



# A framework for technology-based factors for knowledge management in supply chain of auto industry

A framework for  
technology

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## Abstract

**Purpose** – The main aim of this study is to provide a framework for technology-based factors for knowledge management in supply chain.

**Design/methodology/approach** – This is an applied research and has been done as a survey in Iran Khodro and Saipa Company as the largest companies in automotive industry of Iran. In this study, 206 experts participated. Reliability methods were Cronbach's alfa, and validity tests were content and construction analyses. In response to one main question and three sub-questions in this research, first and second confirmative factor analysis were used.

**Findings** – In this research, after a literature review, a comprehensive framework with three factors is presented. These factors are information technology (IT) tools, information systems integration and information security management. The findings indicate that the first framework in supply chain of the automotive industry has a good fitness and perfect validity. Second, in this framework, factors have also been considered based on importance. The technique of factor analysis was given the highest importance to the information systems integration. Then, IT tools and, ultimately, information security management are considered. In addition, findings indicate that information systems integration has the highest correlation with IT tools.

**Originality/value** – The main innovation aspect of the research is to present a comprehensive framework for technology-based factors and indices for knowledge management in supply chain. In this paper, in addition to presenting a grouping for IT tools for knowledge management processes in supply chain, key indices for information systems integration and information security management are also referred.

**Keywords** Knowledge management, Technology, Supply chain, Knowledge, Integration, Information security, Auto industry

**Paper type** Research paper

## 1. Introduction

The effect of technology on the processes of knowledge management is one of the subjects on which different research have been conducted. [Allameh et al. \(2011\)](#) have determined that among technology, culture and structure, technology, with the coefficient of 40 per cent, affects the processes of knowledge management the most. In addition, [Abbasi and Makki \(2010\)](#) specifically insist on the usage of technology-based factors as well as information technology in knowledge management. The reason for this specific attention is due to the high pace of market changes, the need for long-term and continuous learning, more competitive markets for the organizations, the actuality of knowledge as a competitive advantage and ubiquity of information along with unsought access to information all around the world. [McAdam and McCreedy \(2000\)](#) do



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not consider technology as an incentive for knowledge management; they know it as an empowering factor which has a strong link with the execution of knowledge management. [Arevuo \(2002\)](#) recognizes technology-based factors as a catalyst for knowledge management which speeds it up. [Carlsson \(2003\)](#), by confessing the fact that knowledge is the key to succeed in today's competitive world, recognizes the outer communication channels as the medium for this competitive advantage. He believes that the information and communication technologies along with knowledge management have important role in the knowledge flows and knowledge-based processes of the organization. In addition, the existence of inter-organizational channels (outer channels, inner channels and open channels), concerning the pivotal role of information and communication technologies, has a key role in the strategic knowledge management. His research on the inter-organizational channels has solely considered the information and communication technologies. [Collins et al. \(2010\)](#) also believe that there is a positive relation between the abilities of knowledge management, the amount of investing in the technologies of the supply chain and the general performance of the supply chain along with the performance of the organization. [Lopez-Nocolas and Soto-Acosta \(2010\)](#) believe that using the information communication technologies has a great impact on value creation. [Robertson and Hammersley \(2000\)](#) also believe that the movements of an organization's human resource succeed in case the technology-based factors exist parallel to the movements of the human resource. This way, they can affect the series of actions performed on knowledge management more. [Edwards et al. \(2005\)](#) believe that using the technology-based factors is effective in the execution of knowledge management. They have found, in their research, that general information technology (IT) tools like the Internet and electronic mail have more practical usage in knowledge management rather than very professional tools.

Technology-based factors for knowledge management in the supply chain have been divided into three main sections in the structure presented in this research. In the first section, we present and explain the role of information technology tools in knowledge management processes (this part has the biggest share in the research conducted in the field of knowledge management). However, less attention has been drawn toward the role of the second and third sections, which indicate the integrity of information systems, as well as the management of information security in the supply chain, in the actions of knowledge management. Therefore, the innovative aspect of the current research is presenting an almost comprehensive framework for technology-based factors for knowledge management in the supply chain, as well as presenting functional and executive indices in the presented framework. In this paper, in addition to presenting a grouping for IT tools for knowledge management processes in the supply chain, key indices for information systems integration and information security management are also referred.

## 2. Research literature

### 2.1 Information technology tools

[Vahedi et al. \(2011\)](#) believe that the best usage of information technology for knowledge management is resulted in the combination of being aware of the limitations of information technology along with the fact that the development of these technologies is accompanied by the changes made in the global culture toward knowledge values and having access to information technology. [Kruger and Johnson \(2010\)](#) have found out that

information management is one of the empowering factors for knowledge management to mature. Moreover, by differentiating information management from information and communication technology, they have realized that the latter with the percentage of 79.69 influences the maturity of knowledge management more than the former with the percentage of 69.65. [Diakoulakis et al. \(2004\)](#) have surveyed the positive effects of IT tools like communication channels, expert systems, decision-support systems, internal database and data mining tools on knowledge processes. They have observed the most effect on preserving and systematizing of knowledge. [Scott \(1998\)](#) concluded in his research that the Internet, as one of IT tools, can create, transfer and apply knowledge by collecting, integrating and analyzing relevant communications. [Apostolou et al. \(1999\)](#) have considered the pivotal role of the Internet-based network substructures in creating knowledge-based markets to support the partnership of the members of the supply chain. [Alavi and Leidner \(2001\)](#) recognize the Internet, group wares and the communication technology as the technology platform. In addition, they have introduced several IT tools for each process of knowledge. [Bouthillier and Shearer \(2002\)](#) have also introduced different IT tools in private and governmental offices in their research. They recognize web-based intranet, news e-mails and bulletins as the common tools used in private offices, whereas extranet; the Internet; and web-based intranet, teleconferences, portals, satellites, databases and e-mail as the common tools used in governmental organizations. [Gottschalk \(2000\)](#) has considered different tools such as the Internet, extranet, intranet, group waves, library systems, documentary systems, word processors, wide pages and expert systems in their research regarding the usage of IT tools in legal and consulting offices in the knowledge management system. [Benbya and Belbaly \(2005\)](#) have divided knowledge management system into three levels and have mentioned the tools needed for each level. The first level belongs to dynamic systems, and the tools suggested for this level are expert channels, communities of practices and yellow pages. The second level belongs to process-based systems possessing the tools like databases, process description and knowledge repositories. Eventually, the third level belongs to integrated systems which possess the tools like organizational portals, extranet portals and intranet portals.

