Leveraging organizational performance via knowledge management systems platforms in emerging economies

Evidence from the Egyptian Information and Communication Technology (ICT) industry

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Abstract

Purpose – The purpose of this paper is to examine the impact of adopting knowledge management systems (KMSs) on firms' performance. Although many organizations have adopted the notion of KMS, there is little evidence on the effect of KMS on a firm's performance, especially in an emerging economy like the Egyptian one. An intensive literature review is conducted not only to synthesize but also to establish the conceptual foundations for the systemic perspective of knowledge management and its potential impact on knowledge management performance in an emerging information and communication technology (ICT) industry. This systemic perspective fits with the evolutionary nature of such an emerging industry in Egypt.

Design/methodology/approach – The empirical study of this work is conducted on knowledge-intensive firms operating in the field of ICT. The paper is descriptive in nature where a quantitative research design is adopted to survey senior managers' perceptions – from both national and multinational enterprises operating in Egypt – on the pay-off maintained from creating an integrative KMS. The primary data are collected from 90 managers holding significant top positions related to the knowledge management area. A linear simple regression test is conducted to discover the initial association between the conceptual model's key variables.

Findings – The results of this work reveal that there is a positive association between each of the six elements that constitute a KMS, namely, knowledge: creation, acquisition, codification, sharing, transfer and measurement, and the perceived knowledge management performance. Besides, there is a significant positive association between the adopted total KMS and perceived knowledge management performance. This study provides strong evidence that KMSs are essential to improve firms' performance. The results of *t*-test and analysis of variance assert that the gender, types of business, year of experience and age of respondents have no significant difference to perceived knowledge management performance resulting from KMS.

Research limitations/implications – The findings reflect the fact that informants have to deploy six components that constitute a KMS to realize improvements in knowledge management performance. This work also highlights a number of findings of great value to managers in the ICT sector. Yet, the empirical study does not cover all the issues which are linked to KMS implementation. Issues such as culture, trust and leadership role in building a significant KMS are not examined in this work. Also, the generalizability of the findings to other industries must be considered carefully. Although the findings are statistically significant, the framework developed may be quite specific to the ICT organizations.

Practical implications – This paper enhances managers' understanding in deploying the notion of KMSs to leverage their corporate performance. It also provides managers in emerging markets with an

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integrative perspective to fundamental issues that encounter them when they put those KMSs into practice.

Social implications – This research advances understanding of the application and benefit of KMS in ICT firms in several ways: it provides a better understanding of KMS and practices currently being applied in the Egyptian ICT firms. There had been little or no industry-wide empirical research on this topic to date, it provides a better understanding of knowledge processes in the ICT sector; specifically, the links between knowledge acquisition, creation, codification, sharing, transfer and measurement, and their links to performance, the measurement instruments developed for this research constitute a reliable set of construct measures that provide a basis for future research.

Originality/value – This paper advances the knowledge management subject by synthesizing past studies into an integrative KMS that directs scholars' attention on how to examine the notion. It is claimed that KMS help those managers improve core business processes, management decisions and, accordingly, firms' performance. Besides, this study suggests a set of implications for managers in an emerging market that has recently adopted the notion of KMSs. This study also reflects the viewpoints and perceptions of key managers in a strongly evolving knowledge-intensive industry that has an increasing impact on the GDP of an entire nation throughout the past two decades.

Keywords Egypt, Emerging economies, Knowledge management, Knowledge, Information and communication technology (ICT), Knowledge management systems

Paper type Research paper

1. Introduction

Today, intangible resources such as knowledge, skills, expertise, digitization, relationships and organizational learning become very significant for business organizations to sustain their competitive advantage and to realize performance improvements. The efforts to manage knowledge were increasingly addressed with the existence of past ideas of knowledge-intensive companies, organization learning and knowledge-based culture (Brewer *et al.*, 1996; Alvesson, 1993). These efforts were further supported with the emergence of social and group technologies such as e-mail and instant messaging applications, Internet, intranet and extranet (Alavi and Leidner, 2001; Alvesson and Karreman, 2001; Chen *et al.*, 2004). The knowledge management (KM) topic is complex because knowledge is acquired and shared on the personal and organizational level alike. On one hand, knowledge in one of its natures is an object or a thing, yet it reflects a moving dynamic tacit nature at the source. However, limiting knowledge to only one of its forms, that is, an object, which can be divided into parts and handled each separately between business units, would define knowledge as data or information and this can prevent the creation of new knowledge. Although the literature is rich in addressing knowledge, yet the topic has always been viewed from one angle (Hearn *et al.*, 2003). This is due to its difficult nature and the lack of considering all the different features of knowledge and its components as one related subject of interest (Alavi and Leidner, 2001). Furthermore, KM scholars have attempted to develop a rich collective theory that endorse ties to actual practices of information technology, computer sciences, executive expert systems, management information systems and business engineering applications (Courtney and Parrish, 2009). These efforts were also built on the notion of organization learning or what was named double-loop learning (Brewer *et al.*, 1996; Damodaran and Olphert, 2000. The increased pace of globalization of a firm's value chain has also influenced the evolution of KM, as it has necessitated the need for integrating a traditionally isolated experience of various professionals (Ofek and Sarvary, 2001). Areas such as

human resources, innovation, intellectual capital, information management, intangible resources and competitive intelligence are all labeled to KM subject (Sajeva, 2010). The KM area is challenging scholars with its problematical interaction with other fields incorporating organizational learning, strategic management and innovation (Alvesson and Karreman, 2001). These various labels, in turn, deepen the complexity and multifaced views in managing knowledge as a unique corporate intangible asset. Because knowledge is an integral part of all other organizational aspects, reaching a single workable description of KM becomes not only difficult to realize but also open a window for more future research (Martensson, 2000; Lindblom and Tikkanen, 2010). Attempting to address such a dilemma, this paper views KM as a systematic process linked to a set of steps which increase the communication and application of knowledge in modern information and communication technology (ICT) organizations (Desouza, 2003; Faucher *et al.*, 2008; Scarbrough and Swan, 2001).

2. Literature review and research background

2.1 What is knowledge?

Churchman (1964) had defined knowledge process as data leading to information; which is analyzed and, thus, communicated, leading to knowledge. Knowledge is seen as a mode of cognition in which understanding and experiencing of one thing is done in terms of another (Leidner and Schultz, 2002). Knowledge is considered as a state of mind, process, object and capability (Nonaka, 1994), and it has a constrained effect if not transferred to others (Grant and Fuller, 1995; Alavi and Leidner, 2001). Knowledge represents accumulated facts, routine rules and/or heuristics (a rule of thumb based on experience); it reflects human understanding gained by learning and experience of a certain field (Chen, 2009). Moreover, knowledge can be seen as the verification of the processed information, which persists in an individual mind (Alavi and Leidner, 2001), and once an individual owns such information, it turns to knowledge (Chalmeta and Grangel, 2008). Knowledge is thus personalized and it encompasses facts, thoughts, interpretation, actions and judgments (Abdul-Malak *et al.*, 2005; Alavi and Leidner, 2001). Thus, data are certain facts, information is gained by reasoned deduction with some uncertainty, while knowledge is concluded induction with more uncertainty and also, with an increased value when used (Anantatmula, 2009; Carroll and Henry, 1975; Choi *et al.*, 2004; Nonaka and Peltokorpi, 2006; Kumar and Thondikulam, 2006). The resulting awareness helps people acquire skills and develop efficiencies and abilities needed for certain situations like working in problem-solving or grab an opportunity by good decision formulation (Chalmeta and Grangel, 2008; Nonaka and Takeuchi, 1995). Such a gained awareness helps people acquire new skills and develop efficiencies and abilities needed for certain situations like problems solving or seize an opportunity by good decision-making (Chalmeta and Grangel, 2008). Knowledge cannot thus be administered as an object that is separated from human actions rather it is an organizational mind which represents a web with interrelated activities (Leidner and Schultz, 2002). Davenport and Prusak (1998) stated that knowledge can be defined as a flowing combination of structured experiences and values. The conversion of information inside individuals' minds becomes knowledge, and knowledge presentation taking the shape of text, words or any other symbolic form is information (Alavi and Leidner, 2001). Although it might seem as if the issue is beyond agreement, yet what

counts is to find a separation between information and knowledge. Knowledge is viewed as a linear hierarchy that begins with a database, information which consequently forms knowledge base. Knowledge ultimately creates helpful insights but lacks the feedback loops that stimulate cognitive creativity (Faucher *et al.*, 2008). Two important features have been introduced to the hierarchy of knowledge and have a valuable power in creating the proposed feedback loop, namely, communication and collaboration. On one hand, communication is the foundation of understanding because with every piece of information sent, it would be followed with questions answered and explanations given, and so communication becomes bound between the sender and the receiver (Boyd, 1966). On the other hand, collaboration can effectively convey explicit knowledge if inter-collaborative arrangements between markets and firms are deployed (Grant and Fuller, 1995).

In brief, the literature is quiet contradictory when an organization approach to knowledge is offered, as seen by some researchers hierarchies assist in the transfer of knowledge using the firm's capabilities as a method to assist the creation of language and uniqueness (Kogut and Zander, 1992, 1996). Other scholars argue that hierarchies present results in averting knowledge transfer (Conner and Prahalad, 1996; Nonaka, 1990). Leidner and Schultz (2002) defined organizational knowledge as the valuable information that is of value to the organization and has an impact on the organizational economic when used as an input factor of production. The notion of organizational knowledge is derived from Polanyi's (1958) views about knowledge, in which he divides knowledge into tacit and explicit. Tacit has nature characteristics, it is unspeakable, personal, cultural identity related and can be converted to explicit (Abdul-Malak *et al.*, 2005; Chen, 2009; Chen and Xu, 2010; Kleist *et al.*, 2004). However, it is difficult to be transferred because it involves personal experiences, values and individual insights and, hence, it becomes hard to communicate (Fernandez and Stevenson, 2001; Nonaka and Peltokorpi, 2006; Salmador and Bueno, 2007). Conversely, explicit knowledge can be shared as it is articulated taking the form of declarative knowledge (Hansen, 1999). Both tacit and explicit knowledge are not mutually exclusive, but they are complementary. Explicit knowledge is a resource capital which has multiuse: it can be stored but easily outdated, distributed, processed and vital for the production of new products (Hirsch, 1965). Explicit knowledge is one that was acquired, expressed, codified or documented, structured and distributed. It can be incorporated in information technology (IT) communication systems where individuals can share their knowledge; the codified knowledge resides in formal repositories (Markus, 2001). Codification of explicit knowledge results in easy sharing; it is viewed to be justifiable and legitimate due to its availability for recording but can cause dogmatism and inflexibility if relied on separately (Alavi and Leidner, 2001). Explicit knowledge forms the structural capital of the organization, which includes all what is left in the company after employees leave including files, databases, software, trademarks and manuals (Fernandez and Stevenson, 2001; Kleist *et al.*, 2004). Fear of replication can hinder the organization willingness to create codified explicit knowledge; however, given that productive knowledge represents explicit routine or embodied knowledge and the transferability of such information requires codifying all elements, which is partly tacit, proves the complexity in replication

(Pisano *et al.*, 1997). The systemic view of this paper capitalizes on both tacit and explicit knowledge.

