

Knowledge sharing in technology-intensive manufacturing organizations

Analytic hierarchy process approach

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Abstract

Purpose – This purpose of this paper is to identify and prioritize the critical factors impacting knowledge sharing (KS) in technology-intensive manufacturing organizations in the United Arab Emirates (UAE) and to propose a decision-making framework for KS.

Design/methodology/approach – Analytical Hierarchical Process method is used to identify these critical factors impacting KS in technology-intensive manufacturing organizations in the UAE.

Findings – Results show that organizational leadership and culture are the most critical factors impacting KS in the technology-intensive manufacturing organizations.

Research limitations/implications – The data are collected from technology-intensive manufacturing organizations in the UAE; therefore, these cannot be generalized to other locations. Future research in different countries is required.

Practical implications – To implement successful KS practices in technology-intensive manufacturing organizations, it is essential that all impacting factors and sub-factors are well understood within the organizations.

Originality/value – This study is among the first studies in the region that presents a comprehensive framework for KS in manufacturing sector.

Keywords Manufacturing, Knowledge sharing, Contingency theory, Critical factors, Analytic hierarchy process, Technology-intensive organizations

Paper type Research paper

1. Introduction

Knowledge Sharing (KS) is a mean and a process by which individuals and groups communicate their knowledge unconsciously or deliberately within the organization (Nooshinfard and Nemati-Anaraki, 2014). KS has extraordinary significance for organizations working in various businesses and at various levels since it enhances the ability of the general employees' population to address various issues and concerns. However, competitive and creative organizational environments have made it a challenging task to ensure that KS is effective and efficient (Kumar *et al.*, 2013). In dynamic world economy, KS has become significant but complex phenomenon, as stated by Al-Azri *et al.* (2010) who indicate that the field still requires a concrete and comprehensive understanding of the key factors affecting KS effectiveness.

The KS practices in UAE organizations are of great importance as the UAE gains the attention of technology users, specifically in the global manufacturing sector. There are currently numerous projects initiated by foreign technology firms in the UAE that have distinct levels of knowledge and styles from UAE organizations. The UAE is a developing country that has come a long way in building an open knowledge-based economy in recent years by taking advantage of the economic benefits of its vast oil resources, as stated by Katsioloudes and Brodtkorb (2007). The UAE government is implementing initiatives in



developing human capital and knowledge resources by emphasizing education, training and research investment. As a result, the UAE has been recognized in the region with significant local and foreign investment in recent years in the domains of information technology, telecommunication, infrastructure, power resources and education. Despite such investment and infrastructure development, local organizations are reluctant to adopt and implement KS framework in business processes (Yeo *et al.*, 2010).

So, this research is designed by composing multi-criteria decision-making framework for KS factors and sub-factors to identify and prioritize the most critical factors impacting KS in technology-intensive manufacturing organizations in the UAE. To deal with the complexity of the multi-criteria decision-making process, the analytical hierarchical process (AHP) method is used. The research question derived in this study is:

RQ1. What are the key factors affecting KS practices within technology-intensive manufacturing organizations?

This paper is organized as follows. The next section discusses the related theory. In Section 3, the research methodology is explained. Section 4 highlights the preliminary findings and Section 5 concludes the study.

2. Knowledge sharing key factors with theoretical lens

Bartol and Srivastava (2002) defined KS as the sharing of organizationally relevant information, ideas, suggestions and expertise among the organization's employees. This can be through individuals or groups. As stated by Kumar *et al.* (2013), KS is an important aspect of the business world today as it focuses on project management, organizational performance and the innovation capacity of the organization. Moreover, Chyi Lee and Yang (2000) identified that KS is a positive force in creating innovation in organizations when there is a positive socially interactive culture within the organization. KS is influenced by many factors, ranging from organizational leadership (OL), organizational culture (OC), organizational strategy (OSY), organizational structure (OST), organizational process (OP), corporate performance (CP), human resource management (HRM), technology infrastructure (TI) used in the organization, and employee engagement (EE) to organizational KS practices (Syed-Ikhsan and Rowland, 2004; Al-Khouri, 2014; AlShamsi and Ajmal, 2018). To ensure effective KS requires improving how organizations treat these factors and drive effective KS practices. Following section will elaborate these factors through theoretical lens.

Organizational leadership (OL)

Singh (2008) explains that KS as part of OL can be understood by exploring the concepts of integrity, decision-making and ability to change within organizations. Today's competitive and creative organizational environments have made it a challenging task to ensure that KS and its transfer process are effective and efficient. Farkas (2003) further explains that leadership is all about cooperation, trust, integrity and sharing. Trust and integrity capture how team members can be inspired and motivated by leaders who they trust and respect, specifically, in the project environment (Park and Lee, 2014). The qualities of leaders and their leadership styles are what determine the success of the KS process, as leaders must win the trust of their team members to enable effective KS practices.

According to Debowski (2005), KS is overall a critical and complex process, which is inadequate without an effective knowledge leader who shares the trust and coaches team members toward the organization's knowledge agenda. Kumar *et al.* (2013) stated that leaders engender organizational change through insights and decision-making, and through such skills leaders become more valuable to their organizations in leading team members toward organizational goals. In such scenarios, a leader with strong decision-making ability has the aptitude and power to influence the process of KS inside the organization and

influence the activities that affect the process. They further discuss that decision-making involving effective communication and attention helps in transforming information into KS; therefore, the decision-making abilities of the leader are essential to the KS process. Ultimately, decision-making will ensure that the organization is using its embedded knowledge to create new knowledge for its benefit (Gelard *et al.*, 2014).

In terms of the importance of the ability to change, as per Higgs and Dulewicz (2016), they state that one of the success factors of a leader is his/her ability to lead team members toward organizational goals, especially in a rapidly changing environment. Organizational change is a dynamic phenomenon occurring rapidly as businesses become increasingly more competitive and global. Hollenbeck *et al.* (2015) suggest that transformational leadership can influence employee reactions during the period of organizational change in the environment.