[Merono-Cerdan et al. \(2007\)](#) have proposed a series of IT tools for codification and personalization which are the two strategies of knowledge management. They have presented decision-support system tools, group ware, documents repositories, knowledge maps, work flows and mutual database for codification strategy. In addition, group tools, video conferencing, yellow pages and discussion forums were presented for personalization strategy. [Hicks et al. \(2006\)](#) have presented a five-layered hierarchical model for knowledge management. Moreover, they have used specific tools like IT tools in each layer. The key tools presented in this model are databases, data repositories, yellow pages, group wares, decision-support systems, intelligent systems and learning systems. [Tseng \(2008\)](#) has also surveyed the relation of information technology with the different stages of knowledge execution and gap analysis in passing from one stage to another. [Hallouche and Sultan](#) have also categorized different kinds of IT tools based on the existing processes in knowledge management. They have introduced technologies like content management systems, data analysis and blogs for knowledge creation process. Furthermore, they have presented suitable tools for knowledge distribution process such as the Internet networks, extranet and intranet networks, knowledge repositories, portals, mutual web space, cooperation tools and group wares, e-mail,

group calendaring, video conferencing, wikis and online forums. Besides, they have recognized pattern matching tools (filtering tools to have a prompt access to useful data) like intelligent factors for knowledge usage process. [Ngai and Chan \(2005\)](#) have also categorized the series of IT-based tools by using the hierarchical analysis process method. Moreover, their standards are cost, operational (functional) factors and tool supplying standards. [Jecan \(2008\)](#) introduced knowledge management in the forms of explicit and implicit, and has recognized specific tools for each form. For instance, a database tool has been introduced for implicit knowledge, and tools such as content management, search and reporting, records management, information retrieval, documents management, records management, collaborative tools, forums and work flows, e-mail, etc. have been introduced for explicit knowledge. [Chen et al. \(2009\)](#) have been surveying the relation between electronic business technologies and knowledge management to improve the performance of the supply chain. They have found that electronic business and its technologies can lead to organizational knowledge which will improve the performance of the supply chain and will gain competitive advantage. [Choi and Jong \(2010\)](#) have introduced specific IT tools for each strategy of knowledge management. The tools introduced for system-based strategy are content management system, intranet, database, electronic documents management system, electronic repositories, data analysis and expert systems. In addition, the tools introduced for human-based strategy are chat rooms, forums, teleconferencing, videoconferencing, e-mails and voice mails. Besides the mentioned tools, [Sher and Lee \(2004\)](#) have proposed other tools like database, employees' competency, online knowledge searches, electronic learning tools, enterprise resources planning, supply chain management system and customer relationship management system. [Grimaldi and Rippa \(2011\)](#) have classified IT tools like business intelligence, content software, data management tools and collaborative tools in a hierarchical analysis-based framework based on three general criteria, namely, network improvement, performance improvement and knowledge improvement, as well as four subsidiary criteria, namely, cost limitation, time limitation, operational limitation, i.e. to what extent the tools can meet consumers' needs, reliability, i.e. the ability of the system and its parts in executing tasks under the current circumstances and during a specific period.

In [Table I](#), based on the literature review, key indicators of IT tools for knowledge management processes in the supply chain are provided.

### *2.2 Information systems integration*

Business processes can be an important source to create competitive advantage. In addition, data fragmentation in the series of organizational processes results in decreased efficiency and diminished performance. Utilizing the systems which help the organizational processes integrate along with information systems can cause data fragmentation to disappear and can introduce the organizational processes as a competitive advantage.

Integration is the mutual utilization of the same information from the same repository source by two or more users. In addition, it is the link among different balanced parts orienting to strategy, focusing on the market, sources, skills and culture. Moreover, it creates a mutual relation among the inner teams and existing duties ([Braganza, 2002](#)). [Bhatt \(2000\)](#) recognizes "integration" as the amount of sharing and accessing data and existing software in different communication networks. [Jitpaiboon et al. \(2005\)](#) know integration as the amount

Main processes of knowledge management	IT tools	Researchers
Obtain, create and produce	Data analysis tools	Choi and Jong, 2010; Hallouche and Sultan, 2008; Alavi and Leidner, 2001; DiaKoulakis <i>et al.</i> , 2004
Organizing, preserving and repository	Content management system	Grimaldi and Rippa, 2011; Choi and Jong, 2010; Jecan, 2008; Hallouche and Sultan, 2008
	Database	Grimaldi and Rippa, 2011; Sher and Lee, 2004; Choi and Jong, 2010; Jecan, 2008; Hicks <i>et al.</i> , 2006; Merono-Cerden <i>et al.</i> , 2007; Benbya and Belbaly, 2005; Bouthillier and shearer, 2002; Alavi and Leidner, 2001; DiaKoulakis <i>et al.</i> , 2004
	Knowledge repositories	Choi and Jong, 2010; Hallouche and Sultan, 2008; Merono-Cerden <i>et al.</i> , 2007; Benbya and Belbaly, 2005; Alavi and Leidner, 2001
Transfer, share and distribute	Electronic bulletins	Bouthillier and shearer, 2002; Alavi and Leidner, 2001
	Internet, Intranet and extranet networks	Hallouche and Sultan, 2008; Benbya and Belbaly, 2005; Gottschalk, 2000; Bouthillier and shearer, 2002; Alavi and Leidner, 2001; Apostolou <i>et al.</i> , 1999; Scott, 1998; DiaKoulakis <i>et al.</i> , 2004
	Organizational portals	Hallouche and Sultan, 2008; Benbya and Belbaly, 2005; Bouthillier and shearer, 2002
	Videoconferencing and teleconferencing	Choi and Jong, 2010; Hallouche and Sultan, 2008; Merono-Cerden <i>et al.</i> , 2007; Bouthillier and shearer, 2002
	Online forums	Choi and Jong, 2010; Jecan, 2008; Hallouche and Sultan, 2008; Merono-Cerden <i>et al.</i> , 2007; Benbya and Belbaly, 2005; Alavi and Leidner, 2001
Avail, usage and benefit	Group wares or public software (in order to cooperate on a project)	Grimaldi and Rippa, 2011; Jecan, 2008; Hallouche and Sultan, 2008; Hicks <i>et al.</i> , 2006; Merono-Cerden <i>et al.</i> , 2007; Gottschalk, 2000; Alavi and Leidner, 2001
	Expert systems	Choi and Jong, 2010; Hicks <i>et al.</i> , 2006; Gottschalk, 2000; Alavi and Leidner, 2001; DiaKoulakis <i>et al.</i> , 2004
	Decision support systems	Hicks <i>et al.</i> , 2006; Merono-Cerden <i>et al.</i> , 2007; DiaKoulakis <i>et al.</i> , 2004
	Intelligent systems and tools (in order to have prompt access to useful data)	Sher and Lee, 2004; Jecan, 2008; Hallouche and Sultan, 2008; Hicks <i>et al.</i> , 2006