2.2 KM -based perspective

Since Drucker (1967) has used the term "knowledge work and knowledge workers", attention was boosted up to make a better understanding of the topic, which was perceived to be more as a practice rather than a science. From 1980 to 1990, knowledge acquisition became critical, not only did the open market encouraged knowledge transfer across borders but also competition over knowledge retaining and creating prompted the need to manage and share knowledge (Lai, 2009; Newman, 1997; Ribiere and Tuggle, 2010). The KM era needs a restructure in organization's culture and behaviors (Davenport and Prusak, 1998; Liu and Tsai, 2007). Hedlund (1994) also argued that a shift is required from the M-form (multidivisional form), which characterizes the hierarchical organization known for their permanent structure that is monitored from top with a vertical communication network, into a de-bureaucratization, flatter hierarchy and virtual or networked groups or what is named as the N-form, which stand for novelty, hierarchy and lateral sort of organizational interaction. This, in turn, helps organizations to better utilize the information technologies newly introduced such as groupware, intranet and extranet applications (Butler and Murphy, 2007; Meenakshi and Mohan, 2010; Scarbrough and Swan, 2001). Factors such as downsizing adoption, technological expansion and increased communication were responsible not only for the ease of interaction even with the existence of physical distance but also for generating the need for retaining employees' knowledge for future reuse (Leidner and Schultz, 2002; Martensson, 2000). Barney (1991) and Alsadhan *et al.* (2008) also argued that the success of an organization stems from developing a strategy that is not implemented by current competitors and is also a complex for imitation by future (potential) competitors even if they possess the same resource. That is, the resource-based view substituted the competitive advantage dimension (Blackler, 1995). In short, the resources that were opting to provide a competitive edge need to hold specific characteristics, including inimitability, value, rarity and non-substitutability (Barney, 1991; Cater and Cater, 2009; Grant and Fuller, 1995; Holsapple and Singh, 2001; Snowden, 2002; Spender, 1996). These resources require adopting strategies that are heterogeneously dispersed across business (Chen *et al.*, 2004). The resource-based theory is divided into two dominating factors – the external factor representing the firm's environment and the internal organizational factors – but because organizational capabilities rely on the internal factors, they become the most critical and notably important ones (Porter, 1980). Learning and possession of intangible assets, mainly knowledge, become the peak contribution toward strategy gain (Pisano *et al.*, 1997). This fits with Drucker (1967) notion that knowledge exceeds the importance of skills and experience because it encompasses available information and force organized and logical thinking, which in turn facilitates the decision making process. In so doing, firms can be viewed as social communities that are characterized by a rapid and competent ability in creating and transferring of knowledge (Kogut and Zander, 1992; Spender, 1996; Nonaka and Takeuchi, 1995).

KM entails knowledge collection, identification, retention, usage, sharing and development (Chen, 2009). It also involves knowledge change, application and implantation (Schultz and Stabell, 2004). It requires attainment, representation, storage,

education and transfer that will often lead to innovation which cannot exist without knowledge (Chen, 2009). Within this scope, KM becomes the demonstration, conversion, insertion and protection of organizational knowledge (Leidner and Schultz, 2002). From a strategic viewpoint, KM is prompted to use culture, best practices, business processes and IT to grow, distribute and communicate knowledge between those who own it and others who do not and, hence, improve learning (Anantatmula, 2009; Bansal and Bogner, 2007). Competition thus needs to be redefined so as to address the use of organizational knowledge as a precious, unique, path-dependent and not replicable resource (Cabrera *et al.*, 2006). In other words, organizations need to sustain the knowledge resource and the knowing process; these two aspects lies in between the knowledge-based view process and the resource-based view of the firm (Bansal and Bogner, 2007). This type of organizational knowledge is formed when individual knowledge is transformed from the individual level to that of the organization and then, is used to facilitate decision-making process (Broadbent, 1998). As organizational knowledge is created by individuals, the importance of the role played by the organization in fostering the individual's creativity becomes essential to combine the talented knowledge within its strategic sense (Nonaka, 1994). Success in organizations thus depends on exploiting the knowledge which is rooted in employees, procedures, rules and technologies and fostered by management, and this would strengthen the organization processes (Badger *et al.*, 2003). KM can be viewed as an umbrella; which include information system, organization learning, strategic management and innovation (Alvesson and Karreman, 2001). In this view, the word "management" does not reflect control rather running activities to create and transfer knowledge, which is seen as a capability rather than a resource (Barbosa *et al.*, 2008). It is thus viewed that KM is more focused on detecting, developing and sustaining knowledge within firms to create competitive edge (Davenport and Prusak, 1998; Easterby-Smith and Prieto, 2008; Gray and Durcikova, 2005).

KMs centre of attention, accordingly, needs to focus on constructing and sharing knowledge within the organization so as to advance performance levels (Garrigos *et al.*, 2009). With this point in view, KM is likely to fit itself with the resources-based theory of the firm, specifically, in creating a capability for competing successfully (Earl, 2001; Nonaka and Peltokorpi, 2006). It is argued that KM should be viewed as an anthology of processes that encourage learning and internalize knowledge while interconnecting with the human actions and experiences (Mcinerney, 2002). Hence, KM is not another changed form of organization learning, which focuses on people development but more of a variation with its own focus on tools and systems rather than only process and people (Kankanhalli *et al.*, 2005; Scarbrough and Swan, 2001; Nonaka and Peltokorpi, 2006). In such a case, technology enhances the information flow, as organizational social aspects boosted the understanding of knowledge resources (Sajeva, 2010). KM systems (KMSs) are thus introduced to create organizational memory systems, which can encompass knowledge, organizational features such as culture, policies and procedures in an electronic retrieval system (Damodaran and Olphert, 2000). If these systems are successfully implemented, they will offer significant flow of information on what, where, how and why a certain situation occurred. The resulting knowledge can be categorized into segments and, subsequently, it can be compared with other situations (Hansen, 1999; Markus, 2001). Concisely, it is widely argued that knowledge is considered to be a vital organization resource, which leverages performance by

increasing the efficiency level, raise personnel awareness and drive innovation (Arnold *et al.*, 2008; Benbasat and Gregor, 1999; Chalmeta and Grangel, 2008; Martensson, 2000). This paper argues that by creating a systematic KM process, it becomes more visible and controllable, and in so doing, KM can serve improving both performance and innovation and, consequently, it can create success measures for the Egyptian ICT sector (Chang and Ahn, 2005; Law and Nagi, 2008).

3. KM: a systematic perspective and framework

The KM implementation framework represents the formation of guiding principles which supply the procedures' fundamentals and help the communication, corresponding and synchronization process (Chang and Li, 2007). The framework aids in knowledge creation and transfer using technology for the transform of tacit, intangible knowledge into tangible explicit, the central activities are the protection and use of existing knowledge and the creation of new one (Anantatmula, 2009). It can be argued that KM strategies need to focus on acquiring knowledge for increased effectiveness, assessment of knowledge workers to comprehend the inter-collaboration effect on the sharing process (Grant and Fuller, 1995). Such strategies require a combination between hard (technological) and soft (organization and human) elements (Sajeva, 2010). Other effective strategies include purchasing certain software because using systems such as intranet can increase the overall performance (Burkart and Iverson, 2007). Systematic strategies for hard element asks for knowledge which can be structurally classified, coded and saved in databases and then are explored by all individuals, while individual strategies for soft elements calls for personal knowledge that is shared by communication(Tang and Tong, 2007). As a systemic-specific organizational process, KM seeks attaining, classifying and sharing individual's tacit and explicit knowledge for the use of others to generate more productive and efficient workplace (Kankanhalli *et al.*, 2005). This process grasps the collective experiences for the purpose of providing access to the targeted users (Ofek and Sarvary, 2001). It is likely to utilize communication, information and shared technologies to establish organizational memory (Alavi and Leidner, 2001). This takes place when individuals' knowledge (personal memory) is stored in networking computers (organizational memory), and by assessing these assets within the organization, value is added and the organization is guided to work smartly (Abdul-Malak *et al.*, 2005). The multidisciplinary nature of KM arises from its dependence on areas such as organizational learning, strategy, attitudes, behaviors, sociology, etc., and it thus needs to operate on various levels (Lai, 2009). KM is attached to information technology, human resource and others; therefore, it is associated with people, technologies and processes. Accordingly, to get a full view about KM, it has to be explored as a process within a system. One of the notable criticisms in KM implementation is to approach it as a tool and procedures rather than an incorporated systemized process with defined objectives. The system entails all elements such as people, technologies, data and information (Sajeva, 2010). This is because knowledge becomes insignificant if it is detached from the people and activities responsible to produce knowledge and, hence, the systemized view should not focus merely on gaining knowledge but should also focus on the process to create new knowledge (Massey *et al.*, 2002). This, in turn, requires viewing knowledge as an important resource that generates significant expected value (Hendriks, 2001).

