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A knowledge management based framework for enhancing the learning culture in architectural design firms in developing countries

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Abstract

Purpose – In spite of the active role of continuous learning on improving organisational performance, the construction industry generally and architectural design firms (ADFs) in particular are criticised for their inability to use organisational knowledge to foster learning culture towards enhancing their performance. This paper aims to develop a framework based on knowledge management (KM) to enhance the learning culture in ADFs in developing countries.

Design/methodology/approach – To achieve the abovementioned aim, a research methodology consisted of data collection, data analysis and action required is designed to achieve four objectives. First, to examine the nature of the construction industry in developing countries, learning culture in ADFs, as well as knowledge and KM; second, to present three case studies to investigate the effectiveness of KM in enhancing the learning culture in ADFs; third, to investigate the perception and application of KM towards enhancing the learning culture in ADFs in Egypt, finally to develop a KM based framework to enhance the learning culture in ADFs in developing countries.

Findings – Through literature review, the research highlighted the fragmented nature of the architectural design process, which led to the loss of valuable information and made the process of capturing and sharing knowledge a hard task. In addition, it identified the barriers of implementing KM and the building blocks of learning culture in ADFs. Results of data analysis showed that "lack of organisational culture" and "low involvement of top management" were ranked the highest barriers for implementing KM in ADFs. Moreover, respondents mentioned that they do not share openly their information with other employees to maintain their uniqueness and that the strict working environment of their ADFs is not encouraging creativity or enhancing learning culture. Furthermore, "continuous learning and enhancement" and "experimentation, feedback and reflection" were ranked by respondents as the highest building blocks of a learning organisation.

Research limitations/implications – This research focussed on ADFs in developing countries.

Practical implications – Implementing KM strategies will facilitate the enhancement of learning culture within ADFs in developing countries. This will impact positively on improving the performance and increasing the competitiveness and market share of ADFS.

Originality/value – The research identified the barriers of KM implementation in ADFs and the building blocks of creating a learning organisations. It focusses on improving the performance of ADFs through using the capabilities of KM towards building learning culture in ADFs. The proposed framework which was designed to facilitate the implementation of KM for enhancing the learning culture in ADFs in developing countries represents a synthesis that is novel and creative in thought and adds value to the knowledge in a manner that has not previously occurred.

Keywords Architecture, Knowledge management, Culture in construction, Organisational learning and management, Learning culture, Framework, Architectural design firms, Developing countries

Paper type Research paper

1. Introduction
One of the essential and obvious attributes of this century is being a knowledge-driven era. This is because knowledge has become a fundamental asset that every organisation needs to use to achieve numerous strategic objectives (Malhotra, 2005). For architectural design firms (ADFs) to succeed in their uncertain, hypercompetitive and dynamic environment they are encouraged to exercise their ability to compile, preserve and disseminate specialised knowledge to initiate and sustain competitive advantage (Akhavan *et al.*, 2005). It has been acknowledged that project-based organisations such as ADFs are indeed knowledge-intensive business services as their core work comprises the formation and implementation of knowledge (Obeidat *et al.*, 2016). Adequate management strategies and adopting the latest technology are two primary factors that affect the performance of ADFs. Recently, knowledge management (KM) has been widely acknowledged in the professional and academic literature as a well-established area of knowledge (Ponzi and Koenig, 2002; Rylander, 2006). Since its origin, most research on KM has been conducted in developed countries, while the situation of developing countries is rarely addressed and hardly known (Arrau, 2015). Over the past 40 years, the productivity of ADFs in developing countries have remained significantly low although using advanced technologies such as computer-aided design and building information modelling, which succeeded to enhance the quality of drawings but failed to eliminate design errors that can only be detected through the proper use of knowledge (Aziz and Hafez, 2013). Othman and Elsaay (2018) stated that the most leading causes of poor organisation performance are poor communication and coordination; inadequate provision of information, design changes, errors and omissions; increased design cost and time; and lack of regulations, organisational learning culture and skills gap.

It is apparent that these causes are interlinked with the lack of adequate knowledge provision or improper allocation and reuse. Furthermore, the dexterity of ADFs to learn from their projects and the rate of their learning ability have been concluded to be essential not only for their success but also for their survival. Actualizing organisational learning specifically in ADFs can be challenging mainly due to the corporate focus on the latest cutting edge technology and design software instead of their human capital and adjusting any imbalances in their learning culture (Ford *et al.*, 2000). For this epiphany to be put into action, the defects of the learning culture in ADFs especially in developing countries must be studied to begin comprehending how it can be solved via KM strategies and hence improve the overall performance of ADFs. Accordingly, this paper aims to develop a KM-based framework for enhancing the learning culture in ADFs in developing countries. To achieve this aim, a research strategy comprised of literature review, case studies and survey questionnaire is designed to accomplish four objectives. Firstly, to understand the nature of the construction industry in developing countries, learning culture in ADFs and KM; secondly, to examine the effectiveness of KM in enhancing the learning culture in ADFs through presenting and analysing three case studies; Thirdly, to investigate the perception and application of ADFs in Egypt towards KM as an approach for improving the learning culture in ADFs; and finally, to develop a framework based on KM to enhance the learning culture in ADFs in developing countries.

2. Literature review
2.1 Nature of the construction industry in developing countries
Construction is one of the biggest industries worldwide. It plays an important role towards achieving the social and economic development objectives nationally and internationally. Socially, it provides communities with projects and infrastructure facilities that fulfil their needs and meet their requirements (Khan, 2008). Economically, it increases gross domestic product (GDP), offers job opportunities, provides most of the countries' fixed capital assets

and supports other industrial sectors to prosper (Field and Ofori, 1988). Alternatively, the construction industry is responsible for 50% of the material resources extracted from nature, 40% of energy consumption and 50% of total waste generated (Chileshe, 2011). In addition, about 40% of the global economy is used for manufacturing construction materials (Roodman and Lessen, 1995). In fact, the construction industry is one of the leading global economic industries that generates an annual output of US$3,000bn representing 10% of the world's GDP. In the case of developing countries, the construction industry has a dominant role in nourishing the economy, for example in India, the industry accounts for approximately 6% of the country's GDP worthy to note that it is also steadily growing at a rate of 10% annually. In Pakistan, the construction industry contributes about 2% of the country's GDP while the construction sector in Nepal is liable for a significant 9% of the national GDP, as well as to 45% of the overall development investments (Bawane, 2017). As for Egypt, the construction industry is undoubtedly one of the most progressive sectors of the Egyptian economy. It accounts for 5% of the national GDP, uses 11% of the total populations and has a roughly 32 public and 36,000 private contracting firms (Essam and Ehab, 2015). The architectural design process is one of the crucial processes in construction. This is because the decisions made during this process affect the project performance throughout its life cycle. Unfortunately, in developing countries ADFs are generally criticised for their low productivity, lack of originality and uniqueness of projects and poor quality. Furthermore, they are often condemned for lack of innovation, learning from previous projects and implementing new approaches such as knowledge management, integrated project delivery although they are knowledge-based firms (Othman and Youssef, 2020; Bawane, 2017).

2.2 Learning culture in architectural design firms
2.2.1 Background and definitions. ADFs are eminently known for their professional character and knowledge-driven nature. As a result, a firm's experience is needed to succeed in today's complex and highly competitive business environment. One of the major flaws of ADFs is the inadequacy of transmitting lessons learned from completed projects to the whole organisation. Despite the knowledge and experiences developed during the different phases of the project life cycle, they are seldom captured, recorded, regulated, stored and shared effectively amongst employees to allow for reuse in upcoming projects (Alhaji *et al.*, 2012). ADFs can improve their learning culture and hence their overall performance by learning from previous projects' failure and success, which justifies the crucial role played by KM learning could be interpreted as the process of detecting and correcting errors which leads to change as a result of experience and increases the potential of improved performance (Argyris, 2002). Therefore, it is safe to state that a lesson learnt is the knowledge obtained during the process of developing a project which clarifies how knowledge will be used in upcoming projects to achieve enriched future performance. In the majority of firms, this crucial knowledge is obliterated although it is physically present. Wasting knowledge is due to the lack of establishing systems for seizing and circulating it throughout the organisation. As a result, the total sum of the firm's knowledge is far less than the sum of its parts as a significant portion of this knowledge lies beyond documented data, reports and drawings, it lies deep in the minds of experts (Jugdev, 2012).