**Table I.**  
IT tools for knowledge management in supply chain

of collaboration within the organization and with the business partners based on compatible series of fundamental information systems. Georgantzis and Katsamakos (2010) have shown that integration causes the information modules to come to an end. It provides exact, thorough and in-time information from the overall status of the current system. Hanafizadeh and Shafiei Nikabadi (2011) and Shafiei Nikabadi and Khatami Firoozabadi (2009) have also shown that the internal and external integrations are the key factors in executing electronic businesses in holding companies with a chain structure. Morabito *et al.* (2010) have also stated that the integrated information systems can gain competitive advantages for industries. They have divided the integration of information systems into two divisions, namely, data integration and application integration. On the other hand, integration of information systems can be divided into two sections, namely, data integration and network integration (Jitpaiboon *et al.*, 2005; Woznica and Healy, 2009; Bhatt, 2000). Data integration indicates sharing several kinds of databases by different organizations to coordinate the activities more (Bhatt, 2000). Network integration means to transfer the information more easily and promptly in different formats through a series of flexible standards such as fiber, optical cables or satellite (Bhatt, 2000). Lee and Yang (2000) recognize knowledge integration as one of the principal processes of knowledge management in the model of the supply chain. Themistocleous *et al.* (2004), by emphasizing on the importance of integration in the supply chain, have introduced it in soft and hard dimensions. They have used indices such as the amount of concentrating on data exchange and sharing among the members of the supply chain, the amount of interdependence of the processes, the amount of the equal development of the integrated infrastructures among organizations and the possibility to create simultaneous communications. Sedera and Gable (2010) have introduced two indices for information systems regarding the qualifications of knowledge management in the success of organizational systems. The first index is information quality, i.e. the ability to prepare output whenever needed, accessibility to information, presenting usable information, presenting understandable information, presenting readable and clear information in a suitable format and presenting accurate information. Moreover, the second index is system quality, i.e. comfort in learning and usage, in accordance with the needs of an organization, possessing the required specifications, adaptability with persons' approach, integrated fixed and compatible data and repairable system. Benbya and Belbaly (2005) know the integrated information systems as one of the main bases of knowledge management systems. Sambasivan *et al.* (2009) recognize the integration of business information systems as one of the main elements of knowledge management in their survey concerning the effect of knowledge management in the supply chain management. Rosemann and Chan (2000) have surveyed the significant relation between the knowledge of organizational resource planning system and knowledge resources in the organization by presenting a framework. McGinnis and Huang (2007) have proposed a model for executing organizational resource planning system. They believe that this system succeeds in case these two subjects are combined together. Li *et al.* (2006) also believe that a knowledge-based enterprise resources planning system can combine traditional organizational resources planning with knowledge management effectively which is considered to be a necessary factor in today's dynamic knowledge-based economy.

Table II shows the key indices of integration.

Integration	Indices
Integration in DATA	Utilizing standard codes and definitions for the data Utilizing standard formats for the information and data Utilizing standard formats for presentation Utilizing focused databases Utilizing coordinating systems among databases
Integration in NETWORKS	Integration of data and information Utilizing information networks to communicate and to share information with other departments Utilizing information networks to connect to other databases at different departments Utilizing software packages of information networks Utilizing communication networks to connect to focus databases Utilizing communication networks to ease the periodic interdepartmental meetings Utilizing compatible network architecture

**Table II.**  
Key indices of information systems integration for knowledge management in supply chain

**Source:** Jitpaiboon *et al.* (2005), Woznica and Healy (2009), Bhatt (2000)

### 2.3 Information security management

According to the changes occurred in the organizational business processes, companies need to use information technology for information transactions, financial transactions and supervision to survive and keep their competitive situation (Tipton and Krause, 2003). Big and small organizations have used this technology now more than before to control and speed up their business affairs. Specifically, as car manufacturing industries are physically broad and have broad information, they need to utilize this system in their financial processes, supply chain management, information transaction, etc.

As the information systems develop in organizations, the importance of information security increases to be used to decrease the probable abuses of information systems (Kankanhalli *et al.*, 2003). We can define a key role for information security management to manage and confirm the information systems used in businesses (Siponen and Willison, 2009).

Information security management creates security for information transactions and physical transactions through a management system based on information security standards such as BS 7799 belonging to Britain's Standard Institution as well as ISO/IEC 27001 and technical report ISO/IEC TR 13335 belonging to the International Standard Institution considered to be as one of the most eminent standards and technical guides in this field (Broderick, 2006). It affects the process of homogenizing, control increase and centralizing information systems control on the integration of organizational processes in the supply chain, both on internal and external dimensions (Shafiei Nikabadii *et al.*, 2012). Therefore, by means of information security management, which guarantees the reception of accurate and in-time information in the form of a system with a central and precise control, we can observe its tremendous effect on the integration of organizational processes in the supply chain which causes the supply chain to perform with more efficiency (Kannan and Tan, 2005; Shafiei Nikabadii *et al.*, 2012; Taghva *et al.*, 2012) The objective of information security management in an organization is to protect the capitals of the organization; for instance, software,