There are two approaches for managing knowledge either codification or personalization. The codification approach concentrates on the individual knowledge within the organizations and places it in a context for future use, the knowledge here is separate from the creator (Desouza, 2003). The codified knowledge resides in knowledge repositories, it is within this standpoint that knowledge and information are seen as synonyms, thus assuming knowledge is similar to information and can be stored, regained, conveyed and shared (Currie *et al.*, 2008). Iyer *et al.* (2006) introduced codification as the beginning of the production cycle which aims at creating reusable knowledge object; generate knowledge ahead of the demand (manufacture to inventory). The knowledge contained is saved in repositories as objects with attached structure to allow and aid searching (Iyer *et al.*, 2006). In other words, codified knowledge needs to be applied in a framework of user familiarity if the focus is on finding the appropriate knowledge (Wilson, 2007). Nevertheless, codification process might lose something while converting the knowledge into contents (Burkart and Iverson, 2007). Codification captures explicit knowledge but is not able to acquire the informal knowledge that is formed by individual experiences (Ho *et al.*, 2007). In such a case, there is slight consideration to be paid to the wider social and organizational aspects, example of which are culture and politics (Currie *et al.*, 2008). This requires KM to begin as a technical process devoted to distribution of the available knowledge then develop from here to give extra focus on human relation to stir innovation by working on what could be done followed by what should be done (Wilson, 2007). The personalization approach focuses on communication between individuals by using information technology (Ho *et al.*, 2007). This approach focuses on people to people communication and linking knowledge to its source, the information technology in this approach is an enabler (Alvesson, 1993; Desouza, 2003; Nonaka and Peltokorpi, 2006). KM necessitates more focus on human, organizational aspects as knowledge is personal in its first form (Sejeva, 2010). When organizations tackle tacit and explicit knowledge transfer through personalization, computers assist users by communicating the codified knowledge stored within its databases and, accordingly, KM approaches can be viewed as a combination of modular and shared experiences methods (Iyer *et al.*, 2006). Thus, what will judge the success of KM implementation is not the amount of available knowledge, but rather the knowledge applicability to create, process and communicate within a growing feedback circle that join innovation with users ultimately leading to technological revolution (Arnold *et al.*, 2008; Hendriks, 2001; Scarbrough and Swan, 2001).

KM approaches can also be categorized with respect to their background as being human oriented or technology oriented. KM can be basically viewed as a translation of organization learning and organizational memory approaches to management terms and an integration with management concepts, such as strategic management, process management, human resource management, information management (Maier, 2010). According to Maier (2010), neither direction provides a sufficient base for the implementation and development of KMKMS. Integrated KMS have to be developed to promote competitiveness for firms. The introduction of KMSs aims to enhance management performance that the relationship between KM and management performance is worth studying. Holsapple and Joshi (1999) provide a description and comparative analysis of ten descriptive KM frameworks and models. Each of these frameworks attempts to explain one or more aspects of the KM phenomena. Besides, Apostolou and Mentzas (1999) distinguish four groups of KM frameworks:

(1) those that focus on knowledge generation;
(2) those that focus on knowledge processes;
(3) those that focus on technology; and
(4) those that are holistic.

The ability to acquire, create and make actionable the knowledge needed to achieve business goals is critical to enterprises that engage professionally in KMSs engineering (Small and Sage, 2005/2006). It is also viewed that KMSs involve innovative practices for supporting learning processes by reusing past experience of other people and the organization, or by devising totally new approaches and practices, which can lead to better organizational performance (Law and Nagi, 2008). So, the main challenge of modern organizations is how to combine KM and organizational learning practices to improve business performance.

Concisely, a systematic KM process has to focus not only on the use of technology in transferring knowledge, but equally on its creation using all the knowledge resources which reside within an organization. If a KM system is viewed using only the technological lens, the system will then turn to be a data processing system even if it tries to bring forth and maintain the stream of ideas and past experience among knowledge communities (Cabrera *et al.*, 2006; Sajeva, 2010). Although systems are diverse in their design, yet they all have inputs, process, outputs and they should possess a self-validation method to guarantee that only true knowledge is formed (Courtney and Parrish, 2009). They are characterized by sophisticated computation abilities, advanced performance data composition and intelligent query techniques (Liu and Tsai, 2007). Whereas a KMS is designed as an organizational-level system, its uniqueness relies on its ability to develop individual performance that is achievable by supporting the personal intuitive to do more than just copy others by using a variety of databases and repositories (Armstrong *et al.*, 2007). Employees' benefits from a KMS include sharing and organizing with knowledgeable network of workers by using *ad hoc* groups which allow the sharing to extend beyond the internal organization border through the use of networks to connect with partners and products (Abecker *et al.*, 2008). As a result, a KMS is an opportunity to leverage learning more than simply a stimulus, as it consists of a group of official procedures and mechanisms, which impound innovation and best practices information (Butler and Murphy, 2007; Gibson and Vermeulen, 2003). The literature on KMS reveals that KMS incorporates creation and generation, which begins and ends the process; acquisition, which can also be called collecting, gathering, sourcing, contributing, capturing and formalizing; sourcing; selection; documentation, which is codification or storage and can be called recording, retaining and saving; sharing or reuse, transfer or dissemination and distribution and measurement. The link between KM and KMS is quite clear: they are both dependable on the knowledge cycle as well as on each other with one main target, which is to create new knowledge. The assumption that KM is a core technology method is challenged when taking into consideration the social (tacit) facet, information technology act as an enabler and a must at the same time; this is because sharing knowledge without the help of technology is problematic. Consequently, knowledge can be viewed as a product, the system as seller and KM as the entity where they both operate. This study identifies six KM practices that are crucial factors in the improvement of organizational performance

in the Egyptian business environment. This study supports the notion that investing in KMSs improves organizational performance. Though it is greatly discussed that there is a positive relationship between KM and organizational performance, empirical studies have been scarce in supporting that relationship (Carrillo *et al.*, 2003; Choi and Lee, 2003; Hsu, 2008). Although many approaches examined the subject from various standpoints such as the organizational sciences and human resources management, computer science and management information systems, management science, psychology and sociology (Sarmento, 2005), this paper intends to examine the KM subject from a systemic perspective that capitalizes on major processes and systems appropriate to the nature of the ICT industry under investigation. The main purpose of this paper thus is to identify the empirical relationship between the KMS and perceived corporate performance in the Egyptian telecommunication industry. Figure 1 depicts the evolving framework and its relationships.

Figure 1 explains that an adoption of KMS is expected to improve both the results realized by firms as well as the behavior and actions of those who possess knowledge. The primary reason of investing in KMSs is to increase organizational performance, which directly relates to profitability by improving organizational effectiveness, innovation and communication (Bhirud *et al.*, 2005). As Zhu *et al.* (2014, p. 93) put it "challenges for complex systems include identifying what knowledge is needed, determining if and where to find it. Without knowledge sharing, knowledge use and new knowledge creation is not possible". That is, relating KM to performance and profitability strongly encourages top management to highlight KM and the benefits it can have on the organizations' bottom line (Carrillo *et al.*, 2003). The organizational performance survey adopted measures a company's main success indicators and drivers. The conceptual foundations, of the six elements that constitute the evolving KMS framework, are critically reviewed as follows.

3.1 Knowledge creation

Knowledge creation is the first step in KMS which reflects the foundation stage in preparing the organization to acknowledge, embrace and utilize the process; the KM

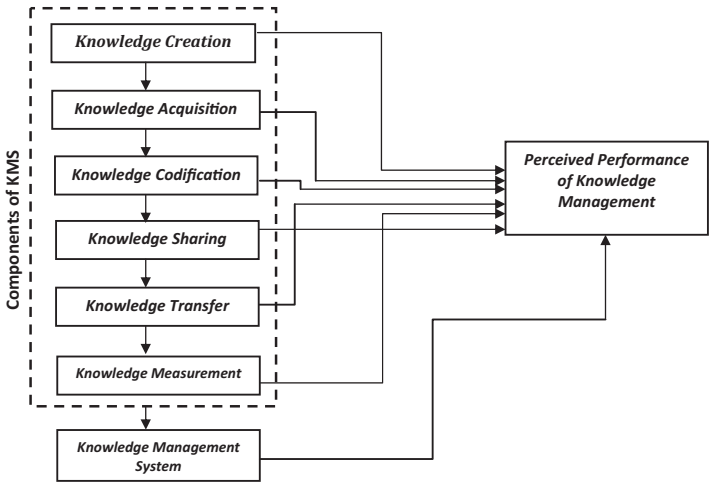

Figure 1.
KMS and a firm's performance

process is then used to work with this created organizational knowledge (Abecker *et al.*, 2008; Alsadhan *et al.*, 2008; Leidner and Schultz, 2002). However, knowledge creation is still problematic at all different levels: individual, group, organizational and inter-organizational (Abecker *et al.*, 2008). Creation represents the development of new tacit or explicit knowledge by using available data or information or through using previous knowledge (Deokar *et al.*, 2010). This will include introducing new concepts or substituting available views inside the organization's explicit as well as tacit knowledge using collective and individual process (Markus, 2001; Massey *et al.*, 2002). Introducing individuals to novel ideas can activate creation of new ones (Alavi and Leidner, 2001). Creation can generate novel products and integrate new services or just develop the present one and reshape organizational procedurals (Barbosa *et al.*, 2008). Creating knowledge influences more aspects than just the creation, it includes the whole knowledge process development because creation is not just an outcome but rather an understanding of the kind of learning that caused the creation; this learning interrelates with other firm's competencies and improves the organizational knowledge and the knowing process (Bansal and Bogner, 2007). Fundamentals for knowledge creation include consistency of work processes, uniformity in employees training to match their work tasks, employees trust in the organization and shared culture and informal contacts (Currie *et al.*, 2008; Lioria and Luzon, 2008; Iyer *et al.*, 2006). There are some attributes that need to be managed for creating knowledge such as access means to information, training, problem-solving techniques, knowledge brokers, identification of present expertise, communities of practice, relevant knowledge and knowledge program, acknowledgment and feedback (Braganza *et al.*, 2009). A variety of systems and technologies can support the creation of knowledge like data mining, KBS (knowledge-based systems), algorithms, etc., (Abecker *et al.*, 2008; Choi *et al.*, 2004; Deokar *et al.*, 2010). Markus (2001) asserts the importance of information systems in creating the appropriate space for knowledge creation and facilitation of links between teams. E-mail and group systems also strengthen group ties, intranet allows gathering of information and can help internalization, and although creation is considered vital but it is difficult to control and less open to IT support (Awazu and Desouza, 2005; Hendriks, 2001; Markus, 2001). Teams are also influential in knowledge creation because if organization needs to learn it has to have knowledgeable employees (Gibson and Vermeulen, 2003). Community of practices is also regarded as one of the primary sources in creating knowledge (Chang *et al.*, 2009; Ofek and Sarvary, 2001). In brief, successful knowledge creation requires: first, to explore the present state and the desired improvements, second, select mental scheme and the process which include people communication and joining insights and, finally, codifying and implementation. The first two processes do not ensure knowledge creation as without the codification process improvements may not be used (Gibson and Vermeulen, 2003).

