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Understanding knowledge sharing in the Jordanian construction industry

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# Understanding knowledge sharing in the Jordanian construction industry

Jordanian  
construction  
industry

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## Abstract

**Purpose** – The purpose of this paper is to develop a model to understand and facilitate more knowledge sharing (KS) among construction companies in Jordan. Sixteen cultural variables that affect KS were identified through self-administered questionnaires.

**Design/methodology/approach** – Factor analysis was used to find possible relationships between the cultural variables for grouping purposes and to eliminate the cultural variables that do not affect KS. The results of factor analysis were further refined using a brainstorming session and Analytic Hierarchy Process (AHP) was used to prioritise the factors obtained through the factor analysis.

**Findings** – Trust, management and communication were identified as the three most important factors, whilst communication was acknowledged as the least important factor.

**Originality/value** – This research uses factor analysis and AHP to study the influence of cultural factors on KS. It develops a hierarchy of factors that affect effective KS within the Jordanian context. The paper investigated KS in-depth and highlighted the components that constitute KS in an organisation. Based on extensive literature review, this study found the relative importance of different factors that affect KS. The emphasis on trust was found to be more critical than the presence of a computer-based system. In addition, this is the first paper of this type to look at KS in the context of the Jordanian construction industry.

**Keywords** Knowledge management, Factor analysis, Knowledge sharing, Analytic hierarchy

**Paper type** Research paper

## Introduction

Knowledge has now become widely recognised and accepted as a valuable organisational resource in the business world. Knowledge-based systems have been used in various industries, including construction at different levels of implementation (Levitt and Kartam, 1990). Knowledge management (KM) is considered a key part of the organisational strategy to create a sustainable competitive advantage. Knowledge sharing (KS) is a major challenge for organisations due to a variety of reasons; therefore, there is a need to understand it further. KS activities are of utmost importance for



knowledge retention because when employees leave an organisation their knowledge leaves with them (Bender and Fish, 2000). If the KS framework is in place, the knowledge which may have been lost with the exiting employees can be transferred to the existing employees.

KS is a very critical process, and furthermore, other KM aspects heavily depend on its successful implementation. For instance, creating new knowledge relies on people, sharing their knowledge within the organisation through practices such as brainstorming and focus groups. Several scholars have highlighted the impact of culture on KS activities (Arif *et al.*, 2009; Ma *et al.*, 2008; Al-adaileh, 2011). Skok and Tahir (2010) advocated national culture (NC) as one of the major barriers to effective KS. Magnier-Watanabe and Senoo (2008) found organisational characteristics to be a stronger prescriptive factor in KM compared to NC.

The research presented in this paper analysed the NC variables and organisational culture (OC) variables that affect KS to improve knowledge retention in construction companies in Jordan. According to Sabri (2007), to address knowledge creation and sharing in the Jordanian context, it was necessary to examine the socio-cultural factors that might affect the development of an effective KM process in Jordanian organisations. Finally, the paper presents a model to facilitate KS and highlights different factors and their priorities in achievement of high levels of KS in an organisation.

The paper is divided into seven sections. The following section presents a review of the literature which was done to determine current KS practices in Arab countries and identify the variables that impact KS is presented next. Following the literature review section is the research methodology, which establishes data collection process. The collected data are analysed under results section, and a model is developed. This understanding of the model is further developed with more insights into its different elements and their relative importance and then the model is further interpreted before presenting the key conclusions of this research.

### **Knowledge management in construction**

Firms in the Middle East are making significant investments in better management of their human resources (Kabasakal and Bodur, 2002). However, there are cultural issues that impact the adopted management systems. According to Sabri (2004), cultural influences have led to a bureaucratic form of organisational structure, which is different from that in the West. Centralisation of power and the existence of lines of authority and hierarchy are among the features that characterise the Western culture. The cultural characteristics of different groups of people play a key role in successful KM (Ciganek *et al.*, 2008). Magnier-Watanabe and Senoo (2010) found organisational characteristics to be a stronger prescriptive factor in KM compared to NC, which, however, was also found to have a significant influence on KM. Moreover, previous studies have confirmed that culture can play a significant role in facilitating or hindering KS (Siakas *et al.*, 2010; Usoro and Majewski, 2011). De Long and Fahey (2000) suggested four ways in which culture affects the behaviours central to knowledge creation, sharing and use. First, culture shapes assumptions about what knowledge is and which knowledge is worth managing. Second, culture identifies the relationships between individual and organisational knowledge, determining who is expected to control specific knowledge, who must share it and who can store it. Third, culture shapes the processes by which new knowledge is created, legitimised and distributed in firms. Fourth, culture creates

the context for social interaction that determines how knowledge will be used in particular situations.