hardware, information, communication and human force against any threat like unauthorized access to information, environmental and system dangers, as well as the perils caused by the users. To reach the mentioned goal, an integrated program is needed (POA, 2003); in addition, we can consider it as one of the principal dimensions of a knowledge management system to keep the intellectual capitals of an organization. Knowledge management system includes a series of saved knowledge in the databases, and it is really necessary to secure this system (Xu and Zhang, 2004; Randeree, 2006). When the first standard for information security management was devised in 1995, the systematic approach toward securing the area of information transactions was proposed (Broderick, 2006). According to this approach, it is not possible to promptly provide the security of the area where information is transacted. It is necessary to reach this goal by the constant use of a securing cycle-containing design, execution, evaluation and correction. For this, it is required for each organization to control the creation and transaction of information based on a specific methodology (BS 7799-2, BS ISO/IEC 27,001, 2005). Loukis and Spinellis (2001) indicate the organizational, technical and human resource dimensions for information security management system. The key indices in the organizational dimension are the deficiency-correcting procedures for the confidentiality of the data, the written and approved plans of the information security, the written and approved policies (roles and procedures), the security areas (both logical and physical), the existing procedures for coping and back-up and the existing procedures for internal audit of the information security. In the technical dimension, we can indicate the physical access control and firewall system indices. In the human resource dimension, indices like full-time employees, information system security and full-time network executive managers, appropriate training of the employees, information and network security managers and training the information system users about the accurate, secure and confident usage of information systems are mentionable. In addition to the indices stated above, there are other indices for information security management in an organization, among which legal necessities to execute information security policies, norms to support information security management, abating probable conflicts in the usage of security controls, constantly informing the users and managers of the reports regarding the information security (Karyda *et al.*, 2005), creating confidentiality, creating integrity and flawlessness in the information, availability to definite information at the right time (Ma *et al.*, 2008; Farn *et al.*, 2008), accountability (protection by anti-virus soft wares, watching the data and preventing unauthorized access to other's accounts can be mentioned (Ma *et al.*, 2008). Chang and Lin (2007) have found in their research that control-based cultures, which are effective and compatible with confidentiality, have a significant and positive relation with flawlessness in the information, accessibility and accountability. However, flexible cultures, which are contributive and innovative, do not have a significant relation with the indices of information security, and there is only a negative significant relation between contributive culture and confidentiality.

The selective indices for information security management are illustrated in Table III according to the study carried out.

#### 2.4 Gap synthesis

Based on the literature review conducted, we found that several studies have been done in the field of information technology tools in organizations. However, certain categories



of these tools have not been found. This article is to classify these IT tools based on key processes of knowledge management and to present a relatively comprehensive classification for IT tools in knowledge management in supply chain. On the other hand, very little research in the area of integration of information systems and information security management has been done in the area of knowledge management. Information systems integration is one of the key items in the proper performance of knowledge management in the supply chain. Without information security management, information systems integration will not be implemented properly. In most articles, most attention has been on IT tools, and these tools are often considered as technological factors. While in the context of the supply chain, which consists of a series of internal and external processes, special attention should be given to process integration and information security within the supply chain. In addition to all this, in this paper, the key indicators for each dimension, based on the research literature, can be extracted.

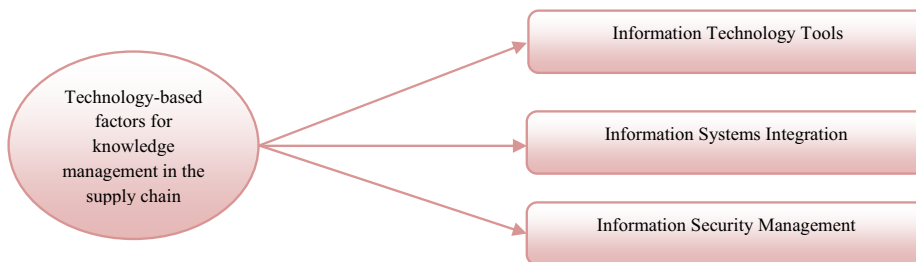
### 3. Research methodology

#### 3.1 Conceptual model

Having reviewed the research literature, the conceptual model of the research can be drawn as follows. This model comprises three key components that have been achieved with the help of an in-depth literature review. Indices of these dimensions can be seen in Tables I-III. In this framework, in addition to presenting a grouping for IT tools for knowledge management processes in supply chain, key indices for information systems integration and information security management are also referred (Figure 1).

Index	Researchers
Creating legal and organizational necessities to execute information security management system	Loukis and Spinellis, 2001; Karyda <i>et al.</i> , 2005
Procedures for data and information confidentiality	Loukis and Spinellis, 2001; Farn <i>et al.</i> , 2008; Ma <i>et al.</i> , 2008
Flawlessness, no conflict and total perfection among information	Karyda <i>et al.</i> , 2005; Farn <i>et al.</i> , 2008; Ma <i>et al.</i> , 2008
Accessibility to definite information at the right time	Farn <i>et al.</i> , 2008; Ma <i>et al.</i> , 2008
Accountability and protection against violations and unauthorized access to information	Loukis and Spinellis, 2001; POA, 2003; Ma <i>et al.</i> , 2008

**Table III.**  
The indices of information security management for knowledge management in supply chain



**Figure 1.**  
Conceptual model of the research

### 3.2 Variables and research questions

According to the conceptual model of the research, we can consider the information technology tools, integration of information systems and information security management as the main variables of the research. In addition, the secondary variables of the research are mentioned in [Tables I-III](#) for each main variable. Therefore, the main question of the research can be posed this way:

*Q1.* What is the most important technology-based factor for knowledge management in the supply chain in the car manufacturing industry?

The three secondary questions which can be posed, based on the main question above, are as follows:

- *Secondary question 1 (Table I):* What are the most important variables of information technology tools for knowledge management in the supply chain of the car manufacturing industry?
- *Secondary question 2 (Table II):* What are the most important variables of information systems integration for knowledge management in the supply chain of the car manufacturing industry?
- *Secondary question 3 (Table III):* What are the most important variables of information security management for knowledge management in the supply chain of the car manufacturing industry?

### 3.3 Research methodology

This research is considered to be as an applied research based on its results and objectives. Its variables are the qualitative ones, and it is categorized as a descriptive research which has been conducted as a survey. The tool used in this research is the questionnaire based on five-spectrum Likert. The research has been conducted at the series of car manufacturing organizations, suppliers and after-sales service providers in the first layer of the supply chain in Iran's automobile manufacturing industry.