2.2.2 Types of learning. The most two common types of learning are "single-loop learning" 'and "double-loop learning". These types of learning can be used by any organisation to adapt and improve its overall performance. The single loop-learning is achieved by correcting an error by following the rules and operating norms of the organisation, it is a three-step process as clarified in Figure 1, while the double loop-learning

occurs when the operating norms of the process are questioned. It is the process of correcting an error by critically questioning the rules and operating norms when solving a problem (Edmondson and Moingeon, 1999) (Figure 2).

Single-loop learning is used when the organisational goals, values and strategies are sound, not questionable and the emphasis is on techniques and their effectiveness. On the other hand, double-loop learning is used when organisational strategy is reviewed and the emphasis is on learning and reviewing previous situations (Argyris, 1999).

2.2.3 Learning organisation. Learning is described as the process of detecting and correcting errors or in other words the mismatch between the intended objectives and the actual produced outcome. Consequently, learning could not be achieved merely by detecting errors, but when an action is followed to rectify detected mismatches (Edmondson and Moingeon, 1999). Organisational learning is not a new approach as it was dated back to 1958. However, it still witnesses a lot of research and development in many fields (Civelek, 2015) such as improving performance of ADFs (Othman and Elsaay, 2018) and marketing ADFs in developing countries (Othman and Hafez, 2019). A learning organisation is referred to an organisation that adopts learning as a continuous process through renewing, adapting and changing itself based on the requirements of its surroundings. Furthermore, it is an
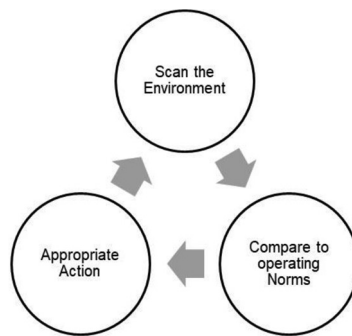
Figure 1.
Single loop-learning

Source: Developed by the authors
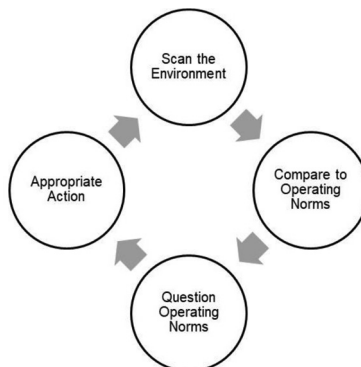
Figure 2.
Double loop-learning

Source: Developed by the authors

organisation that is able to learn from its past experiences and swiftly adjust its course of action. Learning organisation focusses on problem-solving, developing creative ideas and transferring them into practice to improve its performance (Alipour *et al.*, 2011). Moreover, learning organisation uses different systems to capture and share lessons learned to create a process that can be used by its members, therefore continuing to develop competitively within the dynamic market conditions (Sarkis *et al.*, 2011).

2.2.4 The lack of learning culture in architectural design firms in developing countries. Due to the fragmented nature of the construction industry generally and architectural design process, in particular, capturing knowledge and sharing information within ADFs is found to be relatively hard, which leads to the loss of the most valuable information developed during the design process (Othman and Elsaay, 2018; Othman and Halim, 2015). Hartmann and Dorée (2014) stated that the major constraint for adopting learning culture is connected to the gap between design and construction phases, where channels of communication between designers and contractors are disconnected. One of the key reasons behind this is the less attention paid by construction companies and ADFs in developing countries to establish and nurture a learning environment where learning is regarded as a vital tool for development. Although continuous learning is important to sustain competitiveness, ADFs in developing countries are criticised for being unable to apply learning and use it for improvement. This consequently reduces the chance of using learned lessons to improve the performance of new projects. Styhre *et al.* (2004) claim that one of the barriers to learning is the limited time available after each project, where team members are busy with new projects, leaving no time for sharing experience. In many developing countries most ADFs exhibit low attentiveness in capturing and using learned lessons to improve the performance of new projects. Their primary focus is on detecting errors and correcting them instead of embracing preventive means. Consequently, the same errors tend to become chronic throughout every project and decline the overall performance of ADFs (Bordass and Leaman, 2005). To change the focus towards adopting a prevention approach, ADFs are obliged to cultivate a learning culture where learning and knowledge are considered principal pillars for enhancing their overall performance (Love, 2004).

2.2.5 Building blocks of a learning organisation. Garvin (1993) stated that becoming a learning organisation necessitates mastering a number of practices, which form the building blocks of a learning organisation. Applying these practices to some degree or in isolated cases is not enough. To manage learning effectively, these practices should be integrated into the organisational core to transform it into a learning organisation. He identified five practices including systematic problem solving, experimentation, learning from experience, learning from others and knowledge transfer. There are several other contributions to classify the building blocks of a learning organisations. However, all these contributions could be classified under the following blocks (Figure 3).

2.2.5.1 Continuous learning and enhancement. According to Senge (1990), personal mastery is one of the processes of a learning organisation. He stressed on the individual's responsibility to constant learning and striving for lifelong learning. Moreover, he stated that the organisation's chance to learn is reliant on the employee's skills. A culture with a unified aim for continuous enhancement is vital in learning organisations (Hill, 1996; Otala, 1997).

2.2.5.2 Experimentation, feedback and reflection. Garvin (1993) emphasised the significance of experimenting at work, where there should be a culture that everyone is safe to disagree with one another and all opposing ideas are relevant and valued. Feedback and reflection are also important features of a learning organisation, where firms review and evaluate their previous success or failures and highlight the reasons that led them to each (Otala, 1997).

Source: Developed by the authors

2.2.5.3 *Teamwork.* Without teams that learn, there is simply no learning organisation (Senge, 1990). Thinking collectively as a group where rigid barriers are eliminated also fosters the growth of each individual. Goh (1998) further added that teamwork forms the core of the building blocks of a learning organisation as it unites people's collective skills. He insisted on the need to form cross-functional teams for higher effectiveness of teamwork.

2.2.5.4 *Company vision.* An organisation must have a clear vision and values to become a learning organisation (Otala, 1997). Viitala (2013) empahsised the importance of a shared common vision amongst all members of the organisation towards continuous enhancement through leadership. A common shared vision influences employees' commitment which is one of the key building blocks of a learning organisation (Senge, 1990).

2.2.5.5 *Shared learning.* Otala (1997) stated that for effective knowledge sharing amongst employees it must not only be appreciated but also rewarded. A learning organisation is one that has a defined and systematic way of sharing knowledge. Garvin (1993) proposed the idea of work rotation. Hill (1996) further suggested ideas such as coaching, mentoring, as well as providing workshops for group learning as means for knowledge sharing.

2.2.5.6 *External environment.* Otala (1997) argued the importance of staying in close contact with the external environment to be able to swiftly recognise and predict any new requirements or trends. Hill (1996) also mentioned that since construction is a project-based industry this makes it a client focussed industry and hence it should be closely affiliated with the client. Viitala (2013) also proposed that a learning organisation is one that constantly learns by benchmarking its rivals.

2.2.5.7 *Leadership.* Viitala (2013) argued that for organisations to be able to continuously stay up to track with the changes that affect the organisation's operational environment, it must implement an efficient development programme for its members. Leadership holds a significant role as a building block of a learning organisation since it involves leading by example (Garvin *et al.*, 2008).

The lack of learning culture in ADFs necessitated adopting the building blocks of a learning organisation, which will help learning from previous experiences and improving performance in future projects.

2.3 Knowledge and knowledge management
2.3.1 Overview and importance. Knowledge is defined as a combination of experience, value, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and applies in the mind of knowers, while in organisations it often becomes embedded not only in documents or repositions but also in organisation routines, practices and norms (Cooper *et al.*, 2005). There are several statements and perspectives that describe KM and explain its contents and objectives. However, all these definitions and perspectives agree that KM is a multi-disciplinary and holistic initiative adopted across the entire organisation to achieve business objectives by making the best use of knowledge through acquiring, creating, organizing, sustaining, applying, sharing and renewing knowledge (Davenport and Prusak, 2000). KM necessitates developing cultural and technical foundations that support its implementation. KM is tied to organisational objectives such as improving performance, sustaining competitive advantage and innovation, transferring lessons learned between projects and the general development of collaborative practices (Akhavan *et al.*, 2005; Chen and Mohamed, 2008).

2.3.2 Different types of knowledge. There are two types of knowledge, namely, explicit knowledge and tacit knowledge.

2.3.2.1 Explicit knowledge. This type of knowledge is usually found in databases, memos, notes, documents, scientific formulae, product specifications (Botha *et al.*, 2008). It is formalised and codified, and is sometimes referred to as know-what (Brown and Duguid, 1998). Explicit knowledge is easily handled by KM systems, which are very effective at facilitating, storing, retrieving and modifying documents. The greatest challenge with explicit knowledge is ensuring that people have access to what they need on a timely fashion. Many theoreticians regard explicit knowledge as being less important (Bukowitz and Williams, 1999; Cook and Brown, 1999) as it is simpler in nature and cannot contain rich experience that can generate sustainable competitive advantage.

