 200 firmadan veri toplanmıştır. Açıklayıcı Faktör Analizi ile, TZO, BY ve KKP Kullanımı değişkenleri için faktörler bulunmuş ve Doğrulayıcı Faktör Analizi ile bunların geçerliliği test edilmiştir. Bunlara ek olarak, tek boyutluluk testi ile de bu değişkenlerin geçerlilikleri ve güvenilirlikleri test edilmiştir. Bunun için Temel Bileşen Analizi, Cronbach's α ve Dillon-Goldstein's ρ değerleri göz önünde bulundurulmuştur. Değişkenlerin performans üzerine olan dolaylı ve dolaysız etkilerini incelemek için ise Kısmi En Az Kareler Yöntemi (KKY) ile Kapsamlı Yapı Modellemesi (KYM) kullanılmıştır. Yol analizlerine göre, KKP'nin operasyonel performansa anlamlı bir etkisi yok iken, BY ve TZO pozitif ve anlamlı etkiye sahiptirler.Bununla birlikte, BY ve KKP, TZO aracılığıyla performans üzerine dolaylı, anlamlı, pozitif etkiye sahiptirler ve bunlar direkt etkilerden daha kuvvetlidirler.Operasyonel performans ise finansal performansı olumlu bir şekilde etkilemektedir. Bunlara ek olarak, firma büyüklüğü ve kullanılan KKP'nin menşei gibi iki moderatör etki için de yol analizi yapılmıştır. Çalışmada servis sektörü göz önünde bulundurulmamıştır, dolayısıyla ilerleyen çalışmalarda bu sektörle ilgili de analizler yapılarak, sonuçlar imalat sanayi sonuçlarıyla karşılaştırılabilinir. Birçok çalışma BY ve KKP kullanımının performansı üzerine etkisini araştırmasına rağmen, bu çalışma BY'nin ve KKP kullanımının performansa daha fazla olumlu etkisi için TZO'nun önemini vurgulamaktadır. Ayrıca çalışma KKP'nin ve BY'nin birbiri ile çelişmekten ziyade birbirlerini tamamlayıcı olduklarını göstermiştir.

Anahtar Sözcüker: Tedarik Zinciri Odaklılık, Bilgi Yönetimi, KKP, performans

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LIST OF ABBREVIATIONS

CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
df	Degrees of freedom
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
KM	Knowledge Management
KMO	Kaiser-Meyer-Olkin
PLS	Partial Least Square
R&D	Research and Development
SCO	Supply Chain Orientation
USM	Universal Structure Modeling

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CHAPTER 1

INTRODUCTION

1.1. Overview

This section presents a general overview of the thesis, focusing on the problem definition, purpose and significance of the study, the main research questions, the theoretical framework and the analytical approach used in the research.

Overall, the aim of this study is to make a contribution to the literature about effects of Knowledge Management (KM) and Enterprise Resource Planning (ERP) with a mediating effect of Supply Chain Orientation (SCO) on business performance.

Supply chain isone of the most popular topics for managers and academicians in today's highly competitive market environment. Many firms gain competitive advantage by improving their supply chain capabilities. In the literature, there is much research related to Supply Chain Management (SCM) addressing issues such as: selection of suppliers, collaboration among supply chain members, warehouse management, risk and reward sharing between buyers and sellers, logistics of hazardous material, vehicle routing, green supply chain, etc.

Supply Chain Orientation (SCO) can be defined as the motivation of organizations to manage supply chain relations with their contractors. In recent years, companies have begun to improve their supply chain capabilities to gain competitive advantage, because today's market conditions show that real competition is among supply chains rather than among firms (Christopher, 1992).

Knowledge Management (KM) is also a new concept for organizations, and it has been accepted by both academics and managers. Knowledge can be seen as a soft power that provides competitive advantage for its users. Know-how plays an important role in competition, and KM provides a means to get it. Generation, storage, and codification of knowledge can be listed as processes of managing knowledge. Many organizations struggle with different methods in their operations to apply these processes.

Furthermore, ERP is a crucial tool for corporations to manage the flow of inside and outside processes of the firm. To satisfy coordination among departments and contractors, ERP provides control of material and information flows. ERP programs have several different modules including, supply chain, manufacturing, warehouse management, and quality. Despite huge costs, many organizations integrate different modules of ERP into their organizations.

In this research, the effects of Knowledge Management (KM) and ERP on business performance, especially in terms of supply chain capabilities, are investigated in relation to the SCO. Some research has investigated the direct effects of SCO, KM and ERP on performance, this study also focuses on the effects of ERP and KM mediated by SCO on performance by comparing their directs effects.

1.2. Purpose of the Thesis

Many companies buy and sell different items and equipment at the same time as they manufacture goods. Raw materials or equipment are needed for production in corporations, and produced items are sold at a profit. The organization or arrangement of these processes is called as supply chain management. It also can be defined as'*the network of facilities and activities that performs the functions of development, procurement of material from vendors, the movement of materials between facilities, the manufacturing of products, the distribution of finished goods to customers, and after-market support for sustainability*' (Su &Yang, 2010). Therefore, to gain competitive advantage, corporations should determine and consider the key factors that affect supply chain performance.

Supply Chain Orientation (SCO) refers to the management philosophy that reflects the motivation level of firm to provide efficiency in supply chain operations. Hult, Ketchen, Adams and Mena (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*'.SCO emphasizes the value generation in all members of the supply chain such as, investing their resources, capabilities and know-how. Each organization—as a subsystem—contacts other subsystem(s) and the whole of them forms supply chain (Miocevic & Karanovic, 2011).

ERP (Enterprise Resource Planning) plays an important role in managing the information and material flows in organizations. Su and Yang (2010) defined the ERP as an, *'integrated enterprise computing system that is designed to automate the flow of material, information, and financial resources among all functions within an enterprise on a common database*'. If it is fully applied in a business, ERP has many benefits, such as: faster transactions, reduced cycle time, better financial management, and making tacit knowledge explicit (Su &Yang, 2010). Many top managers prefer suitable ERP programs to manage all production and organization processes, such as; human resources, warehouse and transportation management with coordination. With the help of ERP, firms can observe money, material and human flows easily.

Knowledge Management (KM) is also an important concept for organizations. Knowledge generation, storage, and utilization are key elements of Knowledge Management. Corporations which apply these concepts do better than their competitors, showing, in general, higher productivity, efficiency, and customer satisfaction. The purpose of this thesis is to investigate the effects of Knowledge Management and ERP Usage on business performance, taking into account Supply Chain Orientation (SCO). In the literature, a positive relationship between SCO and business performance is discussed. In this study, it is shown that KM and ERP have an even stronger positive impact on performance with the contribution of SCO.

Additionally, factors of SCO, Knowledge Management and ERP Usage are also discussed in this study. There are different elements related with these variables. For SCO, many factors are noted in the literature such as, trust, commitment, credibility, etc. Furthermore KM includes knowledge storage, knowledge generation, utilization from knowledge or technologic infrastructure. The components of ERP are top management support, implementation problems, costs and benefits, as determined as factors by previous research.

In this thesis, data was collected by survey, and statements were prepared after a detailed literature review. Statements were evaluated by academicians and experts from the private sector and were sent to small/medium sized enterprises (SMEs) and

big organizations. Partial Least Squares (PLS) and Universal Structure Modelling (USM), were selected as statistical tools to analyze these relationships.

1.3. Theoretical Framework

According to the Resource Based View (RBV), a company should develop, acquire, and use its strategic resources to become one of the best performing firms (Barney, 1991; Wernerfelt, 1984), and corporations can gain competitive advantage by using their resources effectively. In the literature, there are two types of resources: tangible and intangible. Tangible resources refer to physical items and they can be carried inside firm. However, intangible resources are tacit and difficult to transfer (Kogut & Zander, 1992; Villalonga, 2004). Because of not copying, intangible resources should be seen as critical elements to gain a competitive advantage (Itami& Roehl, 1991; Villalonga, 2004).

Moreover, RBV deals with resource bundling (i.e. Hult et al., 2008). By combining of both tangible and intangible resources instead of focusing on a single resource, corporations can develop an advantage against their competitors. Therefore, ERP and KM should have a stronger positive effect on performance in supply chain-oriented firms because according to resource bundling perspective, combining any two or all of KM, ERP and SCO, which are resources for organizations, brings many benefits to organization.

1.4. Statement of the Problem

In this study, three resources are considered simultaneously: softwarepackages related to ERP, Knowledge Management and Supply Chain Orientation. ERP can be thought as a tangible resource because it is bought from software companies, and it requires CDs, computer networks and technological infrastructure such as telephones, fax machines, and modems; and the system is uploaded on computers. If it is used effectively, corporations can gain benefits from it. In addition to this, SCO and Knowledge Management can be seen as intangible resources, because their characteristics differ from organization to organization. In the literature, different research showed a positive relationship between each of these resources (SCO, KM and ERP) and performance. From the perspective of RBV, combining of both tangible and intangible resources are better than using a single resource, so in this

study, it is asserted that combining of all aforementioned resources have a stronger effects on business performance rather than simply the direct effect of each resource individually.

1.5. Importance of Thesis

In today's market economy, supply chain performance is a crucial factor for companies. Many organizations invest heavily to improve their supply chain capabilities, including factors such as delivery in time, forecasting accuracy, and low inventory cost. To survive in a highly competitive market, firms need to give weight to their supply chain capabilities. As mentioned before, ERP packages and Knowledge Management can affect the supply chain performance (Fugate, Stank & Mentzer, 2009; Su &Yang, 2010), and SCO also has a positive impact on performance (Min & Mentzer, 2004).

According to RBV, resource bundling along with combining tangible and intangible resources, provides more advantages than 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 among SCO, ERP and Knowledge Management. The following questions are addressed in this study:

a) Is there any positive relationship between SCO and operational performance?
b) Do KM and ERP have directly positive impacts on operational performance?
c) With a mediating effect of SCO, does KM and ERP have a stronger impact on operational performance?
d) Are KM and ERP complementary or conflicting?
e) Is there any positive effect of operational performance on financial performance?

Furthermore, factors or elements of these variables will be also defined, because exploratory factor analysis is applied for these variables. Additionally at the end of the study, this thesis provides suggestions and offers opinions to managers about the importance of SCO, ERP and KM.

1.6. Method

In this research, four different systems of analysis were used to evaluate the collected data. Firstly, Exploratory Factor Analysis (EFA) was used with varimax rotation to determine the factors of elements. This method groups the related indicators and sub-factors of variables.

Secondly, to validate the variables with determined factors, Confirmatory Factor Analysis (CFA) was applied for SCO, KM and ERP Usage. There are some critical thresholds that show the better fit of the data to the models. According to these values, indicators belong to factors can be arranged again.

The Partial Least Square (PLS) method is an important statistical tool to examine the proposed model, and it includes the analysis of the relationships among variables in the model. Unlike Structural Equation Modeling (SEM) which is a covariance-based analysis, PLS is a variance-based analysis. Moreover, PLS does not have a normality assumption, so a lower sample size can be enough to compare it with SEM. In this research, it was hard to collect data from manufacturing companies, therefore PLS was used to analyze the relationships among the variables of Supply Chain Orientation (SCO), Knowledge Management and ERP Usage. In addition to this model, also a Universal Structure Equation Modeling (USM) is used to examine the relations among variables. USM is a different than PLS and SEM because it also captures the nonlinear relationship among variables.

Our data was collected from Small and Medium Enterprises (SMEs) and big companies, especially located in Istanbul and Izmir which are the important industrialized cities in Turkey. Firms are from different sectors. A survey was prepared which includes questions related to SCO, KM, ERP and performance criteria.

CHAPTER 2

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Supply Chain Orientation (SCO)

Supply chains are a very popular concept in today's market environment. Sometimes, supply chains can be seen as only logistics activities, but this idea understates the importance of the concept. All processes, from buying of raw materials to after-sale services, are elements of the supply chain. According to many authors (e.g. Betchel &Jayaram, 1997; Min, 2001), it includes all firm functions such as: logistics, manufacturing, purchasing, marketing, promotion, sales, R&D and product design.

Mentzer et al. (2001) defined the supply chain as 'a *set of three or more organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to customer*.' Su and Yang (2010) define supply chain as '*the network of facilities and activities that performs the functions of development, procurement of material from vendors, the movement of materials between facilities, the manufacturing of products, the distribution of finished goods to customers, and after-market support for sustainability*.'

The organization and arrangement or the Supply Chain Management (SCM) concept includes following characteristics:

a) *'a systems approach to viewing the supply chain as a whole, and to managing the total flow of goods from the supplier to the ultimate customer,*
b) *a strategic orientation toward cooperative efforts to synchronize and converge intra-firm and inter-firm operational and strategic capabilities into a unified whole, and*
c) *acustomer focus to create unique and individualized sources of customer value, leading to customer satisfaction'*(Mentzer, 2001, cited by Min &Mentzer, 2004:65).

In contrast to the past, the classical concept of supply chain management (SCM) (ie. functional integration) has expanded in recent years, and the importance of cooperation among supply chain members is increasing to improve competitiveness

of the supply chain (Min & Mentzer, 2004). To satisfy the SCM activities (e.g. efficient consumer response, quick response, forecasting and replenishment) efficiently, collaborative activities such as joint forecasting and planning, information sharing, joint inventory management are needed (Min & Mentzer, 2004). Additionally, many authors (e.g. Min & Mentzer, 2004; Cooper & Ellram, 1993) emphasized several key elements of successful SCM, including information sharing, cooperation, long term relationships, mutual risk and reward sharing. Christopher (1992) suggested that real competition is supply chain against supply chain, rather than company against company.

To manage the supply chain operations effectively, managers should concentrate on supply chain activities inside the firm. Mentzer et al. (2001) underlined the importance of this condition and called it a supply chain orientation (SCO). According to Min and Mentzer (2004), it is not possible to conduct efficient supply chain management among not supply chain oriented firms.SCO can be defined as '*the implementation by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain*' (Min & Mentzer, 2004). Hult et al. (2008) also 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*'. According to them, this predisposition can increase if the members share common values, goals and cultural norms. Furthermore, they suggested that SCO can be seen as a strategic capability, and one of the important factors for getting competitive advantage.

Mentzer et al., (2001:18) discussed the SCO as using a metaphor:

> *'a supply chain is like a river, with products and services flowing down it instead of water. Whether anyone recognizes the systematic, strategic implications of managing the water basin, the river still exists. Similarly, whether any company recognizes the systematic, strategic implications of the supply chain of which they are a part, it still exists. When one state through which the river flows recognizes the need for state above it in the water basin to conserve and preserve the water supply and recognizes its own need to do the same for states below it, the state has taken a systemic strategic*

orientation—the river equivalent of a supply chain orientation. However, without the cooperation of the states above and below it, there is little it can do about implementing this orientation. It is only when a number of continuous states adopt such a similar orientation and actively manage the resources of the river that we can say the water basin is managed. Similarly, supply chain management can only result in managed supply chain when several companies directly linked in the supply chain have a SCO and actively manage to that orientation.'

SCO underlies value generation in all members of the supply chain such as investing their resources, capabilities, and know-how. Each organization—as a subsystem—contacts other subsystems and all of them form the supply chain (Miocevic & Karanovic, 2011). Therefore, SCO and SCM are not independent from each other, but different. SCO is managed by an organization, and SCM is '*shared in relationships between supply chain partners'* (Min et al., 2007).

SCO can be seen as a management philosophy that ensures to see and recognize the importance of integration in supply chain (Mentzer et al., 2001; Hult, Ketchen, Adams & Mena, 2008; Omar, Davis, Fugate & Mentzer, 2012). If this view is operationalized with specific activities and businesses, it is expected to affect supply chain performance positively (Omar et al., 2012). Many studies show that SCO is an important factor for business performance (Hult et al., 2008; Min, Mentzer & Ladd, 2007; Yurt, 2007).

Min and Mentzer (2004) found a positive relationship between SCO and SCM and the SCO-SCM path affects business performance positively (see Figure 2.1). 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. Trust refers to credibility and helpfulness among companies. Trust and commitment are one of the most popular concepts of supply chain literature. These are antecedents of cooperation among organizations and crucial elements to assure efficiency, productivity, effectiveness and long term relationships (Morgan &Hunt, 1994; Yurt, 2007). Benevolence refers to development of suppliers. When a focal firm observes

problems in its operations, helping the suppliers can be a solution and it can improve efficiency with this way. Modi and Mabert (2007) showed that supplier development programs can positively affect performance. For instance, in Eaton Corporation, supplier development programs ensured a progress in quality, delivery, capacity and productivity as well as reduced in lead times and supply costs (Modi & Mabert, 2007).The supplier developmet program is a long term cooperative effort between the focal firm and its supppliers to improve the suppliers' technical, quality, delivery and cost capabilities (Watts & Hahn, 1993; cited by Modi & Mabert, 2007).Commitment is '*an implicit or explicit pledge of relational continuity between exchange partners*' (Dwyer, Schurr &Oh, 1987). It is a need to provide long term relationship among members in the supply chain (Gundlach, Achrol & Mentzer, 1995; Yurt, 2007). In addition to these, cooperative norms are '*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, Simpson & Baker, 1998). It refers that members have nearly same vision and presence of it between firms pushs them to work together (Yurt, 2007). Heide and John (1992) discussed the three parts of it; flexibility norms, information exchange norms and solidarity norms (Yurt, 2007). Organizational compatibility means fitness or suitability of cultural norms and management techniques to SCM. It is a critical success factor to manage supply chain effectively and it improves the value of relationship (Yurt, 2007). Lastly, top management support refers to leadership and being open to changes.Jaworski and Kohli (1993) pointed out the importance of top management support for market orientation. They classified it as two parts; top management emphasis and top management risk aversion. Furthermore, in the literature TMS is shown as one of the crucial factors for being market oriented and having a positive effect on organizational performance (Day & Lord, 1988; Yurt, 2007).

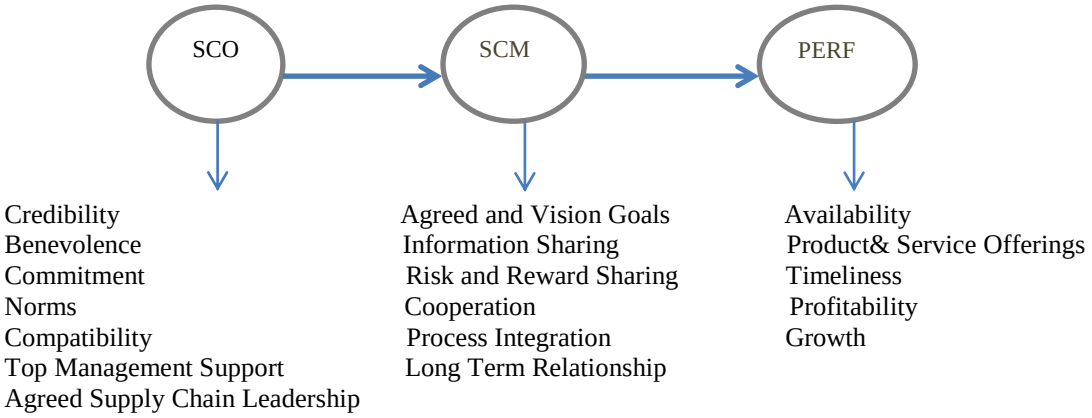


Figure 2.1: The model of Min and Mentzer (2004)

Miocevic and Karanovic (2011) found that SCO has a positive impact on organizational buying effectiveness (OBE). In addition, they showed that key supplier relationship management (KSRM) is a strong mediator between SCO and OBE. Hult et al. (2008) considered six different indicators of SCO in their research; these are customer orientation, competitor orientation, value-chain coordination, supplier orientation, logistics orientation and operations orientation. Customer orientation considers the needs and wants of customers to add value for them. A competitor orientation is being aware of the strengths and weak points of its rivals. Value-chain coordination is '*integrated use of resources at each sequential step of the chain as well as between functional areas, and facilitates the effectiveness of product and process flows within and across firms*' (Hult et al., 2008). Supplier orientation means to manage processes efficiently between raw material and final users. In addition to these, logistics orientation is planning, conducting and observing flows of raw materials, work in process, and finished products (Council of Supply Chain Management Professionals, 2007, cited by Hult et al., 2008.). Operations orientation means activities related with the improvement of the production system (Kaynak, 2005; Mabert & Venkataraman, 1998). Hult et al., 2008 also consider some performance criteria including customer, financial, and internal processes, and innovation and learning performance. According to this research, using LISREL software, it was asserted that above orientations are first order indicators of SCO and SCO is positively related to each performance criterion. The related model is shown in Figure 2.2.

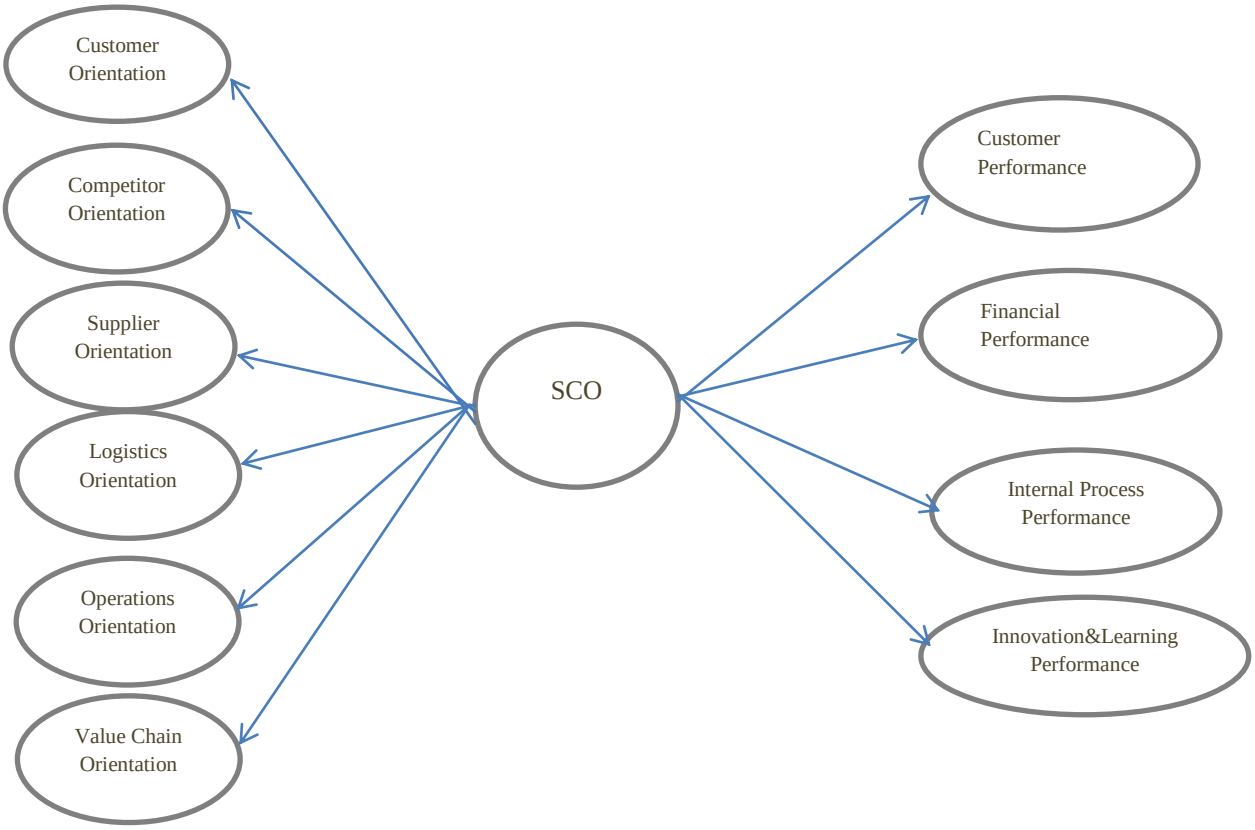


Figure 2.2: The model of Hult et al. (2008)

Min et al. (2007) presented a model that includes Market Orientation (MO), SCO and SCM. They investigated the effects of these items on firm performance. Their analysis showed that there is a positive relationship between MO and SCO. Also SCO and performance are positively correlated. Moreover, similar to previous research, a positive relationship between SCO and SCM are found, and SCO is defined as antecedent to SCM processes. The related model is shown in Figure 2.3.