Egbu (1999) compared the importance of management skills between refurbishment and general construction works. Egbu (1999) found that certain skills in refurbishment works are of much higher importance than general works due to the uncertain nature and higher risk in refurbishment works. An integrated approach of mechanistic and organic approaches which incorporates technological and cultural issues for effective KM in architecture, engineering and construction industry is proposed by Kamara *et al.* (2002). Holsapple and Singh (2001) presented the knowledge chain model, which describes the relationship between knowledge enablers, knowledge processes and organisational performance. Veshosky (1998) concluded that construction industry is normally slow in innovation compared to other industries due to the reason that construction project managers rely mainly on internal sources and trade magazines for information and often unaware of organisations' programs that assist them in obtaining information on innovation. Kululanga and McCaffer (2001) presented principles and framework for KM in construction organisations. The authors stress on the importance of measuring techniques that help the construction companies to move towards a knowledge culture. The relationship between KM and firm's performance measures, between KM and information technology and ways with which knowledge is created, embodied and distributed within organisations are discussed by Demarest (1997). Rezgui (2001) presented the relevance of information technology for KM in construction industry. The paper discussed the barriers which the managers face in construction industry and how managers can use technology to develop solutions for knowledge and information management in construction industry. Lee and Choi (2003) developed a model with seven enablers of knowledge creation and concluded that trust has positive impact on knowledge creation, information technology has a positive impact on knowledge combination and organisational creativity has a positive impact on performance. Hari *et al.* (2005) presented a computer-based knowledge capture awareness tool and identified factors that can warrant the effective implementation of knowledge capture in small and medium enterprises in construction industry. Egbu (2004) presented number of factors for effective KM in construction industry and also the role of KM and intellectual capital for successful innovations. The author stressed on the need for education and training of construction personnel.

A variety of cultural factors that affect KS from both organisational and NC viewpoint are presented in literature. Hofstede (2001) presented 13 variables related to the Arab culture that have impacted KM, and of which, 5 variables (power-distance, uncertainty avoidance [UA], masculinity/femininity, individualism/collectivism and autonomy) have an impact on KS as well, as further documented in subsequent studies (Siakas and Georgiadou, 2006; Liu, 2009). In addition to the 5 NC variables, 11 OC variables have been documented from the literature including, leadership behaviour, organisational structure, organisational form, reward system, recognition, communication technology, social networking, relationship between employees, trust and management commitment. The following section summarises the literature supporting the 16 variables.

**OC variables***Leadership behaviour*

[Lok and Crawford \(2004\)](#) explained that culture strongly affects leadership style and has an impact on the outcome, organisational commitment, expectation, subordinate performance and job satisfaction. [Limsila and Ogunlana \(2008\)](#) argued that in the high power-distance countries which include many Middle Eastern countries, leadership is considered to be more autocratic, and, thus, most employees are afraid to disagree with their managers, are task-orientated and prefer to receive orders rather than take initiative. According to [Ma et al. \(2008\)](#), leadership style significantly affects KS in the construction industry. With an authoritarian style, leaders give team members no chance to participate in the decision-making process, and, therefore, team members are less likely to share knowledge from the team to keep the privileged status and leverage for more power. Compared with a democracy, leaders using this style will enable team members to have their voices heard, and, consequently, members are more willing to share knowledge.

*Leadership style in Arab culture/Jordan*

Various studies ([Ali and Sabri, 2001](#); [Sabri, 2007](#)) concluded that Arab management practices are a mix of different characteristics: hierarchical authority; rules and regulations contingent upon personality and power of the individuals who make them; subordination of efficiency to personal relations and connections; indecisiveness in decision-making; informality among lower level managers; a generally patriarchal approach; and nepotism. [Hofstede \(2001\)](#) characterised the Arab business culture by high power distance (PD), high UA, collectivism and masculinity. Consequently, [Abu Khadra and Rawabdeh \(2006\)](#) stressed the importance of a facilitative leadership in developing organisational learning in Jordan to establish a supportive and participative cultural environment that helps design a new form of organisation which emphasises learning, flexibility and rapid response.

*Mutual trust*

It is important to explain the relationship between trust and the creation of knowledge enabled enterprises. Trust in organisational terms is usually fostered on a leadership level and cascaded down. The flatter the organisation the less there will be issues around trust ([Plessis, 2006](#)). KM practitioners have long since recognised the development of trust in the organisational context as being absolutely pivotal to the successful development of a KS culture ([Kelly, 2007](#); [Hari et al., 2005](#)). [Levin and Cross \(2004\)](#) found that the level of trust affects not only the sharers but the seekers of knowledge, too. The authors believe that both will still be treated fairly and respectfully when passing knowledge to the person they trust.

*Motivation*

Impact of motivation on KS has been studied in the seminal literature. [Plessis \(2006\)](#) stated that recognition is a very important empowerment tool that encourages people to participate in KS activities. In addition, to encourage KS, organisations should design reward and recognition systems that stimulate sharing of all kinds: goals, tasks, vision and knowledge ([Wright, 2004](#)). Furthermore, [Al-Alawi et al. \(2007\)](#) argued that managers must consider the importance of collaboration and sharing best practices when designing reward systems. The idea is to introduce processes in which KS and

horizontal communication are rewarded. The reward system may create a climate of extrinsic motivation rather than that of intrinsic motivation, which should be the end goal (Milne, 2007).