2.3.2.2 Tacit knowledge. This type of knowledge, which is intuitive, highly personal and largely experience based, is hard to define and formalise, making it difficult to communicate or share with others. It is referred to as know-how (Brown and Duguid, 1998; Nonaka, 1994). Tacit knowledge is considered the most valuable source of knowledge and the most likely to lead to breakthroughs in organisations (Wellman, 2009). Gamble and Blackwell (2001) link the lack of focus on tacit knowledge directly to the reduced capability for innovation and sustained competitiveness. Tacit knowledge is found in the minds of human stakeholders. It includes cultural beliefs, values, attitudes, mental models, as well as skills, capabilities and expertise (Rizzi *et al.*, 2009), which made it difficult to handle by KM Systems. There are two dimensions to tacit knowledge. The first is the technical dimension, which encompasses the kind of informal and hard-to-pin-down skills or crafts often captured in the term know-how. The second dimension is "cognitive which consists of beliefs, perceptions, ideals, values, emotions and mental models that shape the way of perceiving the business environment around organisations.

2.3.3 Knowledge management pillars. KM pillars are fundamental and critical for effective and successful implementation on KM in organisations. There are a number of classifications of KM pillars. For example, Chan (2017) identified three pillars, namely, people, processes and technology. In addition, Petrov *et al.* (2019) stated that pillars of strategy, marketing and human resource management are essential for KM implementation. There are also several other contributions to define the KM pillars. However, all these contributions could be classified under the following pillars (Bixler, 2002; Calitz and Cullen, 2017) (Figure 4).

2.3.3.1 *Leadership.* In today's dynamic business environment, leaders play a significant role towards developing business strategies that improve the performance of their organisations and increase their competitive advantage. These strategies include developing organisational vision, mission and objectives which align KM with business tactics to use the value of KM throughout the organisation. Attention has to be devoted towards securing executive support and building KM champions. Effective implementation of KM necessitates senior management support to provide needed resources and ensure successful organisational cultural change (Baldanza and Stankosky, 1999).

2.3.3.2 *Organisation.* The value of creating and sharing knowledge should be interlinked throughout the organisation. This necessitates aligning all organisational strategies and plans with KM activities, which have to be designed in a way that facilitates its application. Successful implementation of KM requires organisational change. Examples of these changes include improving employees' capabilities; rising job complexity and immediate availability and accessibility of information. These changes are fundamental to make better use of KM solutions. Improving organisational performance calls for integrating KM into business processes to ensure flexibility of the organisational and technological infrastructure that meet changes in market demand and to establish formal and informal networks to facilitate knowledge flow (Calitz and Cullen, 2017).

2.3.3.3 *Technology.* The use of communication and collaboration technology to support KM implementation is ubiquitous. Technology is crucial for providing all the infrastructure and tools required to support and ensure effective application of KM within an organisation. This could be accomplished through searching, retrieving, sending, structuring, navigating, collaborating and sharing information and best practice among employees. In addition, technology contributes towards synthesising, profiling and personalising, solving and recommending solutions, integrating with business applications and maintaining databases (Janicot and Mignon, 2012). While organisational and cultural changes are crucial to achieve the objectives of KM, a lack of proper technical infrastructure and tools can lead to failure. Proper assessment and definition of information technology (IT) capabilities and tools is essential to match and align with the organisation's requirements (Bixler, 2001).

2.3.3.4 *Learning.* Learning is an integral part of KM. Using KM to achieve organisational objectives entails the involvement of the whole organisation. Alone, the best tools and processes will not accomplish KM strategies. People are the driving force for using these tools and performing the required tasks. Establishing learning as organisational behaviour is

Figure 4.
Knowledge
management pillars
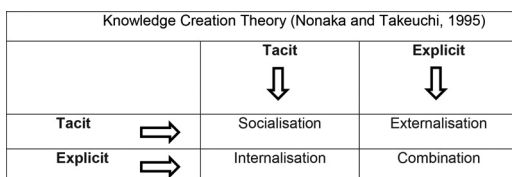
Source: Developed by the authors

essential to support KM strategy. Organisational learning is achieved through improving organisational communications, supporting cross-functional teams and creating a learning community (Alipour *et al.*, 2011). Learning is best described as the acquisition of knowledge or skills through study, experience or instruction, collaboration, sharing knowledge and building on each other's ideas. Senior management has to realise that tacit knowledge exists in people, and knowledge creation is generated through social interaction and learning. KM is not a separate function characterised by a separate department or a process; it must be embedded into all organisational business processes (Kontoghiorghes *et al.*, 2005; Mohajan, 2015).

2.3.4 Knowledge management processes. KM processes refer to the ways that an organisation handles knowledge at various stages of its life cycle. They include the processes of obtaining, creating, gathering and sharing knowledge in an organisation to achieve its objectives. KM processes focus on saving the knowledge and experience of employees within an organisation then sharing and using it in an efficient way (Yap and Lock, 2017). Literature review showed that these processes vary in different references. This is because KM processes are covered from a different viewpoint in some sources than others (Kakabadse *et al.,* 2003; The America Productivity and Quality Center, 1996; Cavaleri, 2004; Sveiby, 1997). However, all KM processes could be classified under the following four processes. It worth mentioning that these processes are a result of combination between tacit and explicit knowledge through sub-processes of socialisation, internalisation, externalisation and combination (Figure 5).

2.3.4.1 Knowledge discovery. It is defined as the development of new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. The discovery of new explicit knowledge relies directly on combination, which happens through communication, integration and systemisation of multiple streams of explicit knowledge. Existing explicit knowledge, data and information are reconfigured, recategorised and recontextualised to produce new explicit knowledge. While the discovery of new tacit knowledge relies most directly on socialisation which is achieved through synthesising of tacit knowledge across individuals, usually through joint activities rather than written or verbal instructions (Botha *et al.*, 2008; Becerra-Fernandez and Sabherwal, 2001).

2.3.4.2 Knowledge capture. It is the process by which knowledge is converted from tacit to explicit and vice versa through the sub-processes of externalisation and internalisation. Externalisation is the sub-process through which an organisation captures the tacit knowledge its workers possess so that it can be documented, verbalised and shared. This is a difficult process because tacit knowledge is often difficult to articulate. Internalisation is the sub-process through which workers acquire tacit knowledge. It represents the traditional notion of learning. Knowledge capture can also be conducted outside an organisation (Anumba *et al.,* 2005; Becerra-Fernandez and Sabherwal, 2001).

2.3.4.3 Knowledge sharing. It is the process through which explicit or tacit knowledge is communicated to other individuals through the sub-processes of socialisation and exchange. Socialisation facilitates the sharing of tacit knowledge in cases in which new tacit

Knowledge Creation Theory (Nonaka and Takeuchi, 1995)		
	Tacit ⇩	**Explicit** ⇩
Tacit ⟹	Socialisation	Externalisation
Explicit ⟹	Internalisation	Combination

Source: Nonaka and Takeuchi (1995)

Figure 5.
Knowledge creation
theory

knowledge is being created or not, while exchange is used to communicate or transfer explicit knowledge among individuals, groups and organisations (Ipe, 2003; Becerra-Fernandez and Sabherwal, 2001).

2.3.4.4 Knowledge application. Knowledge application is used to make decisions and perform tasks through direction and routines. Direction refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to that individual the knowledge underlying the direction. While routines involve the utilisation of knowledge embedded in procedures, rules, norms and processes that guide future behaviour. Both direction and routines are applicable to either tacit or explicit knowledge (Carrillo *et al.*, 2004; Becerra-Fernandez and Sabherwal, 2001).

To make better utilisation of KM capabilities towards building learning culture and enhancing organisational performance, ADFs are required to adopt strategies that raise employees' awareness and integrate KM process and pillars in their day to day activities.