In the study of Yurt (2007), relationships between Supply Chain Orientation and perceived service (supplier) quality in service sectorwas investigated. SCO has six factors; trust, commitment, cooperative norms, dependence, organizational compatability and top management support. In addition to this, perceived industrial service quality has four different level; potential quality, hard process quality, soft process quality and output quality.

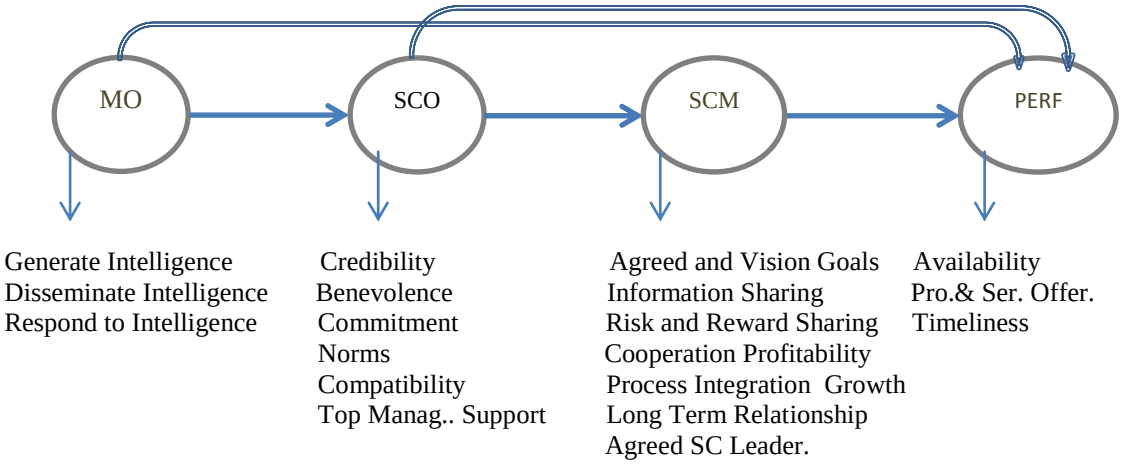


Figure 2.3: The model of Min et al. (2007)

Potential quality includes offering full service, having required personnel and facilities, having a low personnel turn-over, using network of partners / associates. Hard process quality covers offering full service, meeting deadlines, honoring financial agreements, looking at details, understanding of needs. Soft process quality covers accepting enthusiastically, listening problems, becoming open to new ideas, becoming pleasant personality, arguing if necessary, looking after interests. Lastly, output quality dimensions are reaching objectives, having a notable effect, contributing sales, becoming consistent and innovative (Gounaris, 2005)

According to this research, SCO is positively related with service quality. Trust, one of the dimensions of SCO, is also positively asscociated with hard potential quality, soft potential quality and output quality. Secondly, commitment has positive relationship with potential, hard process, soft process and output quality. Moreover, cooperative norm is positively related with hard process, soft process and output quality. Dependence is also positively associated with potential quality, hard process quality, soft process quality and output quality. Furthermore, organizational compatibility does not have any positive effect on any dimension of quality. Lastly, top management support is positively related with hard process quality, soft proces quality and output quality (Yurt, 2007).

2.2 Knowledge Management (KM)

Knowledge has been one of the most popular debate topics in philosophy since old eras (Alavi & Leidner, 2001). Knowledge can be defined as, '*information plus the causal links that help to make sense of this information'* and Knowledge Management is*'a process that establishes and clearly articulates such links*' (Sarvary, 1999, cited by McGinnis & Huang, 2007). Also Alavi and Leidner (2001) defined knowledge as "*information possessed in the mind of individuals: it is personalized information (which may or may not be new, unique, useful or accurate) related to facts, procedures, concepts, interpretations, ideas, observations and judgments".* A knowledge-based perspective has been widely discussed in the strategic management literature. It refers to how services offered by tangible resources can transform to a function of the organization's know-how (Alavi & Leidner, 2001). The knowledge is buried and transfer through many assets such as; organization culture, policies and employees (Grant, 1996). Knowledge-based resources are difficult to copy and it can be change from organization to organization, therefore knowledge assets may provide competitive advantage in the long term. Information can be seen as processed data and knowledge is authenticated information. Text, graphics, words are different ways of knowledge to introduce and these provide a common language and same understanding of information and data for managers (Alavi & Leidner, 2001; Zaim, 2005).

Knowledge can be analyzed with different ways; a state of mind, an object, a process, a condition of having access to information and a capability. The first, knowledge as a state of mind, points out the facilitating employees to magnify the personal knowledge and using it for the needs of organizations. Secondly, the perspective that knowledge as an object presumes it may be stored and manipulated. Moreover, the idea of knowledge as a process relates with knowing and acting (Zack, 1998a). The fourth one is a condition of accessing to information. This idea indicates the importance of organizational knowledge that should be organized to simplify the access to it. Lastly, the perspective of knowledge as a capability focuses on knowledge can not be thought as so much a capability for any situation, additionally the evaluation of what or which type of information is needed in future actions is an

important potential asset for organizations (McQueen, 1998; Carlsson, el-Sawy, Eriksson & Raven, 1996, Watson, 1999, cited by Alavi & Leidner, 2001).

There are two versions of knowledge; tacit and explicit. Tacit knowledge is embedded in action and experience. It covers cognitive and technical elements (Nonaka, 1995). The cognitive one refers to person's mental models includes beliefs and viewpoints, in addition to this, the technical one covers know-how, skill and ingenuity. For instance, situation of teacher in a class when students are speaking with each other during a course she can shout, warn calmly or leave from the classroom. These are possible ways to affect students, but which is the best solution is not clear, it depends on circumstances. The explicit knowledge refers to it can be codified and formed with symbolic or natural language (Alavi & Leidner, 2001). For example, user manual of any machine in a factory is explicit knowledge for employees. There are also different knowledge types in the literature; declarative (know-about), causal (know-why), conditional (know-when) and relational (know-with) (Norton, 1998; Zack, 1998b; cited by Alavi & Leidner, 2001).

Knowledge Management (KM) is a key point for organizations to use their intangible resources efficiently. It is determining and administration of knowledge to help organization's processes and improves the innovation activities inside a firm. In the last years, integration of information systems with Knowledge Management to generate, transfer and apply it in organizations has been also discussed (Alavi & Leidner, 2001). A survey of KPMG showed that nearly half of the organizations faced with problems when their key employees left. Additionally, the different survey indicated that most of firms thought some of necessary knowledge is embedded inside them but the essential problems are to find, store and use it (Hackbarth, 1998; van Krogh, 1998; Cranfield University, 1998; cited by Alavi and Leidner, 2001). Generally, Knowledge Management have three goals; (1) making knowledge clear and stating the importance of it in a firm, (2) establishing a knowledge-intensive culture with stimulating behaviors like knowledge sharing, (3) establishing a knowledge infrastructure, both of technical (i.e. e-mail system, servers etc.) and social (i.e. collaborating, meetings) ones (Alavi and Leidner, 2001).

In the literature, there are three types of learning; individual, with communication, and utilizing knowledge repository (Heijst, Spek, & Kruizinga, 1997; Liao, 2003). Rubenstein, Liebowitz, Buchwalter, McCaw, Newman and Rebeck (2001) constructed a link between Knowledge Management and system thinking, they specified the needs of KM framework (Liao, 2003). KM performance may be evaluated with three stages; strategic level, functional / operational level and employee / performer level. The first one relates with the contribution of KM activities to organizational performance. The functional / operational performance measures the effect of KM processes on operations of organizations such as; production, delivery and forecasting of demand. The last one evaluates the support of KM processes on employees' behaviors or satisfactions (del-Rey-Chamorro, Roy, Wegen, & Steele, 2003; Zaim et al., 2005).

In the study of Zaim et al. (2005), effects of KM processes and KM infrastructure on KM performance were investigated. KM infrastructure has four different factors; these are culture, technology, organization, and intellectual capital. Furthermore, KM process has also four different steps; knowledge generation, knowledge transfer, utilization and coding / storage of knowledge. There are also four performance criteria in this research; overall performance; usability of KM applications; overall employee performance and having a common sense of corporate mission. The study showed that KM processes and KM infrastructure have positive effects on the KM performance. For the KM process, transferring and sharing of knowledge is the leading factor, and for the KM infrastructure, organizational culture is the most important one.

To improve organizational capabilities, firms can apply Knowledge Management processes. Knowledge is an intangible resource for organizations (Hult, Ketchen, Cavusgil & Calantone, 2006), and therefore, it is an important factor to manage supply chain operations properly. Supply chain can be defined as a '*network of facilities and activities that performs the functionsof product development, procurement of material from vendors, the movement of materials between facilities, the manufacturing of products, the distributionof finished goods to customers, and after-market support for sustainment'* (Mabert & Venkataramanan, 1998).

There is very little research that investigates the relationship between Knowledge Management and supply chain performance. Wal-Mart, Toyota, and Dell have used their supply chain management skills effectively, and they acquired competitive advantage and excellent performance (Hult et al., 2006).

There are three theoretical approaches in the study of Hult et al. (2006) that help analyze the impact of Knowledge Management on business performance; these are the resource based view, strategic choice theory, and configurational inquiry. According to the resource-based view, knowledge elements that add value to the supply chain are should be determined. Strategic choice theory points out that why these types of knowledge elements are important for different supply chain strategies: these are prospectors, analyzers, low cost defenders, differentiated defenders and reactors. Configurational inquiry investigates the relationship between supply chain knowledge and business performance.

As mentioned above, RBV is based on refining knowledge elements that can affect business performance (Barney, 1991; Wernerfelt, 1984). To be a strategic resource, knowledge must satisfy some constraints (Barney, 1991). First of all, the knowledge must be valuable, meaning that what it provides generating of outputs that meet customers' needs. Secondly, knowledge must be rare, meaning that resource is not achieved regularly. Lastly, knowledge must be inimitable, which refers to the fact that obtaining the resource is so hard. Knowledge is an intangible resource which can not be moved or bought readily since it is embedded in the structure of an organization (Barney, 1991; Grant, 1996).

Hult et al., (2006) pointed out eight different elements of Knowledge Management: memory, tacitness, accessibility, quality, use, intensity, responsiveness and learning capacity. Memory is the level of obtained knowledge and experience related to organizational activities (Moorman &Miner, 1997). Tacitness means the level of codifiability and teachability of knowledge (Zander & Kogut, 1995; Simonin, 1999). Accessability points out the degree of reachability of the source (Hult etal. 2006). Quality refers to relevance, accuracy, reliability of knowledge (Low & Mohr, 2001). Knowledge use means the application of knowledge for the solving of problems and making decisions (Deshpande &Zaltman, 1982). Knowledge intensity can be defined

as '*the extent to which a firm depends on the credible… information and/or experience inherent in its operations as a source of competitive advantage'* (Craighead Hult & Ketchen, 2009). Responsiveness refers to actions that are sourced from knowledge and learning capacity, and is defined '*as the extent to which a chain continuously builds its usable knowledge to develop a foundation for its competitive edge*' (Hult et al. 2006).

In the study of Hult et al. (2006), key knowledge elements were found for different strategic types. These are prospectors, analyzers, low cost defenders, differentiated defenders and reactors. Prospector is an organization that adopts new developments in a short time. An analyzer adopts new practices rarely. Low cost defenders tend to protect their situation/strategy and consider primarily cost. Differentiated defenders choose a strategy and struggle to apply it well. Reactors do not have a stable strategy and change their tactics or situation with the pressures of market. In this research, key knowledge elements were shown for each of them. Hult et al. (2006) showed that accessibility of knowledge, quality of knowledge, knowledge intensity, responsiveness and learning capacity are important for prospectors. In addition, memory, accessibility of knowledge, quality of knowledge, knowledge intensity, responsiveness and learning capacity are key elements for analyzers. Moreover, for low cost defenders, memory, accessibility of knowledge, knowledge use, and intensity are crucial items. Memory, accessibility of knowledge and quality of knowledge are also important for differentiated defenders. Lastly, for reactors, memory, quality of knowledge and learning capacity are significant knowledge elements.

Knowledge management in the supply chain was discussed as a detailed literature review by Marra, Ho and Edwards (2012). They showed many articles about this issue and classified them. Corso and Paolucci (2001) searched the relationship between knowledge transfer and information technology application. They pointed out the economic implications of knowledge transfer and IT services. However, their research showed no relationship between a firm's growth and its IT investments. Becker and Zirpoli (2003) pointed out knowledge transfer in outsourcing processes. They investigated the suitable outsourcing strategy to improve knowledge

integration. They showed the decomposition strategy through a case study of FIAT. Holtbrügge and Berg (2004) studied knowledge transfer activities in German multinational enterprises (MNEs). Their study showed that the source of knowledge, both external and internal, and characteristics of knowledge flows, depend on firm-specific and country-specific variables. Sivakumar and Roy (2004) studied about knowledge redundancy and supply chain performance. Knowledge redundancy '*conjures up images of duplication and waste created in the pursuit and mastery of knowledge by intra- or inter-firm team members*' (Sivakumar & Roy, 2004). Raisinghani and Meade (2005) studied the relationship between supply chain agility and knowledge management. They considered the strategic decision-making perspective and showed a decision model that helps in determining the best knowledge management strategy for supply chain agility. Douligeris and Tilipakis (2006) investigated opportunities of the semantic web. They focused on the effects of web technologies on supply chains. Applications of a semantic web to improve Knowledge Management and benefits were discussed. Huang and Lin (2010) pointed out a problem of managing knowledge heterogeneity among multiple entities in supply chain. They suggested the use of the semantic web for knowledge sharing. Koh and Tan (2006) showed the knowledge translation process and present a tool for action plan selection (TAPS). It can be considered as a decision-making tool to translate knowledge of supply chain uncertainty into business strategy. Chow, Choy and Lee (2007) wrote a literature review about supply chain and knowledge management.

Duanmu and Fai (2007) studied about vertical knowledge transfer among Chinese suppliers and multinational enterprises (MNEs). In this study, motivations of MNEs entering China were efficiency seeking and cost savings. Cheung and Myers (2008) pointed out the main problem with knowledge sharing in the global supply chain. They searched factors that provide the sustainability of knowledge sharing in global networks. These included management fit, market-related fit, resource fit, shared identity, relational capital, and flexibility. Moreover, Myers and Cheung (2008) proposed a study about how knowledge sharing adds value to buyers and suppliers in global networks. According to their study, knowledge sharing was affected by

market structure, organizational similarities and dissimilarities between buyers and suppliers. Furthermore, Wang, Fergusson, Perry and Antony (2008) highlighted the importance of knowledge sharing in the supply chain. Blumenberg, Wagner and Beimborn (2009) showed the positive relationship between knowledge transfer and outsourcing performance.

Fugate, Stank and Mentzer (2009) investigated the relationship between knowledge management and organizational performance. They found positive impacts of Knowledge Management on performance in logistics operations. Corso, Dogan, Mogre, and Perego (2010) studied the Knowledge Management activities in the supply chain for the food industry. They proposed the general concept of how IT-based processes for supply chain can meet the needs related with Knowledge Management of firm. Pedroso and Nakano (2009) investigated the importance of technical information flows within the supply chain in the context of the pharmaceutical industry. In addition to this, Hult et al. (2007) correlated supply chain knowledge and cycle time reduction (also see Hult, Ketchen & Slater, 2004). 'What we know' and 'what we need to know' that affect supply chain performance are basic questions in the study of Craighead et al., (2009). In this study, the importance of knowledge management for different strategy types was discussed.

According to Craighead et al. (2009), there are four strategic types: cost efficient imitators, cost efficient innovators, costly imitators, and costly innovators. Cost efficient imitators refer to those who get better than average cost efficiencies and prefer to imitate competitors' successful practices rather than innovate. Cost efficient innovators are the opposite of the cost-efficient imitator in that they consider innovation instead of imitation, and their costs are lower than average market cost. Thirdly, costly imitators' costs are higher than their competitors. Lastly, costly innovators work with more costly products than their competitors during the innovation process. In this research, fourteen hypotheses are investigated and they are shown in the above figure. Except hypotheses 6, 8, 9 and 12, they are supported at the end of analysis.

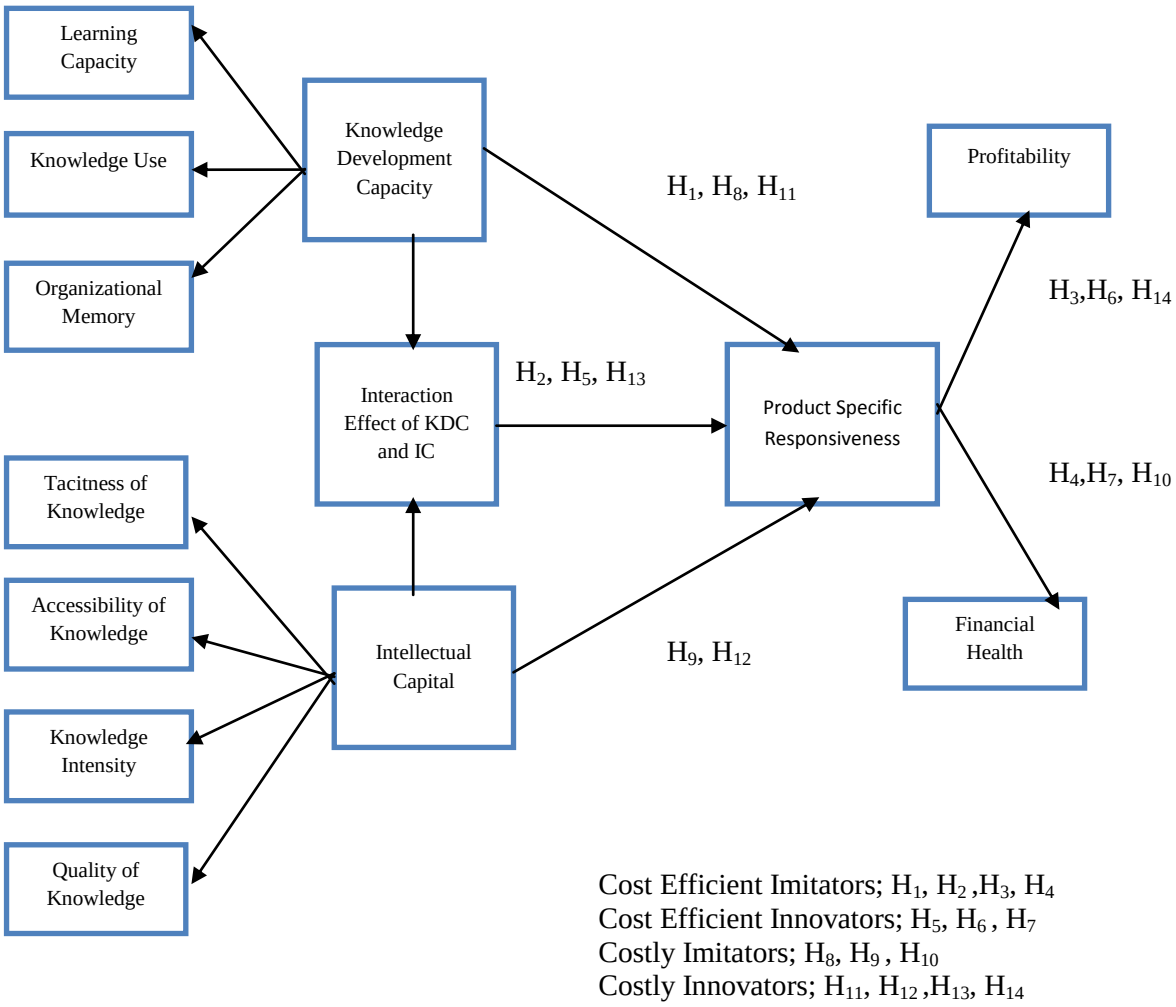


Figure 2.4: The model of Craighead et al. (2009)

Furthermore, Fugate et al. (2009) searched the effects of Knowledge Management forlogistic operations performance. They considered knowledge generation, knowledge dissemination, knowledge-shared interpretation, and knowledge responsiveness. Theoretical framework is shown below. In addition, the analysis showed that all hypotheses were significant.

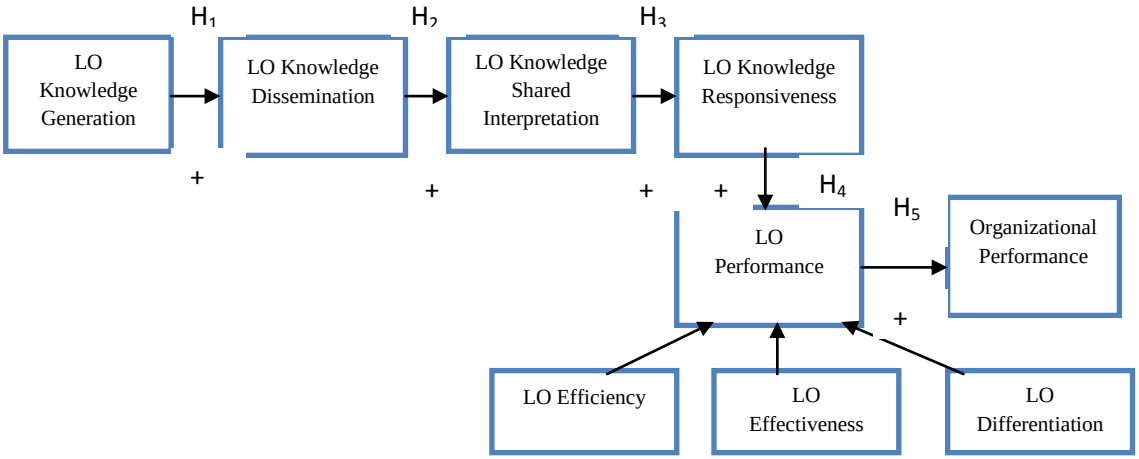


Figure 2.5: The model of Fugate et al. (2009)

2.3. Enterprise Resource Planning (ERP)

Different ERP software packages were widely used by companies in different sectors. Material Requirement Planning (MRP) from the 1970s and Material Requirement Planning II (MRP II) from the 1980s are prior versions of ERP (Su & Yang, 2010). ERP is used because of pressure from competitors or requests from suppliers or customers in the supply chain to provide linkage (Su and Yang, 2010). Su and Yang (2010) defined ERP as, *'is an integrated enterprise computing system that is designed to automate the flow of material, information, and financial resources among all functions within an enterprise on a common database.'*

Lee and Lee (2000), on the other hand, identified ERP as an enterprise-wide package that combines business processes into a single shared database. Shanks and Seddon (2000) (cited by Newell, Huang, Galliers & Pan, 2003) also described ERP as an exhaustive software package that integrates the business functions by using a shared information flow. Akkermans, Bogerd, Yucesan, van Wassenhove (2003) pointed out that ERP has been used to integrate the different operations in a business organization; however in today's SCM, network as suppliers and customers become more important than in the past and the old type of ERP packages are inadequate in the current market economy.