#### *Organisational structure*

The impact of organisational structure in KS has been discussed in many studies (Purcidonio *et al.*, 2008; Claver-Cortes *et al.*, 2007). Gopalakrishnan and Santoro (2004) argued that both organisational structure and OC have been identified as necessary elements for KM initiative success. Terra (2003) highlighted two main types of structure within organisations in terms of implementation innovation, bureaucratic and hierarchical. Some organisations have worked on similar solutions that combine both bureaucratic and hierarchy structures (Purcidonio *et al.*, 2008). Organisational structure is usually categorised into three elements: formalisation, centralisation and integration (Andrews and Kacmar, 2001; Robbins and Decenzo, 2001). Hence, Migdadi (2009) stressed that an effective knowledge creation and KS in Jordan requires a special organisational structure that values and encourages cooperation, trust, learning and innovation, and also provides incentives for engaging in all those knowledge-based activities and processes.

#### *Communication technology*

The current business environments are characterised by globalisation, dynamism and increasing levels of complexity due to rapid changes in technology and its connected intricate knowledge (Siakas *et al.*, 2010). However, the construction sector has been slow to recognise the benefits of information technology (IT) as a major communication tool (Egbu, 2001). Moreover, Stefanescus and Stefanescus (2008) focused on understanding the variables that motivate in KS before implementing any KM strategy to sustain the successful implementation of reengineering projects. The socio-technical analysis can be summarised in terms of three major layers of KM systems:

- (1) infrastructure (hardware/software);
- (2) infostructure (rules); and
- (3) infoculture (stoke of background knowledge) (Haddad and Issa, 2008).

Cultural awareness and the use of IT tools such as Web 2.0 are variables supporting KS (Siakas *et al.*, 2010).

#### *Social networking*

Social networking provides chances for people to begin their interpersonal contact, encourages collaboration among co-workers and tends to create a suitable surrounding or atmosphere for KS. The networking across communities such as professional groups, functional groups and business units needs to involve communication and negotiation among different social communities with distinctive norms, cultural values and interests in the innovation process (Egbu, 2000). Egbu and Robinson (2005) also presented examples of KS networks that can be used in the construction sector, i.e. Construction Best Practice Programme. Furthermore, Tlaiss and Kauser (2011) asserted that the understanding of social networks in the Arab world is limited with only a handful of studies that have provided evidence of how social connections can support career advancement.

*Organisational form (family business)*

Family businesses can be defined as businesses where at least two family members are involved both as owners and managers (Simon and Hitt, 2003). According to Weir and Hutchings (2005), this combination may play a rather different role in Arab business organisations for the evident reason that the business organisation as such is usually structured in terms of familial structures and the discourse of the family and its internal and external relations is readily applied. Subsequently, as trust is vital to social relationships, Jordanians are not completely resistant to KS but will actually share knowledge freely, though only within their trusted networks in which an insider relationship exists between transmitter and receiver (Hutchings and Michailova, 2003; Almahamid *et al.*, 2010).

*Management commitment*

Commitment has been defined as a belief in and acceptance of goals and values: a willingness to exert considerable effort on behalf of an organisation and a strong desire to belong (Yongsun *et al.*, 1996).

Various scholars specifically investigated the relationship between commitment and KS (Hislop, 2002; Smith and McKeen, 2002). Haddad and Issa (2008) highlighted the importance of management support to be included as part of the work process and mentoring in KS and indicate that organisational support and culture have a bigger effect than IT on KS. Furthermore, Jain *et al.* (2007) highlighted the top three strategies including, support from top management, linking KS with reward systems and performance appraisal, and using newsletters to disseminate information. If employees feel the organisation is investing in them, then they will feel empowered, safe and trust the management which leads to organisational commitment (Massingham and Diment, 2009).

*Relationship between employees*

Employee relationships are an index for examining the satisfaction, respect, confidence, justice and trust relationships between employee–employer. Building strong relationships among employees can be considered as one of the most important methods to encourage KS. Not all relationship building is done within the confines of the workplace, but in many instances, they are built more casually outside the work place. Sturdy *et al.* (2006) described the importance of informal settings such as lunches, drinks and dinners. These informal meetings have proven to facilitate KS. Willem and Buelens (2009) argued that trust and informal systems such as meetings, personal networks and incentives are important variables that can encourage KS. Moreover, Ford and Chan (2003) stated that the excellent relations outside and inside the enterprise and a good social network have a considerable impact on KS between employees.

**NC variables**

Basic assertion in cross-cultural studies is that NC expressed in terms of values and beliefs has a direct impact on OC and individual behaviour (Hofstede, 2001). According to Siakas *et al.* (2010), various cultures have preferred ways of structuring organisations, different patterns of employee motivation and different solutions to organisational problems. This research focused on studying five NC dimensions: PD, UA, collectivism, autonomy and masculinity.

*Power distance*

PD is the degree of acceptance or perception of normality in terms of inequality among people of a country. This dimension varies over a continuum from favouring equality (low PD) to accepting inequality (high PD) (Ribiere *et al.*, 2010; Klein *et al.*, 2009). Several studies of knowledge transferring along different PD dimensions of the cultural index have shown that if the knowledge provider enjoys large PD and the recipient enjoys small PD, then the recipient's success is highly dependent upon the provider's keenness to transfer knowledge (Lucas, 2006). The low PD which bridges the gap between the superior and the employees has a positive effect on the KS process and production in the enterprise (Liu, 2009).