3.2 Knowledge acquisition

Fernandez and Stevenson (2001) claimed that knowledge thorough companies are worth three to eight times their financial capital. In 1880, nine of ten workforces were dependent on the personal energy to perform physical works; today, this ratio has dropped to one of five, while four of five are working in service as knowledge workers (Kumar and Thondikulam, 2006). Knowledge acquisition is critical to KMS as knowledge in its tacit form is under loss risk because of employees retiring, released,

redundant or dying (Liu and Tsai, 2007). Knowledge can be acquired externally or internally; external knowledge comes from the surrounding environment and it has to be changed to a form that can be used or/and internalized (Holsapple and Joshi, 2004). Internally, to collect explicit knowledge (know what) of the organization (e.g. technical information, procedures and history of problem-solving), this knowledge, although regarded as explicit, are shaped over time (Arnold *et al.*, 2008). The use and role of KMS is critical to explicit knowledge capturing because explicit knowledge forms the foundation for tacit knowledge development; in KMS, the knowledge held is always referred to as explicit and tacit (Alavi and Leidner, 2001). Declarative knowledge acquisition defines the knowledge that is coded in the long-term memory of the organization and consists of rules, examples and experiences and it is referred to as "know what" or the explicit form of knowledge (Arnold *et al.*, 2008). Tacit acquisition or "know-how" takes place when users place in their own analysis to the system knowledge base. The recent KBS studies conclude that new users to the system depend on explicit knowledge where as skilled users prefer the support of tacit knowledge (Arnold *et al.*, 2008). In its tacit form, knowledge is hard to communicate to others thus it has to be converted into an explicit form like Web pages, e-mails, etc. (Liu and Tsai, 2007). In knowledge acquisition, people store regulations, explanations and patterns in the long-standing memory (declarative) and then use it as interpretive problem-solving which can be explained as problem-solving through comparison with the previously held examples. Individuals turn from this stage toward procedural acquisition, which aims at extending the declarative knowledge toward practice by using the knowledge acquired in production rule and, finally, the declarative knowledge gets changed or improved, although declarative encoding is by itself sufficient in knowledge acquisition (Arnold *et al.*, 2008). Meantime, acquisition may follow certain steps by, first, identifying the adequate knowledge through locating, accessing, valuing and/or filtering; second, by capturing knowledge via extracting, collecting, and or gathering; third, by organizing knowledge throughout distilling, refining, orienting, interpreting, packaging, assembling and/or transforming it into usable representation and, finally, the knowledge is then transferred to a processor or used internally (Holsapple and Singh, 2001).

Liu and Tsai (2007) identified four stakeholders responsible for knowledge formalization: knowledge engineers, domain professionals, users and executives. These four groups usually deploy two major techniques for capturing knowledge; direct technique that permit collecting knowledge via simply asking questions through interviews, observation, etc. and it is influenced by skills, attitudes and consensuses of the individuals involved in and it is a time consuming. The indirect technique is operated by software programs that can capture the desired skills of experts that are difficult to capture by direct forms. Knowledge acquisition has to look for knowledge asset, which is defined as "how to do things, where to find examples and who to ask for help" (Butler and Murphy, 2007). Ho *et al.*, (2007) classified acquired knowledge into three categories: cognitive replication, which represents acquiring knowledge from available cognitive structures to replicate process; within this category, efficiency is reached because knowledge does not need to be recreated. Cognitive adaptation calls for some changes in the fundamental understanding structures as a reaction to either a newly made development or as a requirement from within the organization, while cognitive innovation is the fundamental transform in the use of knowledge. In addition,

knowledge formalizing ensures availability of explicit knowledge, which eases the user from storing the needed knowledge in the long-term memory, as it can be accessed via the KMS and, hence, decreases the mental workload (Alavi and Leidner, 2001). Cognitive load theory suggests that performance can be improved with less mental work load, but this ease of retrieving explicit knowledge can lead to a decline in tacit knowledge as users can depend mainly on KMS while abandoning the need for developing their own foundational explicit knowledge (Arnold *et al.*, 2008). To prompt knowledge acquisition in companies, employees have to see the personal value gained by the obtained knowledge, the responsibilities they attain after obtaining the knowledge, the personal achievement and the kind of recognition they receive from others after knowledge possession (Ho *et al.*, 2007). Knowledge acquisition also requires a deep understanding of two related concepts, namely, knowledge sourcing and knowledge selection. Badger *et al.* (2003) clarified that knowledge sourcing is the organization preferences in acquiring new knowledge from external sources. Gottschalk (2006) defined knowledge sourcing as the transfer of knowledge that locates within and between the intangible assets in three structures forms; the first is the external structure which comprises of the external environment, for the vendor; the client locates in the external environment and for the client; the vendor is in the external environment. The second form comes from the internal structure, which encompasses models, procedurals and information system. The third emerges from the individual structure, which reflects the people capabilities. Knowledge selection stands for collecting knowledge from within the organization and uses it for a certain problem or decision, and although similar to acquisition, it only uses the knowledge available within the organization (Holsapple and Joshi, 2004).

3.3 Knowledge codification

Codification or documentation mode is the use of a system for storing knowledge; it works on codifying the organizational memory (Badger *et al.*, 2003). Organization collective memory includes all the past experiences with the present activities, and it can include culture, structure and physical work settings (Alavi and Leidner, 2001). This memory encompasses available knowledge in its various forms including process, procedurals, documents, databases, expert systems, e-mails, and so on. Knowledge storage and retrieval represent the mechanism used to institutionalize the knowledge for future usage (Claudio *et al.*, 2006). The organization memory is divided into semantic and episodic; the semantic represents the general explicit knowledge such as knowledge about clients, projects and industries, while the episodic is defined as situational knowledge (Alavi and Leidner, 2001; Markus, 2001). The shift to documentation has been occurred due to the inability of the personal networks; which are responsible for knowledge storage and sharing but are insufficient because knowledge within the organization is personal except if there is some way to save it within the organizational memory (Abdul-Malak *et al.*, 2005). KMS technological capabilities are thus essential for codification but they cannot assure that the process is a successful, as there are social and technical obstacles to overcome (Kankanhalli *et al.*, 2005). Codification might offer weaker social ties, yet it strengthens knowledge diffusion by either presenting the knowledge itself or at least a metadata; which is "knowledge about where knowledge resides" and, hence, submitting a list of individuals profiles who possess the required knowledge is needed (Alavi and Leidner, 2001). Most organizations are, in turn, using IT codification methods to aid in structural assortment, support diverse location, functions

and business units, which are expected to promote knowledge activities and, therefore, can help KM activities (Braganza *et al.*, 2009). Anantatmula (2009) classified documentation into five steps: system scope analysis, defining used ontology and its constraints, constructing a knowledge base, operating the knowledge base and modification when knowledge changes. Repositories relate to the codification work in KM; which represents documentation and storage with the aim of reusing the codified knowledge (Kankanhalli *et al.*, 2005). There are two types of repositories, one for documents and the other for data, retrieving information in documents is different than that in data, and thus, the approaches should differ as well (Kubo *et al.*, 2001). Repositories include different kind of knowledge; general like scientific and explicit knowledge; specific as in local context; declarative or factual; procedural; rational, which explains the reasons behind doing things; analytic, which applies both declarative and procedural to come up with a specific conclusion (Kubo *et al.*, 2001).

3.4 Knowledge sharing

KMS are usually established with an internal departmental and business unit's focus which fits specific user's thoughts and languages creating an isolated knowledge pockets which prevent outsiders from acquiring benefits from the system (Iyer *et al.*, 2006). This explains why knowledge sharing is not an easy practice even with the use of IT. Sharing depends on culture and to motivate knowledge sharing inside the organization, attention has to be given to the learning culture process and the surrounding supportive environment (Ho *et al.*, 2007). Sharing is about individual communication; which focuses on gaining knowledge from experienced sources that can either be formal or informal so it is the process and not technology that matters (Sajeva, 2010). While scholars use different terms to describe knowledge sharing such as knowledge exchanging, dissemination, circulation and transaction, yet the core activities for sharing are transmission, which focuses on transferring and offering knowledge to the users, and absorption, which reflects the usefulness of the utilized knowledge (Chang and Yang, 2008). Sharing knowledge among individuals, groups and organizations can be restricted by individuals either because there is a lack of willingness or because of abilities scarcity or culture factors, and these obstacles reflect topics of power and trust and hence, require a fitting platform (Chen, 2009). Knowledge sharing is the responsibility of everyone, yet there are two important stakeholders in knowledge sharing, contributors and seekers, and both are involved in the process (Chang and Yang, 2008). If KMS does not promote knowledge sharing on both levels so as to cover seekers and contributors, it turns out to be an unsatisfactory investment, knowledge seekers' trust in one-to-one interaction raises their acceptance to knowledge sharing. When knowledge contributors externalize their knowledge using codification, they help others gain knowledge and thus they benefit from self-satisfaction (Chang and Yang, 2008). By expanding the benefits and minimizing costs caused by knowledge contribution, knowledge sharing can likely be improved among contributors (Kankanhalli *et al.*, 2005). However, knowledge sharing encounters a problem as experts are rewarded for their personal achievements and, hence, they might be reluctant to share their knowledge, especially when they know that it is this portable knowledge that gets rewarded for achievement (Kubo *et al.*, 2001). Contributors can also avoid knowledge exchange due to shortage of time and effort needed because contributing requires adding knowledge to the system and offers clarification and assistance to the

users after implementing knowledge (Bayer *et al.*, 2005). Mangers have to assure knowledge contributors that their power will not be lost or changed after sharing through establishing fairness policy which can motivate sharing's intention and reciprocity strategies that reflect to contributors the kind of help they can expect from others in return to their contribution (Lai, 2009). Kankanhalli *et al.* (2005) identified two inducements for increasing contribution: *extrinsic benefits* which include rewards, image, reputation enhancement and reciprocal benefits (that is the contributor get to fulfill his/her future needs for knowledge by other contributors), and *intrinsic benefits*, which are more self-related and include the satisfaction as well as self-confidence that the contributor receives when he/she shares valuable information as well as the pleasure received when helping others reach the knowledge they seek. Also, it is widely seen that trust plays a key role in knowledge diffusion and is helpful in building knowledge sharing in an organization (Chai and Kim, 2010; Shu and Chuang, 2011).