ERP market is growing in the last years, for instance sales amount of SAP, which is one of the biggest ERP vendors in the world, was $500 million in 1992 and approximately $3 billion in 1997 (Davenport, 1998). There are many ERP brands in the market, some of them are expensive and have too different modules, however some of them are cheaper and focus on special operations such as; accounting or production. However, ERP implementation is not very easy, nearly 90 percent of ERP projects are late and exceed pre-determined budget (Martin, 1998; cited by Holland & Light, 1999). ERP integration is very complex for organizations, because each department should agree with each other (Davenport, 1998; Holland & Light, 1999). Although many benefits, sometimes ERP implementations are not successful. There are two different ways for gettig ERP; standard package without large deviation and customization (Holland & Light, 1999). According to them, there are many critical success factors for ERP implementation, some of them are at strategic and some of them are at tactical level. Legacy systems, business vision, ERP strategy, top management support and project schedule are strategic factors, in addition to these, client consultation, personnel, software configuration, client acceptance, monitoring / feedback, communication and trouble shooting are tactical factors (Grover, Seung & Teng 1998; Kotter, 1995; Benjamin & Levinson, 1993; Slevin & Pinto, 1997; cited by Holland & Light, 1999).

Legacy system covers the present system or structure of organization (Adolph, 1996). It affects the ERP implementation, for instance, if a firm's legacy system is complex, technical and organizational alteration may high, however if the organization's one is classic and simple, small change can be enough for successful ERP implementation (Holland & Light, 1999). Especially, ERP has gained an extra importance in nowadays with the expanding usage of internet. Davenport (1998) emphasized the scope of enterprise system in detail, these are; accounts receivable and payable, asset accounting, cash management and forecasting, cost-element and cost-center accounting, executive information system, financial consolidation, general ledger, product cost accounting, profitability analysis, profit-center accounting, standard and period related costing are financial contents, human resources time accounting, payroll, personnel planning and travel expenses are

human resources contents, inventory management, materials requirements planning, materials management, plant maintenance, production planning, project management, purchasing, quality management, routing management, shipping and vendor evaluation are operations and logistics contents.

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 of them in the same time are so hard, therefore ERP can help the management of information flow inside organizations (Davenport, 1998).

ERP can provide becoming faster in operations comparing to pre-ERP situation. For instance Autodesk, a company of computer aided software, could reach its customer within two weeks, however after ERP it sends 98 percent of orders in 24 hours. IBM could reprice of its products in 5 minutes, old one was 5 days and could finish the check of credit in 3 seconds against to 20 minutes in past, Fujitsu decreased the cycle time for orders to one day, from 18 days (Davenport, 1998).

There are many benefits of ERP if it is fully applied in business organization, including having faster transactions, reduced cycle time, better financial management, and making tacit knowledge explicit (Su & Yang, 2010). Moreover, Davenport (1998) also pointed out the benefits of ERP, such as reduced cycle time, improving information flow, and rapid formation of financial information. According to Holland and Light (1999), ERP provides greater managerial control, rapid decision making, and reduction of operational cost. Furthermore, in the research of Su and Yang (2010), there is a positive relationship between ERP and SCM competences.

Sedera and Gable (2010) investigated the relationship between KM competence and ERP. According to them, there is a positive relationship between KM competence and Enterprise System (ES) success. In this research, factors of KM competence are knowledge creation, knowledge retention, knowledge transfer, and knowledge application. Meanwhile, those of ERP are system quality, information quality, individual impact, and organization impact.

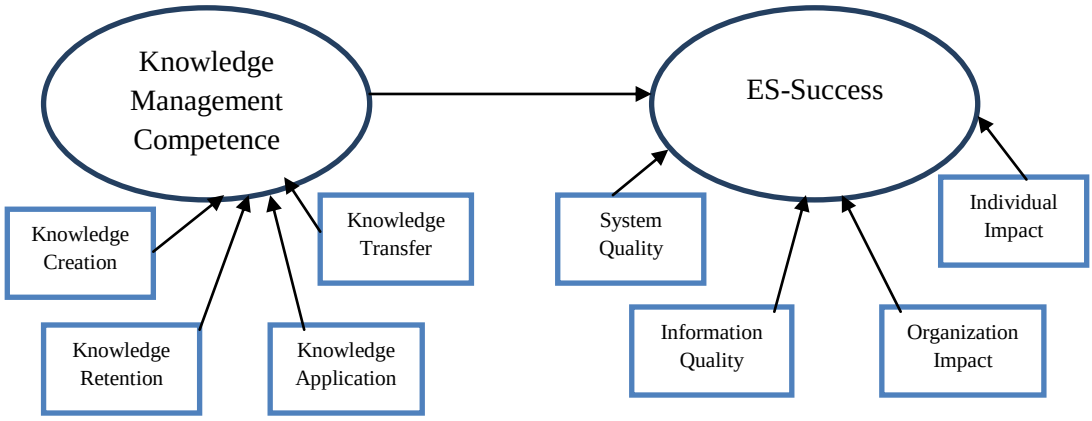


Figure 2.6: The model of Sedera and Gable (2010)

Before ERP, many global firms were faced with difficulties in their operations such as integrating of business processes (Newell et al., 2003). According to Newell et al. (2003), ERP provides a competitive advantage because crucial information is produced, shared, and managed. ERP usage ensures the reduction of costs, advancement of resource control, and decision quality, or, in other words, leaner production (Communications of the ACM, 2000; cited by Newell et al., 2003).

Cotteleer and Bendoly (2006) argued two hypotheses in their research. Firstly, they discussed whether the implementation of enterprise systems like ERP will positively affect the operational performance in the short term. In addition to this, they claimed that after the deployment of enterprise systems, firms get new knowledge, and operational performance is improved. Also, they investigated the situation of Tristen Corporation which is a US-based company and producer of equipment for computers and serverscomparing with pre and post ERP adaptation. Tristen has three production areas around the world including America, Europe, and Asia. In this case study, they showed that the aforementioned hypotheses are supported after the implementation of ERP.

Bendoly and Schoenherr (2005) showed that ERP usage decreased the material procurement costs, because it satisfied advanced material requirements, advanced production planning, and had little bottleneck/ waste in production. Mcafee (2002) also indicated the effects of ERP usage on performance with a case study. In this research, a huge company was studied to observe the consequences of ERP.

According to the analysis, average lead time and late shipments decreased after ERP usage. However, some performance criteria were improved in the long run, though not in the short run. In addition, Mcafee (2002) pointed out all employees in an organization believe that the performance level achieved could not be reached without ERP.

Madapusi and D'Souza (2011) also investigated the effects of ERP modules on performance. They considered different ERP modules, and they searched which of them had positive effects on operational performance. Furthermore, ERP usage in Turkey was discussed in Postacı, Belgin and Erkan's (2012) research. According to their survey, 71 of 154 firms used ERP programs. It showed that the ERP market is open for software companies in Turkey. Additionally, 80 percent of organizations thought that ERP provided successful solutions for them.

Newell et al. (2003) investigated two topics: can ERP and KM be applied in tandem and are they complementary? Both of ERP and KM are used in many organizations (Alavi and Leidner, 2001). Before ERP, many global were firms faced with difficulties in operations such as integration of business processes (Newell et al., 2003). According to this study, ERP provided competitive advantage through producing, sharing, and managing crucial information. Use of ERP ensures the reduction of costs, advancement of resource control and decision quality or, in other words, leaner production (Communications of the ACM, 2000; cited by Newell et al., 2003). KM underlines how an organization can improve its competitive advantage with more effective usage of its knowledge resources. There is a difference between ERP and KM in their orientation: KM systems focus on flexibility and innovation, whereas ERP focuses on efficiency. The dilemma between efficiency and flexibility and innovation is a classic debate in organizational theory (Newell et al., 2003). This research investigated the application of KM and ERP at the same time, using a case study. Newell et al. (2003) argued, based on the research, that the usage of ERP and KM are complementary rather than conflicting, enabling flexibility and efficiency simultaneously. Furthermore, they pointed out the disadvantage of ERP that consultant firms want to decrease the number of suppliers, so it caused the loss of social capital.

Parry and Graves (2008) pointed out the relationship between ERP and KM, and their research reinforced that ERP is useful to capture and codify knowledge. However, to transfer tacit knowledge to explicit knowledge, other knowledge sharing techniques such as discussion groups and expert meetings are needed.

Because of timely and reliable information, enterprise systems can lead to better performance for all members in supply chain (Jin, 2006). Some research also showed that investment in information technologies ensures a competitive advantage for organizations (Kathuria, Anandarajan & Igbaria, 1999), however cost of ERPis expensive and it needs longer time to use fully.

In contrast to positive effects, ERP implementation can cause some problems. For example, relationship between bankruptcy of FoxMeyer Drug and its enterprise system was discussed in past years, Mobil Europe expended hundreds of millions of dollars for enterprise system, Dell Computer's system had problems because enterprise system was not appropriate for its management model, Dow Chemical consumed a billion dollars and seven years for its system (Davenport, 1998).

The dream of successful ERP implementation can turn into nightmare, if managers are not serious about this topic (Davenport, 1998). Benefits of ERP has many rewards, however it also has great risks therefore managers should be careful when they decide to implement enterprise systems to their organizations (Davenport, 1998).

Maintenance and updating costs are important disadvantages of ERP systems. In addition to this, indirect costs also can be seen in organizations like incompatibility of system among departments, for example, not well communicating between a firm's sales / ordering system and production / scheduling system (Davenport, 1998). This problem can be sourced from the implementation process, because it is very crucial point to use ERP effectively, thefore, many firms spend lots of time to implement it fully.

However, Brynjolfsson (1993) pointed out the problem of information technologies that no significant positive effects on performance called 'productivity paradox of information technology.' Many reasons can be discussed for this problem such as time lag, mismanagement, not fully using, ineffective implementation (Brynjolfsson,

1993; Dos Santos & Sussman, 2000; Stratopoulos & Dehning, 2000). Li, Yang, Sun & Sohal (2009) showed that information technology has no direct effect on firm performance, however with the mediating effect of supply chain integration it has positive impact.

2.4. Resource Based View (RBV)

Resource Based View (RBV) suggests that an organization should develop, acquire, and use its strategic resources to gain competitive advantage (Barney, 1991; Wernerfelt, 1984), and to become one of the leading firms in the market. Resource management can be defined as "*the comprehensive process of structuring the firm's resource portfolio, bundling the resources to build capabilities, and leveraging those capabilities with the purpose of creating and maintaining value for customers and owners*"(Yang, 2012). Resources can be classified as tangible and intangible ones. Tangible resources are physical items and they can be transferred inside firm, nevertheless intangible resources are tacit and difficult to copy (Hult et al., 2008; Kogut & Zander, 1992; Villalonga, 2004).Because intangible resources generally can not be transferred easily, they are critical elements to get an advantage against rivals (Itami& Roehl, 1991; Villalonga, 2004).

The theory proposes that resource which is both valuable and rare can supply a competitive advantage (Sirmon, Gove & Hitt, 2008). Human capital is one of the most important intangible resources (Miller & Shamsie, 1996) and it can be explained as the skills, experience and knowledge (Becker, 1964; cited by Sirmon et al., 2008). Additionally, capabilities can be classified as exploration and exploitation (Yang, 2012). Exploration is "*experimentation with new alternatives having returns that are uncertain, distant, and often negative*" and exploitation is "*the refinement and extension of existing competencies, technologies, and paradigms exhibiting returns that are positive, proximate and predictable*" (Marter, 1991, p85; cited by Yang, 2012).

Tangible resources are financial and physical assets, on the other hand intangible resources are technology, accumulated consumer information, brand name, reputation and corporate culture (Itami & Roehl, 1991; Villalonga, 2004). For value added, organizations must collect, integrate and exploit resources (Sirmon & Hitt,

2003, Yang, 2012). However, in the literature there is a lack between management of resources and value added (Yang, 2012).There are four characteristics of resource these are; valuable, rare, imperfectly imitable, imperfectly mobile; not substitutable (Barney, 1991).

Furthermore, RBV cares with resource bundling (i.e. Hult et al., 2008), it means that integrating of both tangible and intangible resources rather than focusing on a single resource, organizations can get more advantages against their competitors. The other definition is integration of resources of firms to form new capabilities (Yang, 2012). So in this research, it is expected that for supply chain-oriented firms, ERP and KM have stronger positive effects on performance. Additionally, the different prospect is ERP's impact on performance is the strongest in supply chain oriented firms that apply KM processes.

Resource bundling can offer competitive advantage and survival. The bundles provide feedbacks, the monitoring and regulating policies, furthermore they can be control mechanism of strategies for managers and organizations (Rootner, 2009). Particular combinations can provide distinctive capabilities for organizations therefore different bundles can be necessary to get incremental change (Prahalad & Hamel, 1994). Because the control levels of many companies on different resources vary, they can combine or integrate their resources according to their expectations. This leads to different services or products, so their competitive position can be firmed (Wernerfelt, 1984; Rungtusanatham, 2003).

To sum up, RBV suggests that a) organizations should obtain, manage and bundle their resources to rival, b) resources can be classified as mainly two parts as tangible and intangible, c) capabilities and mechanisms of companies ensure companies to acquire and apply resources to gain advantages against their rivals, and d) resources which are valuable, rare, imperfectly imitable, imperfectly mobile and substitutable guide for sustainable competitive superiority (Rungtusanatham, 2003).

2.5. Hypotheses Development

In the literature, several studies indicate that SCO has a positive impact on business performance (Hult et al., 2008; Min & Mentzer, 2004; Min et al., 2007). Miocevic and Karanovic (2011) showed that SCO has a positive impact on organizational

buying effectiveness (OBE). In addition, they specified that key supplier relationship management (KSRM) is a strong mediator in the SCO-OBE relationship. Min and Mentzer (2004) also pointed out that SCO and SCM are positively associated. Also, the SCO-SCM path affects business performance in a favorable way. Min et al. (2007) suggested the model that includes Market Orientation (MO), SCO and SCM. They searched the effects of these three factors on firm performance. Their analysis showed that MO and SCO are positively associated. In addition to this, like previous studies, there is a positive relationship between SCO and SCM. Lastly, they emphasized that SCO has a positive effect on firm performance and SCO is a strong antecedent of SCM operations. Hult et al. (2008) defined six different indicators for SCO: customer orientation, competitor orientation, value-chain coordination, supplier orientation, logistics orientation and operations orientation. According this study, it was suggested that these orientations are first order indicators of SCO, and are positively related to performance. Thus, it is asserted that Supply Chain Orientation has a positive impact on firm performance, meaning that firms who focus on supply chain operations more have a competitive advantage over others that do not use SCO.

H1: Supply Chain Orientation (SCO) is positively related with operational performance.

Very few research studies that investigate the correlation between knowledge management and supply chain performance exist. Toyota, Wal-Mart and Dell have used their supply chain management skills effectively, providing them with competitive advantages and excellent performance (Hult et al., 2006).

There are three theoretical approaches of Knowledge Management on organizational performance: resource-based, strategic choice theory, and configurational inquiry in the study of Hult et al. 2006. Firstly, according to resource-based view, knowledge elements that add value to the supply chain should be determined. RBV provides for the refinement of knowledge elements that can affect an organization's performance (Barney, 1991; Wernerfelt, 1984). Furthermore, knowledge must satisfy some constraints to be a strategic resource (Barney, 1991). Firstly, the knowledge must be valuable, meaning that it helps to generate outputs that meet customers' needs.

Secondly, knowledge must be rare, that is it must be a resource that is not acquired frequently. Last, but not least, knowledge must be inimitable, meaning that obtaining it is very difficult. Knowledge can be seen as an intangible resource which cannot be moved or bought readily since it is embedded in the structure of the chain (Barney, 1991; Grant, 1996). Strategic choice theory, on the other hand, points out that how the types of knowledge elements are emphasized depends on different supply chain strategies: prospectors, analyzers, low cost defenders, differentiated defenders and reactors. Lastly, with regard to configurational inquiry theory, the relationship between supply chain knowledge and business performance for different strategic types was investigated and Hult et al. (2006) showed a positive correlation between Knowledge Management and performance.

Fugate et al. (2009) investigated the relationship between Knowledge Management and organizational performance. They considered knowledge generation, knowledge dissemination, knowledge interpretation, and knowledge responsiveness. This research showed the positive impact of Knowledge Management on performance in the context of logistics operations.

'What we know' and 'what we need to know' to improve supply chain performance are basic questions of the research of Craighead et al. (2009). In this study, hypotheses related to knowledge management were tested for different strategy types. They showed that knowledge management had a positive impact on performance for three different strategic types: costly efficient imitators, costly imitators and costly innovators. Cost efficient imitators refer to better than average cost efficiencies and a preference to imitate competitors' successful practices rather than to innovate. Second, costly imitators' costs are higher than their competitors. Lastly, costly innovators innovate and the cost of innovation is higher than that of imitation. Additionally, Blumenberg et al. (2009) emphasized a positive relationship between knowledge transfer and outsourcing performance. Terms of trainings, strategic level agreements and standards are discussed in this research. Sivakumar and Roy (2004) studied about knowledge redundancy and supply chain performance. Knowledge redundancy '*conjures up images of duplication and waste created in the pursuit and mastery of knowledge by intra- or inter-firm team members*' (Sivakumar

& Roy, 2004). Therefore, it is supported that the direct effect of Knowledge Management on operational performance is positive and with the mediating effect of SCO, KM has a stronger positive effect on performance.

H2a: Knowledge Management (KM) is positively related with operational performance.

H2b: The impact of KM mediated by SCO is stronger than KM's direct effect on operational performance.

In the literature, some benefits of ERP are discussed, such as: providing faster transactions, reducing cycle time, better financial management, and making tacit knowledge explicit (Su & Yang, 2010). Davenport (1998) emphasized the different outcomes of ERP implementation, such as: reduced cycle time, improving information flow and rapid formation of financial information. According to Holland and Light (1999), ERP facilitates greater managerial control, rapid decision making, and reduction of operational costs. Furthermore, in the research of Su and Yang (2010), a positive relationship between ERP and SCM competences was shown. So, it is supported that the direct effect of ERP on operational performance is positive, and secondly, with a mediating effect of SCO, ERP has positively stronger effect on performance.

H3a: ERP Usage is positively related to operational performance.

H3b: The impact of ERP Usage mediated by SCO is stronger than ERP's direct effect on operational performance.

Newell et al. (2003) evaluated whether ERP and KM be applied in tandem, and whether there is a complementarity between ERP and KM. Both ERP and KM are applied in many organizations (Alavi & Leidner, 2001). According to Newell et al. (2003), ERP satisfied competitive advantage through crucial information is that is produced, shared, and managed. Reduction of costs, advance resource control, and decision quality, or in other words leaner production, can be seen as advantages of ERP (Communications of the ACM, 2000; cited by Newell et al., 2003). KM emphasizes how an organization can improve competitive advantage with more effective usage of its knowledge resources. Moreover, there is a difference between ERP and KM in their orientation: KM systems focus on flexibility and innovation,

whereas ERP on focuses on efficiency. The dilemma between efficiency and flexibility and innovation is a popular discussion topic in organizational theory (Newell et al., 2003). This paper researched the application of KM and ERP at the same time using a case study. They suggested that ERP and KM are complementary rather than conflicting with enabling flexibility and efficiency simultaneously. Sedera and Gable et al. (2010) showed the relationship between KM competence and ERP. They suggested that there is a positive and significant relationship between KM competence and ERP success. In their research, factors of ERP were system quality, information quality, individual impact, and organization impact. Meanwhile, the factors of KM competence were knowledge creation, knowledge retention, knowledge transfer and knowledge application. Xu, Wang, Luo and Shi (2006) argued the correlation between ERP and KM. According to them, ERP provides an infrastructure for KM to discover, classify, and store knowledge.

H4: The impact of ERP Usage on operational performance mediated by KM and SCO simultaneously is stronger than all aforementioned ERP Usage's affects.

Lastly, 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 types of criteria can also increase revenue and profits. Therefore, higher efficiency means higher operational performance, and this cause better financial performance.

H5: Operational performance is positively related with financial performance.

To sum up, seven different hypotheses have been developed. These emphasize the importance of SCO, KM and ERP Usage. A proposed model is shown in the Figure 2.7 and all hypotheses are summarized in the Table 2.1.