2.4 Relationship between knowledge management and learning culture in architectural design firms in developing countries

While learning culture refers to the attitudes, values and behaviours that facilitate continuous learning in organisations, KM is deemed as a process of leveraging knowledge to achieve innovation in processes, products or services. In addition, it aids in effective decision-making and adapts organisations to the business environment (Yahya and Wee-Keat, 2002). Moreover, KM helps creating value through the activation of know-how of experience inside and outside the organisation (Ruggles, 1998). According to De Long (1997), despite the economic incentives are becoming clearer and technological capabilities now exist to support knowledge-based organisations such as ADFs, it has been found that existing organisational cultures are often a major barrier to implementing KM in organisations. As Davenport and Prusak (2000) stated, effective KM cannot take place without extensive behavioural, learning cultural and organisational change. KM is a process that facilitates knowledge exchange and sharing and establishing learning as a continuous process within the organisation (Cross and Israelit, 1999). The fragmented nature of the construction industry due to the separation between design and construction hindered capturing and sharing knowledge in ADFs which resulted in losing valuable information that could be used to improve project performance (Othman and ElSaay, 2018; Othman and Halim, 2015). This is a result of the poor attention paid towards building learning culture in ADFs. Accordingly, the building blocks of learning organisations have to be adopted to use KM to enhance the learning culture in ADFs. Table 1 depicts the relationship between KM and building blocks of a learning organisation. For example, knowledge sharing could be achieved through socialisation and exchange. These two sub-processes could be facilitated through encouraging continuous learning and enhancement, adopting teamwork approach, integrating KM in the company vision, fostering shared learning between employees and triggering leadership to facilitates all resources needed for successful implementation of KM.

3. Research methodology

Choosing the appropriate research methodology to achieve the purpose of this research was primarily emerged from two factors, namely, the specific research aim and objectives and how they could be achieved; and the research nature and characteristics (Holt, 1998).

For the first factor, this research aims to develop a framework based on KM to enhance the learning culture in ADFs in developing countries. A set of objectives was developed to achieve this aim, including reviewing literature about the research topic, analysing three case studies to support the research argument and presenting results of a survey

KM	Building blocks of a learning organisation	Continuous learning and enhancement	Experimentation, feedback and reflection	Teamwork	Company vision	Shared learning	External environment	Leadership
Knowledge discovery	Combination	X	X	X	X	X		X
	Socialisation		X	X		X		
Knowledge capture	Externalisation		X	X		X	X	X
	Internalisation							
Knowledge sharing	Socialisation	X		X		X		
	Exchange			X	X	X		
Knowledge application	Direction		X		X			
	Routines	X			X			X

Source: Developed by the authors

Table 1.
Relationship between
KM and building
blocks of a learning
organisation

questionnaire to investigate the perception of ADFs in Egypt about the research problem and proposed solution.

For the second factor, this research is descriptive in nature as it discusses a well-defined subject and conducts research to describe it accurately and portray an adequate profile of situations. It requires intensive previous knowledge of the problem or situation to be researched or described (Robson, 2002). In addition, it is a practical research as attempts to solve a practical problem related to enhancing learning culture in ADFs in developing countries.

The above-mentioned factors require three main activities of collecting data from different resources using different techniques, then analysing the collected data quantitatively and qualitatively and, finally, developing an action to solve the problem in hand. Accordingly, the research methodology adopted to achieve the aim of this research consisted of data collection, data analysis and action required. These activities were deemed as a concurrent process rather than sequential steps because analysing collected data, for instance, may entail collecting more data to validate a certain issue (Figure 6).

3.1 Data collection
Data collection was based on literature review, case studies and survey questionnaire. Firstly, literature review used textbooks, academic and peer-reviewed journals, conference and seminar proceedings, dissertations and theses, organisations and government publications, internet and related websites to examine the nature of the construction industry in developing countries, learning culture in ADFs and knowledge and KM. Secondly, three case studies from Turkey and the UK were collected and analysed to investigate in a practical way the effectiveness of KM in enhancing the learning culture in ADFs. Thirdly, results of a survey questionnaire conducted with a representative sample of ADFs in Egypt were analyzed to investigate the perception and application of KM towards enhancing the learning culture in ADFs. The survey consisted of open-ended questions (e.g. thoughts and opinions) and close-ended questions (e.g. Yes/No questions, rating questions based on 1–5 Likert scale). A pilot study of the survey was tested with colleagues to determine its effectiveness and problems. After going over the responses of the preliminary test and making changes, the questionnaire was ready for formal testing (Baker, 1994; Czaja and Blair, 1996).

3.2 Data analysis
A three-stage data analysis approach was adopted. The first stage was to measure the central tendency and dispersion of the questionnaire responses. The measure of central tendency was

Figure 6.
Research
methodology

used to get an overview of the typical value for each variable by calculating the mean, median and mode. The measure of dispersion was used to assess the homogenous or heterogeneous nature of the collected data by calculating the variance and the standard deviation (Bernard, 2013). Analysis of the collected data showed close values of means, medians and modes, indicated typical central values and showed also low values of variance and standard deviation. This confirmed the quality and the homogeneity of the collected data and a low degree of dispersion resulting in reliable findings. Secondly, as not all barriers have the same impact on implementing KM strategies in ADFs, the relative importance index (RII) was used to differentiate between these barriers using the formula of: $RII = \Sigma W/AN$, where W = weighting given to each barrier by the respondents on a Likert scale from 1 to 5, A = highest weight (5 in our case); and N = total number of sample (Shash, 1993; Kometa and Olomolaiye, 1997). The data were analyzed with the aid of Microsoft Excel spreadsheet. Finally, to investigate the correlation between the KM processes and building blocks of learning culture, Spearman correlation test was conducted using Statistical Package for the Social Sciences "SPSS" to perform this type of analysis. As there is no quantification without qualification and no statistical analysis without interpretation (Bauer and Gaskell, 2000) during the course of this research, both approaches of quantitative and qualitative data analysis were used.

3.3 Action required
Based on the results of data collection and data analysis, a KM-based framework was developed to enhance the learning culture in ADFs in developing countries (Figure 7).

3.4 Population and sampling
3.4.1 Questionnaire survey sample. The sampling plan using a random probability sampling method was applied to the population size which was 44 (ADFs) registered in the
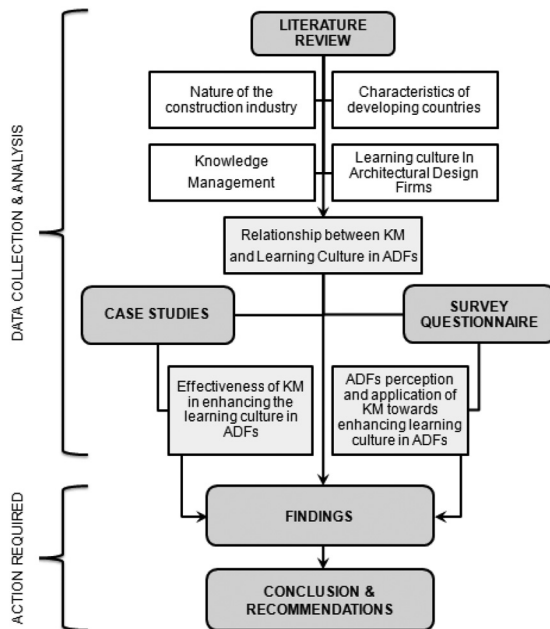

Figure 7.
Research
methodology

Egyptian Engineers Syndicate (EES, 2019). This allowed every unit an equal chance of being included in the sample (Hannagan, 1986). This helped selecting a representative and non-biased sample. To calculate the sample size, the next two equations were used (FluidSurveys Team, 2014):

$$\text{Sample Size Calculation} = \frac{\text{Distribution of } 50\%}{\left[\text{Margin of error\%}\middle/\text{Confidence Level Score}\right]^2}$$

$$\text{True Sample} = \frac{\text{Sample Size} \times \text{Population}}{\text{Sample Size} + \text{Population} - 1}$$

In this research, the confidence level chosen is 95% and the margin of error is 5%. The confidence level score corresponding to the confidence level of 95% is 1.96:

$$\text{Sample Size} = \frac{0.5 \times (1 - 0.5)}{\left[\frac{0.05}{1.96}\right]^2} = 384.16$$

$$\text{True Sample} = \frac{384.16 \times 44}{384.16 + 44 - 1} = 39.57 \sim 40$$

However, as the true sample size is only different from the population size by 4; the population size would be considered entirely for the survey questionnaire. It worth mentioning that the names of these design firms were suppressed for the purpose of security according to their request.

4. Case studies
The case study is a research method used to describe and analysis an individual matter, phenomenon, event or project with the purpose to identify variables, structures, forms and orders of interaction between the participants in the situation or to assess the performance of work or progress in development (Sturman, 1997). Within this research, three case studies were selected from developed and developing countries. The rationale behind selecting these cases was to explore in a practical way the role of KM towards enhancing the learning culture in organisations and the barriers encountered in developing countries. Due to the limited cases of ADFs that applied KM, some of the cases were construction firms as the main aim was to reveal learned lessons for improving the learning culture in ADFs in developing countries.