*Uncertainty avoidance*

Klein *et al.* (2009) defined UA as the degree to which members of a society feel uncomfortable with uncertainty and ambiguity, and they found that Arab countries scored a high UA. Weir and Hutchings (2005) stated that in Middle Eastern cultures there is a very high tolerance of ambiguity, which permits relationships to be maintained even though a particular interaction may have concluded unsuccessfully. On the other hand, Migdadi (2009) argued that Arabs prefer to keep their knowledge and use it in the right time as a source of power. To minimise or reduce this level of uncertainty, strict rules, laws, policies and regulations are adopted and implemented (Klein *et al.*, 2009).

*Collective achievements (individualism vs collectivism)*

The collectivist index refers to awareness of employees that teamwork yields better results than individual work. Workers in individualist societies envision knowledge creation as an intervention of individual effort, while workers in collectivist societies think of the integration and modification of existing knowledge as a group effort (Yoo and Torrey, 2002). Thus, managers in collectivist societies will carefully create the content and structure for KS among different groups to better harmonise differences among the groups involved (Liu, 2009). Moreover, Klein *et al.* (2009) concluded that Arab countries are collectivist societies, as compared to individualist cultures. Consequently, collectivism has been seen as the subordination of personal goals to those of the group with significance on sharing and harmony (Shin *et al.*, 2007). Collectivism has a positive impact on KS activities and also it is related to teamwork as an OC variable. Therefore, for this research, both the NC and OC variables were merged into a collective achievement variable affecting KS in the Jordanian construction industry.

*Autonomy as NC and corporate perspectives*

Autonomy from a corporation perspective is the extent to which an individual or group of individuals has the freedom, independence and discretion to determine what actions are required and how best to execute them (Manz, 1992). In the context of knowledge, all members of an organisation should be allowed to act autonomously as far as circumstances permit (Nonaka and Takeuchi, 1995). The organisations can improve chances of introducing new ideas and knowledge in a way that is not necessarily planned, but is more innovative and efficient (Migdadi, 2009). It can be argued that autonomy as a NC variable has an impact on empowerment as an OC variable in terms of KS. Therefore, this research used the meaning of both perspectives as one variable (autonomy) affecting KS in the construction industry in Jordan.

*Gender differences (Masculinity vs femininity)*

Masculinity focuses on the degree that the society reinforces or does not reinforce the traditional masculine work role model of male achievement, control and power (Klein *et al.*, 2009). Cultures that are high in masculinity may have less knowledge transfer between organisational members if the competition is between individuals, but there is no difference if competitiveness is between organisations (Rivera-Vazquez *et al.*, 2009). In the Arab world, this dimension is slightly higher than the average (50.2) for all other countries because women in Arab countries have limited rights (Klein *et al.*, 2009).

The literature discovered a variety of cultural variables (total of 16) that affect KS from both the OC and NC viewpoints. Prior studies have pointed out that NC influences people behaviours in sharing knowledge within organisations; therefore NC has an impact on OC. According to the literature, there are several OC variables that affect KS practices which include, leadership behaviour style, motivation, the management commitment, trust, relationship between employees, communication technology, social networking, empowerment, teamwork, organisational form and organisational structure. In terms of NC variables, this research adopted 5 out of 13 cultural dimensions presented by Hofstede (2001); PD, UA, masculinity/femininity, individualism/collectivism and autonomy.

**Research methodology**

An initial questionnaire was first designed and a pilot tested with four doctoral students from Jordan. The research topic and the purpose of the questionnaire were explained to the students. Feedback from the students resulted in clarity of some of the variable descriptions and also led to addition of general questions on participants such as age, gender and work experience to understand the research sample. Next, the refined questionnaire was provided to two human resource managers from the Jordanian construction sector who had previous experience in designing questionnaires and data collection and analysis and who were also familiar with the research problem. The feedback from them suggested that the cover letter should explain more of the research problem and the purpose behind the survey. Another suggestion was to separate the NC and OC variables to increase clarity for the participants. The finalised questionnaire is provided in Appendix A. The ontological and epistemological stance of the researcher will influence the response to the methodological questions (Guba and Lincoln, 1994). In principle, ontology concerns with what is believed in constituting social reality, whilst epistemology concerns with the claims of what is assumed to exist can be known (Blaikie, 2000). The ontological stance of the researchers in this research can be considered in line with constructivism, whilst the epistemological stance in line with interpretivism. Constructivist and interpretivist perceive reality not as objective and exterior, but is created and derived by the person involved. Therefore, the truth and reality are social constructs and the researcher should consider the truth and reality from the collective opinions of the participants (Fellows and Liu, 2008). In acknowledging the collective nature of the construction of the social reality, this research uses two different methods to accomplish the stated objectives of this research, namely, survey and semi-structured interviews.

The survey was conducted during the 2010 Jordanian Builders Conference. Participants were chosen from five of the biggest construction companies in Jordan. To obtain appropriate data, middle- and high-level managers who were familiar with KS

activities were chosen. The respondents had to rank each variable in terms of the effect on KS by using a five-point Likert scale with response options ranging from “strongly agree” to “strongly disagree”. A total of 153 responses were received. The questionnaire helped determine the cultural variables which impact most companies on KS. Factor analysis was used to assess the impact of OC and NC variables on KS and also for grouping and rating the selected variables.

