Knowledge transfer for sustainability

The role of knowledge enablers in the construction industries in Jordan

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Abstract

Purpose – Knowledge is a fundamental source for sustainability and transfer as it plays a vital role in gaining and maintaining competitive advantage; thus it is imperative to investigate the factors that might impact knowledge transfer (KT). Therefore, the purpose of this paper is to investigate the association between knowledge enablers (organizational culture (OC), information technology (IT) knowledge leadership (KL) and knowledge strategy (KS)) and KT in the Jordanian construction industry.
Design/methodology/approach – A quantitative research approach was adopted, and structured questionnaire was sent to the employees in the construction industry. An aggregate of 250 surveys were distributed and out of them 195 were obtained, which represented a response rate of 78 percent.
Findings – The results of this paper showed that KS, OC, IT and KL has positive and significant impact on KT.
Originality/value – The study contributes to the literature by empirically testing the antecedents of KT in the Jordanian construction industry. To the best of authors' knowledge, there are not many studies that incorporate these factors in single model, especially in Jordan.

Keywords Construction industry, Knowledge transfer, Enablers' knowledge sharing

Paper type Research paper

Introduction

Knowledge is a fundamental in the sustainability of every organization (Ahmed and Al-Roubaie, 2012), and it serves as the fulcrum on which the competitive advantage is built (Albino *et al.*, 2004; Kogut and Zander, 1992; Rabbi *et al.*, 2015). A critical factor required for enhancing both innovation (Cohen and Levinthal, 2000) and productivity (Janis, 2003) is a successful knowledge transfer (KT). In addition, international technology transfer is considered as a basic requirement for economic development while knowledge is strongly associated with economic progress (Ahmed and Al-Roubaie, 2012; Ahmed and Elhag, 2017; Ahmed *et al.*, 2008). In both developing and developed countries, productive growth is fostered by the acquisition and transfer of technology (Hoekman *et al.*, 2005), there is an inherent difficulty in transferring knowledge due to certain characteristics like tacit and explicit properties (Nonaka, 1991). A class of knowledge pertaining to a particular product or method of production is known as technological knowledge, and it encompasses the technical skills needed to use a production technique or product (Erdilek and Rapoport, 1985).

According to studies performed on the dynamics of technology, it has been suggested that technology can be viewed as a means created by humans to achieve a specific goal (Dosi and Grazzi, 2009). Thus, technology transfer deals with the movement of knowledge in relation to the utilization of a method of production or product. As stated by Derakhshani (1984), technology transfer between companies occurs when a company acquires, develops and uses a technological knowledge which originated from another company.

Nonaka and Takeuchi (1995) said that KT should be regarded as a transfer of explicit or tacit knowledge between humans during their interactions. While tacit knowledge varies with the organizational context, and individuals can only transfer such knowledge during face-to-face interactions, data as well as formal speech can be used to express or transfer explicit knowledge which is cognitive in nature (Wilkesmann *et al.*, 2007).

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Technology, leadership, culture and measurement are KT enablers as stated by O'Dell and Grayson (1998). Two actions involved in the KT process were suggested by Davenport and Prusak (1998), and these actions include the transfer of knowledge to the potential recipient and the adoption of knowledge by the recipient to boost the development of new knowledge or changes in behavior. In addition, four knowledge processes were also identified in a centralized KM approach by Davenport and Prusak (1998), which include: knowledge generation (knowledge creation and knowledge acquisition), knowledge codification (storing), KT (sharing) and knowledge application.