### 3.4 Case study: supply chain of automobile industry in Iran

The basic reason of this selection is that these two companies have the most share of car market in Iran. Historical background of these two companies is more than any other company in this industry. Iran Khodro Co. and Saipa Co. are of the largest companies of auto industry, and these two companies have the largest supply chains in Iran. Iran Khodro Co. and Saipa Co. are managerial holding company with a chain structure. Supply chain of Iran Khodro Co. consists of subsidiaries which include designing and engineering companies (like Taam Iran Khodro), suppliers (like SAPCO), manufacturer (like Iran Khodro Industrial Group) and after-sales services (like ISACO), and in this way, Iran Khodro Co. has formed a supply chain, on which it has control and supervision. In addition, the supply chain of Saipa Co. consists of subsidiaries which include designing, engineering companies and suppliers (like SazehGostar), manufacturer (like Saipa Industrial Group) and after-sales services (like Emdad Khodro), and in this way, Saipa Co. has formed a supply chain, on which it has control and supervision ([Hanafizadeh and Shafiei Nikabadii, 2011](#); [Shafiei Nikabadii and Zamanloo, 2012](#)).

### 3.5 Population and sampling

Because the analysis unit for this research is the supply chain of the car manufacturing industry, the population of the research includes a series of experts in the car industry. The sample had been selected among the managers who had three-year full-time work experience. In addition, they had to at least have one of the following specifications:

- have been majored in the fields of industrial engineering, management and economics;
- have published in a journal, conducted a research or written reports in the fields of knowledge management, supply chain management and assessment of the performance of the supply chain; and
- have been in charge of knowledge management, strategic planning, supply chain and planning and programming in their organization.

The population of the research has been chosen among Iran Khodro and Saipa companies which are the active companies in the supply chain. Because the topic of the research is a new topic discussed in the industries, and the people who can answer the research questions are limited, we have chosen the samples in a judgmental and objective way.

### 3.6 Reliability and validity

Content and construct validity was used to survey the validity of the research, and Cronbach's alpha was used to survey the reliability of the research. If the reliability coefficients are more than 0.7, the research has an acceptable reliability (Momeni, 2012). The Cronbach's alpha for this research is 0.917.

### 3.7 Data gathering and analysis method

The method used for data gathering for this research was through field studies and library. To prepare a research model, the research library has been used. Then to answer research questions, field studies have been used. In addition, in this study, to analyze the findings and recommendations, three industry experts (with over ten-year experience in the supply chain of automobile industry) were interviewed.

Descriptive statistics tools, as well as deductive statistics, particularly confirmatory factor analysis phase one and two, and model fitness were used to analyze the data and answer the research questions. Factor analysis presents a base for creating a new series of variables which develop the specification and identification of the main variables in a fewer number of these variables (Kline, 1998). In this method, the related affairs between a large number of variables and their high interdependence can fundamentally be reduced by the replacement of the new variables. In this research, the objective of using the confirmatory factor analysis is to reduce the variables of the existing dimensions in the research to recognize more important variables.

To remove an index in confirmatory factor analysis technique, the value 0.5 is selected. Indices with factor loading of below 0.5 will be removed. First, for each dimension, based on first-order factor analysis techniques, indicators with loadings below 0.5 will be removed. In the model, however, this index is deleted, re-run (second-order factor analysis), then, the importance of each dimension will be determined. However, before using the confirmatory factor analysis, the knowledge management KMO test must be done to assure the sampling adequacy (Momeni, 2012).

#### 4. Research findings

Among the 220 questionnaires distributed, only 206 questionnaires were suitable for the statistical analysis (response rate: 94 per cent). Seventy questionnaires belonged to suppliers, 104 questionnaires to manufacturers and 32 questionnaires belonged to after-sales service providing companies in the supply chain of the car industry. According to the gathered demographic information from the distributed questionnaires, 48 per cent of the population has higher education, and about 75 per cent have more than seven years of work experience in the car industry. Table IV shows the situation of each variable in the different dimensions of technology-based factors for knowledge management in the supply chain. An index, the factor loading of which is lower than 0.5, is not accepted.

According to Table IV, we can determine which variables in each dimension have the most importance and have been accepted. In addition, the quality of the sampling has also been accepted. The correlation between the technology-based factors for knowledge management in the supply chain has been presented in Table V.

The conceptual model of the research was designed by LISREL software. To survey the fitness of the model, we checked the outputs of the software;  $\chi^2$  was zero and the software showed us the following message: "the model is saturated and the fit is perfect". Therefore, the validity of the model is completely approved. For each main dimension in the presented framework, different factor loadings are created which shows their correlation with the latent variable and the level of importance of each variable in the conceptual model. Table VI shows the factor loading of each existing variable, derived from the phase 2 confirmatory factor analyses, in the model.

#### 5. Discussion, conclusion and suggestions

The main objective of the research is presenting a framework for technology-based factors for knowledge management in the supply chain of the car industry. This research has been conducted in the supply chains of Iran Khodro and Saipa companies which are known as the biggest and the most active car manufacturing companies in Iran. It was specified in the research that the framework presented for technology-based factors for knowledge management in the supply chain of the car industry in Iran has a perfect goodness of fit and validity. To analyze the findings and recommendations, three industry experts (with over ten years experience in the supply chain of automobile industry) were interviewed. The interviews were open, and they were asked to provide their opinions about the statistical findings.

According to the research findings (Table VI), we can realize that information systems integration (with factor loading: 0.87) is the most important among the three factors. Subsequently, information technology tools (with factor loading: 0.85) and in the end information security management (with factor loading: 0.68) are categorized. Moreover, Table V shows that information systems integration has the highest correlation, first with information technology tools (correlation: 0.738) and second with information security management (correlation: 0.586). In this study, we found that the integration of information systems with the development of IT tools in the internal and external processes in the supply chain are interrelated. In addition, we found that for a proper integration of information systems among supply chain members (for better knowledge management processes in the supply chain), creating an information security management system is vital.