The data were analysed using SPSS software. The initial issue with the analysis was that there were a large number of variables and it was important to identify if there is a correlation between these variables. In case there was a correlation between these variables, factor analysis could be used to combine these variables into fewer number of factors. Factor analysis is a generic name given to a class of multivariate statistical methods whose primary purpose is data reduction and summarisation (Hair *et al.*, 2006). Factor analysis is an interdependence technique, in which all variables are simultaneously considered to define the underlying structure among the variables in the analysis. The general purpose of factor analysis is to find a way of condensing the information contained in a number of original variables into a smaller set of new composite dimensions with a minimum loss of information. In this study, factor analysis is used to develop a framework for KS.

The Analytic Hierarchy Process (AHP) has gained widespread application in decision-making problems, involving multiple criteria in systems of many levels (Liu and Hai, 2005). Users of the AHP first decompose their decision problem into a hierarchy of factors, each of which can be analysed independently and once the hierarchy is built, the decision-makers systematically evaluate its various elements by comparing them to one another two at a time, with respect to their impact on an element above them in the hierarchy (Tahriri *et al.*, 2007). The results of factor analysis were further refined using a brainstorming session with three human resource and three project managers from construction companies. AHP was used to prioritise the factors obtained through the factor analysis. The model developed is presented in this paper.

Figure 1 indicates the four major steps in the methodology of the paper. The first one is the assessment of the variables that were compiled from the review of literature. The survey results were then analysed using factor analysis. The results of the factor analysis led to formation of five major factors. These factors were consolidated into three factors after expert interview. Finally, the expert panel prioritised these factors and the data was analysed using the AHP.

### Results and analysis

Of the total number of participants, 103 (67.9 per cent) were male and 50 (32.1 per cent) were female. The participants were from a variety of age groups, education levels, and years of work experience, as shown in Tables I-III.

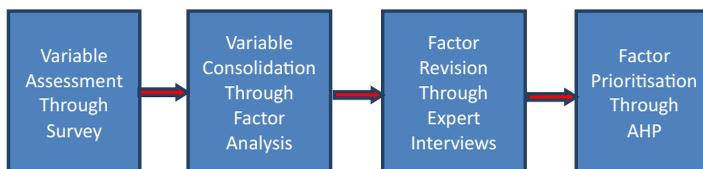


Figure 1.  
Research  
methodology

*Factor analysis output 5*

The scree plot is a graph of the eigenvalues plotted against the ordinal numbers of the variables extracted. The graph is useful for determining how many variables to retain. The point of interest is where the curve begins to flatten out. It can be seen that the curve starts to flatten between factors 5 and 6. Notice also that factor 6 has an eigenvalue of less than 1, so only five factors were used for relationship analysis (Figure 2).

*Factor analysis output 7*

Table IV contains the same information as the component matrix but is calculated after rotation. A rotated factor matrix helps in grouping variables through the loading of each variable onto the five components. Each component can be a group for other variables with loadings more than 0.5. Looking at Table IV, it can be seen that management commitment, teamwork, PD, reward system, Recognition from management, organisational structure in terms of information flow and UA are loaded (more than 0.5) on Component 1. Gender differences, Leadership behaviour style, and Collective achievements are loaded on Component 2. Social networking and Autonomy are loaded on Component 3. Relationships between employees and Communication technology are loaded on Component 4. Finally, mutual trust between employees and organisational

**Table I.**  
Participants age data

| Age range (years) | Frequency | (%)  |
|-------------------|-----------|------|
| 25 and under      | 20        | 13.2 |
| 26-35             | 67        | 43.4 |
| 36-45             | 26        | 17   |
| 46-50             | 26        | 17   |
| Over 50           | 14        | 9.4  |
| Total             | 153       | 100  |

**Table II.**  
Participants education levels data

| Education level | Frequency | (%)  |
|-----------------|-----------|------|
| High school     | 3         | 1.9  |
| Diploma         | 23        | 15.1 |
| Bachelor        | 107       | 69.8 |
| Master          | 14        | 9.4  |
| PhD             | 6         | 3.8  |
| Total           | 153       | 100  |

**Table III.**  
Participants years of work experience data

| Work experience (years) | Within company |      | Overall   |      |
|-------------------------|----------------|------|-----------|------|
|                         | Frequency      | (%)  | Frequency | (%)  |
| Less than 1             | 35             | 22.6 | 12        | 7.5  |
| 1-5                     | 69             | 45.3 | 46        | 30.2 |
| 6-10                    | 26             | 17   | 29        | 18.9 |
| 11-20                   | 12             | 7.5  | 40        | 26.4 |
| Over 20                 | 12             | 7.5  | 26        | 17   |
| Total                   | 153            | 100  | 153       | 100  |