In modern practice, the nerve of knowledge management process within every organization is KT. By integrating knowledge into existing business processes to create new processes, learning can help to improve the development and effectiveness of organizations (Armistead, 1999). For instance, in order to achieve sustainable advantage for long-term business survival, Mazloomi Khamseh and Jolly (2008) stated that it is very important to create and accumulate new knowledge (Carlos Bou-Llusar and Segarra-Ciprés, 2006). Furthermore, Tan *et al.* (2006, p. 149) pointed out that unnecessary duplications can be prevented when organizations have the ability to manage knowledge generated from projects as well as to transfer the lessons learned from problem projects within the organizations, which can subsequently help them to avoid repeating the same mistakes. It was stipulated by Ofek and Sarvary (2001) that knowledge creation and KT were the two processes associated with managing knowledge. To ensure that an organization continues to succeed, Sexton and Barrett (2004) said that it is vital for the organization to manage technology. As a prerequisite for managing knowledge effectively, Kalkan (2006) stressed that knowledge should be efficiently transferred throughout the organization.

Since knowledge is regarded as a commodity, it can be classified into three dimensions (Boisot, 1998) as follows: abstraction – it refers to the level of specificity and concreteness of information as against its generalization, codification – this is the extent to which information is provided in a written form which can be read by others and diffusion – it is the degree at which the information is disseminated throughout the society. As regard the technology and knowledge (T&K) diffusion process, a crucial factor for explaining the growth of advanced economies, as suggested by Eaton and Kortum (1996) is knowledge spillovers. Knowledge is still one of most neglected assets despite the fact that it sustains a business more than capital, labor or land. The ability to understand the role played by policy settings in facilitating international technology transfer among developed countries is limited by a lack of knowledge. This situation might even be worse in developing countries where certain national features may play a bigger role in explaining the ability to manage the imported knowledge. The management of every organization must create a KT-friendly environment in order to support KT behavior within the organization. Thus, this study is targeted at identifying mechanisms which stimulate the creation and protection of knowledge as well as those that build effective KS behavior in construction companies. In line with the scope of the study, the work is centered on verifying the impacts of these elements on KT which is an aspect of the knowledge management process.

Construction technology and KT

International construction deals with the process whereby indigenous firms utilize materials, human resources, plant and equipment, and other construction inputs from foreign countries, or undertake projects or work from foreign clients (Ngowi *et al.*, 2005). Access to international markets is improved by globalization which also increases the competition in domestic markets (Gajendran *et al.*, 2013). Therefore, international business and technology transfer theories are applicable to international construction since the construction industry is involved in the global business environment, though it is "local" with regard to its regulatory, political, procurement and social conditions (Ofori, 2012).

The benefits of using and implementing new technologies have been explored in various studies on construction management (Yang *et al.*, 2012). In order to internationalize their business, construction firms (both foreign and local) should be innovative as well as understand their dynamic capabilities (Teece, 2007). Ofori (1994) said that every technology development program should include technology transfer, and recipients should be involved in the transfer mechanisms so as promote self-reliance regarding technology. Caution needs to be taken when selecting suitable and hybrid technologies to ensure that such technologies are easy to use and transfer, and can utilize local resources, work with existing technologies, improve labor productivity and development of the organization/industry as well as stimulate activities in other sectors.

Five fundamental components of international building and construction "work" are characterized by Howes and Tah (2003) as: design consultancy, contracting, supply of equipment, building materials/products, and facility administration. Although, official government information usually concentrates on four key divisions, specifically: contracting, consulting, construction material production, and plant and equipment – this empowers government authorities to monitor their interests in International construction more attentively by assessing the individual sub-sectors independently. As indicated by Mawhinney (2001), this split can assist in explaining various ways to deal with the subject and the noticeable differences in the-success of each sub-sector of the business industry. In this research, the official-government-subdivision is utilized to assess the T&K lacks in the distinctive sub-sectors. Raftery *et al.* (1998) observed development in the building industry in various Asian nations. They noticed the increased involvement of international firms in the development of infrastructure because of: deregulation and globalization of markets made necessary by fiscal, administrative and technological limitations in the developing economies; and the technical and monetary predominance of developed economies. Ofori (2000) noticed that Raftery *et al.* (1998), concentrated on the corporate advancement; however, contended that researches on building industry development need to think about the whole industry. This more encompassing point of view is tackled in this study by means of an exploration of professional components and industry sub-sectors.