Finally, the path-goal theory was used to support this factor because this theory is one of the important theories of leadership which is considered a contingency approach toward leadership. According to the notion of path-goal theory, leaders play an important role in supporting their followers to accomplish the organizational goals using the specific paths. The behaviors and styles of leaders tend to influence the motivation of the followers toward their paths of organizational goals (Northouse, 2015; Yang and Lim, 2016). Leaders using the path-goal theory tend to have the ability to persuade the behaviors and attitudes of the subordinates to share their knowledge in the organization. Therefore, the OL as a predictor of the KS is also influenced by the notion of the path-goal theory.

Organizational culture (OC)

OC is the framework where the functions, strategies and procedures of the organization are carried out and cannot be ignored (Williams and Glisson, 2014). Al-Alawi *et al.* (2007) state that KS is strongly influenced by OC, as the culture shapes the organization and the behaviors of leaders and employees within that organization. Al-Adaileh and Al-Atawi (2011) studied the impact of OC on KS. Their research findings illustrated that when organizations promote a culture of teamwork and openness through employee involvement and a reward system, it tends to positively affect KS among organizational members. According to Cummings' (2004) research, organizations with collectivist cultures overcame various factors affecting KS through teamwork, problem clarity and innovativeness. Therefore, openness and teamwork, as aspects of an organization's culture, significantly affect KS. In addition, Al-Khouri (2014) found that the overall environment in the Emirates ID organization was encouraged by teamwork and collaboration, which improved KS practices in general.

Collaboration in the OC means having more flexibility and closely connecting employees working together. Brown and Frame (2016) identified collaboration as one of the strongest mechanisms for lowering barriers to effective interaction impacting organizational KS. In addition, Smith and Laycock (2005) and Alshamsi *et al.* (2017) explained that collaboration captured the spirit of KS and represented a strong factor supporting KS within the organization. Many studies have found that management support improves KS in the organization. Lam and Lambermont-Ford (2010) found that top management supported KS activities by motivating employees and practices through the sharing of their knowledge with other employees. Moreover, Ekore (2014) further discussed that management support should not stop in the planning stage, but they should also participate in KS activities with employees to set a good example. The motivation and support from management participation would enhance CP and the overall KS process. Finally, the organization's learning culture, which significantly influences the KS process and causes it to be preserved and retained even after the completion of the project (Duffield and Whitty, 2015), shows a strong link to knowledge to sustain innovation capabilities in the organization as well as training as suggested by Moustaghfir *et al.* (2013).

The competing value framework theory (CVF) is widely used in order to assess and diagnose a culture and its characteristics. The study and analysis of this CVF helps in understanding the assumptions of the organizational members which tend to influence their behavior. According to Hartnell *et al.* (2011), based on CVF theory, the clan culture is the strongest facilitator of KS in an organization. Similarly, the hierarchy culture which is characterized by strong internal focus and considerable predictability tends to put more emphasis on the management of information in the organization (Suppiah and Singh Sandhu, 2011) therefore the CVF used to support the OC factor.

Organizational strategy (OSY)

Zack (1999) has suggested that OSY should be aligned with organizational knowledge in a way that can define business strategy. Moreover, this approach, therefore, considers KS as a process that optimizes creation, sharing and market leverage of knowledge assets and core capabilities of the organization. OSY is all about having a clear mission and vision, planning the strategies and policies that govern the acquisition and allocation of resources to achieve organizational goals and, at the same time, consider the risk and manage that risk (Yeh *et al.*, 2009). The first identified sub-factor is vision and mission, which create significant value in terms of strategic initiatives in any organization. In research conducted by Maier and Remus (2002), they conclude that many organizations do not link knowledge management (KM) strategy with OSY in today's business world. They indicate that this is a result of not having the expected fruitful KS activity results because they were not appropriately linked to OSY. Moreover, Du Plessis (2007) stated that OSY was identified as a key asset that drives the organization's vision and mission and business results, making such knowledge a valuable asset to the organization. Risk taking is considered along with project knowledge because, in the life of the project, the project managers do not want to repeat a mistake. Thus, they want to manage risks based on their KS library (Bresnen *et al.*, 2004). Organizations that are knowledge focused tend to develop the ability to manage risks effectively. Such knowledge focused organizations have better KS practices by managing and reducing risks (Tah and Carr, 2001). For successful KS implementation, it is crucial for the organization to align KS with strategic planning (Rodgers *et al.*, 2001). In addition, Huang (2009) found that strategic planning required a knowledge base system within the organization to have a successful OSY and identified strategic planning as a success sub-factor. The final sub-factor here is organizational policy, as the policy in the organization plays the effective role of either promoting or inhibiting KS. Miles (2005) found out that policy or regulation changes may impact KS. Fountain (2004) stated that to encourage inter-organizational KS, the roles of policy and decision makers in the organization were crucial. Therefore, the organizational policy as part of OSY can support and promote KS in an organization.

The role of knowledge-based theory in OSY is to encourage the individuals in an organization to promote their learning and share their knowledge with others in the organization. Hamel and Prahalad (2005) explained that, organizational strategies affect the inclination of the organizational members to share knowledge and develop knowledge assets which in turn help the organization in creating a sustainable competitive advantage and that is why it has been used to support the strategy factor.