3.5 Knowledge transfer

When knowledge producers and users share the same situations, they can reuse the knowledge, but when knowledge is meant to support individuals who differ significantly from the knowledge creators, it is called knowledge transfer (Markus, 2001). Knowledge creation is usually processed throughout the transfer stage as new gained knowledge unites with the available ones and produce ideas. This occurs through validation of current believes and rejection of false ones (Braganza *et al.*, 2009). Knowledge transfer depicts the process by which one or group of individuals share knowledge and its effect with others' experiences (Hewett and Watson, 2006). Dissemination includes knowledge transfer between individuals, individuals to explicit or groups, among and across groups, from groups to workplace; technology participates a vital role in the transfer, especially in virtual teams and across geographical borders (Anantatmula, 2009). The choice criticality to transfer knowledge to the required location calls for organization awareness about their available knowledge and require a strong system for reviving hidden knowledge (Alavi and Leidner, 2001). Knowledge transfer moves knowledge across the organization either by formal or informal networks to enhance performance and capabilities (Braganza *et al.*, 2009; Landaeta, 2008). Knowledge distribution is affected by a number of factors such as knowledge remoteness, used procedures and tools, the apparent need for knowledge, culture, organization size, the perceptive of individual's cognitive manner, leadership, shortage in regular work processes, location, laws and technological rules (Landaeta, 2008). Knowledge transfer is best viewed through five perceptions: transfer value; motivations to transfer; transmission channels; transfer accessibility and ease; the last one is the most important, while motivations to transfer knowledge and the ability to use the transferred knowledge are the most difficult to manage (Alavi and Leidner, 2001).

3.6 Knowledge measurement

Organizations use the available resources to establish the KM infrastructure, yet they do not explain the same effort for measuring the end results of their established systems and this is due to the lack of effective quantitative methods for measuring KMS performance (Chang *et al.*, 2009). From a transaction cost perspective, a KMS is not a production automation mean because it is not projected to influence the overall production expenses; however, it is expected to establish a detailed and accessible

knowledge repository, thus lessening administrative as well as decision-making expenditure (Chen *et al.*, 2004). Lacking measurement, system improvement can neither be generated nor can the value created be captured. The value is considered an intellectual capital by the firm; thus, by measuring the intellectual capital, a KMS is measured as well (Chang *et al.*, 2009). Measurement incorporates evaluation of the resources and the processors, the process can include quantitative and qualitative assessment, performance estimation and benchmarking (Holsapple and Singh, 2001). It is crucial to launch comprehensible benefits declaration linked to the business objectives on which the system is developed, variance between the benefits that is offered by a system and the users' expectations is due to the lack of explicit benefit estimation prior to the development and the assumption that benefits will exceed costs (Armstrong *et al.*, 2007). The quantification used method for measuring KMS should not be influenced by any other issue than that related to knowledge activities. If the quantitative measures are performed based on the organization level rather than on the process level, the generated results may indicate outcomes that are not attributed solely to KMS (Chang *et al.*, 2009). It is suggested that organizations measure its readiness for the system and inquire not only its KMS but also its business needs and IT systems (Armstrong *et al.*, 2007).

3.7 The research gap

The literature review conducted earlier indicates that in a knowledge-intensive industry, it understandably is seen that KM explicitly enhances organizations to improve their performance (Sabherwal and Sabherwal, 2007). However, organizations find it difficult to identify the relationship between KM, and organizational performance because the implementation of KM often occurs informally (Carrillo *et al.*, 2003). That is, it is crucial that organizations determine whether the investment in a KMS pays off in terms of verifiable performance improvement (Iftikhar, 2003). Yet, many KM-related studies focus only on fragmented or limited KM perspectives, such as knowledge sharing (Hsu, 2008; Papoutsakis, 2007), information flow (Zen *et al.*, 2007) and KM styles (Choi and Lee, 2003). To make KMSs more effective, it is important to identify all possible elements that represent different aspects, tools, contexts, infrastructures or processes influence it. This, in turn, necessitates the need for developing a holistic framework that explains how KMSs impact organizational performance. Zack (1999) argued that knowledge is viewed as the most important strategic resource, and the ability to acquire, integrate, store, share and apply it is the most important capability for building a sustainable competitive advantage. Nevertheless, the link between KM and organizational performance is not supported by enough empirical studies (Choi and Lee, 2003). Moreover, the field of KM is still new to firms in emerging markets, and there is little research and empirical data to guide the development and implementation of KM or to support the potential benefits of it (Alavi and Leidner, 1999). In addition, most quantified research has focused on limited and fragmented aspects of KM. For these reasons, the current study quantifies KM issues holistically to understand the organizational performance implications of KMSs. Accordingly, the main purpose of this study is to test the validity of the emerging framework in a study of key firms serving in the Egyptian ICT sector.

The primary research question involved determining whether organizations' investments in KMSs pay off through organizational performance. Linking KMSs into

organizational performance makes a strong case for adopting and funding KMSs and demonstrating its benefits (Carrillo *et al.*, 2003; Haworth, 2007). Although it is highly feasible that there is a relationship between KM and organizational performance, empirical studies have been deficient in proving that relationship (Carrillo *et al.*, 2003; Choi and Lee, 2003; Hsu, 2008; Papoutsakis, 2007). This study intends to use an empirical evidence to identify the relationship between core elements of KMSs and organizational performance. To fill this gap, this research intends to test a number of hypotheses that relate to the main conceptual argument emerged from the intensive literature review of the subject and are generated from the model presented earlier (see Figure 1 above):

H1. There is a significant positive association between the total KMS and a firm's performance.

H2. There is a significant positive association between the knowledge creation process and a firm's performance.

H3. There is a significant positive association between the knowledge acquisition process and a firm's performance.

H4. There is a significant positive association between the knowledge codification process and a firm's performance.

H5. There is a significant positive association between the knowledge sharing process and a firm's performance.

H6. There is a significant positive association between the knowledge transfer process and a firm's performance.

H7. There is a significant positive association between the knowledge measurement process and a firm's performance.

4. Research methodology and design

The central focus of this research is not only on testing the association between KMSs and perceived performance of KM but also on examining the association between each of the KMS's components and perceived performance of KM. That is, this study emphasizes on investigating the statistical simple linear relationship between the proposed model main variables. This is essential because it is difficult to assume that all surveyed ICT firms are fully adopting the six elements of the KMS under investigation. Thus, a simple linear regression allows testing the partial adoption of any of the components of the KMS. It is also a cross-sectional study, whereas the prominence crucial point is centered on differences at one point of time (Cooper and Schindler, 2003). A research design is the framework for conducting this research project. It details the procedures needed for collecting and analyzing the primary data to solve a problem or to answer research question (Creswell, 1994).

4.1 The ICT industry: background

The emphasis on the telecommunication industry in Egypt has been widened throughout the past decade. The contribution of this sector to the economy has received significant attention from the government and the private sector alike. The Egyptian government has set a long-term strategy for telecommunication sector in

2000. For the past eight years, $6 billion was invested in this area with an annual growth rate of 25 per cent greater than the overall economic growth, which averages 7 per cent. Egypt's ICT new initiative reflects the government's commitment to utilize information technology in developing its human capital and, hence, to create the type of personnel capable of capitalizing on the emerging knowledge revolution (Anonymous, 2007/2010). Egypt was also awarded title of "outsourcing destination" of the year at the National Outsourcing Association in 2008. More recently, Egypt was ranked as the number 1 outsourcing destination in Africa, according to a report conducted by the Commonwealth Business Council and Cyber Media (Commonwealth Business Council, 2009). Egypt has also undergone an unprecedented phase of development as one of the fastest-growing outsourcing locations in the ICT. With more than 8.29 million Internet users and around 395,000 broadband connections in early 2008, Egypt expects to increase its capacity exponentially according to the Information Technology Industry Development Agency (ITIDA, 2008). The government has announced the establishment of a 75-acre contact center park in area named El-Maadi to host Egyptian and international business processing outsourcing (BPO) in the ICT sector. The first phase of the project is expected to facilitate 9,000 job opportunities. Upon completion of the entire technology park in 2012, the project will encompass 40,000 seats for BPO services and will create around 50,000 job opportunities in knowledge-related areas.

This has, in turn, created an interest in examining KMSs that exist in this growing industry with full attention to solicit the viewpoints of key managers in the industry. Respondents interviewed engage in senior positions in the companies surveyed and they hold management titles such as chief information officer, KM officer, systems' analysis officer, systems development officer, managing director, IT and chief programming officer. The ICT industry is considered to be a central cornerstone not only to the development of the Egyptian economy but also to its progress toward building a knowledge-based society. The government realizes that an open, market-oriented and stable economic environment is necessary conditions to leverage a knowledge based-economy (Anonymous, 2007/2010). The government views that technology and KM are main drivers for growing a national competitiveness that rests on knowledge-driven processes and systems. The growing competitiveness relies on four core initiatives that incorporate IT-enabled service industry, building local capacity, applied research and innovation and promoting IT investment FDI. As Stanley Krasnow, the Chairman for Sales Operation, IBM Software Group (2008) put it: "Egypt is vital to our Middle East and African business and wit a strong base in this dynamic marketplace, we see great e-business potential" (cited in ITIDA, 2009/2010). Egypt also has a large and rapidly growing talent pool ideally suited to IT and business process outsourcing. Egypt is equally at home meeting the needs of IT outsourcing. Egypt has the individuals with the necessary skills, attitude and brainpower.