Table 2.1: Hypotheses

No	Hypotheses
H1	*Supply Chain Orientation (SCO) is positively related with operational performance.*
H2a	*Knowledge Management (KM) is positively related with operational performance.*
H2b	*The impact of KM mediated by SCO is stronger than KM's direct effect on operational performance.*
H3a	*ERP Usage is positively related with operational performance.*
H3b	*The impact of ERP Usage mediated by SCO is stronger than ERP's direct effect on operational performance.*
H4	*The impact of ERP Usage on operational performance mediated by KM and SCO simultaneously is stronger than all previous affects.*
H5	*Operational performance is positively related with financial performance.*

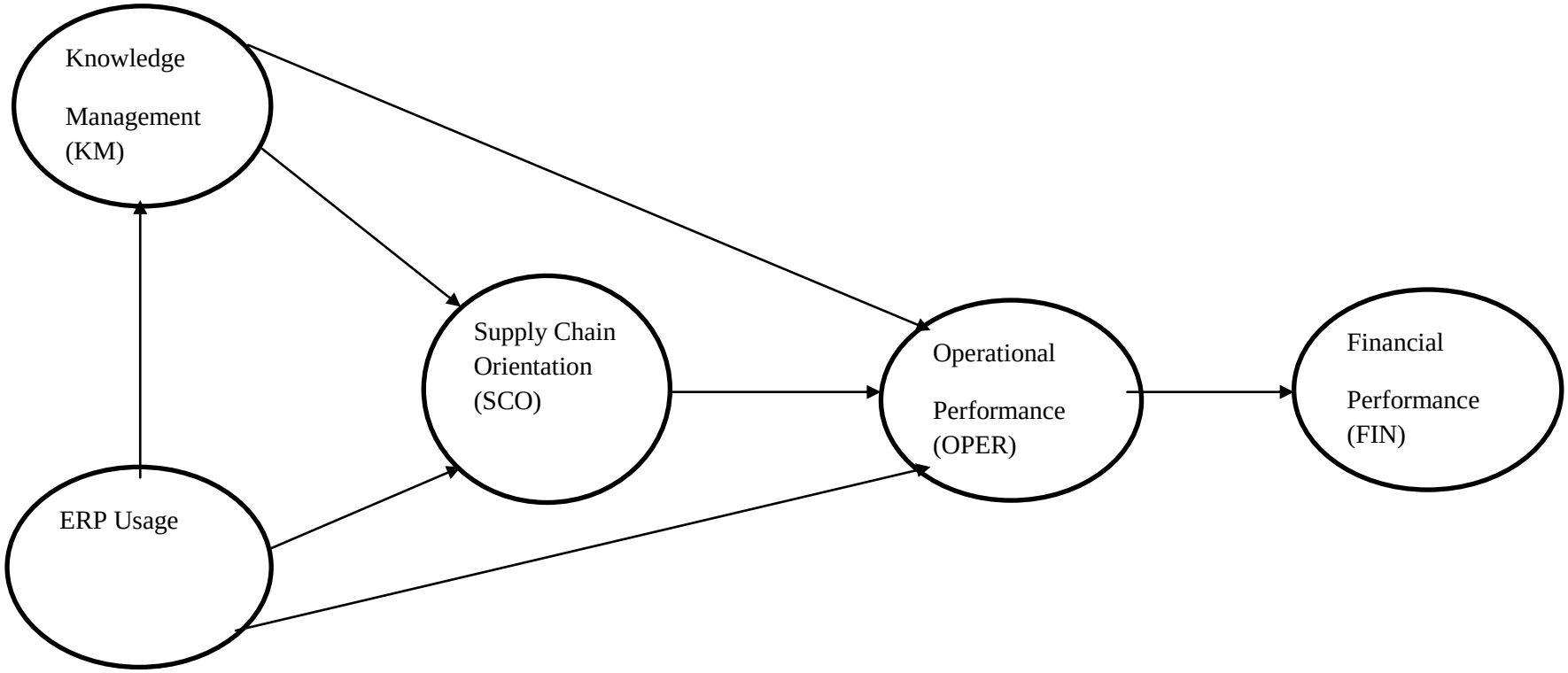


Figure 2.7: Proposed Model

CHAPTER 3

METHODOLOGY

In this section, the theoretical framework and hypotheses are discussed. Measurement information related with each latent variable is provided. In addition to these, survey design, data collection and characteristics of the sample are explained. Lastly, Partial Least Squares (PLS) and Universal Structural Modelling methods are explained.

3.1. Instrument Development andMeasurement Scales

3.1.1. Supply Chain Orientation (SCO)

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. Commitment is '*an implicit or explicit pledge of relational continuity between exchange partners*' (Dwyer, Schurr and Oh, 1987). Furthermore, cooperative norms are '*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, Simpson, and Baker, 1998). Organizational compatibility means fitness or suitability of cultural norms and management techniques to SCM. Last but not least, top management support refers to being open to changes, and leadership means suitability and fitness of management techniques and cultural norms to SCM processes. The respondents were asked to check their opinion about SCO on a scale from 1 (strongly disagree) to 5 (strongly agree). Statements from the study of Min et al. (2007) are shown in Table 3.2.

Table 3.2: Scale for SCO (adapted from Min et al., 2007)

Promises made to our supply chain members by our business unit are reliable.
Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.
Our business unit does not make false claims to our supply chain members.
Our business unit is not open in dealing with our supply chain members.
When making important decisions, our supply chain members are concerned about our welfare.
When we share our problems with our supply chain members, we know they will respond with understanding.
In the future we can count on our supply chain members to consider how their decisions and actions will affect us.
When it comes to things that are important to us, we can depend on our supply chain members' support.
We defend our supply chain members when outsiders criticize them, if we trust them.
We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.
Our business unit is willing to make cooperative changes with our supply chain members.
We believe our supply chain members must work together to be successful.
We view our supply chain as a value added piece of our business.
Our business unit's goals and objectives are consistent with those of our supply chain members.
Our CEO and the CEOs of our supply chain members have similar operating philosophies.
Top managers repeatedly tell employees that this business unit's survival depends on its adapting to supply chain management.
Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business unit's success.
Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business unit's success.
Top managers repeatedly tell employees that sharing risk and rewards is critical to this business unit's success.
Top management offers various education opportunities about supply chain management.

3.1.2. Knowledge Management

Statements about KM are adapted from the study of Zaim, Tatoglu and Zaim (2007), and factors of this scale are knowledge generation, knowledge transfer, knowledge utilization, coding and storage of knowledge processes. These four processes should sustain KM efficiently. Although, this scale includes some statements about technological infrastructure, it is assumed that companies have essential property for it. To survive in highly competitive market conditions, knowledge is an important factor, so organizations should gather tacit knowledge to show and teach their employees. Knowledge generation refers to exposing the capabilities of new and beneficial ideas and solutions. This process is based on human interaction, so companies should encourage their employees to join knowledge generation activities. Firms get new knowledge via R&D activities, benchmarking, and meetings. In addition to these, companies can reach new solutions with imitation, buying, and outsourcing.

Knowledge coding and storage provides solutions or ideas for the right people at the right time. Knowledge coding and storage is also important to evaluate and reuse ideas and solutions in the future. However, it does not refers to storing all knowledge, because solutions that are not beneficial are unnecessary for organizations. Technological infrastructure is needed to store knowledge, so firms should invest in their information system infrastructure.

Knowledge transfer covers processes of knowledge gathering. This transfer can occur both in an organization and among organizations. Some companies, like Chevron, increased their revenues by applying knowledge transfer processes (Zaim, 2005). In contrast to other resources, by sharing, the value of knowledge increases rather than decreases. In particular, knowledge transfer among organizations also requires technological infrastructure like ERP, and it is very crucial to improve supply chain performances.

Knowledge utilization is a consequence of previous KM activities, and there is no value of them without knowledge utilization. KM provides a competitive advantage for organizations. Corporate culture is an important point for companies to easily use new knowledge, therefore some features, such as flexibility andopenness, come into

question. Knowledge can be used in the relationship between firms and customers, in organizations, and among supply chain members. (Zaim, 2005)

The questions were originally designed for knowledge management processes in an organization. However, in this thesis, knowledge management among supply chain members is considered, so questions were modified according to this perspective. Additionally, some arguments were eliminated because they were not suitable for the aims of this research. The final version of this survey is shown in Table 3.3. The respondents were asked to check their opinion about KM on a scale from 1 (strongly disagree) to 5 (strongly agree).

Table 3.3: Scale for KM

The R & D activities in our business related to supply chain are at satisfactory level.
Employees in supply chain departments are encouraged for continuous learning.
Our business makes effort to find qualified personnel for supply chain departments.
Our business encourages and supports innovative ideas related to supply chain operations.
In our business, brainstorming is conducted to improve current system/operations and to solve problems.
In our business, employees in supply chain departments contribute to knowledge generation processes
There is a systematic effort in our business to generate and improve knowledge.
In our business, information about our suppliers and customers is regularly classified, filed and stored.
In our business, I can easily reach information about supply chain operations.
In our business, information about supply chain operations is regularly updated.
We pay attention to sharing information with our supply chain members.
We improve our business operations and processes through sharing our experience and knowledge with our suppliers and customers.
We effectively use e-mail and internet to share information with our suppliers and customers.
For information sharing purposes, we organize coordination meetings with our suppliers and customers.
There is a strong communication between us and our suppliers/customers.
We reflect our knowledge and experience on our services and products.
The knowledge obtained from trainings related to supply chain operations is put into practice in short time.
We are a business that continuously learns and implements what is learned.

3.1.3 ERP Usage

Statements about ERP Usage were developed for this thesis. Usage of different ERP modules were considered when generating arguments, and three basic ERP modules about operations were taken into account: supply chain, production planning, and quality modules. Additionally, some arguments were modified by using the questions of Sternad et al. (2011). Originally, the statement, *'The ERP system provides sufficient information to my needs'* was in the study, and it was changed to: *'The ERP Production/Quality/Supply Chain module provides sufficient information to my needs.'* Moreover, these statements were checked by two ERP experts, and they confirmed their suitability. These indicators can be seen in Table 3.4. As previously, the respondents were asked to check their opinion about ERP on a scale from 1 (strongly disagree) to 5 (strongly agree).

Table 3.4: Scale for ERP Usage

We effectively use the ERP Production module.
ERP Production module gives necessary information about production processes.
The lack of ERP Production module is a serious loss for us.
We effectively use the ERP Supply Chain module.
ERP Supply Chain module gives necessary information about production processes.
The lack of ERP Supply Chain module is a serious loss for us.
We effectively use the ERP Quality module.
ERP Quality module gives necessary information about production processes.
The lack of ERP Quality module is a serious loss for us.

3.1.4 Performance

Performance criteria were decided by reviewing literature related to business performance (e.g. Kroes & Ghosh, 2010; Zaim et al., 2007). However, because of similarities among performance criteria, statements were designed primarily according to supply chain performance and financial performance. As mentioned previously, non-financial criteria common to with supply chain operations, are: delivery in time, forecasting accuracy, and average inventory level. Questions regarding corporate performance were based on the last three years of information. The respondents were asked to check their opinion about performance on a scale

from 1 (very bad) to 5 (very good). Operational and financial performance criteria are shown in Table 3.5.

Table 3.5: Performance Criteria

Number of defective items returned from customer
Delivery on time
Production cost
Lead time in production
Average inventory cost
Average inventory level
Forecasting accuracy
Service after sale
Market Share
Profit
Revenue
Return on investment

In addition to the criteria above, some control variables are added to the survey, including sector, position, brand of ERP used, and number of employees. Furthermore, to prevent the collecting of more than one survey from each firm, the name of company is also asked in the questionnaire. All constructs are reflective variables in this research.

3.2. Survey Design and Data Collection

All scales were collected in a questionnaire along with instructions. The respondents are Turkish companies so the language of questionnaire is Turkish. There are four parts in the questionnaire, and these are related to SCO, KM, ERP Usage, and Performance. The first part was adopted from Min et al. (2007), and these were translated into Turkish by the author, and it was back-translated to English by another bilingual academician. After that, these were again translated to Turkish. In addition to this, a doctor on the author's dissertation committee checked the questionnaire. An expert of Turkish language also checked the accuracy of statements. For the second part, the scale was cited from Zaim et al. (2007), and the original version of the scale is Turkish. Moreover, arguments about ERP and performance were generated by the present author. There are 69 questions in the survey about latent variables and demographic variables.

This study relates with efficiency in operations, therefore organizations which were expected to have well coordinated and systematic supply chain and to use ERP were taken into account. Moreover, only manufacturing companies were considered in theresearch. Firms were 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, Konya and the reference lists of ERP brands which was published their web pages. In addition to these, 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, etc. Two versions of the survey—paper and electronic—were prepared. The electronic copy was prepared with the help of Google Drive. The questionnaire was sent to managers and companies via e-mail and mail. Data collection occurred between 15th October 2012 and 20th May 2013.

3.3. Survey Instructions and Help Statements

In the survey, some instructions and help statements are used to help respondents. These are shown below.

a)

Dear Participant

Your responses are not shared with third parties, and this survey does not have any liability to you. Data collected from this survey is only used for academic research. Please answer the questions. Thanks for your interest.

Prof. Dr. Selim ZAİM, Research Assistant Mehmet Fatih ACAR

b)

IMPORTANT NOTE: Statements are prepared according to a 5-point Likert Scale. In this scale, the categories are shown in ascending order from left to right as: (1) Strongly Disagree; (2) Disagree; (3) Neither Agree/Nor Disagree; (4) Agree; (5) Strongly Agree. In this assessment, there are no correct and incorrect answers. It is

expected to learn from your assessment about subjects discussed in this research and also to reach scientific results.

c)

Below are some statements about supply chain operations of your company. Supply chain refers to operations which are from the gathering of raw materials to after-sale service (i.e. inventory management, production planning, logistics, delivery, transportation etc.).

d)

“Corporations with which you do business” means contractors and suppliers of your company such as distributors, retailers, third party logistics companies, etc.

e)

Please show your opinion about performance of your company in the last 3 years. In this scale, the categories are shown as: (1) Very Bad; (2) Bad; (3) Undecided; (4) Good; (5) Very Good.

3.4. Sample

The sample was collected from manufacturing companies. Each company could complete only one questionnaire. 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 construction sector, 17 surveys were from chemical industry, 12 surveys were from the machine industry, and the remainder were from different sectors, such as iron-steel, furniture, and mining.

Thirty-two organizations used SAP software, 20 of them used Microsoft, 11 of them used Canias (IAS), 21 of them used Netsis and others used different ERP packages such as Workcube, Logo and IFS.

Twenty-eight respondents were production managers, 36 respondents were information technology (IT) managers, 24 of them were CEOs or assistants of CEOs

and the remainder were in different positions, such as engineers, supply chain managers and quality managers.

Additionally, the corporations were of different sizes. Five companies were micro-sized organizations (having less than 10 employees), 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 lastly, 6 firms did not specify their number of employees.

3.6. Data Analysis Methods

3.6.1. Structural Equation Modeling (SEM)

Structural Equation Modeling allows the analyzing of simultaneous equations with considering obtained information and can calculate the direct or indirect effects of variables (Dudaroğlu, 2008).In this research, variance based structural equation modelling, partial least square method (PLS) was used to analyze the data. Partial Least Square (PLS) is a variance-based structural equation modelling. It was developed by Wold (1985), and uses two stage estimation algorithms.

> *'In the first stage, an iterative scheme of simple and/or multiple regressions contingent on the particular model was performed until a solution converges on a set of weights used for estimating the latent variables scores. The second stage involves the non-iterative application of PLS regression for obtaining loadings, path coefficients, mean scores and location parameters for the latent and manifest variables' (Zaim et al., 2007:62).*

Before path analysis, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were applied to data. EFA is used for detecting the possible factors of observed data and it allows resarchers to reduce the number of variables (Suhr, 2013). Moreover, the purpose of CFA is to analyze how well the observed indicators service as a measurement item instead of real latent variables. Indicators can be seen as endogenous variables as well as latent ones are exogenous variables (Dudaroglu, 2008). CFA tests the construct validity for scales, also it gives regression coefficients between factors and indicators. Moreover, significance level of each indicator can be interpreted with it (Kline, 2005, cited by Dudaroglu, 2008), and also considering with some index values like goodness of fit index value, suiting of model formed

between latent (construct) and manifest (factor) variables can be discussed. Furthermore, with the help of some analysis such as Dillon-Goldstein's ρ value and principal component, unidimensionality of constructs was evaluated in this research. Unidimensionality refers to *"the existence of one construct underlying a set of items"* (Hoe, 2008).

For calculations, SPAD Decisia, data analysis software was used. PLS has advantages over co-variance based structural equation modelling (SEM) and multiple regression analysis (Kock, 2010). In contrast to co-variance based SEM, PLS does not require normality assumptions for the variables. Furthermore, co-variance-based SEM needs a larger sample size and variables which include only reflective indicators, but PLS can work with smaller sample sizes of less than 100 and can include formative indicators (Kock, 2012).

3.6.2. Universal Structure Modeling

Universal Structure Modeling (USM) is a structural equation modeling that captures nonlinear relationships between variables in the model (Buckler and Thurau, 2008). It is an explorative tool based on the Bayesian Neural Network. USM can be seen as complementary method for covariance based structural equation modeling (CVSEM), like LISREL and partial least square (PLS).

> *... Because USM combines the iterative methodology of partial least squares with a Bayesian neural network approach involving a multilayer perceptron architecture, it enables researchers to identify 'hidden' structures within their models and highlights theoretically unproposed model paths, nonlinear relations among model variables, and interactive effects…*
>
> *…USM solves the black box problem inherent to universal regression through its combined use of methods that measure the strength of model paths and procedures that quantify and visualize nonlinear and interactive effects among model constructs. Whereas PLS and CVSEM both limit model estimation to a priori hypothesized paths, USM represents a more exploratory approach that also tests for hidden model structures, namely,*

> *theoretically unproposed paths, nonlinearity, and interaction effects…*(Buckler and Thurau, 2008:49 and 50).

Like PLS, USM does not require normality assumptions, and it provides the use of formative scales. Additionally, USM can capture nonlinearity and interactions with sample sizes of less than 250 cases (Buckler and Thurau, 2008).

CHAPTER 4

MODEL ASSESSMENT

The model was assessed at three steps:

1) Applying an exploratory factor analysis (EFA) with varimax rotation to define the dimensions of variables;
2) Testing of the measurement model of each variable with confirmatory factor analysis (CFA) to evaluate whether the dimensions of each variable fit the data well or not and;
3) Unidimensionality tests for variables. These steps are explained in the following sections.

4.1. Exploratory Factor Analysis (EFA)

4.1.1. Exploratory Factor Analysis (EFA) for SCO

EFA with varimax rotationwas performed for each variable: SCO, KM and ERP Usage. Firstly, this analysis was applied for SCO. There were 20 items related to SCO, and factors were considered with eigenvalues greater than 0.9. Instead of using 1, the threshold value was determined as 0.9, because some of the eigenvalues are much closer to 1, so some important factors discussed in the literature could not be captured by EFA. In the first step, SCO12, SCO13, SCO14, and SCO15 were eliminated because of low factor scores. At the end of second step, 16 items were loaded on four different factors (Table 4.6) and these explain the 68.9 percent total variance. Additionally, the Kaiser-Meyer-Olkin measure is significant because it means that data for SCO scale is appropriate to apply factor analysis. Based on the loadings, these factors were named as credibility (CRE), benevolence (BENV), commitment (COM) and top management support (TMS). All these factors were also mentioned previously (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 or greater than the threshold value 0.7 (Nunnally& Bernstein, 1994), therefore all of them are used in this study.

Table 4.6: EFA for SCO

Symbol	Variables	CRE	BENV	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.			0.54	
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.			0.64	
SCO12	Top managers repeatedly tell employees that this business unit's 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 unit's 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 unit's success.				0.77
SCO15	Top management repeatedly tells employees that sharing risk and rewards is critical to this business unit's success.				0.85
SCO16	Top management offers various education opportunities about supply chain management.				0.79

Table 4.7: KMO Test for the data of SCO

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.886
Bartlett's Test of Sphericity	Approx. Chi-Square	1767.183
	df (degrees of freedom)	120
	Sig.	.000

4.1.2. Exploratory Factor Analysis (EFA) for KM

The same calculations were done for KM. There were 18 indicators related with KM, and factors were considered with eigenvalues greater than 0.9. Instead of using 1, the threshold value was determined as 0.9, because some of the eigenvalues are much closer to 1. So some important factors discussed in the literature could not be captured by EFA. After the first step, KM17 was dropped. At the end of second step, 17 items were loaded on three different factors (Table 4.9), and these explain the 67.2 percent of total variance. Furthermore, the Kaiser-Meyer-Olkin measure was significant, meaning that data for KM scale was appropriate to apply factor analysis. Based on the loadings, these factors were named as knowledge generation (KG), knowledge storage (KS) and knowledge usage /sharing (KUS). The Cronbach α values are 0.90, 0.88, 0.89, respectively. These values are bigger than the threshold value 0.7 (Nunnally& Bernstein, 1994). All these factors were also mentioned in the research of Zaim et al., (2007), so the analysis overlaps with the literature.

Table 4.8: KMO Test for the data of KM

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.941
Bartlett's Test of Sphericity	Approx. Chi-Square	2295.442
	df	136
	Sig.	.000

Table 4.9: EFA for KM

Symbol	Variables	KG	KS	KUS
KM1	The R & D activities in our business related to supply chain are at satisfactory level.	0.738		
KM2	Employees in supply chain departments are encouraged for continuous learning.	0.805		
KM3	Our business makes effort to find qualified personnel for supply chain departments.	0.758		
KM4	Our business encourages and supports innovative ideas related to supply chain operations.	0.671		
KM5	In our business, brainstorming is conducted to improve current system/operations and to solve problems.	0.563		
KM6	In our business, employees in supply chain departments contribute to knowledge generation processes	0.564		
KM7	There is a systematic effort in our business to generate and improve knowledge.	0.665		
KM8	In our business, information about our suppliers and customers is regularly classified, filed and stored.		0.785	
KM9	In our business, I can easily reach information about supply chain operations.		0.828	
KM10	In our business, information about supply chain operations is regularly updated.		0.785	
KM11	We pay attention to sharing information with our supply chain members.			0.756
KM12	We improve our business operations and processes through sharing our experience and knowledge with our suppliers and customers.			0.799
KM13	We effectively use e-mail and internet to share information with our suppliers and customers.			0.713
KM14	For information sharing purposes, we organize coordination meetings with our suppliers and customers.			0.525
KM15	There is a strong communication between us and our suppliers/customers.			0.681
KM16	We reflect our knowledge and experience on our services and products.			0.595
KM17	We are a business that continuously learns and implements what is learned.			0.543

4.1.3. Exploratory Factor Analysis (EFA) for ERP Usage

There are 9 items related with ERP Usage and, at the end of EFA, 16 items were loaded on two different factors. These explain the 68.2 percent of total variance (Table 4.11). Moreover, Kaiser-Meyer-Olkin measure was significant, meaning that data for ERP scale was appropriate to apply factor analysis. Based on the loadings, these factors are named as 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& Bernstein, 1994), so they could be used in the analysis.

Table 4.10: KMO Test for the data of ERP

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.777
Bartlett's Test of Sphericity	Approx. Chi-Square	1135.444
	df	36
	Sig.	.000

Table 4.11: EFA for ERP Usage

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 Supply Chain module.	0.76	
ERP8	ERP Supply Chain 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 Supply Chain module is a serious loss for us.		0.80

Lastly, EFA was applied for performance criteria and four elements, number of defective items returned from customer, production cost, average inventory level market share, were excluded. There are two factors for it, operational and financial. Operational one includes, delivery on time, lead time in production, average inventory cost, forecasting accuracy, service after sale; financial one covers, profit, revenue and return on investment criteria.

4.2. Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis tests the measurement model of variables. Therefore, SCO, KM and ERP Usage were tested with a first order confirmatory factor model to evaluate the construct validity. Based on results, it can be said that factor structures for SCO, KM and ERP Usage getting from EFA, were supported.

4.2.1. Confirmatory Factor Analysis (CFA) for SCO

First of all, CFA was performed for SCO. As mentioned before, there were four factors related with SCO: credibility (CRE), benevolence (BENV), commitment (COM) and top management support (TMS). Reference indicators were also determined in the model, these were SCO3 for credibility, SCO7 for benevolence, SCO10 for commitment and SCO19 for top management support. The model is shown in Figure 4.8.