Organizational structure (OST)

Hedberg *et al.* (1997) explain that the OST refers to the framework in which different organizational activities are allocated and managed across the workforce. The structures of organizations are determined by firm size and formalization, centralization and integration strategies; and, all these factors influence organizational KS practices (Andrews and Kacmar, 2001). When talking about OST, firm size and formalization are the two most important factors that tend to affect the KS process. Zheleva and Viklund (2014) discuss the fact that a

large OST means more employees and a larger communication network. The larger the network, the more chances of being misunderstood. Firm size is directly related to the innovative knowledge in an organization, as stated by Dobrai *et al.* (2012). This is because the larger the firm, such as a multinational, the more sources of new knowledge it has. Formalization refers to the level of coding rules and procedures that guide the behavior of employees (Zhang *et al.*, 2014). This structure arises from complex organization frameworks that require clearly defined and specialized roles for employees in the organization. As stated by Chen *et al.* (2010), formalization is negatively affected KS practices in organizations because of the lack of collaborative culture as knowledge and learning become divided.

The centralized authority provides direction to the company and is responsible for all strategic planning and decision-making in the organization. Such a structure can be beneficial for KS and the sharing process as knowledge generation will be centralized. Zhang *et al.* (2014) examined the impact of the OST on KS; their findings reflect that when the OST is less formalized and less centralized, it facilitates a much better approach to KS. Moreover, OST characterized by integration tends to positively influence KS in an organization. Moreover, Willem and Buelens (2009) illustrated that the impact of collaboration on KS depends on the kind of coordination mechanisms used in the organization, and this closely relates to other OST dimensions like centralization. Many publications on KS show that a networked OST is more favorable to KS because it promotes greater integration of employees and enhances the flow of knowledge (Valio Dominguez Gonzalez and Fernando Martins, 2014). Another study found that KS creates a complex differentiation in integration, strongly embedded in its context, thereby improving KS activities (Willem and Buelens, 2009).

The contingency theory of organization proposes that; no organization can have a same size or structure. The structure of an organization depends on certain factors such as the environment in which it operates, the strategy of the organization, market and environmental situation and technological factors. All of these factors tend to influence the way in which these organizations operate and also determines its structure and size. The contingency theory was proposed in order to elaborate different factors of the OSTs and the organization changes which might occur as a result of the changes in internal and external environment. As explained by Birkinshaw *et al.* (2002), the significance of the KS can be explained with the help of the contingency theory.

Organizational process (OP)

There have been various studies on the relation between OP and KS and how they influence each other. Pagell (2004) stated that the organization cannot put knowledge into action without proper processes and, based on Nonaka and Takeuchi's knowledge creation theory in OP, there are four OP sub-factors: socialization, externalization, combination, and internalization. Gupta and Govindarajan (2000) defined socialization as the level of interaction and communication among various actors within and between organizations, which leads to building a base of understanding or improved communications and problem-solving. To promote KS in an organization, KS requires social interaction among employees in a way that facilitates the KS in the organization (Chang *et al.*, 2012). Externalization is another sub-factor that converts tacit knowledge into explicit knowledge through articulation. The transformation of tacit knowledge into explicit knowledge helps in the sharing of knowledge through written documents, images, or other records. Therefore, it becomes easy to share knowledge through the process of externalization (Nonaka and Toyama, 2015). The notion of "combination" and its relationship with knowledge creation and sharing has been elaborated on by Chang *et al.* (2012). They are of the view that knowledge in an organization is stored in the form of documents. Knowledge is also stored in the minds of the individuals in the form of tacit knowledge. Therefore, the "combination" and communication of the learning of individuals helps in creating and sharing knowledge

in the organization (Bratianu, 2016). Finally, internalization can be described as the process in which individuals transfer and share knowledge with each other and internalize the information through a collaborative knowledge building approach. Moreover, the staff who use the internalized information then help in the creation of new knowledge in the organization. Internalization helps in the creation of new knowledge through the expansion of existing knowledge, which leads to an increase in individual learning (Bratianu, 2016).

Corporate performance (CP)

The relationship between KS and improved CP has been studied by Fugate *et al.* (2009). They found that effective KS processes improved CP in general. In other research by Choi and Davis, they studied the relationship between KS and CP and specify three types of relationships. The general findings of the study indicated that KS had a positive relationship with CP as it increased CP when the organization implemented a strong KS process (Choi *et al.*, 2008). Thus, KS relates to the financial performance of the organization. As stated by Moore (2010), “the ability to effectively manage and share knowledge had a positive impact on organizational efficiency and innovation which led to increased financial performance.” Customer satisfaction has been regarded as an important indicator of CP and organizational financial performance in general. In the research by Gilley *et al.* (2004), they study how effective training can improve employee knowledge and how this increases the levels of CP, thus leading to higher financial performance and improved customer satisfaction as well. In addition, Srisamran and Ractham (2014) stated that KS plays an important role in providing relevant information to customer relationship management to improve customer satisfaction and loyalty. Therefore, it can be stated that KS has an association with customer satisfaction as well because the organization needs to know its customers and what they want. Finally, competitiveness of the organization is another factor that determines the degree to which a firm performs better. As stated by Holsapple *et al.* (2007), KS is a must for the organization to maintain competitiveness. Moreover, KS can improve CP as it makes the organization more competitive in delivering value to its customers, employees, and stakeholders. Finally, as stated in another study, KM and effective utilization of HRM and ICT lead to an increase in organizational competitiveness and economic performance (Schiuma *et al.*, 2012).

The notion of the stakeholder’s theory proposes that; it is the responsibility of the firms to maintain a balance among the interests of a range of the stakeholders. When it comes to measuring the CP, there are various dimensions including knowledge on which the organizational performance can be measured.