Technologic factors	Situation	Factor loading
<i>Information Technology Tools (Index KMO:0.869)</i>		
Data excavating tools	Accepted	0.81
Content management system	Accepted	0.78
Mutual database	Accepted	0.69
Knowledge repository	Accepted	0.73
Electronic bulletins	Accepted	0.67
Internet, intranet and extranet networks	Accepted	0.58
Organizational portals	Accepted	0.57
Teleconferencing and videoconferencing	Rejected	0.46
Online forums	Accepted	0.61
Group wares or public software (to do mutual and relevant activities of a project)	Accepted	0.58
Expert systems	Accepted	0.83
Decision-support systems	Accepted	0.85
Intelligent systems and tools (to search and have a prompt access to useful data)	Accepted	0.77
<i>Information System Integration (Index KMO: 0.888)</i>		
Using standard codes and definitions for the data	Accepted	0.67
Using standard formats for the information and data	Accepted	0.65
Using standard formats for presentation	Accepted	0.66
Using focused databases	Accepted	0.58
Using coordinating systems among databases	Rejected	0.48
Integrating data and information	Accepted	0.54
Using information networks to communicate and share information with other departments	Accepted	0.59
Using information networks to connect with the other databases of different departments	Accepted	0.65
Using information network software packages	Accepted	0.69
Using communication networks to connect to focused databases	Accepted	0.53
Using communication networks to ease the periodic interdepartmental meetings	Accepted	0.56
Using compatible network architectures	Accepted	0.58
<i>Information Security Management (Index KMO:0.804)</i>		
Devising legal and organizational necessities to execute Information security system management	Accepted	0.65
Procedures for devising data and information confidentiality	Accepted	0.83
Flawlessness and perfection among information	Accepted	0.65
Accessibility to certain information at the right time	Accepted	0.57
Accountability and blocking the unauthorized access to the information	Accepted	0.68

**Table IV.**  
The situation of each variable in the different dimensions of technology-based factors for knowledge management in supply chain

According to the findings in Table IV, we can find that in the series of variables presented for information systems integration, the variables relating to the integration in the network are more important than the integration in the data. We can observe the same matter in the index of “using the information network software packages” (factor loading: 0.69) with the

highest factor loading in this part. So it must be noted that development of IT tools and development of a suitable security management system for integration in the network in the supply chain are more important than development of IT tools for data integration and securing the integrity of the data in the supply chain. Carlsson (2003) knows the communication networks which locate outside the organization as the competitive advantage gained from the execution of knowledge management.

The next important part is information technology tools. The most important variable for knowledge management in the supply chain are the indices related to decision-support systems (factor loading: 0.0.85), expert systems (factor loading: 0.83) and data excavating tools (factor loading: 0.81). With little contemplation, we realize that the variables related to knowledge usage tools have more importance than the other dimensions. Consequently, we can conclude that knowledge usage in the supply chain is more important than the other dimensions of knowledge management; as a result, its tools have more importance. In addition, the findings show that professional tools are more important than ordinary and normal tools; it is due to the communication complexity among the members of the supply chain in the car manufacturing industry. On the other hand, according to the research conducted by Meronó-Cerdan *et al.* (2007), we can find that the tools which follow the knowledge coding strategy are considered as the most important ones. Moreover, the findings show that system-based tools have more importance than human-based tools. This fact is also in accordance with the results gained from the research done by Choi and Jong (2010). The reason for this is the high bureaucracy in the chained structures of the car industry.

The other factor is information security management which has the least importance. It is due to the fact that people are not aware enough about information security management in the supply chain because they have not felt its importance in their business activities. Among the variables introduced for information security management the “procedures developed for data and information confidentiality” (factor loading: 0.83) index has the highest factor loading.

The points which researchers found out during surveying this subject in the car industry were as follows:

- The members of the supply chain of Iran’s car manufacturing industry have not reached the perfect maturity in technology, i.e. they have not been able to enhance

**Table V.**  
The correlation between technology-based factors for knowledge management in supply chain

Dimensions	Information technology tools	Information systems integration	Information security management
Information technology tools	1		
Information systems integration	0.738	1	
Information security management	0.576	0.586	1

**Table VI.**  
The factor loading of the main dimensions in the conceptual model of the research

Information technology tools	Information systems integration	Information security management
0.85	0.87	0.68

their human resource knowledge to technological factors; in addition, they have not been able to provide the key substructures, as well as the web-based specific tools for their businesses in the supply chain.

- The members of the supply chain have not been able to comprehend the value of technology in knowledge management; they have just considered the hardware advantage of technology and have neglected the soft dimensions and usage of technology. Moreover, they have not been able to get familiar with the key usages of current technology due to its newness. What is more, they have not been able to confront with its existing challenges.
- Lack of e-business and e-commerce policies (business to business and business to client) among the members of the supply chain is among the other factors. This fact can challenge the companies on their outer organizational and inner organizational integration process and make the execution of enterprise resource planning system impossible. That is why the data integration has less importance than networks and information banks integration. The members of the supply chain of Iran's car manufacturing industry voluntarily desire to transact and exchange data with each other; however, they are not willing to share their whole data and information banks with others. This proves that there is not enough trust among the members of the supply chain, and they are not mature enough to create a win – win relation between the members of the supply chain.

The three aforementioned points are the biggest problems in the industry to achieve the framework presented in this research. These three questions, determine why the industry has failed to properly implement the framework. These issues, based on interviews with three industry experts, have been discussed.

All efforts of this study were to identify the key technological indices for knowledge management in the context of supply chain, and I think presenting these indices can help managers of knowledge management department in implementation of knowledge management processes among members of the supply chain. In addition, it is worth mentioning that this research has been conducted in the supply chain of Iran's car manufacturing industry; therefore, generalizing the findings and results of the current research to other supply chains in various industries or even in other countries' car manufacturing plants need more research.

## References

- Abbasi, M. and Makki, M. (2010), "The necessity of innovation in knowledge management and information technology management programs in Iran", *Roshd-e-Fanavari*, Vol. 5 No. 24, pp. 12-21.
- Alavi, M. and Leidner, D.E. (2001), "Review: knowledge management and knowledge management systems: conceptual foundations and research issues", *MIS Quarterly*, Vol. 25 No. 1, pp. 107-136.
- Allameh, S.M., Zare, S.M. and Davoodi, S.M.R. (2011), "Examining the impact of KM enablers on knowledge management processes", *Procedia Computer Science*, Vol. 3, pp. 1211-1223.
- Apostolou, D., Sakkas, N. and Mentzas, G. (1999), "Knowledge networking in supply chain: a case study in the wood/furniture sector", *Information, Knowledge and Systems Engineering*, Vol. 1 Nos 3/4, pp. 267-281.