International construction companies that are currently based in developing economies are considered to bring forth major advantages to that country (Carrillo *et al.*, 2006).

The existence of foreign companies provides various career options for the native firms and also upgrades their capability to learn building technology and advanced design (Ling *et al.*, 2005). But, van Egmond (2012) noticed a need for native T&K-development in developing nations to lessen dependency on international firms. Thus, Chatterji (2016) contends that technology transfer must aim at native capacity construction and lessen the dependence on imported resources and international contractual workers. Technology transfer itself encircles the transfer of physical resources, human capacities and knowledge in order to upgrade the productive organization of a building project and services (Dunning and Lundan, 2008). The embodied and disembodies information are the most critical building blocks for T&K transfer (Sexton and Barrett, 2004; Carrillo, 1996). Embodies transfer takes place by importing and the replicating the construction designs, materials, equipment and programming for different designs and building strategies. Disembodied transfer mainly comprises of human capital and abilities seen as vital for viable transfer, adjustment and absorption to new advancements.

Construction T&K transfer is confused by bi-cultural hindrances and administrative limitations (Langford, 2000) and additionally worsen by bespoke building output requisites and production procedures for every new project (Kumaraswamy and Shrestha, 2002; Mohamed *et al.*, 2009). Ofori (1994) proposes that TK transfer may happen by means of international native firm joint ventures (JVs) of a long-term or project-specific nature. Sub-contracting arrangements are also potential vehicles of T&K transfer; however, viewed

as having a few restrictions since relationships are usually not equal (Devapriya and Ganesan, 2002). Thus, the World Bank inclines toward JV arrangements (Ofori, 1991, 1994). There is a limited number of studies on venture level technology transfer especially in Jordan. Bakuli (1994) featured well-aimed yet unsuccessful building business industry technology transfer attempts by the Government of Kenya because of execution challenges and proposed local-foreign JVs as an answer. The limit/ability suggestions were not assessed and the research concentrated just on the contractor sub-sector as the unit of investigation. Carrillo (1996) examined JV technology transfer in developing economies by the help of 12 case studies across over eight nations (counting Nigeria and Lesotho) as SSA nations. The research inspected the technology transfer components and figured that no particular technology transfer systems existed for the SSA nations; the work was confined to utilizing international contractual workers as its experimental concentration with no assessment of sub-sector T&K gaps and the possible transfers between international and native firms. This research tries to bridge some of these gaps by assessing the distinctive sub-sectors and the T&K transfer potential between international and native firms.

KT in the construction industry

Knowledge possessed by members in a building task is representative of the knowledge resources for the associations. Eliufoo (2007) carefully analyzed knowledge resources that are possessed by the members in building and distinguished consideration, for example, constructability (e.g. quality, time and cost matters, safety, maintenance and profitability); and appropriateness of the final construction or infrastructure item (e.g. comfort, durability, finished product's marketability, administrative and insurance matters). These knowledge resources must be overseen and distributed in order to gain the maximum benefit and advantage. However, the building sector is disreputable because it lacks a well-functioning framework for gathering and disseminating T&K.

KT process

Szulanski (1996) presented a system for intra-firm KT. Through a poll study, Holsapple and Joshi (2001) carefully analyzed Szulanski's (1996) model. The model pin-pointed four phases in the KT procedure: initiation, implementation, ramp-up and integration. The initiation phase includes all such events that prompt the decision to transfer. As per Szulanski (1996), KT happens only if need and knowledge which address the need are available. The second phase, i.e. implementation starts when the decision to transfer is taken at this phase, stream of knowledge between the receiver and the source, builds up social ties prompting –customizing-of-transfer in order to meet the receiver's needs. Then, the receiver starts to utilize the transferred knowledge. While trying to spot and resolve issues of brand new knowledge, anticipated post-transfer performance will be accomplished at the ramp-up phase. Lastly, transferred knowledge will be stored and regulated at the integration phase.