Human resource management (HRM)

Jimenez-Jimenez and Sanz-Valle (2012) explored the relations between KS and HRM in knowledge-oriented organizations. They showed that personnel requirements and training programs in terms of knowledge are needed by the organization’s employees. In addition, Tan and Nasurdin (2011) show how the relation with KM effectiveness mediates the relationship between HRM practices and organizational innovation. They found that the relationship was positive, where HRM practices enhanced KM, which then improved organizational innovation. Additionally, as per Soliman and Spooner (2000), recruitment/ selecting can assist by selecting staff with the right KS culture mindset and backgrounds to support KS activities. KS is an essential part of the training process of the employees carried out by the HRM team, as stated by Sammarra *et al.* (2017). Moreover, Matsumoto *et al.* (2005) found that training was a very important factor, particularly in the engineering and technology-intensive sector; for demographic and education reasons, intergenerational transfer of industrial knowledge among engineers was the weak link that required extra training effort. Finally, rewards are another HRM sub-factor that encourages employees to enhance their collective performance such as creating a sense of cooperation, ownership,

and commitment; however, tangible rewards are not always effective as employees look for encouragement to contribute to KS in the organization (Razmerita *et al.*, 2016). In addition, Wang and Hou (2015) found that rewards had a positive impact on KS by motivating employees and making them feel appreciated and valued. This, in return, enhances the willingness of the employees to contribute to effective KS and their performance in general.

The role of the HRM is crucial in the knowledge-based economy as the skilled and well-trained individuals are the ones who are carriers of the knowledge and transfer the knowledge in the organization. The human capital theory proposes that, in order to produce economic and business gains for the individuals as well as organization, the individuals in an organization needs to be skilled, competent, and possess adequate of knowledge which in turn help them to perform better (Becker, 1975) and this make this theory perfect fit with the purpose of this research.

Technology infrastructure (TI)

The technology acceptance model (TAM) plays a vital role in understanding the link between KS and the organization. As stated by Chris Evans *et al.* (2014) and Tsui and Malhotra (2005), TI in KS enables the organization to become more knowledge-intensive and enhances the process of KS among employees and with customers. Through technology tools, the organization can create effective communications with its customers. Davis *et al.* (1989) proposed that the TAM could show different stages in which users accepted and then became able to utilize the TI. As per this model, there are four factors that affect technology acceptance and its utilization. Organizational KS also depends on those factors as defined in the TAM because technology is required to support KS activity within the organization. Davis *et al.* (1989) and Hendrickson *et al.* (1993) found that the KS process in relation to new technology also depends upon the reliability of the technology for users.

Flocco (2015) found that an organization's employees were not aware of what they did not know and thus, their decisions and attitudes were based on the limited information available to them. Chris Evans *et al.* (2014) stated that implementing the latest technology can also be relatively advantageous for organizational KS strategy. Implementing the latest technology allows the organization to vie with competitors and gain an extra advantage in terms of serving customers and achieving appropriate optimization strategies. Davis *et al.* (1989) believe that the TAM is based on user perceptions about the usefulness and ease of use of the technology for a specific purpose. It implies that users should be convinced of ease of use or user-friendly nature of the technology to assure a higher level of technology acceptance; this they will also assist in the acceptance of the KS process (Davis *et al.*, 1989; Evans *et al.*, 2014).

Employee engagement (EE)

There is no general definition of EE. However, Perrin's (2003) Global Workforce Study uses the following: "employees" willingness and ability to help their company succeed, largely by providing discretionary effort on a sustainable basis. This could be described as the positive attitude of the employees regarding their employer and organization. Employees who are engaged with their organizations tend to reflect a positive attitude toward the values of the organization. In a research study conducted by Markos and Sridevi (2010), they found that EE was linked to CP outcomes and organizations with engaged employees had higher employee retention based on reduced turnover and intention to leave the organization; thus, they maintained better productivity, profitability, growth and customer satisfaction. The first sub-factor of EE is growth opportunity, which was defined by Kular *et al.* (2008) as employees having enough variety, opportunities to learn, and independence, as well as the ability to move ahead within the organization in terms of remuneration, training, and career opportunities. They suggested that work engagement among employees can increase if

training and career growth and development programs are introduced that facilitate the personal growth and development of the employee. Other research stated that growth opportunities and development would increase employee willingness to dedicate more effort and this would result in achieving the organizational goal of having effective KS practices (Bakker and Demerouti, 2008). In terms of the working environment, this significantly affects EE in KS. As explained by Coradi *et al.* (2015), a multi-space work environment tends to positively influence and promote KS in the organization. In addition, Bakker *et al.* (2012) identified the drivers of EE in the organization as based on relationships with others to complete the work and a social environment which enables the employee to be highly engaged in different elements in the organization. Trust in the organization has been identified as an antecedent of KS in the organization. As stated by Seijts and Crim (2006), employees like to feel proud of their jobs, their performance and their organization because they trust their organization. Their research findings revealed that engaged employees believe that they can make a difference in the organization by having confidence in the KS, skills, and abilities of both themselves and others. Other research suggests that the nature of the organization involvement and the source of knowledge, as well as type of trust promoted in the organization, are crucial for KS (Niu, 2010). Finally, self-worth or self-efficacy, which has been defined as the employee's belief in his/her capability to meet task demands in the work context, will be measured with the general self-efficacy of the organization scale (Chen *et al.*, 2001). In another study by Bakker and Demerouti (2008), the relationship between personal resources and employee work engagement was investigated. Individuals with high self-efficacy believe in themselves and thus, they tend to fulfill organizational demands and expectations in a broad manner by depicting high levels of engagement.

Employee's engagement has been found to be linked with the theories of motivation in the organizational contexts. Employee's engagement refers to the degree to which employees are committed and dedicated toward the organization in which they are working (Sundaray, 2011). Frank *et al.* (2004) are of the view that, the classical theory of motivation is related to the employees' engagement. The Maslow's need for hierarchy theory and Herzberg's two factors theory are found closely related to employee's engagement.

Based on previous research and related theories, the factors and sub-factors impacting organizational KS are illustrated in Figure 1.