4.1 Case study (1): Keppie design, Scotland, UK
Keppie Design is a Scottish leading independent architectural practice established about 150 years ago. The firm, which uses 250 skilled employees distributed amongst numerous offices in Scotland, has an international reputation in the design of health care and educational facilities. Throughout the years, the firm has established a reputable background in quality buildings that work well technically and aesthetically. A number of issues was raised and led the firm to invest in KM. Firstly, the rapid expansion of health care and educational projects necessitated opening new offices and doubling staff members, which added loads on ordinary forms of knowledge transfer, training and communication.

Secondly, the gap between the technical skills of fresh architectural graduates and the needs of the construction industry affected the firm's reputation. Accordingly, the firm assigned a knowledge manager to enhance the training of new architects, improve the learning culture of employees and align KM strategy with the firm's strategic goals. Analysis of the case study showed that the main challenges that encountered KM Implementation and achieving stated objectives were lack of understanding the benefits of applying KM, poor circulation of information to remote offices and contacts between architects to discuss repeated issues, the need to form a repository of experience and skills such as directory of standard drawing details, library of technical and design information and directory of standard firm information for bid documents and finally the need for training. Through developing a working plan that fosters the culture of learning and collaboration between working groups, creating intranet and database for experience and skilled employees, the Knowledge Manager succeeded in facilitating the internal communication, improving the training and professional development within the firm and identifying the expertise developed in projects. Over a two-year period Keppie Design achieved substantial advantages from a relatively small financial investment in KM. Trainee staff was quickly inducted into the business, reducing the time to productivity; technical information was readily accessible under the guidance of experienced technical managers; the staff directory allowed increased collaboration among dispersed teams of architects; and the efficiency of bid preparation was substantially improved (Ogiwara, 2009).

4.2 Case study (2): Pochins PLC construction company, UK
Pochins PLC is a construction company that was founded in 1935 in North-west England. In addition, to construction, the Pochin Group is interested in many other fields such as commercial and residential property developments. Apart from that, Pochin Group deals in concrete pump hiring. There are almost 500 employees employed in Pochin Company within all offices. The company has a number of workshops in Middlewich, Bathgate, Tamworth and Colnbrook, to serve and maintain the concrete pumps. The main problem that directed Pochin Company to invest in KM is the need to tackle the issue of wasting organisational resources and repeating the same errors due to poor learning culture and information transfer between workshops operators. According to Koskela (2007), it was identified that the social interaction within the knowledgeable workers is more efficient and effective than any other tools or technologies used when managing knowledge. Hence, social interactions should be put into consideration when implementing new solutions in construction organisations. As Pochin Company cares about innovation, an "innovative forum" was implemented in the company so that an employee can submit his/her idea and receive a small encouragement if the idea was accepted. Another implementation that was adopted by Pochin Company was the development of an intranet solution called "Pochinet". The Pochinet service is used to share different types of documents such as "daily notices, contact lists, standard forms, health and safety information, QA documents and standard work procedures". Pochinet is available to the local and wide area of the company, to all Pochin's staff, offices depots, workshops and the majority of construction sites. After six month of implementation, result showed that ideas were well exchanged, better communication between employees and new topics were discussed, extensive feedback were posted which helped enhancing learning culture and generating more knowledge and applying it to work workplace.

4.3 Case Study (3): a pilot study in the Turkish capital
A pilot study was conducted through face-to-face interviews with a sample of ADFs in Turkey to investigate the dilemma of KM practice and learning culture in the architecture

and construction industry in Cankaya district in Ankara, Turkey. The country holds 32,300 registered architects and 6,494 architectural offices according to the Architects Council of Europe (ACE). Initially, a survey questionnaire was prepared and published on the website of the Chamber of Architects of Turkey. Surprisingly only 12 firms answered the questionnaire and after a second attempt 16 more replied representing a significantly low response rate. Consequently, the questionnaire approach was denied and replaced by interviews conducted with 15 out of 211 architectural practicing offices in Cankaya district of Ankara, Turkey. The majority of the selected firms had less than 10 employees. These firms conducted various types of projects including residential, commercial, industrial, education, transportation, office building, health care, to name a few. Results of the pilot study could be summarised as.

According to 12 of 15 ADFs answered the questionnaire, the Internet is the most effective means to gather project data, gain information and communicate with other organisations. The internet is an excellent resource for obtaining information in a short period of time and with minimal effort. Partners and clients were discovered to be an important source of intelligence in the project's development process. It is observed that14 of the 15 firms reported that they work with clients on a regular basis, while 2 firms stated that they log any piece of information obtained from clients because it is unpredictable when it may be needed. Because of the volume of project work, material, knowledge application, expertise and rights, government agencies were identified as the most important clients. A total of 13 ADFs strongly believe that they meet with government officials on a regular basis for a variety of reasons, such as having new rules or obtaining bidding material. Despite the fact that communication with other parties was found to be critical for organisations, communicating with ADFs was discovered to be risky and highly reliant on personal relationships (Tanyer and Kayacetin, 2009). In the design phase of a project, 11 out of 15 ADFs indicated that they primarily generate and achieve awareness and automatically assess challenges for better solutions. A total of 5 ADFs argued that during the construction phase they should be able to log and capture useful experiences and knowledge to allow them to develop real-life solutions for projects. Other ADFs stated that during or post-project reviews, they were able to increase their knowledge spectrum. This is because ADFs barely have time to complete their projects, or they turn to the next project at once. It is observed that 10 out of 15 ADFs stated that they use post-project feedback mostly to gather information in a catalogued manner and save time in archiving their knowledge for future reuse. One large ADF reported that it uses two teams to update and secure its project information archive after the conclusion of the project (Tanyer and Kayacetin, 2009).

According to the findings of the pilot study, ADFs primarily use their existing intranet system to exchange information among their employees through emails, instant messaging and other means. It is observed that 14 out of 15 ADFs believe that social networking is the most often used approach and that social communication was often considered essential for internal employee training. In addition, setting regular training sessions for employees is essential for improving their architectural drawing standards and enhancing learning culture. According to the findings, 13 out of 15 ADFs perceived that lack of standard procedures is the main barrier for managing architectural knowledge, while lack of time and the exceptional nature of architectural projects were perceived as prominent barriers by 9 out of 15 ADFs. The inadequacy of management participation and employees' lack of interest, were identified as strong barriers by 7 ADFs. None of the selected firms disregard the importance of employees' involvement which implies that the firms are amenable to change how they handle the management of knowledge yet it is only possible if the employees are willing to cooperate. To conclude, the application of KM was seen to achieve a

significantly more homogenous working environment in Turkish ADFs through enhancing their learning culture. Despite the benefits of managing architectural knowledge in terms of enhancing productivity, improving employees' satisfaction and reducing rework, the distinctive nature of architectural work, lack of time, lack of management support and employees' resistance to change were identified as the strongest barriers against enhancing learning culture via KM. Table 2 summarise the building blocks of learning organisation and KM process implemented in case studies.

5. Data analysis

This section presents and analyses the results of a survey questionnaire conducted with a representative sample of ADFs in Egypt to examine their perception and application of KM as an approach for improving the learning culture in ADFs.

5.1 Response rate and respondents' profile

Out of 44 ADFs invited to participate in the study, only 30 firms responded to the survey questionnaire which represents 68.2%. A total of 25 firms are sole proprietors and the rest are partnerships. The number of years of experience of these firms in the construction industry ranges from 5–50 years. They are involved in all types of projects including residential, commercial, medical, industrial, cultural, business, recreational and educational. The size of these firms ranges from 10–50 employees with architecture, engineering and construction backgrounds.

5.1.1 Perception and application of knowledge management. The maturity of the ADFs surveyed was indicated by 88% of respondents who confirmed their perception of KM concepts. Furthermore, while 69.8% of respondents stated that they implement KM strategies such as collecting and sharing knowledge among team members, 30.2% mentioned that architects are unwilling to share information with other colleagues and prefer to keep it for their own use, reflecting a poor understanding of learning culture. Furthermore, 77% of respondents stated that the primary goal of implementing KM strategies in ADFs is to ensure proper collection, sharing and utilisation of organisational knowledge, which will positively impact project outcomes. Moreover, 63.4% of respondents mentioned that they use post-project reviews to capture and exchange information needed to accomplish a specific mission, while 39.6% of respondents stated that they connect with previous projects if they are given a new project.