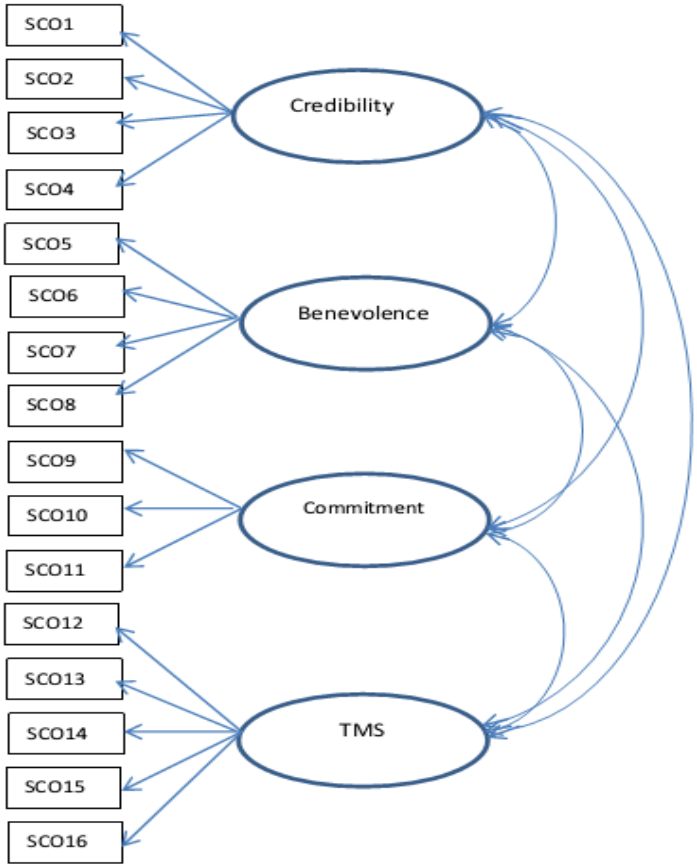


Figure 8: CFA model for SCO

To fit well, there was a little change in that correlation between e15 and e16 was high, so this relationship was defined in the model. Lastly, the critical ratio, X^2/df was equal to 2.25. This value was expected to be between 0 and 3, where lower value implies a better fit (Demirbag, Koh, Tatoglu & Zaim, 2006). Moreover, the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and Tucker-Lewis coefficient (TLI) values for SCO (see Table 15) were highly satisfactory, because these indices should be close to 1 to show a perfect fit (Demirbag et al, 2006).Therefore, it can be said that each model shows a good fit considering related factors. The model parameters were calculated with the maximum likelihood method. For the SCO variable, most of the indices were at an acceptable level (Cheung & Rensvold, 2009; Hair, Anderson, Tatham & Black, 1995; Hooper, Coughlan & Mullen, 2008). Therefore, reliability and validity of the SCO variable were satisfied. Then, it can be seen that all the individual factor loadings were significant (for $p < 0.001$), so convergent validity is also supported. The measurement model for SCO was summarized, and standardized regression weights for each variable are shown in Table 4.12. All t-values in the CFA were statistically significant ($p< 0.001$).

Table 4.12: 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.	0.74***
SCO4	Our business unit is not open in dealing with our supply chain members.	0.28***
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.	0.57***
SCO10	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	0.52***
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 unit's 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 unit's 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 unit's success.	0.89***
SCO15	Top management repeatedly tells employees that sharing risk and rewards is critical to this business unit's success.	0.74***
SCO16	Top management offers various education opportunities about supply chain management.	0.61***

***significant for $p < 0.001$

4.2.2. Confirmatory Factor Analysis (CFA) for KM

Secondly, CFA was performed for KM. As mentioned before, there were three factors related with KM. These are: knowledge generation (KG), knowledge storage (KS), and knowledge usage/sharing (KUS). Reference indicators were also determined in the model; these were KM2 for knowledge generation (KG), KM9 for knowledge storage, and KM12 for commitment knowledge usage/sharing (KUS).The model is shown in Figure 4.9.

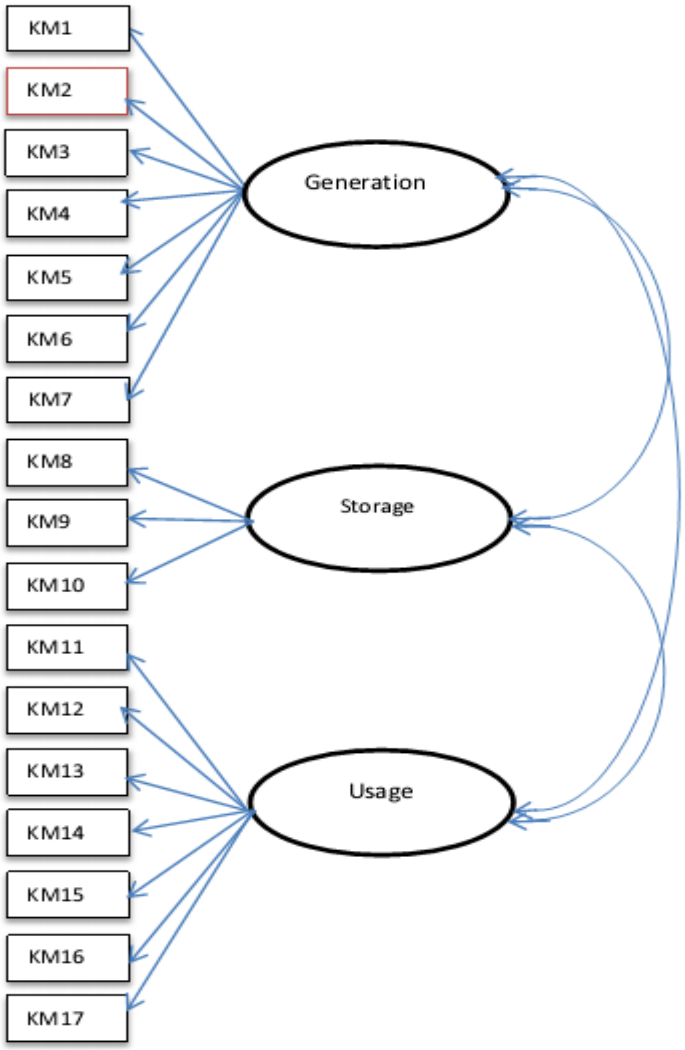


Figure 4.9: CFA model for KM

The correlation between e8 and e9 was high so, to fit the data to the model well, this relationship was defined in the model. The critical ratio, X^2/ df was equal to 1.88. This value is expected to be between 0 and 3, where a lower value implies a better fit (Demirbag et al, 2006). Moreover, the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), the comparative fit index (CFI), and the Tucker-Lewis coefficient (TLI) values for KM (see Table 15) were highly satisfactory, because these indices should be close to 1 to show a perfect fit (Demirbag et al, 2006). Thus, 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 the KM variable, most of the indices were acceptable (Cheung & Rensvold, 2009; Hair, Anderson, Tatham & Black, 1995; Hooper, Coughlan & Mullen, 2008). Therefore, the reliability and validity of KM variable were satisfied. Thus, it can be seen that all the individual factor loadings were significant (for $p < 0.001$), so convergent validity was also supported.The measurement model for KM is summarized, and standardized regression weights for each variable are shown in Table 4.13. All t-values in the CFA were statistically significant ($p< 0.001$).

Table 4.13: CFA for KM

Symbol	Variables	Regression weights
Know. Generation		
KM1	The R & D activities in our business related to supply chain are at satisfactory level.	0.74***
KM2	Employees in supply chain departments are encouraged for continuous learning.	0.80***
KM3	Our business makes effort to find qualified personnel for supply chain departments.	0.69***
KM4	Our business encourages and supports innovative ideas related to supply chain operations.	0.75***
KM5	In our business, brainstorming is conducted to improve current system/operations and to solve problems.	0.77***
KM6	In our business, employees in supply chain departments contribute to knowledge generation processes	0.74***
KM7	There is a systematic effort in our business to generate and improve knowledge.	0.75***
Know. Storage		
KM8	In our business, information about our suppliers and customers is regularly classified, filed and stored.	0.78***
KM9	In our business, I can easily reach information about supply chain operations.	0.89****
KM10	In our business, information about supply chain operations is regularly updated.	0.89***
Know. Usage and Sharing		
KM11	We pay attention to sharing information with our supply chain members.	0.68***
KM12	We improve our business operations and processes through sharing our experience and knowledge with our suppliers and customers.	0.81***
KM13	We effectively use e-mail and internet to share information with our suppliers and customers.	0.73***
KM14	For information sharing purposes, we organize coordination meetings with our suppliers and customers.	0.62***
KM15	There is a strong communication between us and our suppliers/customers.	0.75***
KM16	We reflect our knowledge and experience on our services and products.	0.83***
KM17	We are a business that continuously learns and implements what is learned.	0.76***

***significant for $p < 0.001$

4.2.3 Confirmatory Factor Analysis (CFA) for ERP

Lastly, CFA was performed for ERP. As mentioned before, there are two factors related with ERP, these are modules of ERP (MO) and Utility of ERP (UTIL). Reference indicators were also determined in the model, these are ERP1 for modules of ERP (MO) and ERP10 for the utility of ERP (UTIL). The model is shown in Figure 4.10.

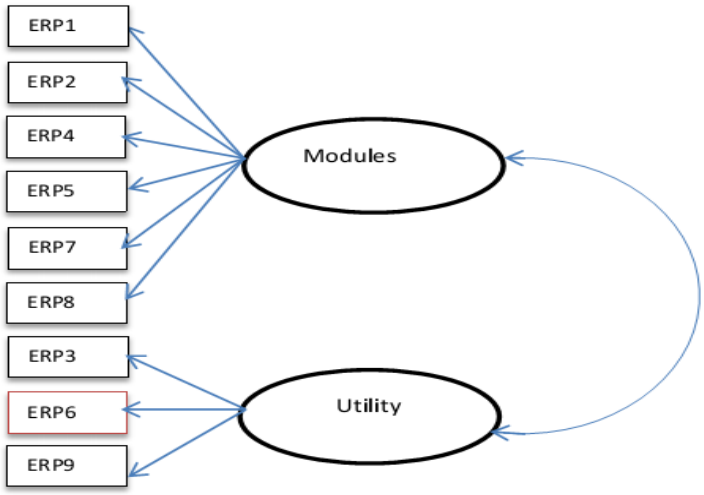


Figure 4.10: CFA model for ERP

To fit well, there were some changes and correlations between e1 and e2, e1 and e5, e3 and e6, e4 and e6, e5 and e6; they were high. Therefore, these relationships were defined in the model. Lastly, the critical ratio, X^2 / df is equal to 3.6, since this value is closer to 3, it can be acceptable. Moreover, the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the comparative fit index (CFI) and the Tucker-Lewis coefficient (TLI) values for ERP Usage (see Table 4.15) were highly satisfactory, because these indices should be close to 1 to show a perfect fit (Demirbag et al, 2006). Therefore, it can be said that the ERP model showed a good fit considered with related factors. The model parameters were calculated with the maximum likelihood method. For the ERP variable, most of the indices were acceptable (Cheung & Rensvold, 2009; Hair, Anderson, Tatham & Black, 1995;

Hooper, Coughlan & Mullen, 2008). Therefore, reliability and validity of ERP Usage variable were satisfied. Thus, it can be seen that all the individual factor loadings were significant (for $p < 0.001$), so convergent validity is supported. The measurement model for ERP Usage was summarized, and standardized regression weights for each variable are shown in Table 4.14. All t-values are in the CFA are statistically significant ($p< 0.001$).

Table 4.14: CFA for ERP

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 Supply Chain module.	0.63***
ERP8	ERP Supply Chain 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 Supply Chain module is a serious loss for us.	0.72***

*significant for $p < 0.001$

The goodness-of-fit and other indices for three variables are shown in Table 4.15.

Table 4.15: Goodness of fit statistics

Variable	x^2	Df	x^2/df	GFI	AGFI	CFI	TLI
SCO	187.21	83	2.25	0.88	0.83	0.93	0.92
KM	216.75	115	1.88	0.88	0.84	0.95	0.94
ERP Usage	75.71	21	3.6	0.92	0.84	0.95	0.91

4.3. Unidimensionality Tests of Variables

The validity and reliability of three variables were also evaluated by testing unidimensionality three ways: principal component analysis, Cronbach's α and Dillon-Goldstein's ρ. All the Cronbach's α values were closer or greater than the threshold value of 0.70. When considering principal component analysis, the first eigenvalue score of the manifest variable of each variable was greater than one, and the second score was lower than one. Therefore, each variable could be thought as

unidimensional (Chin, 1998; cited by Zaim et al. 2007). Lastly, Dillon-Goldstein's ρ value for each variable is larger than 0.70, so this also gave extra support for unidimensionality for all variables.

Table 4.16: Unidimensionality tests

Variable	Number of ind.	Cronbach'sα	Dillon-Goldstein's ρ	First eigen.	Second eigen.
SCO	4	0.7419	0.8393	1.4158	0.4241
KM	3	0.8616	0.9185	1.6011	0.2888
ERP Usage	2	0.6216	0.8459	1.6384	0.5811

CHAPTER 5

RESULTS

The partial least square (PLS) method was applied to the proposed model using Spad Decisia software. PLS works with two processes, outer and inner model estimations. Outer model estimation relates to the relationships between variables and factors, and inner model estimation gives information about significance of relationships between variables or among variables. In this chapter, results of outer and inner model estimations are given.

5.1. Outer and Inner Model Estimations

The outer model, also called the measurement model, correlates between the manifest variables and their latent variables. Results are shown in Table 5.17. Correlations between manifest variables and their latent variables were very satisfactory. A communality measure, also known as R^2, is the square of the correlation value between the manifest variable and its latent variable. Communality values are expected to be higher than 0.5 for each manifest variable. In this research, except for delivery on time, forecasting accuracy, lead time and credibility, all the communality scores show that the manifest variables are able to estimate the change in related latent variables. However, because all correlation values were higher than 0.5, this situation is not a serious problem. In addition to these, outer weights between manifest variables and their latent variables also can be seen in the Table 5.17.

Weights of factors for the ERP Usage variable, modules of ERP, and utility of ERP were 0.61 and 0.50, respectively. When considering KM, weights were 0.47, 0.44 and 0.46 for knowledge generation, knowledge storage, and knowledge usage, respectively. Moreover, those of credibility, benevolence, commitment, and top management support were 0.35, 0.41, 0.35 and 0.52, respectively, when taking into account SCO.

Table 5.17: Outer model estimation results

Latent Variable	Manifest Variable	Outer weight	Correlation	Communality
ERP	Modules	0.6159	0.8593	0.7384
	Utility	0.5081	0.8473	0.7179
KM	Generation	0.4721	0.8947	0.8005
	Storage	0.4424	0.8764	0.7681
	Usage	0.4654	0.9008	0.8114
SCO	Credibility	0.3555	0.669	0.4476
	Benevolence	0.4192	0.764	0.5836
	Commitment	0.3582	0.7093	0.5031
	TMS	0.526	0.8421	0.7091
OPER	Delivery on time	0.3198	0.6365	0.4052
	Forecasting accuracy	0.2722	0.6862	0.4708
	Lead time	0.227	0.5777	0.3337
	Service after sale	0.3558	0.7368	0.5429
	Average inventory level	0.451	0.7973	0.6358
FIN	Profit	0.5432	0.8498	0.7221
	Revenue	0.4285	0.8641	0.7466
	Return on investment	0.4512	0.8387	0.7034

The proposed model is shown in Figure 14, and results of the calculation are shown Table 18. After the parameter estimation, to satisfy the robustness of the findings, bootstrap analysis was applied. Therefore, 500 samples were reproduced by re-sampling (Chin, 1998; cited by Brown and Chin, 2004). The bootstrapping results were also given in the last column of Table 18. The bootstrap coefficients of the inner model were close to an estimation of PLS.

When ERP Usage is considered, Modules criteria is the most important factor (β=0.61). The utility factor's weight was 0.50 and this criterion has a lower impact than modules on ERP Usage. Secondly, knowledge generation appeared to be the leading factor for KM with the value of β=0.47. Additionally, knowledge usage and sharing was the second most critical factor for KM which is β=0.46, and lastly, knowledge storage has comparatively less impact on KM (β=0.44).

Moreover, when SCO is considered, top management support (TMS) was the most critical factor with the value of β=0.52, followed by benevolence, which has a significant effect on SCO of β=0.41. In addition to these, commitment and credibility had approximately same impact on SCO; those are β=0.358 and β=0.355, respectively.

For operational performance, service after sale was the leading factor (β=0.45), and forecasting accuracy appeared as the second most important factor, with the value of β=0.35. Delivery in time had comparatively lower impact on operational performance of β =0.31. Lead time and average inventory level factors were less important than other factors with the value β=0.27 and β=0.22, respectively.

Last but not least, financial performance was explained by three factors, and profit is the most crucial criteria at β=0.54, Second, return on investment had a significant effect on financial performance with the value of β=0.45. Finally, revenue had the least significant impact, at β=0.42.

There were seven hypotheses tested in the research. The first of them, that SCO is positively related with OPER, was supported. The standardized regression weight for SCO is significant (β=0.40). The second one is that KM has a positive effect on OPER. Also, this hypothesis was accepted according to the calculations (β=0.25). However, the hypothesis, ERP Usage had a positive impact on OPER, is not accepted.

Additionally, the hypothesis 2b that with the mediating effect of SCO, KM has a stronger effect than the direct effect of KM on OPER is supported ($\beta_{KM\text{-}SCO\text{-}OPER}$ =0.71*0.40 =0.284 >$B_{KM\text{-}OPER}$= 0.25). Partial mediation is also supported with Sobel test (test statistic=5.8).

Furthermore, the other hypothesis that mediating by SCO, ERP Usage has a stronger effect than the direct effect of ERP Usage on OPER is also accepted ($\beta_{ERP\text{-}SCO\text{-}OPER}$=0.11*0.40 =0.044). There is a full mediation between ERP Usage and OPER when considering the SCO as mediator that is also supported with Sobel test (test statistic= 2.3).

Moreover, the hypothesis 4 that ERP Usage, mediated by SCO and KM, has a stronger effect rather than all previously aforementioned effects of ERP Usage on

OPER is also accepted ($\beta_{ERP\text{-}KM\text{-}SCO\text{-}OPER}$=0.45*0.71*0.40 =0.1278>$\beta_{ERP\text{-}SCO\text{-}OPER}$= 0.044, $\beta_{ERP\text{-}OPER}$is not significant,) and it is supported by Sobel test (test statistic = 5.3). Finally, the last hypothesis that there is a positive relationship between OPER and FIN, is supported (β=0.52).

In Table 19, detailed information about path analysis is given. To confirm the robustness of coefficients, 500 bootstrap samples were reproduced by re-sampling from the original sample. The bootstrap results were also shown in the Table 5.19. When looking at the bootstrap results, estimated coefficients are very close to PLS coefficients. Moreover, all the bootstrap results are between lower and upper confidence bounds, so these indicators confirm the reliability of PLS coefficients. R^2 of KM, SCO, OPER and FIN are 0.20, 0.59, 0.38 and 0.27, respectively. Correlations between variables are also given, according to results and those between KM and ERP, ERP and SCO, KM and SCO, ERP and OPER, KM and OPER, SCO and OPER, OPER and FIN are 0.45, 0.44, 0.76, 0.30, 0.56, 0.60 and 0.52, respectively.

To sum up, six of the hypotheses are supported and only one of them is not. The results of the model is summarized in Table 5.18, and the PLS calculations with related coefficients and significance levels are shown in Figure 5.11.

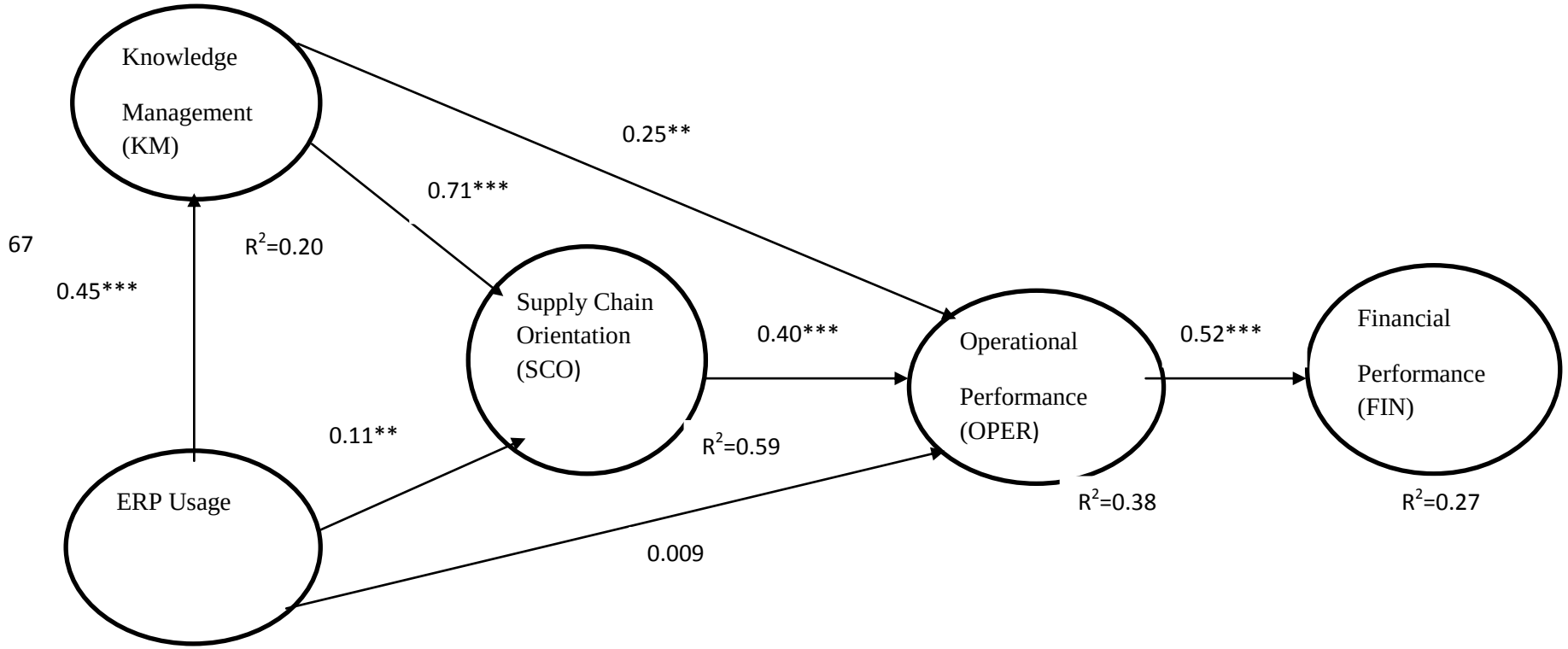
Table 5.18: Results

No	Hypotheses	Results
H1	Supply Chain Orientation (SCO) is positively related with operational performance.	Supported
H2a	Knowledge Management (KM) is positively related with operational performance.	Supported
H2b	The impact of KM mediated by SCO is stronger than KM's direct effect on operational performance.	Supported
H3a	ERP Usage is positively related with operational performance.	Not supported
H3b	The impact of ERP Usage mediated by SCO isstronger than ERP's direct effect on operational performance.	Supported
H4	The impact of ERP Usage on operational performance mediated by KM and SCO simultaneously is stronger than all previous affects.	Supported
H5	Operational performance is positively related with financial performance.	Supported

Table 5.19: Inner model results

Path	Path Coefficient	Estimated (Bootstrap) Coeff.
ERP-------->KM	0.4532***	0.4498
ERP-------->SCO	0.1168*	0.1144
KM---------> SCO	0.7134***	0.7159
ERP-------->OPER	0.0094	0.0101
KM---------> OPER	0.2503**	0.2466
SCO--------> OPER	0.4060***	0.4077
OPER------> FIN	0.5211***	0.5165

*****p<0.05, ******p<0.01 , ***p<0.001



Note: Significance levels are 1%(***), 5%(**) and 10%(*)

Figure 5.11: Results of model

5.2. Neusrel Results

To analyze the nonlinearity among variables, universal structural equation modelling (USM) was applied to the proposed model. In addition to PLS, nonlinear relationships were shown using NEUSREL v5 software.