The model by Argote and Ingram (2000) manages to put a good basis for the KT procedure; however, it remains unsuccessful in determining a well-ordered process. For example, the model urges the movement of systems to limit knowledge overflow to the other organizations yet it does not recommend mechanisms and techniques to do that. Szulanski (1996), Sverlinger (2000) and Liyanage *et al.* (2009) provided with more sensible models for transference of knowledge and do not conflict with other knowledge administration aspects. These three models have resemblance with one another. The initiation phase of Szulanski's (1996) model is like the awareness phase suggested in the model by Liyanage *et al.* (2009). Sverlinger (2000) presented three phases as: Knowledge and information acquisition, information dissemination and recovery of data and information while Liyanage *et al.* (2009) presented two phases, namely acquisition and transfer for the similar reason. Although, Szulanski (1996) covered each one of those things through the phase called implementation.

Association, integration and the organization memory have a similar motive in every model. Both Szulanski (1996) and Sverlinger (2000) have a phase for critical thinking as ramp up and recovery of data while such is not demonstrated in the model proposed by Liyanage *et al.* (2009). Although, it has an application phase which is covered by substitute stages in the other two models. Hence, this study takes Szulanski's (1996s) KT process (initiation, implementation, ramp-up and integration) as the KT procedure for an in-depth analysis since it covers all the transfer phases while Liyanage *et al.* (2009) does not incorporate a ramp stage while Sverlinger (2000) fails to include the initiation phase.

KT enablers

A combination of academic research and empirical results tries to identify the relationship between KT and knowledge enablers. The final-model created and then consolidated knowledge enablers as independent factors and KT as the dependent factor. To recognize the knowledge enablers, four topical classifications were derived from the literature, to be specific: company's culture, information technology, knowledge methodology and knowledge administration.

Organizational culture (OC)

As indicated by Wen-bao (2007), culture is the common conduct, belief, values and rules shared by every single members of the organization. Organization culture can be grouped into three kinds: bureaucratic culture – where the greater part of the work in an association is institutionalized and operates based on power and control. Projects are finished in the right order and the company's ethic is particularly stressed upon; inventive culture – where work in an association is demanding and creative. Here the members from the association are urged to be bold and step up; and supportive/strong culture – where an open and amicable workplace environment if cultivated. Cooperation, collaboration and interpersonal relationship are specifically stressed upon. Jennex and Olfman (2005) say that: "a hierarchical culture that promotes learning, sharing and utilization of knowledge encapsulates attributes, for example, reciprocity, trust, altruism, openness, solidarity, repute amiability, inspiration and commitment". Hierarchical culture is a framework shared by every single authoritative member in order to distinguish it from other associations.

Information technology (IT)

As indicated by Brink (2003), technology support refers to information sharing (KS) by empowering the communication, joint effort, provision of accumulated knowledge storing and recovery of information. Mohamed *et al.* (2009) observed that IT may fill in as a financially effective and practical methods for storing, acquiring and exchanging/transferring information but it requires human motive and readiness to take part in KM. A few analysts argue that IT assumes four distinct parts in knowledge administration: obtaining knowledge; characterizing, storing, indexing and arranging; looking to recognize related substance; and easily communicating the substance based on different utilization foundation (Safa *et al.*, 2006). An instance of IT facilities support is by giving, online databases, groupware, virtual communities of practice an intranet of things.

Knowledge leadership (KL)

As indicated by Nonaka and Konno (1998), knowledge leadership is crucial for knowledge creation and requires active dedication from all the individuals of an organization. Leadership interfaces the context and the procedure. It assumes different roles in the knowledge creation procedure, for example, providing vision; making, empowering and

associating; and enabling and advancing the persistent spiral of the knowledge creation. Von Krogh *et al.* (2000) stated that: "the managers belonging to the knowledge industry will make sense of what their organization should know for the future." Knowledge administration is an essential enabler that helps KT and upgrades knowledge creation in the organization (Von Krogh *et al.*, 2000).