5.1.2 Barriers to implementing knowledge management strategies in architectural design firms. Of respondents 34.9% agree that corporate culture is the most important obstacle to KM strategy execution in ADFs with mean (4.9/5), median and mode (5/5), V (0.8), SD (0.89) and RII (0.98). These findings are consistent with the findings of a literature review, which highlighted the importance of culture as a recurring obstacle or enabler for effective KM execution, and it may be the most challenging restriction that KM managers face (Coopers and Lybrand, 1998; Davenport *et al.*, 1998). Culture cannot be modified explicitly, but only indirectly by training, incentives and role models (Wiig, 1997). In addition, 22.2% of respondents reported that the lack of top management participation was the second most significant obstacle to applying KM policies in ADFs with mean (4.83/5), median and mode (5/5), V (0.78), SD (0.88) and RII (0.97). This is because senior management engagement encourages the development of chosen policies and provides the necessary tools to ensure the effective execution of KM strategies. Furthermore, 19% of respondents accepted that low employee involvement and resistance to change are the third obstacle to the effective introduction of KM in ADFs with mean (4.7/5), median and mode (5/5), V (0.74), SD (0.86) and RII (0.94). These results are reinforced by a literature review, which claimed that one

| | Building blocks of a learning organisation | | | | | | |
	Continuous learning and enhancement	Experimentation, feedback and reflection	Teamwork	Company vision	Shared learning	External environment	Leadership
Case study (1)	X	X	X	X	X	X	X
Case study (2)	X	X	X	X	X	X	X
Case study (3)	X	X	X		X	X	X

Source: Developed by the authors

(continued)

|	Knowledge management							
	Knowledge discovery		Knowledge capture		Knowledge sharing		Knowledge application	
	Combination	Socialisation	Externalisation	Internalisation	Socialisation	Exchange	Direction	Routines
Case study (1)	X	X	X	X	X	X	X	X
Case study (2)	X	X	X	X	X	X		X
Case study (3)	X	X	X	X	X	X		X

Table 2.

significant cause of change initiative failure is reluctance of organisational participants to change due to factors such as fear of change, insufficient resources, short time to complete the change process and increasing workload (Benowitz, 2001; Loosemore *et al.*, 2003). Moreover, 14.3% of survey respondents claimed that a shortage of IT capabilities and poor organisational procedures were the fourth obstacle to effective execution of KM strategies, ranking alongside mean (4.63/5), median and mode (5/5), V (0.72), SD (0.85) and RII (0.93). This is due to the fact that IT is one of the most important and successful foundations of KM implementation in organisations. Besides, 9.5% of the respondents highlighted that the excessive amount of time and money needed to implement KM strategies was ranked the fifth barrier with mean (4.47/5), median and mode (5/5), V (0.67), SD (0.82) and RII (0.89). This is due to the fact that projects have insufficient resources (i.e. time and budget), which puts pressure on staff and prevents them from having adequate time to record, share and benefit from their projects (Robinson *et al.*, 2005) (Figure 8 and Table 3).

5.1.3 Organisationl culture. Of respondents 66.7% stated that they do not openly share their knowledge with their co-workers. This attitude halts the process of knowledge sharing because some employees may be afraid of losing their uniqueness or power as a result of their knowledge becoming common knowledge amongst all employees. Furthermore, 61.9% of respondents characterised their ADFs' working culture as a strict environment with standardised working hours, protocols, standard timetables and firm hierarchy. Such an atmosphere is not conducive to the development of talented workers such as architects. ADFs with such working environments are less likely to promote innovation or allow for the development or dissemination of information among employees. As a result, such ADFs are likely to have a very poor learning culture. The findings of a literature review backed up these findings, emphasising the importance of cultural change and innovative methods including talent management to promote innovation and information sharing in ADFs (Othman and Khalil, 2018). Furthermore, 84.1% of respondents agreed that implementing KM methods improves the learning culture in ADFs. Besides, 34.9% of respondents stated that to reap the benefits of KM strategies, a shift in organisational culture is needed.

5.1.4 Building blocks of learning culture. Table 4 summarises the results of respondents with regard to the building blocks of learning culture in ADFs. These results are in line with findings of literature review as mentioned in Section 2.2.5. Respondents ranked lack of continuous learning and enhancement as the highest building block for implementing KM in ADFs with mean (4.93/5), median and mode (5/5), V (0.81), SD (0.90) and RII (0.99). While they ranked leadership as the lowest building block for implementing KM in ADFs with mean (4.33/5), median and mode (5/5), V (0.63), SD (0.79) and RII (0.87).
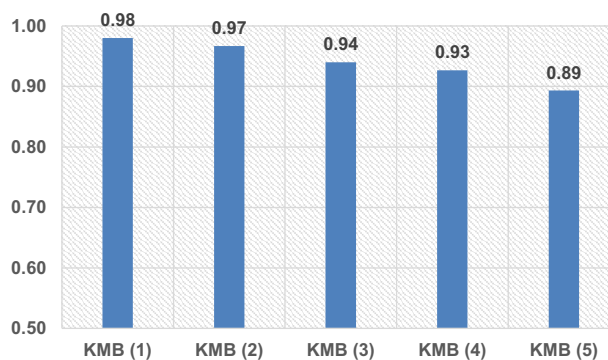
Figure 8.
KM barriers (KMBs)
in ADFS

No.	KM barriers in ADFs	Mean	Median	Mode	V	SD	% age of respondents scoring			RII	Rank
							<3	3–4	>4		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
KMB (1)	Organisational culture	4.90	5	5	0.80	0.89	0	3	27	0.98	(1)
KMB (2)	Low involvement of top management	4.83	5	5	0.78	0.88	0	4	26	0.97	(2)
KMB (3)	Low involvement of employees and resistance to change	4.70	5	5	0.74	0.86	1	5	24	0.94	(3)
KMB (4)	Lack of IT capabilities and poor organisational procedures	4.63	5	5	0.72	0.85	1	6	23	0.93	(4)
KMB (5)	Excessive amount of time and money needed to implement KM strategies	4.47	5	5	0.67	0.82	2	8	20	0.89	(5)

Table 3.
Barriers to implementing KM strategies in architectural design firms against their measures of central tendency, dispersion and ranking

No.	Building blocks of learning organisation	Mean	Median	Mode	V	SD	% age of respondents scoring			RII	Rank
							<3	3 – 4	>4		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BBLC (1)	Continuous learning and enhancement	4.93	5	5	0.81	0.90	0	2	28	0.99	(1)
BBLC (2)	Experimentation, feedback and reflection	4.87	5	5	0.79	0.89	1	2	27	0.97	(2)
BBLC (3)	Teamwork	4.83	5	5	0.78	0.88	1	3	26	0.97	(3)
BBLC (4)	Company vision	4.67	5	5	0.73	0.85	1	5	24	0.93	(4)
BBLC (5)	Shared vision	4.50	5	5	0.68	0.82	2	6	22	0.90	(5)
BBLC (6)	External environment	4.47	5	5	0.67	0.82	2	8	20	0.89	(6)
BBLC (7)	Leadership	4.33	5	5	0.63	0.79	3	8	19	0.87	(7)

Table 4.
Building blocks
learning culture in
architectural design
firms against their
measures of central
tendency, dispersion
and ranking

5.2 Correlation analysis of knowledge management barriers in architectural design firms
A correlation analysis test was conducted on all KMBs to investigate their correlations. Spearman correlation test was carried out through using SPSS to perform this type of analysis as all the variables are ordinal and categorical. While SPSS highlighted that some barriers are correlated, others were not. For instance, there is a significant correlation between KMB1 and KMB2 which is supported by literature review. This is because when a change is proposed in organisations such as implementing KM, organisational culture plays a significant role towards resisting change and discouraging employees from being involved in the change process (Othman and Youssef, 2020). Fear of the unknown, lack of information/knowledge/skills, threats to status, fear of failure, lack of perceived benefits, uncertainty about the change outcomes and internal politics and lack of trust in senior management are some of the reasons for resistance to change and poor employee involvement (Ford *et al.*, 2000; Proctor and Doukakis, 2003). Furthermore, there is a correlation between KMB1 and KMB4. This correlation corresponds to literature findings because an organisational culture that is resistant to change will not provide needed IT requirements or improve related organisational procedures such as investment in training or motivation (Kiani and Khalili Ghomi, 2013) (Table 5).

6. A knowledge management based framework for enhancing the learning culture in architectural design firms in developing countries
According to the results of the literature review, case studies and survey questionnaire, the research proposed the development of a framework to enhance the learning culture in ADFs in developing countries.