- Arevuo, M. (2002), *Technology and Human Resource Based Enablers for Successful Knowledge Transfer in Organizations*, Frontiers of E-Business Research, e-Business Research Forum – eBRF, Finland, pp. 71-92.
- Benbya, H. and Belbaly, A.N. (2005), “Mechanisms for knowledge management systems effectiveness: an exploratory analysis”, *Knowledge and Process Management*, Vol. 12 No. 3, pp. 203-216.
- Bhatt, G.D. (2000), “An empirical examination of the effects of information systems integration on business process improvement”, *International Journal of Operations & Production Management*, Vol. 20 No. 11, pp. 1331-1359.
- Bouthillier, F. and Shearer, K. (2002), “Understanding knowledge management and information management: the need for an empirical perspective”, *Information Research Journal*, Vol. 8 No. 1, pp. 1-39.
- Braganza, A. (2002), “Enterprise integration: creating competitive capabilities”, *Integrated Manufacturing Systems*, Vol. 13 No. 8, pp. 562-572.
- Broderick, J.S. (2006), “ISMS, security standards and security regulations”, Information security technical report, Vol. 11 No. 1, pp. 26-31.
- BS 7799-2, BS ISO/IEC 27001 (2005), *Information Technology-Security Techniques-Information Security Management Systems – Requirements*, British Standards Institution, UK, 1st ed.
- Carlsson, A.S. (2003), “Knowledge managing and knowledge management systems in inter-organizational networks”, *Knowledge and Process Management*, Vol. 10 No. 3, pp. 194-206.
- Chang, S.E. and Lin, S.-H. (2007), “Exploring organizational culture for information security management”, *Industrial Management and Data Systems*, Vol. 107 No. 3, pp. 438-458.
- Chen, P.K., Huang, C.M. and Su, C.H. (2009), “Successful supply chain practices through organizational knowledge and e-business technology”, *Information Technology Journal*, Vol. 8 No. 6, pp. 879-886.
- Choi, B. and Jong, A.M. (2010), “Assessing the impact of knowledge management strategies announcements on the market value of firms”, *Information and Management*, Vol. 47 No. 1, pp. 42-52.
- Collins, D.J., Worthington, J.W. and Reyes, M.P. (2010), “Knowledge management, supply chain technologies, and firm performance”, *Management Research Review*, Vol. 33 No. 10, pp. 947-960.
- Diakoulakis, E.I., Georgopoulos, B.N., Koulouriotis, E.D. and Emiris, M.D. (2004), “Toward a holistic knowledge management model”, *Journal of Knowledge Management*, Vol. 8 No. 1, pp. 32-46.
- Edwards, S.J., Shaw, D. and Collier, P. (2005), “Knowledge management systems: finding a way with technology”, *Journal of Knowledge Management*, Vol. 9 No. 1, pp. 113-125.
- Farn, K.J., Lin, S.K. and Lo, C.C. (2008), “A study on e-Taiwan information system security classification and implementation”, *Computer Standards and Interfaces*, Vol. 30 Nos 1/2, pp. 1-7.
- Georgantzias, N.C. and Katsamakas, E.G. (2010), “Performance effects of information systems integration: a system dynamics study in a media firm”, *Business Process Management Journal*, Vol. 16 No. 5, pp. 822-846.
- Gottschalk, P. (2000), “Knowledge management systems: a comparison of law firms and consulting firms”, *Informing Science*, Vol. 3 No. 3, pp. 117-124.



- Grimaldi, M. and Rippa, P. (2011), "An AHP-based framework for selecting knowledge management tools to sustain innovation process", *Knowledge and Process Management*, Vol. 18 No. 1, pp. 45-55.
- Hallouche, F. and Sultan, A. (2008), "Knowledge management: assessment of strategies and innovative technologies", *Proceedings of the World Congress on Engineering and Computer Science 2008 WCECS 2008, 22-24 October, San Francisco*.
- Hanafizadeh, P. and Shafiei Nikabadii, M. (2011), "Framework for selecting an appropriate e-business model in managerial holding companies, case study: Iran Khodro", *Journal of Enterprise Information Management*, Vol. 24 No. 3, pp. 237-267.
- Hicks, C.R., Dattero, R. and Galup, D.S. (2006), "The five-tier knowledge management hierarchy", *Journal of Knowledge Management*, Vol. 10 No. 1, pp. 19-31.
- Jecan, S. (2008), "Document management vs. knowledge management", *Revista Informatica Economică*, Vol. 4 No. 48, pp. 87-90.
- Jitpaiboon, T., Ragu-Nathan, T.S. and Vonderembse, M.A. (2005), "An empirically derived taxonomy of information systems integration", *Journal of International Technology and Information Management*, Vol. 15 No. 2, pp. 17-37.
- Kankanhalli, A., Teo, H.H., Tan, B.C.Y. and Wei, K.K. (2003), "An integrative study of information systems security effectiveness", *International Journal of Information Management*, Vol. 23 No. 2, pp. 139-154.
- Kannan, V.R. and Choon, K. (2005), "Just in time, total quality management and supply chain management: understanding their linkages and impact on business performance", *Omega*, Vol. 33 No. 2, pp. 153-162.
- Karyda, M., Kiountouzis, E. and Kokolakis, S. (2005), "Information systems security policies: a contextual perspective", *Computers and Security*, Vol. 24 No. 3, pp. 246-260.
- Kline, R.B. (1998), *Principles and Practice of Structural Equation Modeling*, The Guilford Press, New York, NY.
- Kruger, C.J. and Johnson, D.R. (2010), "Information management as an enabler of knowledge management maturity: a South African perspective", *International Journal of Information Management*, Vol. 30 No. 1, pp. 57-67.
- Lee, C.C. and Yang, J. (2000), "Knowledge value chain", *Journal of Development*, Vol. 19 No. 9, pp. 783-793.
- Li, Z., Chaudhry, S.S. and Zhao, S. (2006), "Designing ERP systems with knowledge management capacity", *Systems Research and Behavioral Science*, Vol. 23 No. 2, pp. 191-200.
- Lopez-Nocolas, C. and Soto-Acosta, P. (2010), "Analyzing ICT adoption and use effects on knowledge creation: an empirical investigation in SMEs", *International Journal of Information Management*, Vol. 30 No. 6, pp. 521-528.
- Loukis, E. and Spinellis, D. (2001), "Information systems security in the Greek public sector", *Information Management & Computer Security*, Vol. 9 No. 1, pp. 21-31.
- McAdam, R. and McCreedy, S. (2000), "A critique of knowledge management: using a social constructionist model", *New Technology, Work and Employment*, Vol. 15 No. 2, pp. 155-168.
- McGinnis, T.C. and Huang, Z. (2007), "Rethinking ERP success: a new perspective from knowledge management and continuous improvement", *Information and Management*, Vol. 44 No. 7, pp. 626-634.
- Ma, Q., Johnston, A.C. and Pearson, J.M. (2008), "Information security management objectives and practices: a parsimonious framework", *Information Management & Computer Security*, Vol. 16 No. 3, pp. 251-270.