3. Methodology

The manufacturing sector was chosen as the subject of this research because the relationship of KS and its processes within the manufacturing sector can be realized based on the fact that knowledge relies on human actions (Davenport and Prusak, 1998). In the future, manufacturing companies will need to be able to effectively utilize their knowledge and reuse it for innovation and for attaining a sustainable competitive advantage (Hung *et al.*, 2005). Aluminum manufacturing was selected as the field of study, specifically because this field heavily uses technology in the manufacturing process and could be recognized as technology-intensive (Brown *et al.*, 1995). In the Gulf region, the extensive growth and development in infrastructure have given rise to an increase in the demand in the aluminum manufacturing sector. Due to this, the UAE has become a hub for aluminum. The aluminum industry of the UAE is growing at a rate of 8.4 percent annually. Whereas the average growth rate of the global aluminum sector is 3.7 percent per year. In the future, there is a solid chance for further growth in the UAE aluminum industry because of several reasons such as an easy recycling aluminum process, and the UAE's high infrastructure development demand, which increases aluminum demand along with other building materials (Anwar, 2016). The UAE government is implementing critical initiatives to boost the growth of its aluminum manufacturing sector, which in turn, will enhance its competitiveness. However, there is a need for effective KS in the UAE aluminum manufacturing sector to promote its future growth.

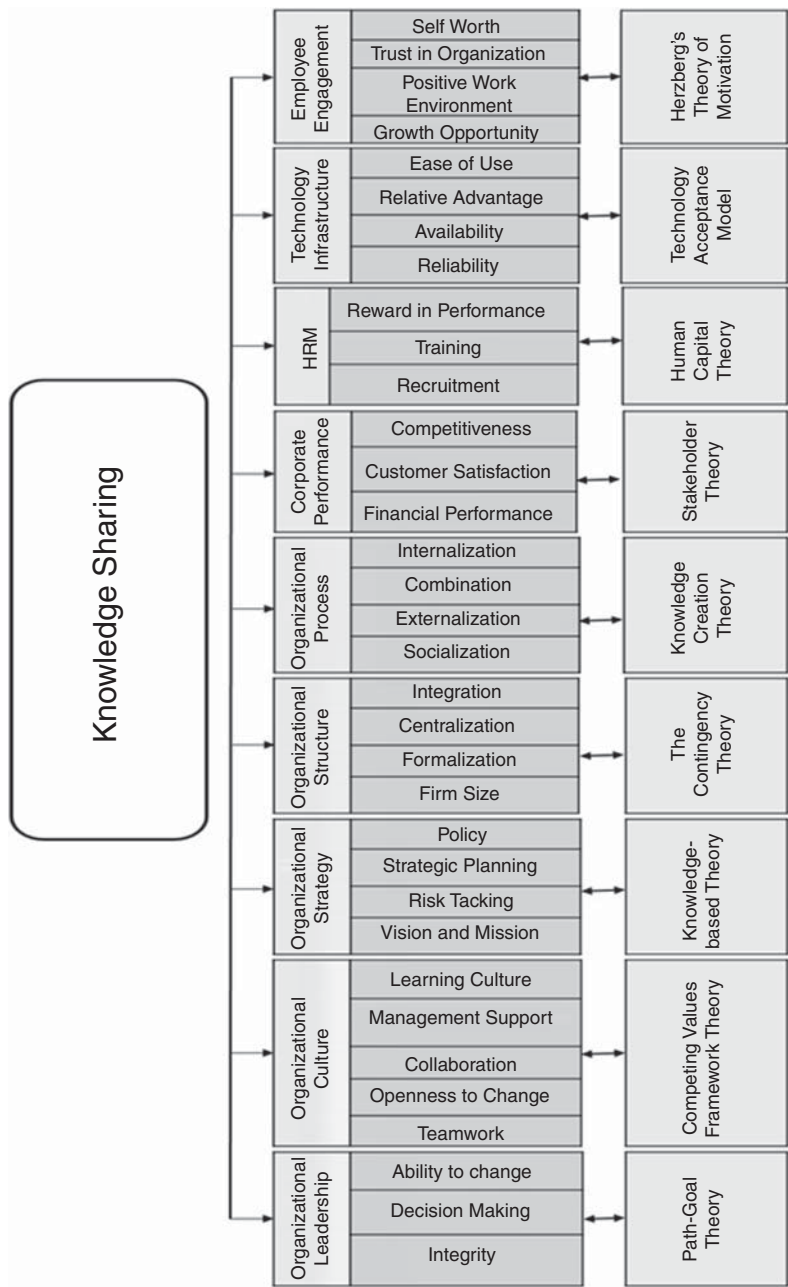


Figure 1.
Factors and sub-
factors impacting KS
with theoretical lens

Constructing analytical hierarchy process

This research builds a multi-criteria decision-making model for KS in technology-intensive manufacturing organizations. Therefore, this research builds an analytical hierarchy process. In which the classification of the goal and all other decision criteria and variables are presented at three major levels. The highest level of the hierarchy is the overall goal, namely, to select the competitive criteria that impact KS in technology-intensive organizations. Level 2 represents the criteria and sub-criteria factors used in selecting the KS factors. Based on the literature review, nine factors are identified, and these are the basic criteria for measuring the competitive dimensions of KS at UAE technology-intensive manufacturing organizations. Level 3 contains the decision sub-criteria that affect the critical selection of the KS factors. For each main criterion, there are three to five different sub-criteria; based on the literature review. The hierarchy of the AHP for evaluating KS criteria is as shown in Figure 2.

After building the AHP hierarchy, the next phase is evaluation and data collection. The data were collected from technology-intensive organizations that had an interest in the knowledge transfer practice in the UAE; additionally, these were large organizations with 5000 or more than employees, as defined by Dwivedi *et al.* (2009). The questionnaire was designed on a nine-point scale, as suggested by R.W. Saaty (1987); based on the hierarchy of the AHP, there are nine main criteria or factors of KS and a total of 34 sub-criteria or factors under those main factors to evaluate the factors impacting KS in technology-intensive organizations, as shown in Figure 2.