Knowledge strategy (KS)

Strategies for customer focus, knowledge creation and KT are considered by associations when creating and executing KM (Wiig, 1997). The approach used is related with business targets, objectives, plans, strategies, decision making and the sort of association the company is arranged to be regarding its investors, workers, customers and groups (Andrews, 1992).

From the above discussion, following suitable hypotheses were developed:

H1. KT has a positive and significant relationship with OC.

H2. KT has a positive and significant relationship with IT.

H3. KT has a positive and significant relationship with KL.

H4. KT has a positive and significant relationship with KS.

Research approach

The collection of data for this research was undertaken with the Jordanian construction experts in the third quarter of 2017. The target audiences of respondents include design and construction experts from construction projects. The study only seeks the view of the transferee since the TT initiatives are eventually undertaken in order to advance knowledge levels and upgrade the business industry's capacity of host members. Deciding the accurate population of potential respondents who fitted the illustration for this target audience was hard to build up in light of the fact that no such records exist right now. Hence, snowballing and purposive non-probability-sampling methods were chosen.

A structured questionnaire was adopted from Ngoc (2005) and Wilkesmann *et al.*, (2007). An aggregate of 250 surveys were handed out and out of them about 195 were obtained, which represented a response rate of 78 percent. Since there is no experimentally demonstrated minimally satisfactory response rate. A response rate of 60 percent has been utilized as the threshold of acceptability by a few and has the face validity as a measure of survey quality; however, similar $p < 0.05$ in factual correlations, 60 percent is just a "rule of thumb" that covers a more intricate issue (Johnson and Wislar, 2012). Accordingly, our response rate is viewed as generally high, which agrees with past researches.

Data analysis and results

To analyze the collected data, we used structural equation modeling technique which is a second-generation data analysis technique. The partial least squares technique is a powerful component-based method widely used in prior studies (Abd Razak *et al.*, 2016; Acaray and Yildirim, 2017; Farooq, 2018; Farrukh *et al.*, 2017; Farrukh *et al.*, 2016; Farrukh *et al.*, 2016; Khanmirzaee *et al.*, 2018; Mashahadi *et al.*, 2016; Mohammed *et al.*, 2017; Namagembe *et al.*, 2016; Namagembe *et al.*, 2017; Riaz *et al.*, 2016; Srinita, 2018; Ziyae, 2016).

To run the analysis, we used SmartPLS software version 3.27. In terms of analysis, PLS SEM is a two-stage approach. In the first-stage validity and reliability of the measured and in the second stage, the significance is investigated. Following section shows the results of data analysis (Table I).

Latent variable	Factor loading	Construct reliability	AVE
Organizational culture	0.65	0.846	0.52
	0.75		
	0.77		
	0.74		
	0.68		
Information technology	0.54	0.826	0.56
	0.63		
	0.85		
	0.89		
	0.73		
Knowledge leadership	0.66	0.787	0.55
	0.81		
	0.77		
	0.9		
	0.77		
	0.72		
	0.69		
	0.49		
	0.79		
Knowledge strategy	0.73	0.728	0.56
	0.58		
	0.82		
	0.7		
	0.73		
Knowledge transfer	0.64	0.809	0.52
	0.77		
	0.72		
	0.65		

Table I.
Measurement model quality criteria

Discriminant validity

To establish discriminant validity in this study, Fornell and Larcker's (1981) criterion was implemented by comparing the correlations among the latent constructs with square roots of average variance extracted as presented in Table II. Furthermore, as a rule of thumb for establishing discriminant validity, Fornell and Larcker (1981) suggested that the square root of the AVE should exceed the correlations among latent constructs.