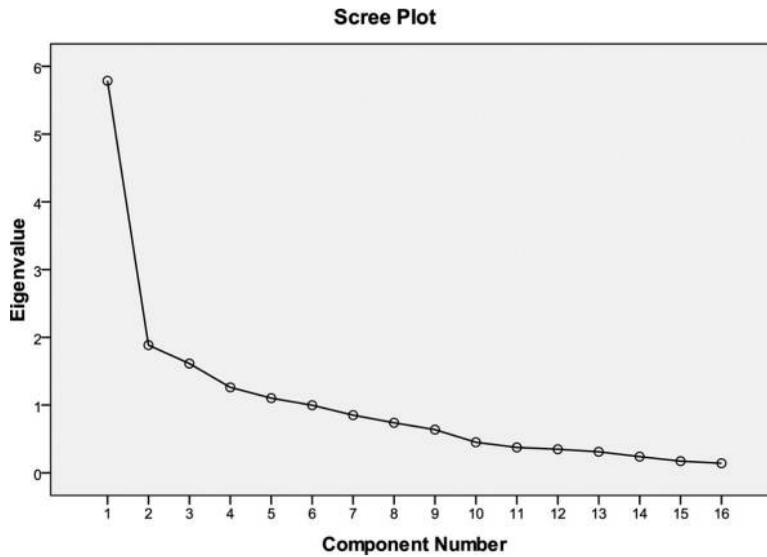


Figure 2.  
Scree plot

| Variable  | Component    |              |              |              |              |
|---|--------------|--------------|--------------|--------------|--------------|
|   | 1            | 2            | 3            | 4            | 5            |
| Management commitment                                 | <b>0.820</b> | 0.097        | -0.097       | 0.111        | 0.208        |
| Teamwork  | <b>0.786</b> | 0.131        | 0.375        | 0.023        | 0.134        |
| Power distance  | <b>0.780</b> | 0.044        | 0.173        | 0.067        | 0.030        |
| Reward system   | <b>0.760</b> | 0.034        | 0.232        | 0.098        | 0.229        |
| Recognition from management                           | <b>0.741</b> | 0.251        | 0.001        | -0.136       | 0.158        |
| Organizational structure in terms of information flow | <b>0.718</b> | -0.146       | 0.070        | -0.109       | -0.249       |
| Uncertainty avoidance                                 | <b>0.492</b> | 0.414        | -0.214       | 0.471        | 0.150        |
| Gender differences                                    | 0.204        | <b>0.768</b> | 0.070        | 0.267        | -0.190       |
| Leadership behaviour style                            | -0.010       | <b>0.763</b> | 0.212        | -0.014       | 0.215        |
| Collective achievements                               | 0.087        | <b>0.641</b> | 0.192        | -0.226       | 0.238        |
| Social networking                                     | 0.133        | 0.167        | <b>0.785</b> | 0.166        | 0.097        |
| Autonomy  | 0.175        | 0.175        | <b>0.776</b> | -0.002       | -0.013       |
| Relationships between employees                       | -0.063       | 0.042        | 0.082        | <b>0.819</b> | -0.240       |
| Communication technology                              | 0.119        | -0.075       | 0.209        | <b>0.653</b> | 0.447        |
| Mutual trust between employees                        | 0.120        | 0.140        | -0.021       | 0.015        | <b>0.752</b> |
| Organizational form                                   | 0.465        | 0.209        | 0.291        | -0.275       | <b>0.610</b> |

Table IV.  
Rotated component  
matrix

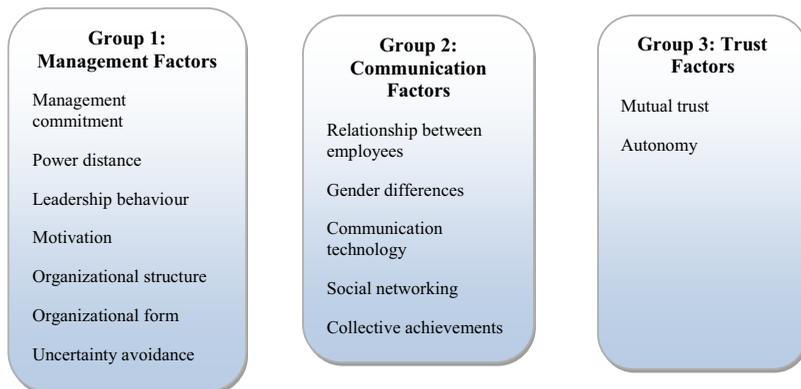
Note: This is standard factor analysis output where bold represent high correlations (above 0.45)

form are loaded on Factor 5. It can be concluded that there are five groups for the cultural variables that have an impact on KS. It is not necessary that these relationships between variables are true. SPSS is predicting that there a commonality between them, according to the given data. So, further investigation is recommended into these relationships.

Table IV shows five groups of cultural variables. These variables were presented to six managers; three human resource managers of large construction companies and three senior project managers in the same companies. This is the same team of participants that will be used in the prioritisation exercise in the next step. This team felt that the number of variable groups can be reduced to three. The team argued that the first group which includes management commitment, teamwork, PD, reward system, recognition, organisational structure and UA relate to management factors. The team categorised the seven factors as the management factors group. The second, third and fourth groups contain seven factors including gender differences, leadership behaviour, collective achievements, social networking, autonomy, relationship between employees and communication technology relate to communication factors. The team categorised the seven factors the communication factors group. The last group contains two factors including mutual trust and organisational form. However, as the first group deals with management factors, the panel moved leadership behaviour into the first group. The team also merged reward system with recognition and renamed them collectively as motivation. Teamwork from the first group is merged with collectivism as collective achievements. The relationship between teamwork and collectivism has been discussed in the literature. After merging some of the factors, 14 factors are left and are grouped, as shown in Figure 3.