Analysis and results

The next step in the AHP is to determine pair-wise comparisons among the criteria applied. For determining pair-wise comparison criteria, Saaty (1987) suggested a nine-point scale, as shown in Table I.

In defining pair-wise comparisons, for example, if a company identifies leadership moderately more important than technology, the former is rated “3” and the latter “1/3” in this comparison, and so on. To check the consistency, the consistency index (CI) is applied. Saaty (1987) defined consistency as follows:

$$\text{Consistency Index(CI)} = (\lambda \max - n)/(n-1),$$

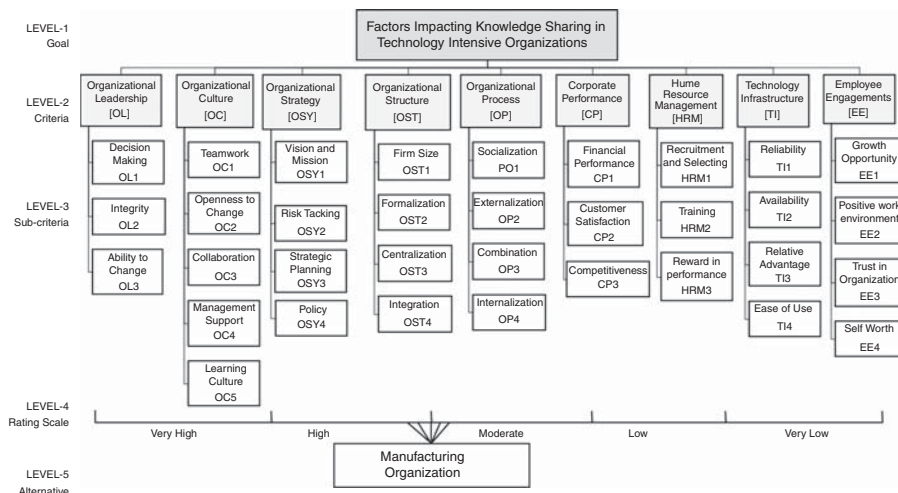


Figure 2. Analytical hierarchy process for KS key factors

$$\text{Consistency Ratio(CR)} = \text{CI/RI}.$$

To find the computing “priority vectors”, Saaty (2008) introduced the consistency principle for calculating priority vectors. As stated by Anish Sachdeva *et al.* (2015),

Importance of definition explanation	Definition	Explanation
1	Equal importance	Two criteria contribute equally to the objective
3	Moderate importance	Judgment slightly favors one over another
5	Strong importance	Judgment strongly favors one over another
7	Very strong importance	The criterion is strongly favored, and its dominance is demonstrated in practice
9	Absolute importance	Importance of one over another affirmed on the highest possible order
2, 4, 6, 8	Intermediate values	When compromise is needed

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

Note: n is number of factors

[illegible]

the consistency principle equation is ($a_{ik} = a_{ij}.a_{jk}$) and the subsequent argument for using the special case of the consistency matrix formed by elements is $a_{ik} = w_i/w_j$, where w_i and w_j are the elements of the priority weight corresponding to criteria i and j , respectively. As per the result in the last columns of Table IV, the OL factor has the highest weight (0.172) impacting KS, followed by OSY (0.150) and OC (0.139), which are competitive priorities, then CP (0.104), HRM (0.038), OST (0.95) and TI (0.092). The least important factors were OP (0.084) and EE (0.069). All of these results certainly reveal some underlying issues, and these will be discussed in more detail in the next part in terms of their specific effects on KS to better understand the factor in general.

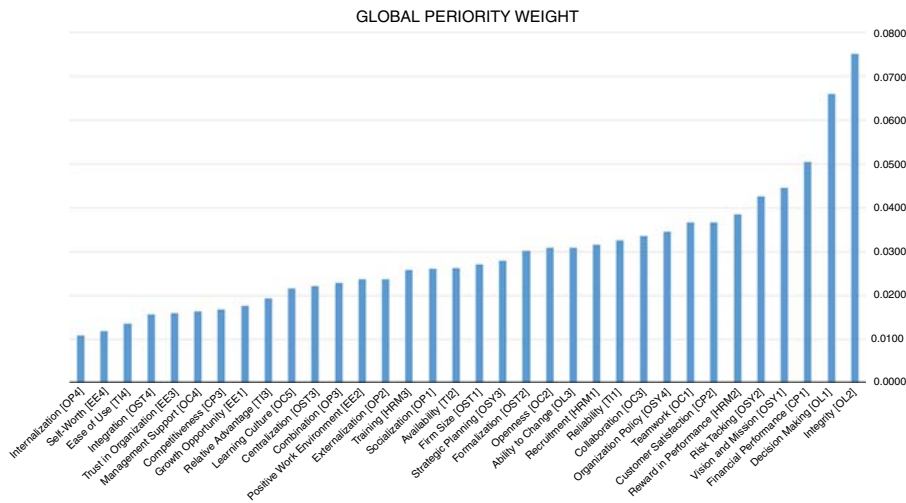
The results of the criteria priorities were accepted because they were equal to or less than 0.1 and thus acceptable as defined by Saaty (1987), and the last step in AHP method is to define the relative priorities of the criteria and the global priority weights of the sub-factors, as shown in Figure 3.