Every year approximately 330,000 students graduate from Egyptian universities. Of these, around 66,000 graduate in commerce, around 17,000 graduate in science and technology and approximately 16,000 in engineering – creating an annual talent flow of over 90,000 graduates suited to IT and business process outsourcing. Around 31,000

students fluent in Western European languages graduate from Egyptian universities every year. As Assem Khalil, Director of Support, Oracle (2008), put it:

> […] we looked at different countries around the world to select a location to establish Oracle's eighth global product center. We chose Egypt for a number of factors, including its talent pool, political support from the Egyptian government, telecom infrastructure, and the flexibility of the labor law (cited in ITIDA, 2009/2010).

The European Language Program is, for instance, designed to increase the pool of entry-level business process outsourcing and technical support talent with proficiency in French, Spanish, German and Italian languages. Microsoft, IBM, Oracle, Vodafone, Orange, Intel, Wipro, SQS and Teleperformance are just some of the leading multinationals who have selected Egypt as the location for their global service delivery centers. Egypt is home, for example, to one of only two Microsoft Innovation Centres worldwide, focusing on research and development. As Bill Gate, Chairman of Microsoft (2009), puts it:"today Egypt is one of Microsoft's fastest-growing subsidiaries. Our entirely Egyptian local staff shares my pride in this accomplishment" (ITIDA, 2009/2010). To sum up, Egypt's foreign language skills, relatively competitive labor costs and proximity to Europe, Asia-Pacific and the Middle East make it a prime contender to be the next IT outsourcing hotspot. On top of that, it is viewed that the government, through multiple organizations including ITIDA, supports the training of graduates to very advanced level. Egypt has a large and rapidly growing talent pool ideally suited to IT and business process outsourcing. In short, it can be claimed that the application and effective usage of KMSs is an effective instrument for ICT organizations to meet the global challenges of knowledge economy successfully (Majors, 2010). This, in turn, enhances this study to focus on such an industry in examining the KMSs topic where respondents can be better positioned to provide a more reliable answer to key questions.

4.2 Data collection and sampling

The data of this research was collected via a structured survey or questionnaire; which was distributed among the active information and KM managers. The instrument is described along with the rationale for using the chosen format. Primary data covered a sample of the experienced managers for some of the national and multinational companies serving in Egypt. The survey was administered as a one-on-one interview; where the respondents' true and genuine perception and attitude can be observed. The survey was directed in both English and Arabic languages. The questions incorporated in the survey were divided into two sections: the first addressed a number of questions concerning the investigation of existing KMSs and they were built from the intensive literature review conducted for this research. The second section highlighted a number of a firm's performance issues based on an instrument developed by Marsick and Watkins (2003). The actual questionnaire also incorporated an introductory statement; which explained to the participants the general topic, and was followed by a brief explanation stating that participation in the study is thoroughly voluntarily and merely for an academic purpose. Variables on KMSs, incorporating knowledge creation, acquisition, codification, sharing, transfer and measurement were addressed. Company performance, nature of business, years of experience, age and gender were also included. The rationale behind collecting data about these variables is to test whether the suggested KMS is currently used in the Egyptian ICT firms, and if it does exist, does it

positively impact a firm's performance? Respondents were asked to rate the answers on a scale which ranged from 5 (Strongly Agree) to 1 (Strongly Disagree). These statements were formalized as a result of the study's literature review. This research is guided by both the conceptual and practical considerations, and by obtaining an adequate sample size for the number of variables investigated.

A sample size represents the subgroup of the population selected for participation in this study. The first step was to identify managers to take the survey from the participating organizations. Within the identified 120 organizations that are officially listed in the ICT sector, which were willing to participate in the study, two or more managers were identified to participate in the survey. A convenience sampling procedure, a form of non-probability sampling in which participants self-select (Urdan, 2005), was used to collect information from managers at participating organizations. An invitation e-mail to participate in the survey was distributed to each of those managers within the 120 organizations. This procedure increased the sample size of the study, as it was distributed to a larger number of potential participants (Cozby, 2008). A random sampling plan was not used because there was no guarantee that each individual randomly selected for the study would complete the survey. Completion of the survey instruments was voluntary. Therefore, convenience sampling was deemed the most appropriate plan for the current study. Contact information was also obtained from each company's Web site, phone directory and walk-in visits. Once the contact information was collected, the researcher sent invitation emails to targeted managers. In terms of the convenience sampling plan, a potential limitation exists, that is, the sample of managers may not represent the entire population of managers in Egypt. Thus, generalizations regarding the target population may be limited to those individuals who voluntarily completed the survey instrument, rather than the entire population. The response rate is 75 per cent or 90 of the 120 respondents, who prejudged to have the information needed to answer this research's main questions. This is a significant sample size and a response rate in non-participatory sort of culture, especially for such evolving subject. A number of criteria were considered when selecting respondents. The gender diversity is represented. Additionally, the respondent's experience is also emphasized where participants chosen had different level of experience in terms of year spent on current job. The educational background of respondents is also considered where the sample targets respondents with a bachelor degree, master degree, professional certificates and a PhD degree. The sample also considers the age of respondents where respondents represent various age categories. The management level is also considered where respondents represent both senior management positions and middle management level.

5. Empirical findings

5.1 Reliability test and frequency statistics

The analysis process is commenced with a reliability test that determines the properties of measurement scales and the items that make them up. The reliability analysis procedure calculates a number of commonly used measures of scale reliability as well as provides information about the relationships between individual items in the scale. Reliability is a measure of consistency. The Cronbach's alpha method was used to measure the scale reliability. Briefly, alpha is measured on the same scale and typically varies between 0 and 1. Although there is no definite value for evaluating the reliability

of a measure, the closer the alpha is to 1.00, the greater the internal consistency of items in the instrument being assessed. Nunnally (1978) suggested that a set of items with coefficient alpha greater than or equal to 0.70 is considered to be internally consistent. Table I illustrates the outcomes of Cronbach's alpha analysis.

Table II summarizes the descriptive statistics of the research sample, which refers to the transformation of raw data into an understandable form by summarizing, categorizing, rearranging and other forms of analysis not only to simplify but also to clarify the research data. Table II shows that 22.2 per cent of respondents are from IT outsourcing firms, 56.7 per cent from telecommunication firms, 3.3 per cent serve in software development firms and, finally, 17.8 per cent serve in IT and information systems solution firms.

In terms of years with the business organization, respondents vary from 5 or less years of experience to more than 15 years. Of these, 31.1 per cent of respondents have 5 years or less of service in their firms, 35.6 per cent have 5-10 years of service, 22.2 per cent maintain 10-15 years of experience and, finally, 11.1 per cent have more 15 years of service in their present companies. The sample also represents different age categories with 8.9 per cent of respondents aged 30-35 years old, 53.2 per cent aged 35-40 years old, 32.2 per cent aged 40-45 years old and, finally, 5.6 per cent are older than 45 years. The sample is also divided between gender type where 40 per cent of the sample is female and 60 per cent represents male respondents. Table III below summarizes weighted average, standard deviation, rational weight and rank of 45 factors constituting a KMS. Table III indicates that the highest value of rational weight is for the "knowledge transfer" factor with 77.07 per cent. The second rank is for "knowledge creation" factor with rational weight 76.05 per cent. The minimum value of rational weight is 58.40 per cent for "knowledge measurement" factor.

Table IV shows the weighted mean, standard deviation, rational weight and rank of 12 variables represent the perceived performance of KM. The scale provided in Table IV consists of 12 indicators to performance results from KMS. Table IV shows that all performance indicators perceived have weighted mean greater than 3 (i.e. rational weight greater than 60.0 per cent). The market share indicator has the maximum rational weight (70.0 per cent), i.e. ranked 1, while the number of suggestions implemented scores the lowest rational weight at 60.22 per cent and, hence, has lowly ranked. Generally, the average of the weighted means for the twelve performance indicators is 65.5 per cent; which is greater than 60.0 per cent.

Measure	No. of statements (items)	Cronbach's alpha
Knowledge management system (45 items)		
Creation	8	0.851
Acquisition	7	0.755
Codification	8	0.842
Sharing	10	0.853
Transfer	8	0.792
Measurement	4	0.730
Knowledge management performance (12 items)		
Firm performance	12	0.858

Table I.
Cronbach's alpha reliability test outcomes

Table II.
Sample profile and frequency statistics

Type of business			Years with the company			Age			Gender		
Business	Frequency	(%)	No. of Years	Frequency	(%)	Age	Frequency	(%)	Gender	Frequency	(%)
IT outsourcing	20	22.2	0-5	28	31.1	30-35	8	8.9	Male	54	60
Telecom	51	56.7	5-10	32	35.6	35-40	48	53.3	Female	36	40
Software development	3	3.3	10-15	20	22.2	40-45	29	32.2			
IT and information systems solution	16	17.8	>15	10	11.1	>45	5	5.6			
Total	90	100.0		90	100.0		90	100		90	100

5.2 Inferential statistics and hypotheses testing

Inferential statistics deployed in here enhance this research to draw conclusions about the population from the research's sample. That is, they are used to determine whether an expected pattern designated by the hypothesis is actually found in the observations or not. The main hypothesis of this study can be formulated as follows: an adoption of a systematic approach to KM significantly associates with a firm's performance. To test this hypothesis, first, a multiple correlation coefficient was conducted to test the linear relationship between the six elements of a KMS and a firm's performance. Table V summarizes the outcomes resulted from the correlation coefficients statistics. Table V shows that the correlation coefficients are all positive (direct relationship) and they are significant at the 0.01 level. The relation between a firm's performance and each element of the KMS is significant. The lowest correlation coefficient is 0.385 between a firm's performance and knowledge codification. Whereas the highest correlation coefficient has a value of 0.520 and it is between a firm's performance and knowledge measurement. Meantime, the greatest correlation coefficient between the elements of a KMS itself scored a value of 0.814 and it is between knowledge acquisition and knowledge sharing. While the lowest correlation coefficient has a value of 0.446 and it is between knowledge transfer and knowledge measurement. This, in turn, leads to the conclusion that there is a positive association between a systematic approach to KM and a firm's performance.