*Model development*

The model containing the three factors can now be developed as a result of the factor analysis. Once the factors and their variables were finalised, the next step in the process was to further refine the model and understand the model by focusing on the importance that each of these factors has in facilitating the overall KS in an organisation. To understand this further, a brainstorming session consisting of three human resource managers of large construction companies and three senior project managers of the same companies was organised. All these companies were from Jordan and dealt with large projects. All the participants were given a presentation about the work and findings so far, and then they were asked to do a comparative rating of factor pairs. To make pair-wise comparisons, a scale of numbers is needed to indicate how many times more important or dominant one element is over another element with respect to the



**Figure 3.**  
Results of the factor analysis

criterion or property with respect to which they are compared (Saaty, 2008). Table V exhibits the rating scale.

When making pair-wise comparisons using the AHP, the six participants were presented with this numerical Saaty scale as reference for the participant to decide the importance levels of the indicators in the numerical range -9 or their reciprocals, i.e. 1/2 to 1/9, as explained in Table V above.

First of all the participants were asked to do this pair-wise comparison individually. Once they had done it individually, then everyone was asked to share their ratings and explain why they chose a certain rating scale. This session was then used to generate consensus and arrive at an agreement about the relative importance. Table VI shows the final agreed rating.

Table VII depicts the results of the AHP analysis for overall factors. The consistency ratio is 0.0929, which is <0.1 (Saaty, 2008). Hence, the judgments for the factors are consistent.

Given the values in the Eigen vector column of Table VII, the level of importance from the most important to the least important is as follows: trust factor, management factor and communication factor, and is depicted in Figure 4, and is the model developed to understand the application of KS in construction organisations. The most important factor being trust, followed by the elements of management factor and then finally communication factors.

### Discussion

The participants in the brainstorming session discussed in the previous section were shown these results as the calculation was done in their presence and they all agreed with the interpretation of the results. They all agreed that trust was the most important factor. Organisations can demonstrate that they trust their employees by giving them more autonomy and by not watching over their shoulder all the time. This in turn creates employee trust towards the organisation. One more element is the trust among colleagues. This also creates an environment where people are comfortable sharing their knowledge among their peers. Therefore, if trust is there between the employee and the

| Intensity of importance | Definition                | Explanation  |
|-------------------------|---------------------------|--|
| 1                       | Equal importance          | Two factors contribute equally to the objective  |
| 3                       | Somewhat more important   | Experience and judgement slightly favour one over the other  |
| 5                       | Much more important       | Experience and judgement strongly favour one over the other  |
| 7                       | Very much more important  | Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice |
| 9                       | Absolutely more important | The evidence favouring one over the other is of the highest possible validity                                |
| 2,4,6,8                 | Intermediate values       | When compromise is needed  |

**Table V.**  
Saaty rating scale  
(Saaty, 2008)

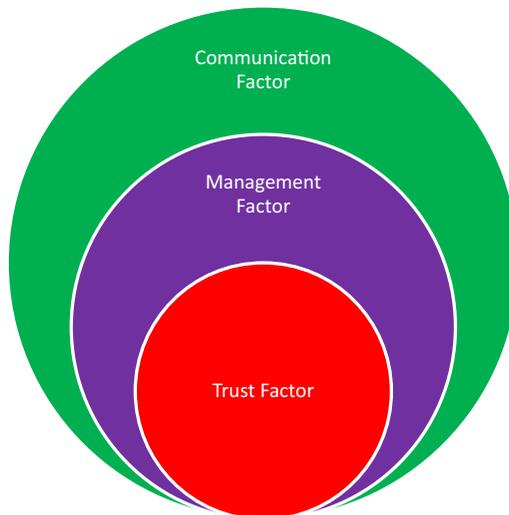
organisation or among the employees, an environment is created conducive for KS. Trust factors considered as a core group for KS, without mutual trust and strong relationships between employees knowledge can be difficult to be shared. The relationship between employees is the key for mutual trust in terms of KS; people are not willing to share information with others that they don't trust. Mutual trust can be achieved by building strong relationships between employees through social activities that can be inside and outside the company. An effective reward and recognition system for the contributors of knowledge is helpful to facilitate KS. It is important that employees feel that even after sharing the knowledge with the rest of the organisation, they will still be recognised as the producers/originators of the knowledge. They will also have the autonomy to present and use that knowledge for the benefit of the organisation and be recognised for it. Management has a very important role to play in developing the trust and also in motivating the employees to share their tacit knowledge. One of the issues that is, often a source of concern is the lack of trust among

**Table VI.**  
Agreed rating

| Indicator to be rated | Intensity of importance | Indicator against which to be rated |
|-----------------------|-------------------------|-------------------------------------|
| Management factors    | 4                       | Communication factors               |
| Management factors    | 1/2                     | Trust factors                       |
| Communication factors | 1/3                     | Trust factors                       |

**Table VII.**  
AHP results for the factors

| Factors              | Trust factor | Management factor | Communication factor | Eigen vector | Consistency ratio |
|----------------------|--------------|-------------------|----------------------|--------------|-------------------|
| Trust factor         | 1            | 2                 | 3                    | 0.517134     | 0.0929775         |
| Management factor    | 1/2          | 1                 | 4                    | 0.35856      |                   |
| Communication factor | 1/3          | 1/4               | 1                    | 0.124306     |                   |



**Figure 4.**  
Model for KS

the employees at the bottom levels who are creating knowledge about operations of the organisation, that they will be recognised by the top management. Even worse, they do not even know if the top management will ever be able to find out that they created the knowledge. Therefore, this poses an additional responsibility on the mid-level managers to ensure that proper credit goes to the creator of the knowledge. Generally, a flatter organisation structure would be beneficial in accomplishing this.