The goodness of fit index was calculated as 0.53 after three iterations. Moreover, when R^2 values are compared, Neusrel results are bigger than linear PLS results. These are shown in Table 5.20 below.

Table 5.20: Comparison of R^2 values and Goodness of Fit index

R^2	KM	SCO	OPER	FIN
Neusrel	0.2105	0.6917	0.5286	0.2772
Linear	0.2054	0.5981	0.3889	0.2716

GOF -Goodness of Fit: 0.53

Moreover, factor score represents the correlation coefficients between factors and latent variables (LV). Factor weights are '*weights which are used to calculate an LV using this set of manifest variables (MVs)'* (Buckler, 2013). Factor scores refer to correlation coefficients between manifest and latent variables. When compared to PLS results, correlation coefficients getting from USM are mostly greater than they were.

In addition to these, Cronbach α values, Average Explained Variance (AEV) scores and composite reliability scores were closer or larger than the critical threshold values 0.7, 0.5 and 0,6, respectively (Nunnally and Bernstein,1994; Fornell and Larcker, 1981; Bagozzi and Yi; 1998). These calculations are shown in Table 5.21.

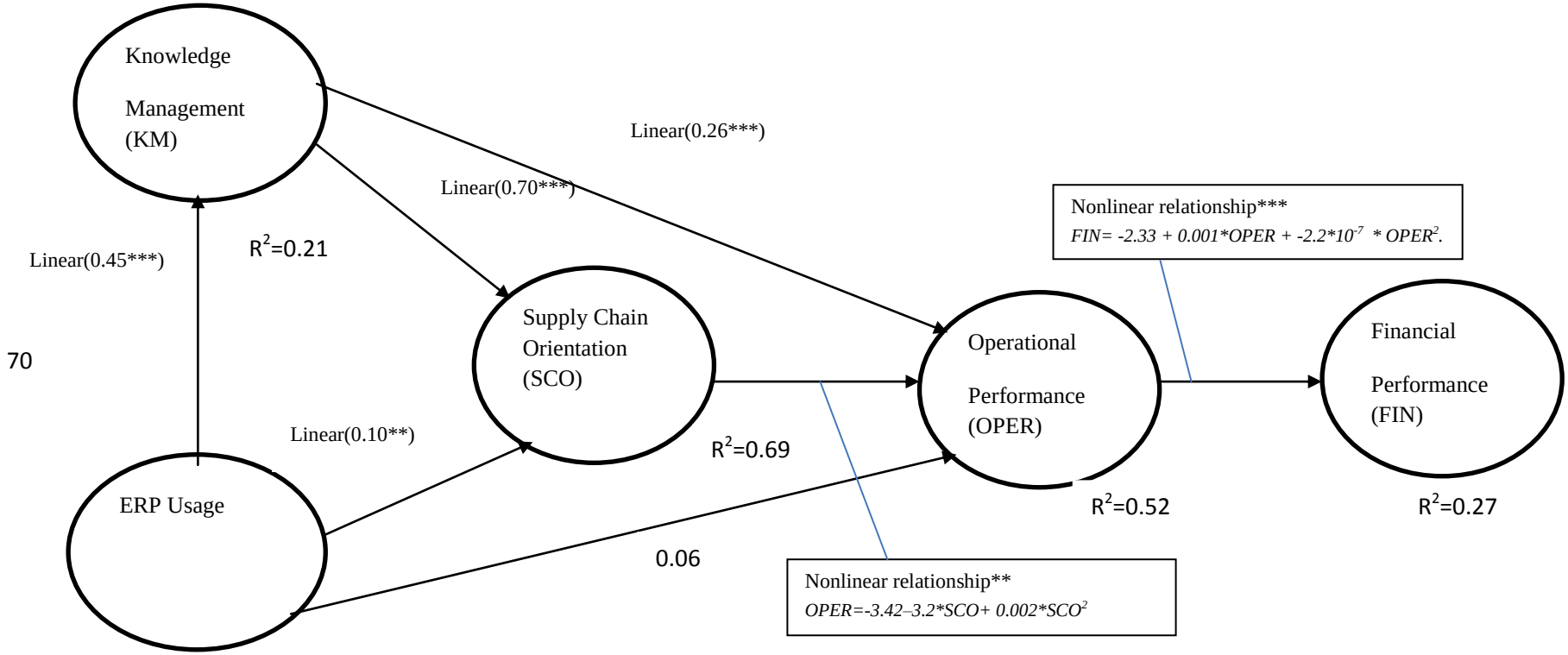
Table 5.21: Measurement values for USM

	Cronbach's Alpha	AEV Average Explained Variance	Composite Reliability
KM	0.88	0.80	0.95
SCO	0.76	0.58	0.76
ERP	0.62	0.72	0.90
OPER	0.73	0.48	0.63
FIN	0.81	0.72	0.91

Table 5.22: USM estimation results

Latent Variable	Manifest Variable	Factor Scores
ERP	Modules	0.79
	Utility	0.90
KM	Generation	0.92
	Storage	0.84
	Usage	0.92
SCO	Credibility	0.71
	Benevolence	0.76
	Commitment	0.78
	TMS	0.80
OPER	Delivery on time	0.71
	Forecasting accuracy	0.70
	Lead time	0.49
	Service after sale	0.70
	Average inventory level	0.81
FIN	Profit	0.85
	Revenue	0.85
	Return on investment	0.85

Furthermore, Neusrel gives nonlinear relationships between variables. According to the results, there are three possible nonlinearities. However, when significance levels are considered, the number of nonlinear relationships decreased by two, since the significance level for ERP and SCO relationship is greater than 0.05. In conclusion, there are nonlinear relationships between SCO and OPER and OPER and FIN. The USM results with related coefficients and significance levels are shown in Figure 5.12.



Note: Significance levels are 1%(***), 5%(**) and 10% (*)

Figure 5.12: Results of USM

The formula between OPER and SCO is:

$OPER = -3.42 - 3.2*SCO + 0.002*SCO^2$

and the formula between OPER and FIN is:

$FIN = -2.33 + 0.001*OPER + -2.2*10^{-7} * OPER^2$.

There are quadratic relationship between OPER and SCO and OPER and FIN. The leverage factors of two models are 0.17 and 0.75 respectively. It shows whether the model is degressive or progressive. *'Degressive means that a change in the effected variable is higher for low values of the causing variable than for high values. The opposite is true for progressive functions -the effect of high values is higher as with low values'* (Buckler, 2013). A leverage factor lower than 1 refers to a degressive function and higher than 1 refers to progressive function. Therefore, both relationships have degressive functions.

The first formula refers that ratio of the effect of SCO on OPER is decreasing in high values. It is an expected result, because if there is no supply chain orientation in the organization, the settlement of it can bring many benefits in the beginning period, however in the following times inreasing rate of operational performance will decrease. Since, there are many determinative factors except SCO that affect the operational performance, it means that to improve efficiency, capabilitiy of SCO is limited. Moreover, the second formula shows the same relationship between OPER and FIN. A change in the financial performance is higher for low values of operational performance. This situation is expected normally, when companies transform from inefficient situation to efficient one in thier operations, their financial performances increase significantly. However, in the next times the increasing ratio of finacial indicators will decrease, because financial performance is not affected just operational performance. Nonlinear relationships are also shown in Figures 5.13 and 5.14.

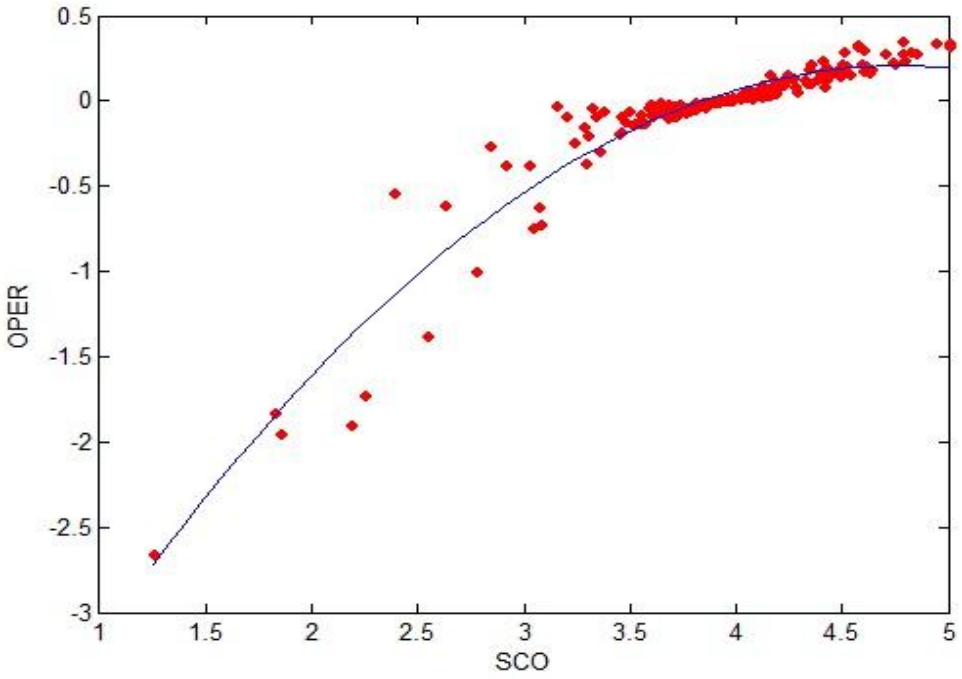


Figure 5.13: Relationship between SCO and OPER

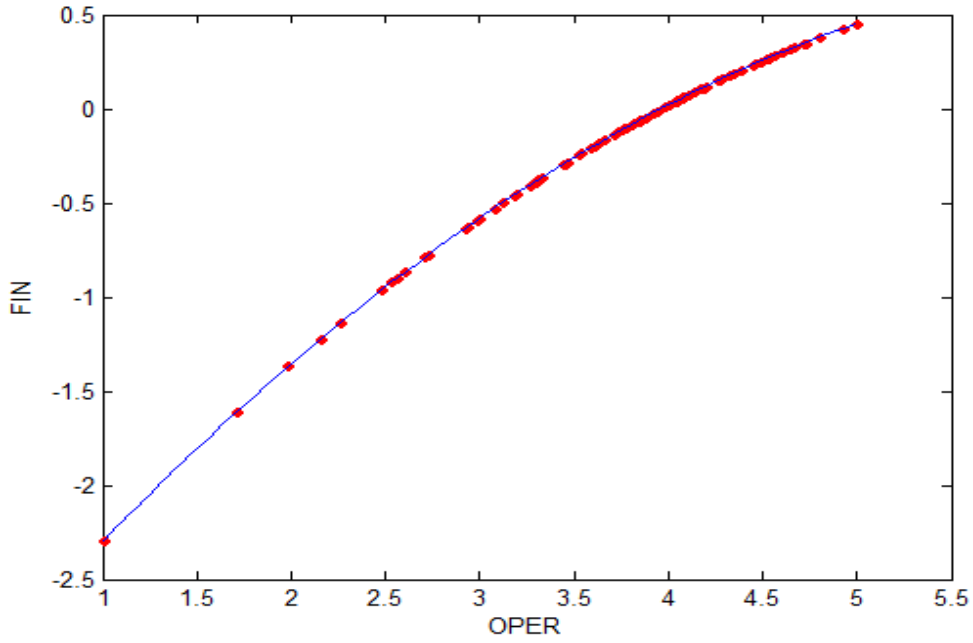


Figure 5.14: Relationship between OPER and FIN

5.3. Moderator Effects

There are two moderator effects considered: these are company size and origin of brand of ERP used. For company size, two criteria were selected. These were SMEs and big companies. According to the European Commission, SMEs are defined as corporations or organizations which have less than 250 employees, and annual turnover is less than €50 m (http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/). In addition to this, big companies refer to firms which have more than 250 employees. Origin of the ERP brand used is the other moderator, both Turkish-based and foreign. Because many respondent organizations, especially SMEs, used an ERP which is produced by Turkish (local) software companies, the data was analyzed both according to the Turkish ERP brand and the foreign ERP brand.

5.3.1. Company Size

First of all, the proposed model was tested according to company size: SMEs and big companies. Results are shown in Table 5.23, and models can be seen in the appendix. It can be easily seen that, for SMEs, like similar to previous path analysis, the hypotheses were all supported except for the ERP and OPER relationship (the related coefficient was insignificant). When considering the SCO, ERP had stronger effect on OPER ($\beta_{ERP\text{-}SCO\text{-}OPER}$= 0.12*0.36= 0.04). Moreover, ERP, with a mediating effect of KM and SCO, had a stronger positive impact on OPER rather than all previous ERP's effects. ($\beta_{ERP\text{-}KM\text{-}SCO\text{-}OPER}$=0.74*0.36*0.43= 0.11 >$\beta_{ERP\text{-}SCO\text{-}OPER}$= 0.04). KM had a positive effect on OPER with $\beta_{KM\text{-}OPER}$= 0.30, and also with a mediating effect of SCO, KM had a lower positive impact on performance. ($\beta_{KM\text{-}SCO\text{-}OPER}$=0.74*0.36=0.26<$\beta_{KM\text{-}OPER}$ = 0.30). In addition to these, for big companies, hypotheses that investigated the positive relationship between ERP and SCO, ERP and OPER, KM and OPER, were not supported (p values are 0.45, 0.60 and 0.38, respevtively). These results showed that, especially for big companies, both for KM and SCO it was so important to use ERP efficiently. In SMEs, ERP has no direct effect on OPER, but with a mediating effect of KM and SCO, there is a positive correlation between them.

Table 5.23: PLS Results for SMEs

Path	Path Coefficient
ERP-------->KM	0.4319***
ERP-------->SCO	0.4480*
KM---------> SCO	0.8009***
ERP-------->OPER	0.2949
KM---------> OPER	0.5954*
SCO-------> OPER	0.6075**
OPER------> FIN	0.5592***

***p*<0.05, ****p*<0.01 , *****p*<0.001

Table 5.24: PLS Results for big companies

Path	Path Coefficient
ERP-------->KM	0.5238***
ERP-------->SCO	0.4244
KM---------> SCO	0.7067***
ERP-------->OPER	0.3432
KM---------> OPER	0.5221
SCO-------> OPER	0.6335***
OPER------> FIN	0.5066***

***p*<0.05, ****p*<0.01 , *****p*<0.001

Table 5.25: Hypotheses results for company size moderator

No	Hypotheses	Results for SMEs	Results for big companies
H1	Supply Chain Orientation (SCO) is positively related with operational performance.	Supported	Supported
H2a	Knowledge Management (KM) is positively related with operational performance.	Supported	Not Supported
H2b	Impact of KM mediated by SCO is stronger than KM's direct effect on operational performance.	Not Supported	Supported
H3a	ERP Usage is positively related with operational performance.	Not supported	Not supported
H3b	Impact of ERP Usage mediated by SCO is stronger than ERP's direct effect on operational performance.	Supported	Not Supported
H4	Impact of ERP Usage on operational performance mediated by KM and SCO simultaneously is stronger than all previous affects.	Supported	Supported
H5	Operational performance is positively related with financial performance.	Supported	Supported

5.3.2. Origin of Used ERP Brand

Secondly, the proposed model was tested according to origin of the ERP brand used. Results are shown in Table 5.28 and models can be seen in the appendix. It can be easily observed that, for Turkish ERP users, like original model path analysis, the hypotheses were supported except for the ERP and OPER relationship (the related coefficient is insignificant). When considering the SCO, ERP had a stronger effect on OPER ($\beta_{ERP\text{-}SCO\text{-}OPER}$= 0.14*0.40= 0.056). Moreover, ERP, mediated by KM and SCO, had a stronger positive impact on OPER rather than all previous effects if ERP ($\beta_{ERP\text{-}KM\text{-}SCO\text{-}OPER}$=0.77*0.39*0.43= 0.12 >$\beta_{ERP\text{-}SCO\text{-}OPER}$ =0.056, $\beta_{ERP\text{-}OPER}$ is insignificant). KM had a positive effect on OPER with $\beta_{KM\text{-}OPER}$= 0.39, also with a mediating effect of SCO, KM had a lower positive impact on performance ($\beta_{KM\text{-}SCO\text{-}OPER}$=0.77*0.40= 0.30). In addition to these, for foreign ERP users, the hypotheses that investigated positive relationships between ERP and SCO, ERP and OPER, KM and OPER, were not supported (p values are 0.21, 0.17 and 0.69, respectively). These results show that, especially for foreign ERP users, both of KM and SCO, it was so important to use ERP efficiently. For Turkish ERP users, ERP had no direct

effect on OPER, but with a mediating effect of KM and SCO, there was a positive correlation between them.

Table 5.26: Results for firms which use Turkish based ERP

Path	Path Coefficient
ERP-------->KM	0.3935***
ERP-------->SCO	0.1444*
KM---------> SCO	0.7782***
ERP-------->OPER	-0.0001
KM---------> OPER	0.3987**
SCO-------> OPER	0.4085**
OPER------> FIN	0.4911***

***p*<0.05, ****p*<0.01 , *****p*<0.001

Table 5.27: Results for firms which use non Turkish based ERP

Path	Path Coefficient
ERP-------->KM	0.4936***
ERP-------->SCO	0.1183
KM---------> SCO	0.6128***
ERP-------->OPER	0.1447
KM---------> OPER	0.0511
SCO-------> OPER	0.4641***
OPER------> FIN	0.5481***

***p*<0.05, ****p*<0.01 , *****p*<0.001

Table 5.28: Hypotheses results for origin of used ERP brand moderator

No	Hypotheses	Results for local ERP users	Results for foreign ERP users
H1	Supply Chain Orientation (SCO) is positively related with operational performance.	Supported	Supported
H2a	Knowledge Management (KM) is positively related with operational performance.	Supported	Not Supported
H2b	Impact of KM mediated by SCO is stronger than KM's direct effect on operational performance.	Not Supported	Supported
H3a	ERP Usage is positively related with operational performance.	Not supported	Not supported
H3b	Impact of ERP Usage mediated by SCO is stronger than ERP's direct effect on operational performance.	Supported	Not Supported
H4	Impact of ERP Usage on operational performance mediated by KM and SCO simultaneously is stronger than all previous affects.	Supported	Supported
H5	Operational performance is positively related with financial performance.	Supported	Supported

CHAPTER 6

MANAGERIAL IMPLICATIONS AND DISCUSSIONS

6.1. Supply Chain Orientation

It can be seen that SCO is very important for manufacturers to become successful in supply chain operations because, in the proposed model, positive impacts of ERP and KM on OPER with a mediating effect of SCO are stronger than the direct effects of each variable alone or together. This is compatible with the literature, because many authors emphasized the importance of SCO.

Top Management Support (TMS) suggests leadership and being open of managers to change. It is required for market orientation (Jaworski & Kohli, 1993) and in the literature it was shown that TMS has a positive effect on organizational performance (Day & Lord, 1988; Yurt, 2007).

Benevolence implies the improvement of suppliers. Assisting to them can be a solution for problems which cause inefficiency. It was shown that supplier development programs can positively affect performance (Modi & Mabert, 2007). The supplier developmet program induces long term cooperative effort among organizations to advance the suppliers' capabilities (Watts & Hahn, 1993; cited by Modi & Mabert, 2007).

In the literature, different ways for supplier development can be seen such as, trust building, financial investment, relational norms development, knowledge transfer, collaborative communication, bilateral management involvement, internal & external supplier integration and socialization mechanisms (Narasimhan, Mahapatra & Arlbjørn, 2008; Giannakis, 2008; Modi & Mabert, 2007; Lawson, Cousins, Handfield & Petersen, 2009; Das, Narasimhan & Talluri, 2006; Bai & Sarkis, 2010). Moreover, developing supplier peformance goals, training, technological support, exchanging personel, monitoring supplier progress with awards were also discussed (Monczka, Trent & Callahan, 1993; Galt & Dale, 1991; Newman & Rhee, 1990; Giunipero, 1990; Watts & Hahn, 1993, Curkovic, Vickery & Dröge, 2000; cited by Li, Humphreys, Yeung & Cheng, 2007). Krause, Scannell and Calantone (2000)

categorized these activities as competitive pressure, evaluation / certification system, incentives and direct involvement. Competitive pressure refers the providing of competition among suppliers and this situation pioneers better performance. For example, if best performing supplier in quality earns high volume of business, so the condition can be motivation for others to improve quality level (Modi & Mabert, 2007). Evaluation and certification systems also make pressure on contractors. Feedback activities, controls and incentives bring being more efficient and qualified for suppliers. Futhermore, direct involvement can be seen as the main part of supplier development processes. In the literature, it was categorized as three parts, capital and equipment investments in supplier operations, acquiring of supplier firms and investing human / organizational resources, means operational knowledge transfer activities (Dyer & Ouchi, 1993; Monczka et. al, 1993; cited by Modi & Mabert, 2007).

Supplier development programs have been applied by some organizations, for example Honda establishes BP (Best Practice, Best Process, Best Performance) supplier development programs (MacDuffie & Helper, 1997), many earospace and defense companies such as Boeing, Lockheed, Rockwell Collins and United Technologies organized “Supplier Excellence Alliance” to partake their experience, Wal-Mart cooperated with their suppliers, and it caused the increased sales as well as improvement in customer awareness (Hahn, 2005; cited by Wagner, 2011).