6.1 Definition and background
A framework is defined as a plan of interconnected concepts, tools and techniques that collectively provide an encompassing understanding of a phenomenon and complete a product, process or design (Jabareen, 2008; EDMS, 2010). The framework developed by this research is a KM-based framework aimed at enhancing the learning culture in ADFs in developing countries. It focusses on overcoming the barriers that obstruct the implementation of KM in ADFs. It includes a set of approaches, notions and techniques that serve to achieve the processes of KM, as well as the building blocks of a learning culture in ADFs.

6.2 The need for the framework
The framework is needed to enhance the performance of ADFS through providing a structured plan for senior management to overcome the barriers of KM implementation in ADFs in developing countries. The importance of the framework stems from the necessity to enhance learning culture in ADFs to overcome the issues of recurring errors and mistakes in projects which lead to projects' delay and cost overrun. In addition, the framework is required to address the issue of employees' resistance to change and to surmount the lack of

	KMB (1)	KMB (2)	KMB (3)	KMB (4)	KMB (5)
KMB (1)	*1.000*	−0.130	0.672**	0.416*	0.323
KMB (2)	−0.130	*1.000*	0.319	−0.214	−0.101
KMB (3)	0.672**	0.319	*1.000*	0.199	0.371*
KMB (4)	0.416*	−0.214	0.199	*1.000*	0.323
KMB (5)	0.323	−0.101	0.371*	0.323	*1.000*

Table 5.
Spearman correlation factors for barriers to KM implementation

conformity and trust between project members and to avoid the development of unrealistic scheduling or reinventing the wheel. Moreover, the framework is required to fill the gap in construction literature towards learning culture in ADFs in developing countries.

6.3 Development of the framework

The development of the framework was based on the results of the literature review, case studies and data analysis gleaned from the survey questionnaire. Firstly, literature review showed that there are a number of barriers that obstruct the implementation of KM in ADFs in developing countries. These barriers included organisational culture, low involvement of top management and employees, resistance to change, lack of IT capabilities and poor organisational procedures and excessive amount of time and money needed to implement KM strategies. In addition, literature review identified KM processes and building blocks that help developing learning culture in ADFs which included continuous learning and enhancement, experimentation, feedback and reflection, teamwork, company vision, shared learning, external environment and leadership. Secondly, results of the case studies showed that the firms that adopted learning culture approach succeeded in enhancing their performance and delivered values to their clients. Moreover, these findings are in line with results of the survey questionnaire. Respondents highlighted that they frequently encounter the same problems they have faced before due to lack of learning culture. In addition, respondents stated that integrating KM strategies will reduce the time and cost of solving problems. Respondents stated that most employees do not openly share knowledge with one another as a result of poor team spirit. They share only limited knowledge that is necessary to complete a specific task. Moreover, respondents highlighted the inflexible work environment which does not encourage innovation and empowering employees. Furthermore, literature review highlighted the absence of a framework dedicated to KM as an approach for improving learning culture in ADFs in developing countries (Figure 9).

### 6.4 Aim of the framework

The devised framework is an innovative conceptual business improvement tool designed to facilitate the implementation of KM for enhancing the learning culture in ADFs in developing countries.

6.5 The conceptual description of the framework

The framework consists of five steps, namely, nourishing organisation culture, involving senior management, empowering employees, enhancing organisation IT capabilities and maximising organisation resources (Figure 10).

The description of the framework is based on a systematic process. Firstly, explaining each step related to the barriers of implementing KM in ADFs in developing countries. Secondly, clarifying the activities; tools and techniques; involved personnel and needed resources to achieve the related KM process and building blocks of learning culture which leads to the enhancement of learning culture in ADFs in developing countries (Figure 11).

6.5.1 Nourishing organisation culture. Culture is defined as the set of shared values, beliefs, behaviours, goals, attitudes, practices that characterises an institution, organisation, society or group. From a business perspective, culture is the sum of peoples' habits related to how they get their work done. Employees describe their organisation's culture as a reason why they can or cannot do something. Organisation's culture is enabling or inhibiting change or resistance (Mann, 2005). "Nourishing organisation culture" step aims to change the attitudes, behaviors, skills or performance of employees in ADFs. The activities involved in achieving the aim of this step involve:
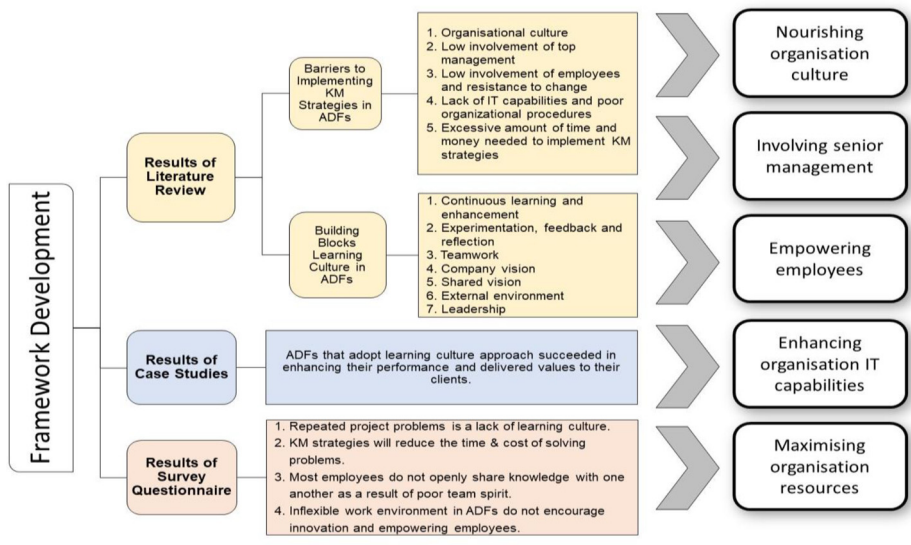
Figure 9.
Framework
development

Figure 10.
KM Framework to
enhance the learning
culture in ADFs in
developing countries

- communicating, motivating, leading and interacting with employees through forming a KM team responsible for conducting the culture change.
- investigating the perception of employees on the internal atmosphere of their ADFs and how they propose work should be done.
- changing the perception of how knowledge is discovered, captured, shared and applied.
- changing the learning culture of employees and how new skills could be acquired and how employees perceive themselves, their jobs and their organisations (Benowitz, 2001).
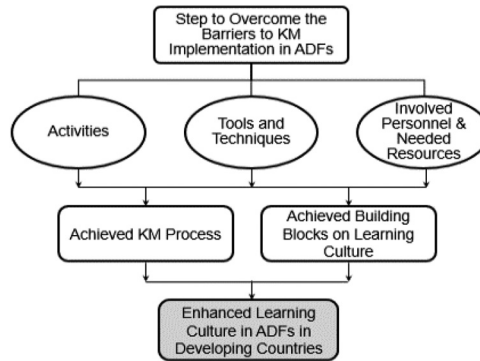
Due to the reluctance to change in the construction industry, nourishing organisation culture is essential for successful implementation of KM in ADFs. The tools and techniques that are required to achieve this step include brainstorming sessions, meetings, survey questionnaires and interviews. The involved personnel and needed resources contain Departments' heads, KM team leader, architects and other employees. Ample time and friendly environment is required to enable the KM team to achieve the KM process of knowledge discovery and sharing, as well as the building blocks of learning culture involving teamwork, leadership, company vision, continuous learning and enhancement and experimentation and feedback.

6.5.2 Involving senior management. A committed senior management is not only important for the daily running of a business, the formulation of goals and strategies but it is also essential for high engagement, commitment and trust (Martensson, 2000). In today's dynamic business environment, leaders play a significant role towards developing business strategies that improve the performance of their organisations and increase their competitive advantage. These strategies include developing organisational vision, mission and objectives which align KM with business tactics to use the value of KM throughout the organisation (Sharp, 2003). Storey and Barnett (2000) added that top management support should be ongoing and delivered in a practical manner that contributes to the success of KM implementation. The activities required to achieve the aim of "involving senior management" step include:

- conducting meetings with top management to raise their awareness by presenting the current issues in ADFs in terms of project delivery, quality, rework expenses and weak organisation culture.
- establishing organisational benchmark against competitors.
- increasing the confidence of top management by demonstrating the success of KM implementation in enhancing learning culture in ADFs and explaining that KM yields better working environment and increasing organisational performance and competitiveness.