Then comes the management factors, which provide the employees with a vision for the organisation and its future. Elements within this factor include motivation provided by the top management for promoting the KS, demonstrating top management support and commitment towards KS, UA behaviour and the acceptance of new ideas to promote innovation and organisational structure (flat organisational structure might promote the KS more as the people at the bottom might feel that they will be recognised for sharing their knowledge by the top management and will be rewarded or recognised for that). Management factors are important to encourage employees to share their knowledge by adopting managerial strategies and techniques. Leadership behaviour and management commitment factors are responsible on enhancing KS as culture value among subordinates through encouragement, support and build up strong relations with them. In terms of motivation factor, rewarding or recognising KS contribution will motivate employees to increase KS activities within organisations. The other factors including organisational form (family business), PD, UA and organisational structure allow the company to create an environment that encourages the company members to share knowledge. Organisational form (family business) describes the relationship between family members or relatives with other employees in terms of KS. Most of powerful positions are given to family members even if they are not suitable for that job, and family members do share knowledge with people they trust the most. Therefore, this type of form should close the gap between family members and other employees, and encourage them to share their knowledge despite of their relation to the owner. In addition, the power within organisations has to be distributed equally among the company members which creates trustful environment to share knowledge. On the other hand, the organisational structure type is supporting the information flow within firms to send and receive the knowledge at the right time, and to the right person which increases KS activities. Therefore, it is expected that when the organisational structure is less formalised, less centralised and more integrated, social interaction among organisational members is more favourable which increases KS activities. In terms of UA, sometimes employees feel unconformable with uncertain issues that affects negatively on the company's performance and minimise KS practices. To avoid uncertainty within organisations, employees have to be continually up dated with the new changes through memos or meetings, and provided with instructions (job manual) to gain knowledge and share it others. It can be argued that the management factors create an encouragement environment to increase KS.

The last factor was the communication system which provides a KS platform through IT systems, social networking or teamwork among employees. The message was very clear through this analysis; no matter how good an IT system or database, KS will not happen unless there is trust in employees and a commitment from the top management. Communication factors facilitate KS practices and increases the communication channels inside and outside the company by adopting techniques and tools that support KS effectively. For instance, through communication technology and

social networking it becomes easier for employees to send or receive knowledge in the right time, at the right place and for the right person. Moreover, gender differences, autonomy and collective achievements reduce the gap between employees. Gender differentiation can affect negatively on KS practices such as in Arab culture, where female employees have limited rights compared to males. These differences have an influence on the relationships and trust between employees to share knowledge. Organisations with high level of autonomy, the gap between managers and subordinates are smaller compared with low autonomy organisations. High level of autonomy gives opportunity for employees to share decision-making, take responsibility and build strong relationships between managers and subordinates, which in turn support KS. In terms of collective achievements, working in teams or as one team within organisations provides a chance for employees to exchange information with colleagues and gain more experience or knowledge to complete tasks. But if people are unwilling or distrusting of the system, then such a sharing will never occur.

### Conclusion

The aim of this research was to develop a model to understand and facilitate more KS among construction companies in Jordan. However, further analysis needs to be done to see the applicability of this in other countries and other sectors. The KS factor most important for an organisation was ascertained to be the trust factor. Here, the term “trust” refers to trust within the organisation among the employees and between employees and the leadership. The second important factor was the environment created by the management through motivation, demonstration of its commitment and appropriate organisational structure, climate and form. The third factor was the communication factor, which includes technologies, platforms and avenues created to facilitate KS. This research found that the environment created by the management must provide a platform to facilitate KS before technology can be implemented. For the Jordanian construction industry, trust was at the heart of control of knowledge within the organisation. Therefore, before an organisation can establish the control over knowledge, it needs to convince employees that they can trust the organisation and their colleagues. The results of this research have several implications for Jordanian construction companies. The vast majority of construction companies are family-owned. In family-owned businesses, there tends to be a big divide between employees who are members of the family and those who are not. Employees who are family member see a long-term future in such companies, whereas non-family employees do not. This often leads to issues dealing with trust. Making non-family employees feel part of the system is a challenge that has to be overcome, and management needs to do more to make them feel welcomed and valued. The installation of IT systems and databases should be done only once the employees feel that they can trust the organisation and management has created an environment where KS is appropriately recognised.

This research has made some significant original contributions, particularly on KS. However, previous research has not attempted to bring these factors together into a cohesive model for the Jordanian construction sector. The findings of this research are important, but one of the major limitations is that it has collected and analysed data only from Jordan. The model is, therefore, not generalisable until data from other countries are collected, appropriately analysed and subsequently embedded into this model. This model can be used by future researchers as a starting point for the context of their own countries.

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