- Meronó-Cerdan, L.A., Lopez-Nicolas, C. and Sabater-Sánchez, R. (2007), "Knowledge management strategy diagnosis from KM instruments use", *Journal of Knowledge Management*, Vol. 11 No. 2, pp. 60-72.
- Momeni, M. (2012), *Statistical Analysis using SPSS*, Nashr e Ketabe No, Tehran.
- Morabito, V., Themistocleous, M. and Serrano, A. (2010), "A survey on integrated IS and competitive advantage", *Journal of Enterprise Information Management*, Vol. 23 No. 2, pp. 201-214.
- Ngai, E.W.T. and Chan, E.W.C. (2005), "Evaluation of knowledge management tools using AHP", *Expert Systems with Applications*, Vol. 29 No. 4, pp. 889-899.
- POA (2003), *Asset Protection and Security Management Handbook*, Auerbach Publications, POA Publishing LLC, USA.
- Randeree, E. (2006), "Knowledge management: securing the future", *Journal of Knowledge Management*, Vol. 10 No. 4, pp. 145-156.
- Robertson, M. and Hammersley, O.G. (2000), "Knowledge management practices within a knowledge-intensive firm: the significance of the people management dimension", *Journal of European Industrial Training*, Vol. 24 Nos 2/3/4, pp. 241-253.
- Rosemann, M. and Chan, R. (2000), "Structuring and modeling knowledge in the context of enterprise resources planning", in Gable, G. and Vitale, M. (Eds), paper proceeding of the Pacific Asia Conference on Information Systems-PACIS 2000, 2-4 June, Hong Kong.
- Sambasivan, M., Loke, S.P. and Abidin-Mohamed, Z. (2009), "Impact of knowledge management in supply chain management: a study in Malaysian manufacturing companies", *Knowledge and Process Management*, Vol. 16 No. 3, pp. 111-123.
- Scott, J.E. (1998), "Organizational knowledge and the internet", *Decision Support System*, Vol. 23 No. 1, pp. 3-17.
- Sedera, D. and Gable, G.G. (2010), "Knowledge management competence for enterprise system success", *Journal of Strategic Information Systems*, Vol. 19 No. 4, pp. 296-306.
- Shafiei Nikabadii, M. and Khatami Firoozabadi, A. (2009), "The role of integration of processes in Enterprise Resource Planning System in Selection and Implementation of Electronic Business", *Journal of Roshd-e-Fanavari*, Vol. 5 No. 18, pp. 42-47.
- Shafiei Nikabadii, M. and Zamanloo, S.O.Z. (2012), "A multidimensional structure for describing the influence of supply chain strategies, business strategies, and knowledge management strategies on knowledge sharing in supply chain", *International Journal of Knowledge Management*, Vol. 8 No. 4, pp. 50-70.
- Shafiei Nikabadii, M., Jafarian, A. and Jalili Bolhasani, A. (2012), "Effect of information security management on enterprise processes integration in supply chain", *Journal of Information Processing and Management*, Vol. 27 No. 2, pp. 27-44.
- Sher, P.J. and Lee, V.C. (2004), "Information technology as a facilitator for enhancing dynamic capabilities through knowledge management", *Information and Management*, Vol. 41 No. 8, pp. 933-945.
- Siponen, M. and Willison, R. (2009), "Information security management standards: problems and solutions", *Information and Management*, Vol. 46 No. 5, pp. 267-270.
- Taghva, M., Jafarian, A. and Shafiei Nikabadii, M. (2012), "The role of information security management systems to improve supply chain performance", *Journal of Information Science and Technology*, Vol. 27 No. 1, pp. 151-170.
- Themistocleous, M., Irani, Z. and Love, P.E.D. (2004), "Evaluating the integration of supply chain information systems: a case study", *European Journal of Operational Research*, Vol. 159 Nos 2/1, pp. 393-405.

- 
- Tipton, H.F. and Krause, M. (2003), *Information Security Management Hand Book*, 5th Ed., Vol. 2, CRC Press LLC, USA.
- Tseng, S.M. (2008), "The effects of information technology on knowledge management systems", *Expert Systems with Applications*, Vol. 35 Nos 1/2, pp. 150-160.
- Vahedi, M., Nejad Haji, F. and Irani, A. (2011), "Information technology (IT) for knowledge management", *Procedia Computer Science*, Vol. 3, pp. 444-448.
- Woznica, J. and Healy, K. (2009), "The level of information systems integration in SMEs in Irish manufacturing sector", *Journal of Small Business and Enterprise Development*, Vol. 16 No. 1, pp. 115-130.
- Xu, S. and Zhang, W. (2004), *PBKM: A Secure Knowledge Management Framework*, Proc. Workshop Secure Knowledge Management (SKM), New York, pp. 207-212.

#### Further reading

- ISO/IEC 27001 (2005), *Information technology-Security techniques-Information security management systems – Requirements*, British Standards Institution, UK, 1st Ed.
- ISO/IEC 27005 (2008), *Information technology – Security techniques-Information security risk management*, British Standards Institution, UK, 1st Ed.

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