The tools and techniques that are required to achieve this step include meetings, lectures and seminars. The involved personnel and needed resources contain top management, KM team leader, Departments' heads, external specialists and business development team. Ample time and persuasive skills are needed to enable the KM team to achieve the KM process of knowledge discovery, capture and sharing, as well as the building blocks of

learning culture involving teamwork, leadership, company vision, shared learning and experimentation and feedback.

6.5.3 Empowering employees. Employee empowerment is described as the ways in which organisations provide their employees with a certain degree of autonomy and control to their day-to-day activities. This may include providing employees with means for making decisions, having a voice in process improvement, helping to create and manage new systems and tactics and running smaller departments with less oversight from higher-level management (Loosemore *et al.*, 2003). Employees in ADFs tend to work on very stressful tight schedules and therefore they genuinely do not have the time nor energy to consider any type of change. In addition, the construction industry is known for its reluctance to change and improvement which leads to poor involvement in KM implementation. To increase the participation of employees three aspects must be targeted, namely, awareness, safety and rewards (Lau and Rowlinson, 2011). The activities required to achieve the aim of "empowering employees" step include:

- creating a conducive environment to carry out discussions to raise awareness and communicate organisation vision.
- reassuring architects and other employees that their participation in the implementation of KM practices will enhance the learning culture in their ADFs.
- providing principal architects and team leaders with power for making decisions in their departments.
- announcing for incentives to those who exert full effort in participation and involvement.

The tools and techniques that are required to achieve this step include brainstorming sessions, meetings, lectures, monetary/psychological incentives, training workshops. The involved personnel and needed resources contains of KM team, HR department (to arrange training workshops), architects, other employees and IT department. Adequate time and encouraging environment are needed to conduct brainstorming sessions and meetings, in addition to budget for setting rewards, training, workshops and transportation. This will help achieving the KM process of knowledge discovery, capture, sharing and application, as well as the building blocks of learning culture involving teamwork, leadership, company vision, shared learning and experimentation and feedback.

6.5.4 Enhancing organisation IT capabilities. IT is indisputable one of the key enablers for implementing KM is ADFs. IT capability has evolved from merely being a static archive of information to being a connector of a human to information and of one human to another. IT plays an important role in enabling rapid search, access and retrieval of information, and can support collaboration and communication between organisational members, as well as facilitate organisational KM implementation (Lee and Hong, 2002). However, it is noteworthy that lack of IT capabilities is one of the issues that obstruct the implementation KM strategies. Hence, having a solid IT infrastructure forms one of the pillars on KM implementation as it acts as a platform for knowledge sharing, organisation and storage. Improving the existing IT infrastructure or creating a new one in ADFs will involve the efforts of the KM team, HR Department, employees and IT department. The activities required to achieve the aim of "enhancing organisation IT capabilities" step include:

(1) conducting meetings with Departments' heads to highlight the importance of having a strong, easily operated and organised IT infrastructure.

(2) establishing the current state of the existing IT system and determining the needed improvements.

(3) devising an IT system with a user-friendly interface for all employees to be able to use. The system should include elements such as:
- staff profile (name, years of experience, activity level).
- projects participated in.
- role in each project.
- areas of expertise.
- attended training/workshops.

(4) conducting a follow-up meetings to explain the changes made, explain to employees that each member will be rewarded based on their activity level.

The tools and techniques that are required to achieve this step include brainstorming sessions, meetings, lectures, monetary/psychological incentives, training workshops. The involved personnel and needed resources contains of KM team, HR Department (to arrange training workshops), architects, other employees and IT department. Ample time and friendly environment are required to conduct brainstorming sessions and meetings. In addition, budget for setting rewards, training, workshops and transportation. This will help accomplishing the KM process of knowledge discovery, capture, sharing and application, as well as the building blocks of learning culture involving teamwork, leadership, company vision, shared learning and experimentation and feedback.

6.5.5 Maximising organisation resources. The "maximizing organisation resources" is an important step for implementing KM towards enhancing the learning culture in organisations. This implies establishing a set of roles and teams to perform knowledge-related tasks (Davenport *et al.*, 1998). The activities required to achieve the aim of this step include:

- offering financial support to cover the cost of investment in technological systems.
- providing training programmes to enhance the skills of human resources (i.e. architects and employees).
- encouraging coordination between team members to facilitate the implementation of KM activities.
- freeing up time for employees to learn and perform KM activities (Martensson, 2000).
- encouraging the adoption of flexible working hours and open working environment.
- using rewarding systems to motivate architects to implement KM activities.
- Creating team-building events to foster the team spirit among team members.

The tools and techniques that are required to achieve this step include brainstorming sessions, meetings, lectures, monetary/psychological incentives, training workshops. The involved personnel and needed resources are KM team, HR Department (to arrange training workshops), architects, other employees and IT Department. Sufficient time and friendly environment are required to conduct brainstorming sessions and meetings. In addition, budget for setting rewards, training, workshops and transportation is required. This will help achieving the KM process of knowledge discovery, capture, sharing and application, as well as the building blocks of learning culture involving teamwork, leadership, company vision, shared learning and experimentation and feedback. Ultimately, the enhancement of the learning culture in ADFs in developing countries can be attained.

6.6 Benefits and limitations of the framework
The benefits of the framework lie in providing ADFs with innovative and practical tool to enhance their learning culture through KM implementation. This will enable ADFs to foster their knowledge pool and use it effectively to enhance their performance and gain competitive advantage. The framework provides a five-steps solution to address the five main barriers highlighted by literature review and emphasised by case studies and respondents of the survey questionnaire. However, the limitation of the devised framework is because it is a conceptual tool that needs to be applied and tested to ensure its outcome or perform further amendments. In addition, the adoption of the framework by ADFs could be hindered due to the fact that achieving its results requires time and resources as well overcoming employees' reluctance to change. Therefore, ADFs must strongly believe in the importance of having a learning culture and be fully committed to the devised framework. The successful adoption of the framework will require the efforts of all personnel and support of senior management to offer the require time, resources and persuading reluctant employees with the benefits of the framework.

7. Conclusion and recommendations
The construction industry plays an important role towards achieving the social and economic sustainable development objectives at national and international levels. One of the important phases in the construction process is the architectural design phase. Within this phase the client requirements are transferred into engineering drawings and technical specifications. Project-based organisations such as ADFs are knowledge-intensive business services as their main work include the formation and implementation of knowledge. To enhance their performance, increase their competitiveness and market share, ADFs have to use the benefits of knowledge generated during the design process. However, ADFs in developing countries are criticised for their lack of innovation, learning from previous projects and implementing new approaches such as KM. Literature review, case studies and results of the survey questionnaire highlighted the great potential of KM to serve as a cutting edge approach to minimise the causes of project delay and cost overrun, as well as enhance the society trust, public image and reputation of ADFs in developing countries through improving their learning culture. Data analysis showed that "lack of organisational culture" and "low involvement of top management" were ranked the highest barriers for implementing KM in ADFs. In addition, respondents to the survey questionnaire mentioned that they do not share openly their information with other employees to maintain their power and uniqueness. Besides they mentioned that the strict working environment of ADFs is not encouraging creativity or enhancing learning culture. Moreover, "continuous learning and enhancement" and "experimentation, feedback and reflection" were ranked by respondents as the highest building blocks of a learning organisation. Based on the above results, the research comes to the following recommendations to ADFs to overcome the barriers of implementing KM towards enhancing learning culture in ADFs in developing countries. In addition, these recommendations are in-line with the developed framework.

- Raising the awareness of ADFs to be open-minded and change their behaviours, attitudes and habits towards adopting new approaches such as KM. This will help enhancing learning culture that improves organisational performance and delivers best values to clients and stakeholders.
- Fostering the involvement of senior management of ADFs through providing them with successful examples of the benefits gained through implementing KM. This

will help offering the needed resources, time and money that ensure successful results of implementation.

- Encouraging coordination, integration, communication and information flow between project participants during the design process. This will facilitate having a shared vision, creating learning culture and enhancing organisational performance.
- Providing necessary training programmes, technologies, IT infrastructure and resources will enhance the technical skills of the design team to facilitate the implementation of KM.
- Boosting trust, transparency and building long-term relationship between members of the design team and project participants to enable discovering, capturing, sharing and applying knowledge. This will help enhancing learning culture and provide feedback that facilitate the adoption of proper decisions for complex and innovative projects.
- Engaging employees in integrating KM processes and building blocks of learning culture in their ADF' visions, missions and strategies. This will give employees sense of ownership and responsibility.
- Establishing incentives, rewards' systems and empowerment mechanisms to excite employees to participate and disseminate knowledge for the creation of learning culture across ADFs.

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