4. Discussion and implications

The result of this study showed that the most significant factors that tend to influence KS in an organization include OL, OSY and OC. On the other hand, factors such as CP, HRM, OST and TI have, are also factors with average impact on the KS in an organization. Factors OP and EE showed the weakest impacting factors toward the KS in the organization. The results of the data analysis indicate that, of all the other variables, OL was found to be the most significant factor in promoting KS, because the organization leadership was found to be the predictor of KS and team efficacy which leads to an increase in the performance of teams in an organizational setting. In the same manner, when the leadership in an organization is strong and effective, it helps in developing trust among the organizational members and motivates them to share their knowledge with each other, which then leads to an enhanced CP (Paliszkiewicz *et al.*, 2014). In addition, the results also reveal that OL needs to be considered in the day to day operations as well to facilitate KS in the organization due to its importance in KS productivity. Also, in a current research study, OSY has been considered as the second most significant factor affecting the KS in an organization. The KS strategy of an organization needs to be aligned with the OSY, similarly, Garud and Kumaraswamy (2005) necessitated the integration of an agile OSY with the KS strategy of an organization. Their research findings suggest that, without agile OSY, the inflexible organizational practices can make it difficult to create, share and utilize the knowledge. The third highest impacting factor was the OC factor which could leverage knowledge and promote KS and is considered as a source of competitive advantage. If the OC is not facilitating sufficiently, then it might affect the ability of the organizational members to share knowledge. As suggested by Kayworth and Leidner (2004), the OC plays a significant role in creating the knowledge as well as leveraging it. In this research, OC has been considered as one of the most significant factors influencing the KS in an organization. Regarding the factors with average impact on the KS, as CP which has been identified as the fourth most significant factor influencing KS in an organization. According to Gold *et al.* (2001), CP can be enhanced through the use of KS elements such as knowledge acquisition, storage, sharing and transfer through for deployment of knowledge infrastructure. Moreover, Ho (2008) has stated that KS helps the organizations in achieving sustainable competitive advantage because of the enhanced organizational performance, for instance, compensation management as an HRM practice significantly affects the KS behavior of the employees in an organization (Zárraga and Bonache, 2003). TI has also been identified as an average factor affecting KS in an organization and its result is not acceptable especially as the survey was conducted in manufactory field which uses hi-end technology. Ryan *et al.* (2010) explained that use of advanced technological infrastructure in the form of an intranet system allows employees to collaborate and interact with each other, which in turn helps in

Table IV.
Global priority
weights of KS sub-
factors in technology-
intensive
organizations

Sub-criteria	(OL1)	(OL2)	(OL3)	Global priority weight	Rank		
(OL1)	1	1.21	1.57	0.066	2		
(OL2)	0.83	1	3.47	0.075	1		
(OL3)	0.64	0.29	1	0.031	13		
CR = 0.09							
Sub-criteria	(OC1)	(OC2)	(OC3)	(OC4)	(OC5)	Global priority weight	Rank
(OC1)	1	1.33	0.67	2.52	2.59	0.037	8
(OC2)	0.75	1	1.84	0.94	1.60	0.031	14
(OC3)	1.49	0.54	1	1.17	3.06	0.0336	10
(OC4)	0.40	0.54	0.85	1	0.51	0.0164	29
(OC5)	0.39	1.06	0.33	1.98	1	0.022	25
CR = 0.09							
Sub-Criteria	(OSY1)	(OSY2)	(OSY3)	(OSY4)		Global priority weight	Rank
(OSY1)	1	1.73	1.80	0.64		0.045	4
(OSY2)	0.58	1	1.89	1.74		0.0426	5
(OSY3)	0.56	0.53	1	1.27		0.028	16
(OSY4)	1.57	0.53	0.79	1		0.0345	9
CR = 0.10							
Sub-criteria	(OST1)	(OST2)	(OST3)	(OST4)		Global priority weight	Rank
(OST1)	1	1.33	1.25	1.28		0.027	17
(OST2)	0.75	1	1.64	2.78		0.0302	15
(OST3)	0.80	0.61	1	2.06		0.022	24
(OST4)	0.78	0.61	0.49	1		0.0157	31
CR = 0.10							
Sub-criteria	(OP1)	(OP2)	(OP3)	(OP4)		Global priority weight	Rank
(OP1)	1	1.85	0.81	2.21		0.0261	19
(OP2)	0.54	1	1.62	2.44		0.024	21
(OP3)	1.23	0.62	1	2.47		0.0229	23
(OP4)	0.45	0.62	0.41	1		0.0109	34
CR = 0.10							
Sub-criteria	(CP1)	(CP2)	(CP3)	Global priority weight	Rank		
(CP1)	1	1.75	2.42	0.050	3		
(CP2)	0.57	1	2.80	0.037	7		
(CP3)	0.41	0.36	1	0.017	28		
CR = 0.05							
Sub-criteria	(HRM1)	(HRM2)	(HRM3)	Global priority weight	Rank		
(HRM1)	1	1.12	0.90	0.0315	12		
(HRM2)	0.90	1	2.07	0.038	6		
(HRM3)	1.12	0.48	1	0.026	20		
CR = 0.09							
Sub-criteria	(TI1)	(TI2)	(TI3)	(TI4)		Global priority weight	Rank
(TI1)	1	2.21	1.43	1.65		0.0326	11
(TI2)	0.45	1	2.06	2.26		0.0263	18
(TI3)	0.70	0.49	1	1.86		0.0193	26
(TI4)	0.60	0.49	0.54	1		0.014	32
CR = 0.08							
Sub-criteria	(EE1)	(EE2)	(EE3)	(EE4)		Global priority weight	Rank
(EE1)	1	1.39	0.88	0.97		0.0177	27
(EE2)	0.72	1	2.22	2.56		0.0237	22
(EE3)	1.14	0.45	1	1.74		0.0159	30
(EE4)	1.03	0.45	0.57	1		0.0118	33
CR = 0.10							



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Figure 3. Global priority weights of KS sub-factors

the transformation of individual knowledge into organizational knowledge. Technological infrastructure encompasses the system, platform, and tools along with internet capabilities which facilitate processes including KS (Chong *et al.*, 2010). According to the findings of the survey, the effect of the OP and EE turned out to be a low impacting factor and this result required more attention from organizations to improve both factor contribution toward organizational KS, because this result is contrary comparing to previous research findings which have reflected a stronger association between both OP and EE toward KS in an organization. On the contrary, research findings of Nakano *et al.* (2013) reflected that providing an engaging environment to the employees helps in developing EE which in turn leads to KS, also in the same study, it shows the importance of having OP which should support knowledge creation and records.