Assessment of significance of the structural model

After establishing the reliability and validity of the measurement model, the results of the structural model are then presented. In the current study, a bootstrap resampling method has been applied based on 5,000 replicates and 295 cases to assess significance of the path coefficients (Hair *et al.*, 2016). R^2 measures the predictive accuracy of the model and represents

S/No.	Variable	1	2	3	4	5
1	Organizational culture	*0.72*				
2	Information technology	0.43	*0.74*			
3	Knowledge leadership	0.33	0.18	*0.73*		
4	Knowledge strategy	0.62	0.26	0.27	*0.77*	
5	Knowledge transfer	0.34	0.32	0.06	0.36	*0.68*

Note: Correlations and square roots of AVE estimates in italics on the diagonal for all variables

Table II.
Fornell and Larcker criteria for discriminant validity

the percentage of variance in the dependent variables as explained by the independent variables in the model. Whereas, path coefficients indicate the degree of change in the dependent variable for each independent variable (Hair *et al.*, 2016) (Table III).

Discussions

These statistical results affirm the presence of a significant relationship amongst KT and knowledge strategy, OC, IT, and knowledge leadership. As indicated by Wen-bao (2007), OC is the normal belief, direct standards and qualities shared by all individuals being part of an organization. Past research works (Kim and Lee, 2006; Lu *et al.*, 2006) found that joint effort and teamwork are imperative cultural features that help KS in an organization which think of KT as apart from within KS. Besides, IT is additionally an imperative enabler that assists KT. The findings of data analysis show that IT encourages a process of KT. As indicated by Brink (2003), technology support alludes to KS by empowering communication and coordinated effort by the means of storing accumulated knowledge and retrieves the knowledge of such. Ahmed *et al.* (2009) stated that IT may fill in as a cost-effective and quick medium to obtain, store, offer and transfer knowledge but it requires a human motive and ability to take part in KM. Finally, as per Nonaka and Toyama (2005), leadership is a key in creating knowledge which needs active dedication from every one of the members of the association.

Implication

The problem with transference of T&K has been an incredible area for scholastics, industrialists in both developing and developed economies and policy makers. This current research's discoveries have suggestions for the public policy, which regards KT and technology as a key zone inside the more extensive space of development strategy. Additionally, the study has evaluated the present condition of building technology and KT and use within the economy. As per the findings, the research uncovers that there is a key critical relationship of knowledge enablers on KT in the building business. The verified hypothesis demonstrates that knowledge enablers (knowledge technique, hierarchical culture, IT and KL) assist KT.

Both industry and government policies should plan to strategically develop native firms to guarantee that they can genuinely team up with international rivalry through any transfer components. This development must especially look at the knowledge background of native firms whose experience and capacities fuels their incapacity to contend and handle intricate projects on a large scale. This research unites relevant building technology, KT enablers and KT process in developing economies particularly in Jordan. A few explanatory methodologies adopted disclose the complexities associated with KT and technology in a developing nation's context. T&K has additionally been seen from item, process and administrative technology points of view; again a more comprehensive way to deal with KT than most past researches which tend to center around just one or two of the technologies. Most importantly, this investigation goes past simply recognizing T&K gaps and related difficulties to disclose how and why to facilitate KT and technology, especially in the Jordanian construction industry. In perspective of the shortage of such research works in developing economies, the findings enhance our comprehension of the T&K issues.

Table III. Results of hypothesis testing via bootstrapping

Path	Path coefficient	SE	*t*-statistics
KT→OC	0.5407	0.1582	3.41
KT→IT	0.2508	0.1979	2.71
KT→KL	0.2434	0.1609	2.51
KT→KS	0.2091	0.275	2.36

Limitation and suggestions

The paper does, however, have limitations, in spite of the fact that the findings add toward widening the literature base on T&K in developing nations, the work could not be generalized to each industry and thus, must be extended to cover different enterprises as to share approaches and experiences as far as KT is concerned. Also, the recognition of the key factors which could facilitate KT and technology will help in making a platform for more longitudinal studies later on.

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