Supplier development concept is classified as collaborative and evaluative activities. Collaborative one refers that organizations of supply chain can achieve some improvements together, furthermore, evaluative activities imply assessment and monitoring of supplier performance (Klassen & Vachon, 2003). Incentives, training, technological and personel support are examples of collaborative activities. In industry, samples of collaboration are widely argued in the last years, for instance, Xerox organized a common programs with its contractors to raise the amount of reused equipments (McIntyre, 1998), Castrol, a lubricant supplier to automotive producers, played a role with the members in the supply chain in a joint program that resulted lower coolant consumption, cost and environmental impact (Reiskin, White,

Johnson, & Votta, 1999). Also, evaluative activities such as assesment and monitoring can be considered by organizations for supplier development.

Credibility implies trust and it is one of the most widely discussed topics of supply chain literature. It is an antecedent of collaboration among companies and important element to ensure productivity, efficiency and long term relationships (Morgan & Hunt, 1994; Yurt, 2007). Commitment refers to promise and engagement of companies to suppliers. For long term relationship, commitment plays an important role in the supply chain management (Gundlach et al., 1995; Yurt, 2007).

The USM shows that the effect of SCO on OPER is decreasing in high values, means degressive relationship. This is an expected situation, since the establishment of SCO can bring many benefits in the beginning period, but later rising rate of operational performance will decrease. There are many elements except SCO that affect the operational performance, it means that capabilitiy of SCO is limited to raise efficiency. Furthermore, the USM result indicates that there is a nonlinear relationship between OPER and FIN. The change in the financial performance is higher for low values of operational performance. This is an expected situation because improvement in efficiency results the increasing of financial performance. Nevertheless, the raising ratio of financial indicators may decline later, because there are also different factors such as, marketing strategy, customer relationship that influence financial performance.

Moreover, when moderators are considered, the importance of SCO was more obvious for big companies and foreign ERP users, because there were no direct effects of ERP and KM on performance without SCO. For this research, it can be said that most of the big companies and the foreign ERP users were the same companies. ‘Therefore, it is not surprising that the results for both groups were the same. The importance of SCO was observed most clearly in the analyses of big companies and foreign ERP users. The reason can be that respondents from big companies and/or foreign ERP users filled the questionnaire more realistically than SMEs, because they may have problem with institutionalization.

To sum up, managers should be supply chain-oriented, because in today’s market environment, SCO brings competitive advantages to firms, including being credible

and benevolent, which provides closer and sustainable relationships between contractors.

6.2. Knowledge Management

It can be observed that KM is crucial for manufacturers to use ERP efficiently, because ERP had no direct effect on OPER. However with a mediating effect of KM, ERP provided an advantage for organizations. It implies that, if a firm simply uses ERP, without KM, managers may not identify the problems within an organization, and ERP can not bring competitive advantages to the corporation. Data getting from ERP should be used for knowledge generation in meetings, discussions, and brainstorming. Then these exchanges can be used to improve efficiency in organizations. Additionally, ERP can be used for knowledge sharing intra-and-inter organizations, because it provides an infrastructure for communications among workers, managers, departments and companies. Especially in the last years, ERP has been improving with today's technologies, and it transforms to ERP II and ERP III with using internet in operations. Therefore, members in the supply chain can communicate with each other via ERP and internet connections. For instance, suppliers can see updated orders, production planning, and inventory level of focal firm in its ERP program through internet, and they can arrange their plans according to these information. In past, ERP was only implemented within organizations, however in today's condition it has been also performed among organizations.

Additionally, results showed that KM is positively related to operational performance, so managers should consider its impact on supply chain activities. Members in the supply chain should collaborate and play a role in jont programs to generate knowedge. These processes can provide the elimination of inefficient points in the chain, because lack of communication among organizations is one of the most crucial problems in the business world.

Knowledge repository system can also be implemented among companies in the supply chain. It is an "*online database that systematically captures, organizes, and categorizes knowledge-based information*" (http://www.trainingindustry.com/taxonomy/k/knowledge-repository.aspx). Knowledge repository provides different advantages to parties of supply chain such as; learning of different solutions for

specific problems, ensuring collaboration and meeting environment to discuss special topics within forums and communication of managers in different factories, cities, countries etc. for common projects. For example, assuming that a big automotive producer company that has more than a hundred suppliers, it establishes a knowledge repository system for itself and its suppliers, then one of its contractors can write the solution of any specific accounting problem between them and in the future if an other supplier will face with the same issue, it may easily find the remedy and overcome trouble. Therefore, organizations should generate knowledge and share their experiences with knowledge repository systems.

Knowledge storage is also a critical issue for companies, because it assures the linkage of communication among old - new managers and organizations in different places. If there is no a serious storage system, a firm may encounter different problems in the following times. For example, the survey of KPMG indicated that nearly half of the organizations met with troubles when their key employees left (Hackbarth, 1998; cited by Alavi & Leidner, 2001). Furthermore, it was shown that most of firms thought some of necessary knowledge is embedded inside their organizations but the essential problems are to find, store and use it (Cranfield University, 1998; Alavi & Leidner, 2001). It means that transforming of knowledge from tacit to explicit form is a critical process for firms and information technology tools such as ERP or knowledge repository systems can help managers about this issue.

Moreover, Total Quality Management (TQM) can be considered as one of the perspectives of Knowledge Management. According to this philosophy, all departments in organizations are responsible for improvement of efficiency and quality in their operations. Also it recommends to continuous improvement in the processes. Therefore, top managers should struggle to establish TQM philosophy in their firms.

To sum up, knowledge generation with discussions, meetings and brainstorming brings new ideas and solutions to problems of companies. Kaizen, Business Process Reengineering (BPR) or other continuous improvement processes for quality management are examples of knowledge generation processes. With the help of

technology such as; softwares, ERP, servers etc., organizations can code, store and share their knowledge. After the usage of new ideas or solutions, organizations can decrease their costs, increase profits and improve their efficiencies. Therefore, KM enhances their competitive advantages against rivals.

6.3. Enterprise Resource Planning

When results are considered, it can be easily observed that ERP has 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 can face this type of problem for several reasons. The most important ones are time lags and mismanagement (Brynjolfsson, 1993). Time lags mean that to see the positive effects of investment in information technology requires a long lead time. Therefore, in the short and medium terms, firms may not get any positive impact from information technologies on operational performance. Secondly, mismanagement is a serious problem for organizations, especially if there is a lack of expert managers in them. Many firms have ERP or different information technologies, but if there are not enough experts to use these types of systems, getting the full benefit or utility from these systems is not possible. So firms should hire qualified managers to utilize the information systems. Furthermore, not fully using information technology (IT) capabilities is another significant problem (Dos Santos & Sussman, 2000). Since IT occurs from different parts and software, lacking of any section or part may cause a loss in the utilization. For instance, if any SME uses ERP with only few modules, it can not take full advantages of using ERP. Therefore, firms should struggle to implement ERP fully in their organizations.

Additionally, when using ERP in its simplest form, it may not bring competitive advantage for organizations. Since ERP is applied on 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'* (http://www.brainyquote.com/quotes/ quotes/b/billgates104353.html)

If organizations are not careful, the dream of successful ERP implementation may transform to nightmare. Although many benefits, ERP also has great risks so managers should consider many factors when they decide to implement enterprise systems to their organizations (Davenport, 1998). In the literature some examples were given about this issue such as; relationship between its enterprise system and bankruptcy of FoxMeyer Drug, expending of Mobil Europe is millions of dollars for information systems, impropriety of enterprise system of Dell Computer and its management model, consuming price of Dow Chemical is approximately billion dollars and taking of fully implementation of information technology systems is seven years (Davenport, 1998).

Maintenance and updating costs play an important role in prevention of positive effects of ERP on performance. Moreover, indirect costs like incompatibility of systems among departments avoid the improvement of efficiencies in organizations. For instance, if an organization's purchasing department system does not fit well with the one of production department, the inventory level can be negatively affected from this problem. To prevent these types of troubles of ERP, implementation process must be organized well, experts of ERP vendors and managers of firms should collaborate and plan projects together in detail.

Moreover, this research indicated that ERP and KM are complementary rather than conflicting. ERP focuses on efficiency and KM considers flexibility, but application of these in organizations simultaneously is possible, and KM enhances the effect of ERP on operational performance. Data received from ERP can be used to generate knowledge, define and eliminate problems and then the improvement in efficiency may be provided by managers through KM and enterprise systems.

CHAPTER 7

CONCLUSION

7.1. Overview of Findings

In this research, the effects of KM, ERP Usage and SCO on operational and financial performance were investigated. Firstly, factors of latent variables were determined according to exploratory factor analysis (EFA), then reliability and validity of variables were evaluated with confirmatory factor analysis (CFA). In the next step, unidimensionality was tested for three variables. In the path analysis, seven hypotheses were evaluated with the partial least square (PLS) method and universal structure modelling (USM).

The analysis with PLS and USM showed that SCO affects operational performance positively (USM found a degressive nonlinear relationship between SCO and OPER). It is an expected result because much research (Hult et al., 2008; Min & Mentzer, 2004; Min, Mentzer & Ladd, 2007) has pointed out SCO has a positive impact on performance. SCO can be defined as willingness to be efficient and successful in supply chain operations, so it is hoped that there is a positive relationship between SCO and operational performance. Additionally, the results indicated that operational performance had a positive and significant impact on financial performance (USM found a degressive nonlinear relationship between OPER and FIN); therefore, it can be said that SCO affects financial performance indirectly (over operational performance) in a positive way.

Furthermore, the direct effect of KM on operational performance and indirect effects on financial performance (over operational performance) is positively significant. These results are not surprising, because, like SCO, earlier research had pointed out this relationship (Fugate et al., 2009; Blumenberg et al., 2009). When SCO can be thought as a mediator, the effect of KM had a stronger effect than without a mediator. This means that supply chain oriented firms were more successful in showing impacts of KM on their operational and financial performance. Therefore, it is important to show firms and managers the importance of SCO in order for them to utilize from KM activities efficiently.

In addition to this, ERP Usage had no significant impact on operational performance. This issue has been argued by academicians, although several studies have claimed there no direct effect of ERP on performance (Etezady, 2011; Hendricks et al. 2007; Li et al. 2009). It has been named as the 'productivity paradox of information technology' (Lim et al, 2004) Several reasons have been proposed about this problem, including not fully utilizing information technology (IT) capabilities (Dos Santos & Sussman, 2000) and needing a long time for fruition after IT investment (Devaraj & Kohli, 2000). However, when considering the KM as mediator, ERP has a positive impact on operational performance and on financial performance. Similarly, with a mediating effect SCO, ERP effects operational and financial performance positively. Last but not least, ERP has the strongest effect on operational performance mediated by both KM and SCO, so it implies that for managers to benefit fully from ERP, firms should apply KM within organizations and should be supply chain-oriented.

7.2. Supply Chain Orientation

Supply Chain Orientation 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 firm activities. To design an efficient supply chain, thus, firms should be supply chain oriented. SCO is a strategic capability, and one of the required factors to achieve a competitive advantage (Hult et al., 2008). SCO and Supply Chain Management (SCM) are not independent from each other, but different. SCO is managed by an organization, whereas, 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 exploratory factor analysis, four factors were found. These were credibility, commitment, benevolence, and top management support. Credibility refers to trust, and benevolence implies helpfulness among companies. Commitment implies the engagement or promise of organizations to contractors. Lastly, top management support refers to leadership and being open to changes.

After the factor analysis, 16 indicators were loaded on four different factors. The highest weight indicator for credibility is SCO3. This indicator's statement was 'Our business unit does not make false claims to our supply chain members.' For benevolence, the statement which had the greatest weight was: 'In the future we can count on our supply chain members to consider how their decisions and actions will affect us'. Thirdly, 'We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated,' was the most important indicator for commitment factor. Lastly, for top management support, the highest weighted statement was 'Top management repeatedly telling employees that sharing risk and rewards is critical to this business unit's success.'

Moreover, according to the Neusrel results, TMS is the most important criteria for SCO with factor score is 0.80. Secondly, commitment's score on SCO was 0.78. In addition, the scores of benevolence and credibility were 0.76 and 0.71, respectively.

7.3. Knowledge Management

Knowledge can be defined as, '*information plus the causal links that help to make sense of this information*'and Knowledge Management (KM) is '*a process that establishes and clearly articulates such links*' (Sarvary, 1999, cited by Mc Ginnis & Huang, 2007). Knowledge and KM can be thought as an intangible resource for organizations. Wal-Mart, Toyota and Dell have used their supply chain management skills effectively, and so it resulted in competitive advantage and excellent performance for their companies (Hult et al., 2006).

In this research, the scale of KM was adapted from the study of Zaim et al., (2007). According to this analysis, three factors were found. These were knowledge generation, knowledge storage, and knowledge usage/sharing. Knowledge generation refers to exposing the abilities of new and beneficial ideas/solutions. This process is based on humans, so companies should encourage their employees to be involved in knowledge generation activities. Knowledge storage allows solutions or ideas to reach the right people in the right time. Knowledge storage is also important to evaluate and reuse ideas and solutions in the future. Knowledge sharing covers all processes for accessing knowledge. This transfer can occur both within an organization and among organizations. Some companies, like Chevron, increased

their revenues by applying knowledge transfer processes (Zaim, 2005). In comparison with other resources, the value of knowledge increases with sharing rather than decreases. Knowledge sharing among organizations also requires a technological infrastructure like ERP, and it is very crucial point to improve supply chain performance of members. Lastly, knowledge utilization is a consequence of previous KM activities and, similarly KM is meaningless without knowledge utilization. It provides competitive advantage to corporations. Corporate culture is an important place for companies to promote and use new knowledge, therefore some features, such as flexibility and openness, come into question. Knowledge can be used in relationships between firms and customers, in organizations, and among supply chain members (Zaim, 2005).

After the exploratory factor analysis, 17 indicators were loaded on three different factors. The greatest weight for knowledge generation was given to KM2. This indicator's statement was: 'Employees in supply chain departments are encouraged to do continuous learning.' For knowledge generation, the statement which had the second greatest weight was 'In our business, I can easily reach information about supply chain operations.'Thirdly, 'We improve our business operations and processes through sharing our experiences and knowledge with our suppliers and customers' was the most important indicator for knowledge usage/sharing factor.

Moreover, according to the PLS model, knowledge generation is the most important criteria for KM, with an outer weight of 0.47. Secondly, knowledge usage's weight on KM is 0.46. In addition the weight of knowledge storage was equal to 0.44.

7.4. Enterprise Resource Planning (ERP)

ERP is an enterprise-wide package that combines business processes into a single shared database (Lee & Lee, 2000), and it is an exhaustive software package that integrates the business functions using a shared information flow (Shanks & Seddon, 2000; cited by Newell et al, 2003). Material Requirement Planning (MRP) of the 1970s and Material Requirement Planning II (MRP II) in the 1980s are prior versions of ERP. Su and Yang (2010) defined ERP as, *'an integrated enterprise computing system that is designed to automate the flow of material, information, and financial resources among all functions within an enterprise on a common database.'*

In this study, the scale for ERP was firstly developed. According to exploratory factor analysis, two factors were found: modules of ERP and the utility of ERP. The first factor refers to the functions of different ERP modules. Today's ERP packages cover many modules related to different departments, such as production planning, quality, supply chain and human resources. 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.

After the exploratory factor analysis, nine indicators were loaded on two different factors. The highest weight indicators for module factor were ERP1 and ERP4. These indicators' statements were: 'We effectively use the ERP Production module,' and 'We effectively use the ERP Supply Chain module.' For the utility factor, the statement which has the highest weight is 'The lack of ERP Supply Chain module is a serious loss for us.' Moreover, according to the PLS model, the module factor was the most important criteria for the ERP variable with outer weight of 0.61. The second most important utility factor's weight on ERP variable was 0.50.

6.5. Limitations and Future Research

Although it is an intensive study, this research has some limitations. Since only manufacturing companies were considered, it is very hard to collect data from large number of companies, so the sample size of this research is not sufficient to apply covariance-based structural equation modelling. To overcome of this problem, instead of AMOS or LISREL, variance based structural equation modelling, partial least square (PLS) was used. In contrast to SEM, it has no restrictions, such as the normality assumption, therefore, the proposed model in this research can be analyzed using covariance-based structural equation modelling (AMOS or LISREL) with restrictions.

In addition to this, the service sector was not considered in the dissertation. In future research, it may be also added and results can be compared with those of the manufacturing sector. Like 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 (CRM), accounting, and finance, need to be added to the scale.

Thirdly, data can be collected from different countries, so 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. Also using international business theory, how the impact of ERP and KM on performance changes in different geographical region can be investigated.

Like 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 supply chain orientation, and explain how it contributes to operational and financial performance. They can also clarify further reasons of why ERP has no direct effect on operational performance.

In the future research, different case studies should be undertaken to show the positive effects of supply chain orientation on performance. In addition, many firms have different stories about successful and unsuccessful ERP implementation, so these can be added to future research to show the importance of knowledge management and supply chain orientation for using ERP efficiently.

Lastly, variables in this research are thought of as a second order; therefore like a first order analysis, a proposed model may be constructed among factors. Doing this, the new model shows the relationship among sub-factors, so extra discussions can be made about supply chain orientation, knowledge management and ERP. Because there are nine different factors related to three variables, the new model can provide different perspective to researchers about variables.

SURVEY FORM (Turkish and English version)

-ANKET FORMU-		
Sayın Katılımcı, Elinizdeki bu anket formu sonucunda elde edilecek veriler tamamen gizli kalacak, anketi yanıtlayacak bireye herhangi bir yükümlülük getirmeyecek, vereceğiniz cevaplar akademik çalışmalar için kullanılıp, başka hiçbir amaç için kullanılmayacaktır. Lütfen ilgili yerleri cevaplayınız veya işaretleyiniz. İlgi ve katkılarınızdan dolayı şimdiden teşekkür ederiz. **Prof. Dr. Selim Zaim, Araş. Gör. Mehmet F. Acar**		
1	**Firmanın Adı**	
2	**Sektör**	
3	**Firmadaki Ünvanınız**	
4	**Kullandığınız ERP yazılımının markası**	
5	**Çalışan Sayısı**	

ÖNEMLİ NOT: Sorular beşli Likert Ölçeği formatında hazırlanmıştır. Bu ölçekte; beş (5) ile 'KESİNLİKLE KATILIYORUM'; dört (4) ile 'KATILIYORUM'; üç (3) ile KARARSIZIM; iki (2) ile 'KATILMIYORUM' ve bir (1) ile 'KESİNLİKLE KATILMIYORUM' ifade edilmektedir. Bu değerlendirmede doğru veya yanlış bir cevap bulunmamakta, tamamen sizin birikiminizden faydalanılmaya ve bunun sonucunda bilimsel bir sonuca / sonuçlara ulaşılmaya çalışılmaktadır.

BÖLÜM 1							
	Aşağıda firmanızın Tedarik Zinciri (TZ) ile ilgili bazı sorular vardır. Tedarik Zinciri (TZ) ile kastedilen hammadde /yarı mamül alımından satış sonrası hizmete kadar olan (hammadde alımı, depo yönetimi, üretim planlama, lojistik, teslimat, dağıtım vb.) operasyonlardır.						

1	Kurumumda Tedarik Zinciri(TZ) ile ilgili araştırma geliştirme (Ar-Ge) faaliyetleri yeterlidir	1	2	3	4	5
2	TZ ile ilgili çalışanlar sürekli öğrenme konusunda teşvik ediliyor	1	2	3	4	5
3	TZ ile ilgili yetenekli insanların kuruma çekilmesi için çaba gösteriliyor	1	2	3	4	5
4	TZ ile ilgili kurumumda yenilikçi düşünce teşvik edilmekte ve yeni fikirler desteklenmektedir	1	2	3	4	5
5	Sistem geliştirmeye (mevcut ürün ve hizmetlerin nasıl daha iyi yapılacağına dair fikir üretme süreci) ve sorunlara alternatif çözümler üretmeye yönelik beyin fırtınaları yapılmaktadır	1	2	3	4	5
6	TZ ile ilgili çalışanlar kurumun bilgi üretme sürecine aktif biçimde katkıda bulunmaktadır	1	2	3	4	5
7	TZ ile ilgili kurum genelinde bilgi üretmeye ve geliştirmeye yönelik sistemli bir biçimde çaba harcanmaktadır	1	2	3	4	5
8	Tedarikçilerimiz ve müşterilerimizle (iş çevresi) ilgili tüm bilgiler düzenli biçimde tasnif edilmekte, dosyalanmakta (elektronik ortamda) ve saklanmaktadır	1	2	3	4	5
9	TZ ile ilgili aradığım bilgiye kolayca (hızlı) ulaşabiliyorum	1	2	3	4	5
10	TZ ile ilgili bilgiler düzenli biçimde güncellenmektedir	1	2	3	4	5
11	Tedarikçi ve müşterilerimizle bilgi paylaşmaya özen gösteririz	1	2	3	4	5
12	Tedarikçi ve müşterilerimizle bilgi ve tecrübelerimizi paylaşarak iş ve süreçlerimizi geliştiriyoruz	1	2	3	4	5
13	E-posta ve interneti tedarikçilerimiz ve müşterilerimiz ile bilgi paylaşmada etkili biçimde kullanıyoruz	1	2	3	4	5
14	Tedarikçilerimiz ve müşterilerimiz ile bilgi paylaşımı sağlamak için koordinasyon toplantıları yapıyoruz	1	2	3	4	5

15	Tedarikçilerimiz ve müşterilerimiz ile firmamız arasında güçlü bir iletişim vardır	1	2	3	4	5
16	TZ ile ilgili bilgi ve tecrübelerimizi ürün ve hizmetlerimize etkili biçimde yansıtıyoruz	1	2	3	4	5
17	TZ ile ilgili verilen eğitimlerde elde edilen bilgiler kısa sürede uygulanmaya başlamaktadır	1	2	3	4	5
18	Sürekli öğrenen, ve öğrendiğini hayata geçiren bir kurumuz	1	2	3	4	5

Aşağıdaki sorularda geçen '*beraber çalışılan firmalar*' ile firmanızın tedarik zinciri içerisinde iş yaptığı *hammadde sağlayıcı, toptancı, bayi, lojistik hizmet sağlayıcı gibi firmalar kastedilir*.