The in-depth analysis of each one of the factors revealed a set of sub-criteria/sub-factors with high impact within its group and as per the result of global priority weight shown in Figure 3. The highest impacting sub-factors were the trust/integrity (OL2) and decision-making (OL1) which were identified as sub-factors of leadership (OL). Both showed the highest impact on KS because KS is an entirely human-based process and as such being social based requires that leadership develops social and communicative competences. Trust and integrity as social values, perceived by employees on their leaders, can enable opportunities for knowledge creation and application, and at the same time contribute to building trust inside an organization (Park and Lee, 2014). Another important consideration is the expectation that members of an organization have, regarding that the process of KS generates decision-making actions (Brown and Frame, 2016). If the flow of information does not trigger decisions, it can be perceived as worthless and unnecessary, so it was usual to have this result from the survey which is matching the literature found. Financial Performance (CP1) sub-factor which had been identified under the CP main factor also showed the third highest impacting sub-factor, and such result is acceptable as per the literature. Moreover, it is expected because the survey was implemented in a revenue-driven organization, and for better financial performance the organization should focus to have better learning and KS procedures because they have a positive relationship toward financial performance (Kim *et al.*, 2017). The findings also show that the Vision and Mission (OSY1) sub-factor which had been identified as a fourth highest impact sub-factor under the main factor of OSY, is a clear link between all the KS processes and KS outcomes. It will allow the

organizations to develop a clear metric on how their knowledge processes can be managed and systematically evaluated (Ramachandran *et al.*, 2008). Finally, the Risk-Taking (OSY2) sub-factor under the main factor OSY has been identified as the fifth highest impact sub-factor and this result also shows an accepted result because the survey data were collected from manufacturing organization which considers risk as a major factor that should be studied carefully before start (Brouthers and Brouthers, 2003). Above findings illustrate how these factors and sub-factors are very important to organizational KS which needs more attention from those organizations that are looking to attain effective KS practices.

These results indicate that OL is the most significant factor to influence the KS in the technology-intensive organizations of the manufacturing sector. These findings can be related to the research findings of Paliszkievicz *et al.* (2014) who are of the view that OL is highly effective in influencing the attitudes and behaviors of the employees in sharing their knowledge with others in the organization. It implies that to promote KS in the manufacturing sector, there is a need for effective leadership. The results also revealed that OSY and OC tend to affect the KS in an organization significantly. These findings of the data analysis can be related to the research of David and Fahey (2000), according to which, OC not only promotes the creation of knowledge but also positively influences the sharing of tacit and explicit knowledge in an organization. In the same manner, an effective OSY not only recognizes the significance of KS but also facilitates the organizational policies and processes in promoting the KS in the organization. Therefore, the results of the relative priorities of criteria in the context of the manufacturing sector of UAE reveals that the most significant factors that tend to influence KS include OL, OSY and OC. On the other hand, factors such as CP, HRM, OST and TI have been taken as factors with average impact on the KS in an organization. The results of the global priority weighting in the case of the manufacturing sector give a detailed analysis on the sub-factors which are likely to have an impact on the KS in the manufacturing sector of UAE. The results reveal that the most significant factor that can affect the KS is the integrity (OL2) along with the decision making (OL1) as OL sub-factor. It indicates that OL needs to be directed toward building trust among employees along with the decision making to enhance KS in the organization. Financial performance (CP1), which is the sub-factor of CP, also influences the KS in the organization. It necessitates that the organization needs to have a KS culture to enhance its financial performance. The findings are in line with the research findings of Kim *et al.* (2017) who demonstrate a strong association between KS and financial performance of the organization. The vision and mission as the sub-factor of OSY are the highest impacting factor influencing KS in the organization. The results are in line with the research findings of Ramachandran *et al.* (2008) who stressed that, for a better KS, organizations need to develop a shared vision and mission to manage all the KS processes accordingly. The results also reveal that risk-taking, which is the sub-actor of OSY, i.e., OSY tends to be the fifth most influential factor affecting the KS in the manufacturing organizations of UAE. In addition, the use of rewards and recognition as the sub-factors of HRM are found to be significantly related to the KS in the organizations.

5. Conclusion

Most of the studies have indicated that KS still lacks confirmation of the several key factors that influence KS success. This makes it difficult for organizations to implement efficient KS practices, especially in growing economies such as the UAE. The purpose of this research was to identify and prioritize the critical factors impacting the KS in manufacturing technology-intensive organizations in UAE. This research used the AHP as an empirical method of study in the manufacturing sector to investigate successful KS factors in manufacturing technology-intensive organizations in the UAE. The nine competitive priority factors were identified as, OL, OC, OSY, OST, OP, CP, HRM, TI and EE, were all

generally accepted as the main factors that impact organizational KS. Other sub-factors were also identified in from the literature with appropriate theory support under each main factor and built the analytical hierarchy processes for decision making. A questionnaire was designed on a nine-point scale based on these nine main KS factors and the sub-factors of each main factor. The questionnaire was pilot-tested using industry experts and academics, and some of the items were modified to make them more representative of the intended constructs. Primary data were collected from the manufacturing field in UAE. Consistency was observed in the sample by using the same criteria in all organizations.

This study will be useful to any organization in general, and more specifically to technology-intensive manufacturing organizations. As this study found that three factors organization leadership, organization culture and organization strategy are most important one; however, others should not be ignored for successful KS. Moreover, future research should cover different fields. Also new methods could be used to study the factors from different aspect by applying analytic network process as the research methodology or as an empirical study by using exploratory factor analysis and confirmatory factor analysis to confirm or improve the findings of this research.

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