Table VI summarizes the outcomes generated from conducting a simple linear regression to test the effect of each element of the KMS on a firm's performance. The rationale for using a linear regression in this study stems from its intention to test for a linear relationship between KM performance and each of the six elements that constitute the proposed KMS. This is done via executing a simple linear regression at first between each two variables and then a simple linear regression model to incorporate the total effect of six independent on a single-dependent variable. Regression analysis is a statistical tool that is widely used to test the relationship between variables. In other words, it is deployed to model the relationship between a response variable (dependent) and one or more predictor variables (independent) for the purpose of predicting future values (Hair *et al.*, 2004). The strength of the linear relationship between the two variables in the regression equation is the correlation coefficient. The coefficient of determination or R^2 represents the per cent of the data that is the closest to the line of best fit. It is the total variation in "Y" that can be explained by the linear relationship between X and Y. It is the ratio of the explained variation to the total variation. Table VI summarizes the outcomes of regression analysis.

Table VI above, in addressing the relationship between knowledge creation and a firm's performance, shows that a correlation coefficient equal to ($r = 0.463$) and, hence,

Factors	Weighted mean	SD	Rational weight (%)	Rank
Knowledge creation	3.80	0.926	76.05	2
Knowledge acquisition	3.28	1.103	65.64	5
Knowledge codification	3.30	1.120	66.00	4
Knowledge sharing	3.33	0.983	66.68	3
Knowledge transfer	3.85	0.938	77.07	1
Knowledge measurement	2.92	1.011	58.40	6

Table III. Means, standard deviation, rational weights and ranks of KMS variables

Variables	Weighted mean	SD	Rational weight (%)	Rank
1. In my company, return on investment is greater than last year	3.49	0.96	69.77	2
2. In my company, average productivity per employee is greater than last year	3.28	0.92	65.62	7
3. In my company, time to market for products and services is less than last year	3.14	0.88	62.89	10
4. In my company, response time for customer complaints is better than last year	3.33	0.85	66.67	4
5. In my company, market share is greater than last year	3.50	0.96	70.00	1
6. In my company, the cost per business transaction is less than last year	3.06	0.77	61.11	11
7. In my company, customer satisfaction is greater than last year	3.29	0.86	65.84	6
8. In my company, the number of suggestions implemented is greater than last year	3.01	0.88	60.22	12
9. In my company, the number of new products or services is greater than last year	3.47	0.91	69.44	3
10. In my company, the percentage of skilled workers compared to the total workforce is greater than last year	3.25	0.92	64.94	8
11. In my company, the percentage of total spending devoted to technology and information processing is greater than last year	3.20	0.99	64.00	9
12. In my company, the number of individuals learning new skills is greater than last year	3.33	0.95	66.67	5
Overall averages	3.28	0.904	65.6	

Table IV.
Means, standard deviations, rational weights and ranks of performance variables

the relation between the two variables is a positive. The strength of the relationship is approximately moderate 1. The coefficient of determination ($R^2 = 0.215$) and it means 21.5 per cent of the total variation in a firm's performance can be explained by knowledge creation process. The regression coefficient value equals to 0.418 and it informs how much the dependent variable is expected to positively increase. That is, if independent variable or knowledge creation variable increases by one unit, the firm's performance will be increased by approximately 0.42. It can thus be concluded that there is a significant positive association between knowledge creation process (as an element of a KMS) and a firm's performance. The regression outcomes that examine the relation between the knowledge acquisition as independent variable and a firm's performance as an dependent variable, indicate that the correlation coefficient equals ($r = 0.453$) and,

Table V. Correlation matrix (dependent and independent variables)

Variables	Dependent variable Firm's performance	Independent variables Knowledge creation	Knowledge acquisition	Knowledge codification	Knowledge sharing	Knowledge transfer	Knowledge measurement
Firm's performance	1						
Knowledge creation	0.463*	1					
Knowledge acquisition	0.453*	0.741*	1				
Knowledge codification	0.385*	0.535*	0.574*	1			
Knowledge sharing	0.448*	0.735*	0.814*	0.618*	1		
Knowledge transfer	0.392*	0.697*	0.580*	0.633*	0.626*	1	
Knowledge measurement	0.520*	0.570*	0.596*	0.576*	0.625*	0.446*	1

Note: *Correlation is significant at the 0.01 level (2-tailed)

hence, the relation between the two variables is positive, and the strength of such a relationship is approximately medium. The coefficient of determination ($R^2 = 0.205$) and it means that 20.5 per cent of the total variation in a firm's performance is explained by knowledge acquisition. Table VI also shows that the regression coefficient equals 0.368 and this means every change in knowledge acquisition by one unit increases a firm's performance by 0.37. It is thus be concluded that there is a significant positive association between knowledge acquisition and a firm's performance.

Table VI also reveals that the regression analysis conducted to test association between the independent variable knowledge codification and the dependent variable firm's performance shows a correlation coefficient equals ($r = 0.385$) and, hence, the relation between the two variables is positive and the strength of such a relationship is approximately less than medium. The coefficient of determination ($R^2 = 0.184$), which indicates that 18.4 per cent of the total variation in a firm's performance can be explained by knowledge codification process. The regression coefficient equals 0.286. Then, every change in knowledge codification by one unit increases a firm's performance by approximately 0.29 and, consequently, it can be concluded that there is a significant association between knowledge acquisition and a firm's performance. In Table VI, the simple regression analysis performed to examine the association between the knowledge sharing as independent variable and a firm's performance as dependent variable has a correlation coefficient equals ($r = 0.448$), and thus the relation between the two variables is positive, and the strength of the relationship is approximately moderate. Meantime, the coefficient of determination ($R^2 = 0.200$) and this, explains that 20 per cent of the total variation in a firm's performance is explained by knowledge sharing. The regression coefficient equals 0.405 and hence, an increase in knowledge sharing by one unit increases a firm's performance by 0.41. It is thus concluded that there is a significant association between knowledge sharing and a firm's performance.

The regression analysis conducted to test the association between the independent variable knowledge transfer and a firm's performance as dependent variable shows that the correlation coefficient equals ($r = 0.392$) and then the relation between the two variables is positive and the strength of such a relationship is approximately less than a moderate one. The coefficient of determination ($R^2 = 0.154$); which means that 15.4 per cent of the total variation in a firm's performance can be explained by knowledge transfer. Whereas the regression coefficient is 0.395 and, hence, a change in knowledge

Table VI.
Summarized outcomes of the simple regression models with a firm's performance as a dependent variable and each of KMS elements as independent variables

Independent variables	(r) Correlation coefficient	(R^2) Determination coefficient	Standard error	Regression coefficient	ANOVA F-Value	ANOVA Significance
Knowledge creation	0.463	0.215	0.506	0.418	22.411	0.000
Knowledge acquisition	0.453	0.205	0.512	0.368	20.612	0.000
Knowledge codification	0.385	0.184	0.528	0.286	14.126	0.000
Knowledge sharing	0.448	0.200	0.515	0.405	20.058	0.000
Knowledge transfer	0.392	0.154	0.523	0.395	14.525	0.000
Knowledge measurement	0.520	0.270	0.491	0.406	29.584	0.000
Knowledge management systems	0.543	0.295	0.489	0.571	30.995	0.000

transfer by one unit increases a firm's performance by 0.40. It is thus be concluded that there is a significant association between knowledge transfer and a firm's performance. The simple regression analysis performed to test the relation between the independent knowledge measurement and the dependent variable a firm's performance shows a correlation coefficient equals ($r = 0.520$), and thus the relation between the two variables is positive, and the strength of the relationship is moderate. The coefficient of determination ($R^2 = 0.270$); which indicates that 27 per cent of the total variation in a firm's performance can be explained by knowledge measurement. Moreover, the regression coefficient equals 0.406; hence, a change in knowledge measurement by one unit increases a firm's performance by approximately 0.41. Then, it can be concluded that there is a significant association between knowledge measurement and a firm's performance. Finally, Table VI indicates that the simple regression conducted to test the relation between a total KMS and a firm's performance has a correlation coefficient equal to ($r = 0.543$) and, accordingly, the relation between the two variables is positive, and the strength of the relationship is moderate. The coefficient of determination ($R^2 = 0.295$) and this means that 29.5 per cent of the total variation in a firm's performance can be explained by the sixth elements collectively that constitute a KMS. The regression coefficient equals 0.571 and this shows that a change in the sixth elements form a KMS by one unit increases a firm's performance by 0.57. Accordingly, it can be concluded that there is a significant association between the sixth elements represent a KMS and a firm's performance. Finally, in light of the above discussion that aims at interpreting Table VI of a simple regression analysis, it can be concluded that the main research's hypothesis; which states that there an association between a KMSs and a firm's performance cannot be rejected.

The analysis section of this paper also placed emphasis on testing the differences of sample characteristics on perceived performance emerged from a systematic approach to KM. The *t*-test for independent samples is the most commonly used method to evaluate the differences in means between two groups of variables. The *p*-value reported with a *t*-test represents the probability of error concerned with accepting a research hypothesis about the existence of a difference. In other words, this is the probability of error associated with rejecting the hypothesis of no difference between the two categories of observations (corresponding to the groups) in the population when, in fact, the hypothesis is true. Table VII summarizes the statistics of means, standards deviation and standard error in means in performance according to gender. Table VII shows that females have a mean of 3.29 (from 5) and standard deviation of 0.579, versus a mean of 3.25 and standard deviation of 0.564 for males. The difference between the two means is very small (mean difference equals is 0.045). The independent sample *t*-test is used to evaluate the significance of the difference between the two means. Table VIII below shows that the value of (*t*) equals 0.356 and *p*-value significance (two-tailed) equals 0.723, which is greater than 0.05. It is concluded that the difference between

Table VII. Summary statistics of company performance according to gender

Gender	No.	Mean	SD	Standard error mean
Female	36	3.2904	0.57890	0.10077
Male	54	3.2451	0.56431	0.07902

females mean and males mean is insignificant and hence, no significant difference exist between females and males according to perceived performance.

To test for differences in means according to type of business, a one-way analysis of variance (ANOVA) was conducted. ANOVA is a method of testing the null hypothesis that several group means are equal in the population, by comparing the sample variance estimated from the group means to that estimated within the groups. The one-way ANOVA procedure generates a one-way analysis of variance for a quantitative-dependent variable by a single factor (independent) variable. Analysis of variance is thus used to test the hypothesis that several means are equal. This technique is an extension of the two-sample *t*-test. Results of Table IX present the summary statistics of a firm's performance according to a type of business. The highest mean is for "Telecom Type of Business"; it equals 3.39 (from 5) and standard deviation of 0.537, versus a mean of 3.26 and a standard deviation of 0.567 for other categories, and a mean of 3.09 and a standard deviation of 0.485 for "IT outsourcing" and a mean of 2.58 and a standard deviation of 0.589 for the "software development" category. Table X shows the results of the ANOVA test. The value of the test (*F*-value) equals 2.513, and the significance value (*p*-value) is 0.064; which is greater than 0.05. Accordingly, the differences between means of the four categories represent the type of business are insignificant. Thus, it can be claimed that there is no significant differences between the four categories of type of business according to a perceived KM performance.