BÖLÜM 2						
1	Firmamızın, tedarik zincirinde beraber çalıştığı firmalara verdiği sözler güvenilirdir.	1	2	3	4	5
2	Temsilcilerimiz ürünlerimiz/hizmetlerimiz konusunda bilgilidir.	1	2	3	4	5
3	Tedarik zincirindeki beraber çalıştığımız firmalara karşı gerçek olmayan iddialarda bulunmayız.	1	2	3	4	5
4	Tedarik zincirindeki beraber çalıştığımız firmaların görüşlerine/fikirlerine firmamız kapalıdır.	1	2	3	4	5
5	Beraber çalıştığımız firmalar önemli kararlar alırken, bizim menfaatlerimizi de düşünürler.	1	2	3	4	5
6	Beraber çalıştığımız firmalarla problemlerimizi paylaştığımızda bize karşı anlayışlı davranırlar.	1	2	3	4	5
7	Beraber çalıştığımız firmaların alacağı kararların ve yapacaklarının bizi nasıl etkileyeceğini göz önünde bulunduracaklarına eminiz.	1	2	3	4	5
8	Bizim için önemli olan konularda beraber çalıştığımız firmaların desteğine güvenebiliriz.	1	2	3	4	5
9	Dışarıdaki kişiler, beraber çalıştığımız firmaları eleştirdiğinde onları savunuruz.	1	2	3	4	5
10	Beraber çalıştığımız firmalar, bizi sıkıntıya sokan fakat tekrarlanmayan hatalar yaptıklarında sabırlı davranırız.	1	2	3	4	5
11	Firmamız, beraber çalıştığımız firmalarla işbirliği içinde değişiklikler yapmaya hazırdır.	1	2	3	4	5
12	Tedarik zincirindeki firmalar olarak başarılı olmak için beraber çalışmalıyız.	1	2	3	4	5

13	Tedarik zinciri operasyonları firmamız için katma değer oluşturmaktadır.	1	2	3	4	5
14	Firmamızın amaç ve hedefleri, tedarik zincirimizdeki çalıştığımız firmaların amaç ve hedefleri ile örtüşmektedir.	1	2	3	4	5
15	Tedarik zincirimizdeki beraber çalıştığımız firmalar ile benzer yönetim felsefelerine sahibiz.	1	2	3	4	5
16	Üst yönetim, çalışanlara firmamızın başarılı olmasının tedarik zinciri yönetiminin benimsenmesine bağlı olduğunu defaatle belirtir.	1	2	3	4	5
17	Üst yönetim, çalışanlarına firmamızın başarılı olması için beraber çalıştığımız firmalarla kurduğumuz uzun dönemli ilişkilerin önemini vurgular.	1	2	3	4	5
18	Üst yönetim, çalışanlarına firmamızın başarılı olması için beraber çalıştığımız firmalarla değerli ve stratejik bilgi alışverişinin önemini vurgular.	1	2	3	4	5
19	Üst yönetim, çalışanlarına firmamızın başarılı olması için risk ve ödül paylaşımının önemli olduğundan bahseder.	1	2	3	4	5
20	Üst yönetim, çalışanlarına tedarik zinciri yönetimi ile ilgili eğitim imkânları sunar.	1	2	3	4	5

BÖLÜM 3						
1	ERP Üretim modülünü etkin bir şekilde kullanırız	1	2	3	4	5
2	ERP Üretim modülü firmamızın üretim süreçleriyle ilgili ihtiyacı olan bilgileri verir.	1	2	3	4	5
3	ERP Üretim modülünün eksikliği firmamız için önemli bir kayıptır.	1	2	3	4	5

4	ERP Tedarik Zinciri modülünü etkin bir şekilde kullanırız	1	2	3	4	5
5	ERP Tedarik Zinciri modülü firmamızın tedarik zinciri ile ilgili ihtiyacı olan bilgileri verir.	1	2	3	4	5
6	ERP Tedarik Zinciri modülünün eksikliği firmamız için önemli bir kayıptır.	1	2	3	4	5
7	ERP Kalite modülünü etkin bir şekilde kullanırız	1	2	3	4	5
8	ERP Kalite modülü firmamızın kalite ile ilgili ihtiyacı olan bilgileri verir.	1	2	3	4	5
9	ERP Kalite modülünün eksikliği firmamız için önemli bir kayıptır.	1	2	3	4	5

Firmanızın son 3 yıllık kurum performansı hakkındaki görüşleriniz nedir?

Bu ölçekte; **beş (5) ile 'ÇOK İYİ'; dört (4) ile 'İYİ'; üç (3) ile 'KARARSIZIM', iki (2) ile 'KÖTÜ' ve bir (1) ile 'ÇOK KÖTÜ'** ifade edilmektedir.

BÖLÜM 4						
1	Müşteriden geri gelen hatalı ürün sayısı	1	2	3	4	5
2	Zamanında teslimat hızı	1	2	3	4	5
3	Üretim maliyetleri	1	2	3	4	5
4	Üretimdeki çevrim süresi	1	2	3	4	5

5	Ortalama stok maliyeti	1	2	3	4	5
6	Ortalama stok miktarı	1	2	3	4	5
7	Talep tahminlerindeki tutarlılık	1	2	3	4	5
8	Satış sonrası hizmet	1	2	3	4	5
9	Pazar Payı	1	2	3	4	5
10	Kar	1	2	3	4	5
11	Ciro	1	2	3	4	5
12	Yatırım getirisi	1	2	3	4	5

-SURVEY FORM (English version) -

Dear Participant

Your responses are not shared with third parties, and this survey does not have any liability to you. Data collected from this survey is only used for academic research. Please answer the questions. Thanks for your interest.

Prof. Dr. Selim ZAİM, Research Assistant Mehmet Fatih ACAR

Prof. Dr. Selim Zaim,Res. Assist. Mehmet F. Acar

1	**Name of Company**	

2	**Sector**	
3	**Your Position**	
4	**Brand of ERP Used in Your Company**	
5	**Number of Employees in Your Company**	

IMPORTANT NOTE: Statements are prepared according to a 5-point Likert Scale. In this scale, the categories are shown in ascending order from left to right as: (1) Strongly Disagree; (2) Disagree; (3) Neither Agree/Nor Disagree; (4) Agree; (5) Strongly Agree. In this assessment, there are no correct and incorrect answers.It is expected to learn from your assessment about subjects discussed in this research and also to reach scientific results.

PART 1

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	Below are some statements about supply chain operations of your company. Supply chain refers to operations which are from the gathering of raw materials to after-sale service (i.e. inventory management, production planning, logistics, delivery, transportation etc.).					
1	The R & D activities in our business related to supply chain are at satisfactory level.	1	2	3	4	5
2	Employees in supply chain departments are encouraged for continuous learning.	1	2	3	4	5
3	Our business makes effort to find qualified personnel for supply chain departments.	1	2	3	4	5
4	Our business encourages and supports innovative ideas related to supply chain operations.	1	2	3	4	5
5	In our business, brainstorming is conducted to improve current system/operations and to solve problems.	1	2	3	4	5

6	In our business, employees in supply chain departments contribute to knowledge generation processes	1	2	3	4	5
7	There is a systematic effort in our business to generate and improve knowledge.	1	2	3	4	5
8	In our business, information about our suppliers and customers is regularly classified, filed and stored.	1	2	3	4	5
9	In our business, I can easily reach information about supply chain operations.	1	2	3	4	5
10	In our business, information about supply chain operations is regularly updated.	1	2	3	4	5
11	We pay attention to sharing information with our supply chain members.	1	2	3	4	5
12	We improve our business operations and processes through sharing our experience and knowledge with our suppliers and customers.	1	2	3	4	5
13	We effectively use e-mail and internet to share information with our suppliers and customers.	1	2	3	4	5
14	For information sharing purposes, we organize coordination meetings with our suppliers and customers.	1	2	3	4	5
15	There is a strong communication between us and our suppliers/customers.	1	2	3	4	5
16	We reflect our knowledge and experience on our services and products.	1	2	3	4	5
17	The knowledge obtained from trainings related to supply chain operations is put into practice in short time.	1	2	3	4	5
18	We are a business that continuously learns and implements what is learned.	1	2	3	4	5

'Corporations with which you do business' means contractors and suppliers of your company such as distributors, retailers, third party logistics companies, etc.

PART 2						
1	Promises made to our supply chain members by our business unit are reliable.	1	2	3	4	5
2	Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.	1	2	3	4	5
3	Our business unit does not make false claims to our supply chain members.	1	2	3	4	5
4	Our business unit is not open in dealing with our supply chain members.	1	2	3	4	5
5	When making important decisions, our supply chain members are concerned about our welfare.	1	2	3	4	5
6	When we share our problems with our supply chain members, we know they will respond with understanding.	1	2	3	4	5
7	In the future we can count on our supply chain members to consider how their decisions and actions will affect us.	1	2	3	4	5
8	When it comes to things that are important to us, we can depend on our supply chain members'support.	1	2	3	4	5
9	We defend our supply chain members when outsiders criticize them, if we trust them.	1	2	3	4	5
10	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	1	2	3	4	5
11	Our business unit is willing to make cooperative changes with our supply chain members.	1	2	3	4	5
12	We believe our supply chain members must work together to be successful.	1	2	3	4	5

13	We view our supply chain as a value added piece of our business.	1	2	3	4	5
14	Our business unit's goals and objectives are consistent with those of our supply chain members.	1	2	3	4	5
15	Our CEO and the CEOs of our supply chain members have similar operating philosophies.	1	2	3	4	5
16	Top managers repeatedly tell employees that this business unit's survival depends on its adapting to supply chain management.	1	2	3	4	5
17	Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business unit's success.	1	2	3	4	5
18	Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business unit's success.	1	2	3	4	5
19	Top management repeatedly tells employees that sharing risk and rewards is critical to this business unit's success.	1	2	3	4	5
20	Top management offers various education opportunities about supply chain management.	1	2	3	4	5

PART 3						
1	We effectively use the ERP Production module.	1	2	3	4	5
2	ERP Production module gives necessary information about production processes.	1	2	3	4	5
3	The lack of ERP Production module is a serious loss for us.	1	2	3	4	5
4	We effectively use the ERP Supply Chain module.	1	2	3	4	5

5	ERP Supply Chain module gives necessary information about production processes.	1	2	3	4	5
6	The lack of ERP Supply Chain module is a serious loss for us.	1	2	3	4	5
7	We effectively use the ERP Supply Chain module.	1	2	3	4	5
8	ERP Supply Chain module gives necessary information about production processes.	1	2	3	4	5
9	The lack of ERP Supply Chain module is a serious loss for us.	1	2	3	4	5

Please show your opinion about performance of your company in last 3 years.

In this scale, the categories are shown as: (1) Very Bad; (2) B[illegible]3) Undecided; (4) Good; (5) Very Good.

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PART4						
1	Number of defective items returned from customer	1	2	3	4	5
2	Delivery on time	1	2	3	4	5
3	Production cost	1	2	3	4	5
4	Lead time in production	1	2	3	4	5
5	Average inventory cost	1	2	3	4	5

6	Average inventory level	1	2	3	4	5
7	Forecasting accuracy	1	2	3	4	5
8	Service after sale	1	2	3	4	5
9	Market share	1	2	3	4	5
10	Profit	1	2	3	4	5
11	Revenue	1	2	3	4	5
12	Return on investment	1	2	3	4	5

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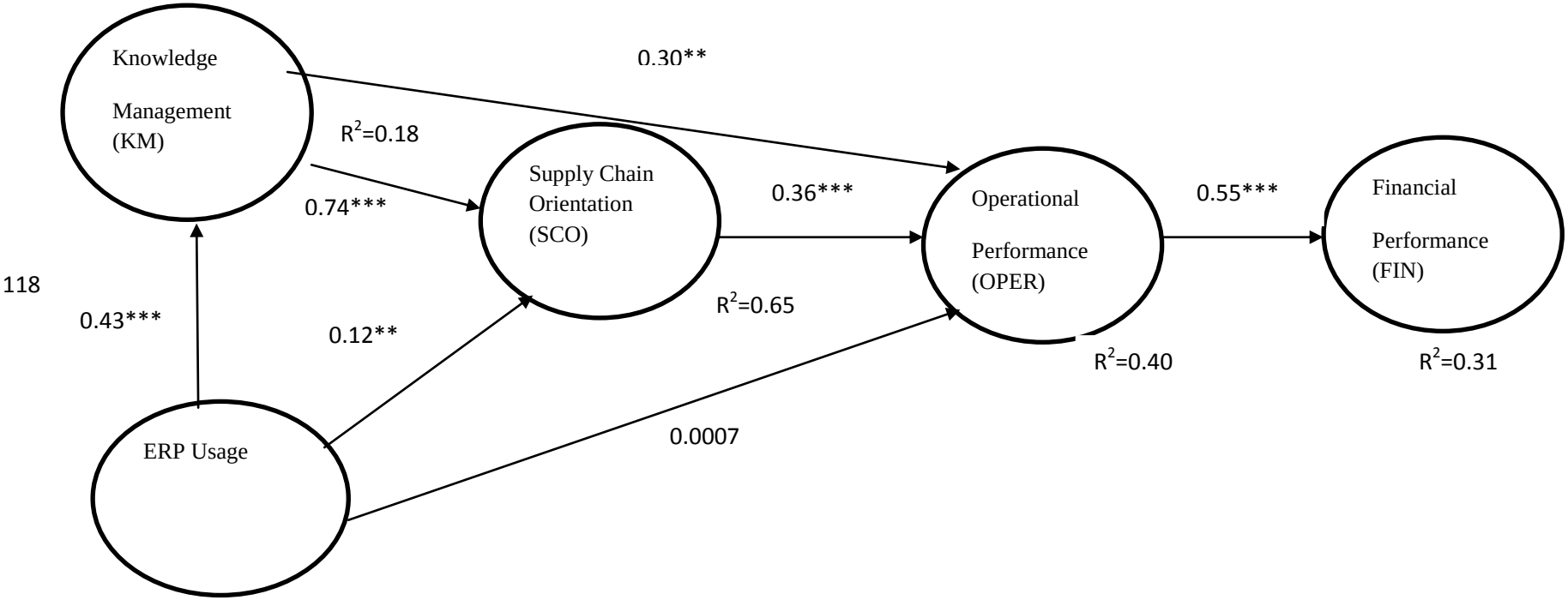
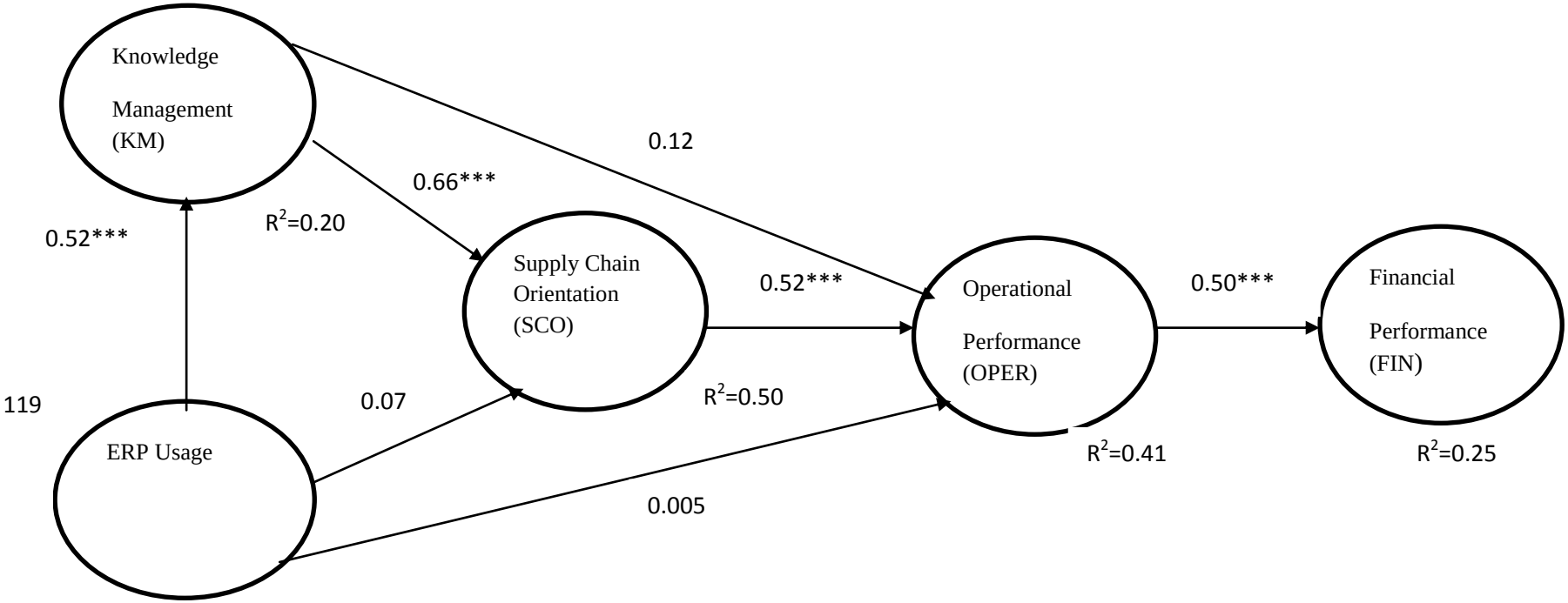
APPENDIX- RESULTS



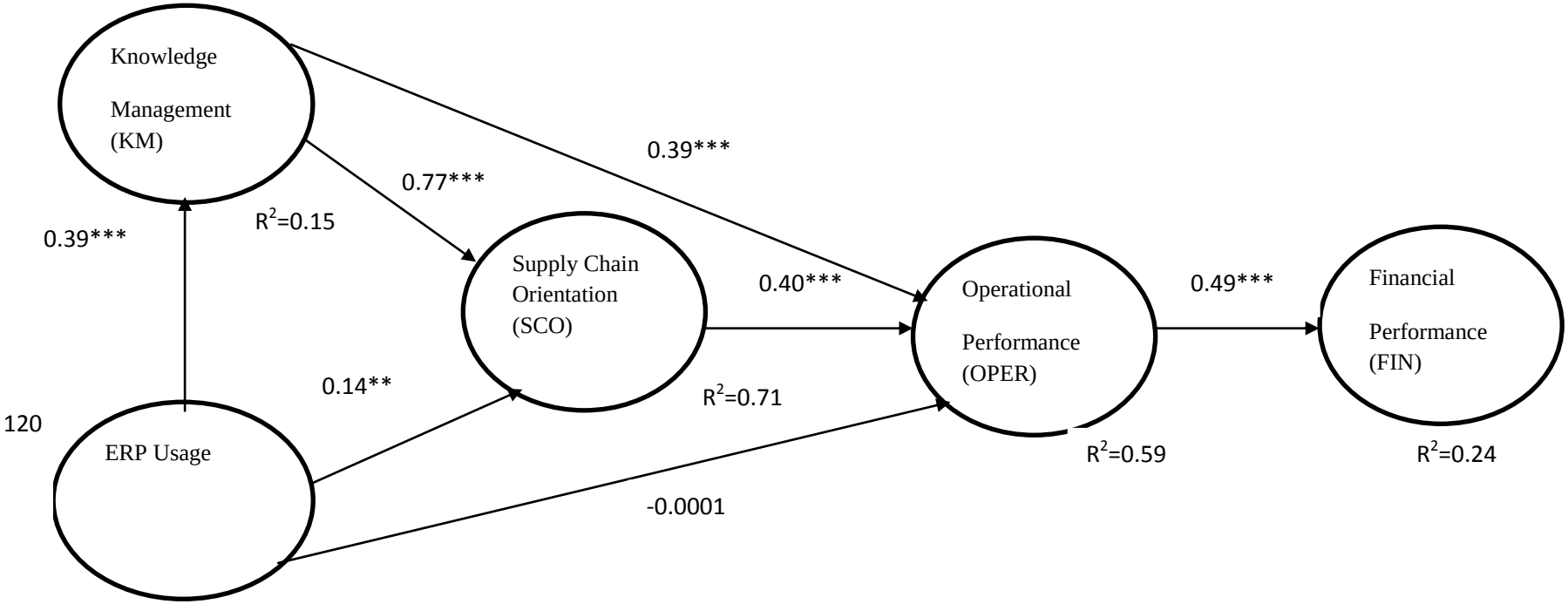
Note: Significance levels are 1%(***), 5%(**) and 10%(*)

Figure 5.15: Results for SMEs



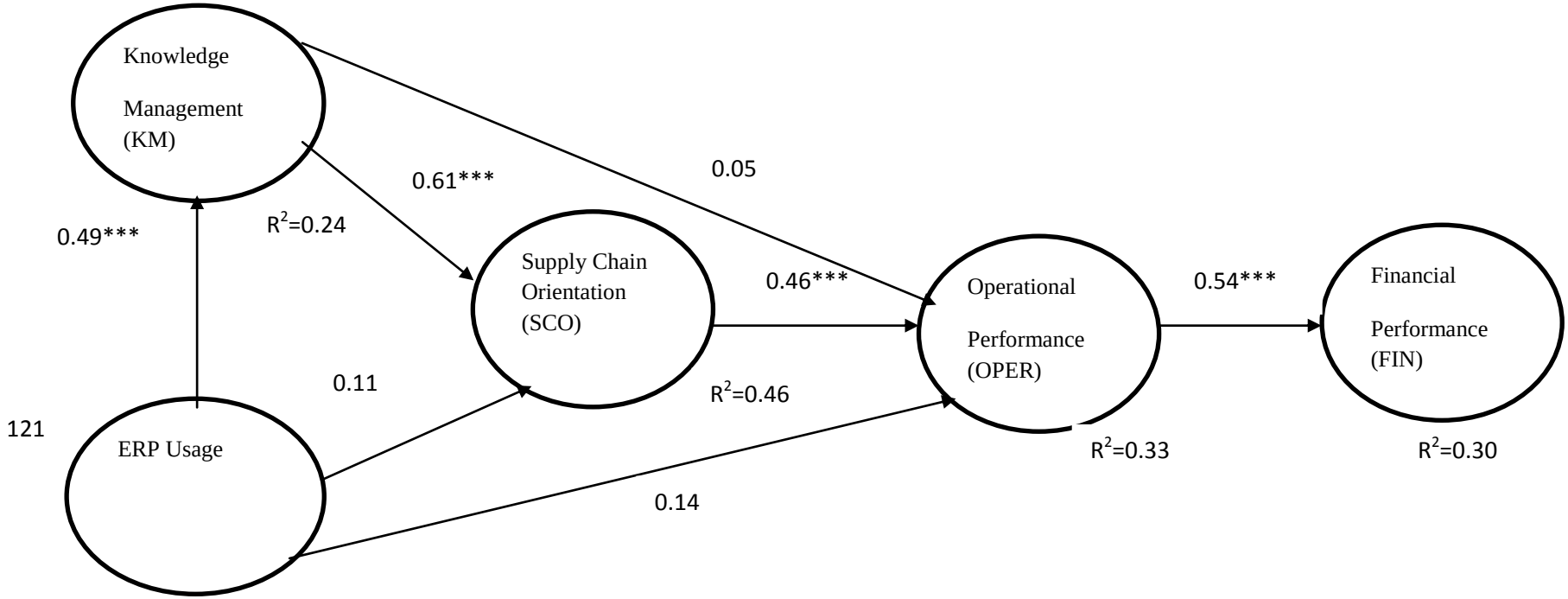
Note: Significance levels are 1%(***), 5%(**) and 10%(*)

Figure 5.16: Results for big companies



Note: Significance levels are 1%(***), 5%(**) and 10%(*)

Figure 5.17: Results for firms which use Turkishbased ERP



Note: Significance levels are 1%(***), 5%(**) and 10%(*)

Figure 5.18: Results for firms which use non-Turkishbased ERP