In measuring differences according to years with the company, Table XI shows that the highest mean is for "more than 10-15" years with the company and the mean of 3.36 with a standard deviation of 0.556, versus mean of 3.35 and standard deviation of 0.374 for "more than 15" years with the company, and a mean equals 3.26 and standard deviation of 0.548 for "0-5" years with the company and, finally, a mean of 3.19 and a standard deviation of 0.63 for 5-10 years with the company. Table XII shows the results of ANOVA. The value of the test (*F*-value) equals 0.422, and the significance value

Table VIII.
t-Test statistics

T	df	Significance (two-tailed)	Mean difference	Standard error difference
0.356	88	0.723	0.04531	0.12735

Table IX.
Summary statistics of company performance according to "Type of business"

Type of Business	*N*	Mean	SD	Standard error
IT Outsourcing	20	3.09	0.485	0.114
Telecom	51	3.39	0.537	0.078
Software development	3	2.58	0.589	0.417
IT and information systems solution	16	3.17	0.657	0.164
Total	90	3.26	0.567	0.062

Table X.
ANOVA test of company performance according to type of business

	Sum of squares	df	Mean square	*F*	Significance
Between groups	2.299	3	0.766	2.513	0.064
Within groups	24.389	87	0.305		
Total	26.687	90			

(p-value) is 0.737, which is greater than 0.05. Then, the differences between means of the four categories of "years with the company" are insignificant. This, in turn, indicates that there are no significant differences between the four categories of "years with the company" according to "perceived knowledge management performance".

Table XIII shows the different values of means of age categories. As it can be seen from Table XIII, the means and standard deviations of the four age categories are very close to each other. The means equals to 3.3 and a standard deviation of 0.57 roughly. Table XIV presents the ANOVA test. Table XIV below shows that the (F-value) equals 0.214, and the significance value (p-value) scores 0.886, which is greater than 0.05. Then, the differences between means of the four categories of "Years with the company" are insignificant. Then, we have the conclusion that no significant differences between the four categories of "Age" according to "perceived knowledge management performance".

In brief, the statistical analysis performed in this paper assisted us to conclude the hypothesis, which states the adoption of a systematic KM approach impact performance is a true assumption. It can also be concluded that such a perceived KM performance is not affected by variables such as gender, age, type of business and years with the

Table XI. Summary statistics of company performance according to years with the company

Years with the company	N	Mean	SD	Standard error
0-5	28	3.2562	0.54788	0.10544
More than 5-10	32	3.1882	0.63061	0.11326
More than 10-15	20	3.3640	0.56260	0.12907
More than 15	10	3.3452	0.37401	0.14136
Total	90	3.2629	0.56704	0.06187

Table XII. ANOVA test of company performance according to years with the company

	Sum of squares	df	Mean square	F	Significance
Between groups	0.416	3	0.139	0.422	0.737
Within groups	26.271	87	0.328		
Total	26.687	90			

Table XIII. Summary statistics of company performance according to age

Age (years)	N	Mean	SD	Standard error
30-35	8	3.34	0.537	0.199
35-40	48	3.22	0.580	0.085
40-45	29	3.31	0.576	0.111
>45	5	3.25	0.589	0.417
Total	90	3.26	0.567	0.062

Table XIV. ANOVA test of company performance according to age

	Sum of squares	df	Mean square	F	Significance
Between groups	0.212	3	0.071	0.214	0.886
Within groups	26.475	87	0.331		
Total	26.687	90			

company. This finding fits with other scholars who have always understood that above-average sustainable performance is in large part derived from intangible assets such as knowledge (Liebeskind, 1996). ICT firms presume that investment in KMSs boost better business performance. The final aim of a KMS is to improve performance. As Bhirud *et al.* (2005, p. 1) stated:

> Knowledge management is the process of managing the organization's knowledge by means of systematic and organizational specific processes for acquiring, organizing, sustaining, applying, sharing and renewing both tacit and explicit knowledge by employees to enhance the organizational performance and create value.

Also, Dawson (2000) defined KM capabilities as the ability to deploy knowledge resources effectively and implement knowledge processes efficiently to derive organizational benefits. KM has been recognized as "an integral part of an organization's strategy to improve business performance" (Carrillo *et al.*, 2003, p. 1). It is widely accepted that the essence of any KMS is to improve organizational performance by approaching the processes such as acquiring knowledge, converting knowledge into a useful form, applying or using and protecting knowledge (Lee and Lee, 2007).

6. Conclusions and final remarks: so what

This research represents the first study of its kind by providing an integrated KMS and performance model for the Egyptian ICT organizations. No prior empirical studies could be found in the literature that directly explores these relationships collectively as our framework suggests. This research advances understanding of the application and benefit of KMS in ICT firms in several ways:

- It provides a better understanding of KMS and practices currently being applied in the Egyptian ICT firms. There had been little or no industry-wide empirical research on this topic to date.
- it provides a better understanding of knowledge processes in ICT sector; specifically, the links between knowledge acquisition, creation, codification, sharing, transfer and measurement, and their links to performance.
- the measurement instruments developed for this research constitute a reliable set of construct measures that provide the basis for future research and will support the ongoing assessment of KMS practices, knowledge processes and ICT performance by the industry.

This fits with what was addressed by Majors (2010, p. 173) who stated that:

> […] success of an organization is more and more dependent on its capability to create an effective environment for knowledge creation and application and on the knowledge and talent factors of production.

In other words, the insights obtained from this research will help managers to better understand how and why KMSs are effective at improving organizational performance, and by what mechanisms this occurs. In summary, the research provides much-needed insights and guidance to help ICT managers maximize the benefit from KM initiatives in future. This study, in return, complies with the literature that KM practices are an important factor in achieving overall organizational performance (Boekema, 2000; Bou-Llusar and Segarra-Cipres, 2006)

and that KM is an important driver of performance and essential to maintain competitive advantage (Marques and Simon, 2006; Schack, 2004; Zack, 1999). Another significant point of view that this study concludes is that the past researches revealed that the focus was mostly placed on learning, learning organizations and learning styles but the literature fell short to place similar focus toward elaborating the outcomes of learning; which is reflected in the creation of new knowledge. This, in turn, calls for effective integration between KMSs and organizational learning, as they are mutually inclusive research areas. That is, the KMS must enhance forming communities of practices that are characterized by closer ties and teamwork culture. This further assists people not only in sharing interests and using a common language but also in getting together to create and share knowledge and discuss that of others. Putting knowledge into effect requires a KMS to be aligned with the strategy, which produces a context relevant to effective KM.

Consequently, this helps examined firms to internally, improve decision-making capability and to externally, satisfy customers. Employees tend to contribute to knowledge sharing if they can regularly use and benefit from this exchanged knowledge. Culture that is centered on rewarding knowledge acquisition and sharing would boost the process. To successfully boost KMSs, formal and informal transfer channels need to be implemented which is parallel in context and content to that of the organization's objectives. Further research is thus recommended to better understand the combined intermediary and moderation effects of the level of supportive organizational culture on the links between KMS and performance. The literature indicates that organizational culture is one of the most powerful influences on behavior, and it can enable or hinder KMSs (Cummings and Worley, 2005; Iftikhar, 2003). As Trainor *et al.* (2008, p. 40) stated "successful knowledge management systems involve a change in organizational culture that fosters a willingness to capture, transfer, and build knowledge". Knowledge transfer requires a strong technological system to diffuse knowledge between individuals, teams and across geographical locations. Employees have to receive training on how to use the transfer system or alternatively it might be complicated and hence, rejected due to complexity. While information technology plays a pivotal role in the knowledge transferring process, the most important point of this process is encouraging organizational members to use and apply knowledge and to take action beneficially and productively, which can be the whole point of KM (Iftikhar, 2003; Sanchez, 2005). Another element in KMS that demands significant attention is measurement, which evaluates the process and guides managers to areas of strengths and weaknesses. Measuring KM performance and outcomes is vital to test whether the objectives are met or not. Organizations should test the effect of KMS on the business performance, which targets both organizational and individual levels. This can be done when testing the exact knowledge activities that caused the impact. Measurement requires setting qualitative and quantitative measures which will ultimately reveal the financial gain resulting from utilizing KMS and, hence, justifying its cost. Meanwhile, measuring can extend to cover organizational performance in terms of financial, internal procedures, clients, learning and growth instead of just using financial measures. A new established measurement is the benchmarking with the top performers in the business field. Developing measuring

system is problematic because of the tacit and intangible nature of knowledge, and thus organizations need to involve its members in the measurement stage.

6.2 Study limitations

There are several limitations that should be taken into account when interpreting the results of this work. First, survey data based on self-reports may be subject to social desirability biases, common method variance and response distortion due to sense of self-defense tendencies were a concern. Second, the data were cross-sectional in nature and this limitation impedes the inference of causality. This only allows to analyze a specific situation in time of the ICT companies surveyed not their overall conduct over time and, accordingly, future research should focus on a longitudinal study. Thirdly, due to sample size limitations, it was not possible to develop an acceptable and complicated model such as structural equation model (SEM) methods. The analytical benefits of this methodology would likely improve the trustworthiness of the analysis and may yield additional findings or further clarify some of the issues raised above. If the survey is repeated in future, additional effort to increase response rates and quality is recommended to enable SEM methods be applied to grasp various elements that improve the findings. Finally, this study is limited to the systematic process of KM with its six major components and supportive infrastructures. However, the research does not address important aspects like culture, trust and leadership. This finding has been rooted in past literature clearly and it suggests that KM can be a work process or activity (Carvalho and Ferreira, 2001; Frappaolo, 2006; Milam, 2005), a technology infrastructure (Chinowsky and Carrillo, 2007; Hansen *et al.*, 1999) or an organizational culture to manage valuable corporate assets and knowledge (Pauleen *et al.*, 2007).

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