

Pursuing sustainable development with knowledge management in public sector

Mohsenah Al Yami

Abu Dhabi University, Abu Dhabi, United Arab Emirates, and

Mian M. Ajmal

College of Business Administration, Abu Dhabi University, Abu Dhabi, United Arab Emirates, and University of Vaasa, Vaasa, Finland

Abstract

Purpose – Knowledge management (KM) is increasingly becoming critical to public sector organizations as it is to private sector organizations. This is because public sector organizations are increasingly held accountable for their actions and are forced to move away from traditional bureaucratic approaches to more managerial ones. For instance, public sector is facing pressure to improve its operational efficiency such as productivity, lead time and expenditure. Similarly, it is also facing pressure to improve its transparency, trust, reliability and accountability, which are key elements of sustainable development (SD). The purpose of this study therefore is to understand the intricate relationship between KM processes, operational efficiency and SD in the public sector.

Design/methodology/approach – A framework consisting of eight constructs (knowledge acquisition, knowledge creation, knowledge capture, knowledge storage and retrieval, knowledge sharing, knowledge utilization, operational efficiency and SD) and their underlying items was developed through an extensive literature review. Using 383 usable responses collected through a structured questionnaire from the UAE public sector, the constructs and framework were first validated and then the current level of implementation/achievement of KM processes, operational efficiency and SD was assessed along with the hypothesized relationships between the constructs.

Findings – The findings show that KM processes had a positive and significant direct impact on operational efficiency and SD. Also, operational efficiency was found to strongly mediate the relationship between KM processes and SD.

Practical implications – The findings are expected to help UAE public sector organizations devise strategies and policy interventions to align and improve their KM processes for achieving operational efficiency and SD. Public sectors looking to focus on SD must focus on KM processes and strive to improve stakeholder engagement, which is a vital aspect of SD.

Originality/value – Integration of KM processes, operational efficiency and SD has not been attempted previously and hence constitutes the novelty of this work.

Keywords Knowledge management, Public sector, Sustainable development, Operational efficiency, United Arab Emirates

Paper type Research paper



1. Introduction

The use and application of knowledge are widely recognized as an important asset in the management domain, especially in this day and age of globalization, digitalization and liberalization. As a result, knowledge management (KM) as a discipline has witnessed significant interest in recent years among academics and practitioners alike (Mariano and Awazu, 2016). The central aspect of KM is the efficient and effective implementation of

“knowledge management processes,” namely, knowledge acquisition, knowledge creation, knowledge capture, knowledge storage and retrieval, knowledge sharing and knowledge utilization (Von Krogh, 1998; Alavi and Leidner, 2001). Today, organizations, both private and public, are looking at ways to implement “knowledge management processes” for their sustainability. However, even though KM is as critical to public sector organizations as it is to private sector organizations (Willem and Buelens, 2007), most KM studies are undertaken in the private sector (Oluikpe, 2012, Ringel-Bickelmaier and Ringel, 2010). This lack of academic inquiry into KM in the public sector implies that several important aspects which are critical to the success of the KM programs in the public sector are not sufficiently understood.

Meanwhile, public sector organizations worldwide are increasingly held accountable for their actions and are forced to move away from traditional bureaucratic approaches to more managerial ones (Sandhu *et al.*, 2011). For instance, they face budgetary pressure to reduce spending and wastage of resources, without diluting the standards of service. Citizens are expecting the service offered by public sector entities (such as health care and education) to be above or at least at par with private sector organizations. There are often complain about the long waiting time in accessing public sector services such as government clinics and municipality. Also, citizens complain about going to multiple departments and that too many times to get things done. This general lack of operational efficiency of the public sector is a concern that needs to be addressed (Massaro *et al.*, 2015).

Moreover, the public sector is also facing pressure to improve its integrity and transparency in the services offered to its citizens, as well as to promote innovation through partnerships with the private sector and other financial institutions (Cong and Pandya, 2003; Alińska *et al.*, 2018). According to OECD (2018), integrity, trust, reliability, accountability, innovation and quality in public sector services are key to increase the willingness of citizens, businesses and other stakeholders to respond to public sector policies and contribute to SD. There is a consensus that an effective, efficient and fair public service is essential for achieving the SD goals by 2030 (GCPSE, 2018).

While the effective implementation of all the above three aspects, namely, KM, operational efficiency and SD, is critical for the public sector, they are not mutually exclusive. Instead of focusing separately on these aspects, the public sector could greatly benefit if they can integrate these three critical pillars. For instance, Butler *et al.* (2008) highlighted that KM in the public sector would lead to better efficiency in the services offered. Similarly, Aldabaldetrekue *et al.* (2016) highlighted the importance of KM in implementing an effective SD agenda. Similarly, Sinclair (2006) stressed the importance of KM to accelerate the socio-economic developments of the country. At present, not only is the research in KM limited in the public sector, there is hardly any understanding of the complex relationship between KM and operational efficiency and SD.

While this is a concern in general, the concern is even more so for certain countries. This is because any advances in KM in the public sector have happened mostly in developed countries such as Australia (Bardy *et al.*, 2016) and fast-emerging economies such as China (Cong *et al.*, 2007). Also, countries in the Organization for Economic Co-operation and Development (OECD) have also recognized the importance of KM in the public sector and have started implementing processes to address their economic problems (Biygautane and Al-Yahya, 2011). In comparison, there is limited understanding on KM in the public sector in the Middle East region, especially in the Gulf Cooperation Council (GCC) context even though these countries are trying to diversify their dependence on oil and move toward a knowledge-based economy from an oil-based economy.

While understanding the KM processes and its impact on operational efficiency and SD in the public sector is important for the GCC, this understanding would be even more critical for the UAE. This is because, UAE is one of the few countries in the region where different levels of government have supported the national KM program as part of its own 2021 vision (DSG, 2014) to transition from an oil-based economy to a knowledge-based economy in the wake of declining oil prices. For example, the establishment of the Mohammed Bin Rashid Al Maktoum Foundation in 2007 with a \$10bn endowment fund is perhaps one of the significant government initiatives taken to advance KM in the Arab region (Al Maktoum Foundation, 2007). The efforts of UAE toward KM are reflected by the fact that the UAE was ranked first in the Arab world and 42nd overall in the knowledge economy index created by the World Bank (DSG, 2014). Similarly, UAE like other governments around the world is continually exploring ways to improve operational efficiency. This is because public expenditure and spending are subject to scrutiny from audit bodies, central agencies, expenditure review programs, political decision-makers, media and think tanks (TGS, 2013). Therefore, improving operational efficiency is now considered as a critical public sector priority in the UAE. Further, in line with the United Nations 2030 Agenda for Sustainable Development, UAE as a member country is required to achieve their respective SD goals, which are economic, social and environmental development (UN, 2018).

The aim of this study, therefore, is to assess the current status of KM, operational efficiency and SD in the UAE public sector, and how the KM processes are impacting the operational efficiency and SD of the UAE public sector.

At present, given the dearth of KM studies in the public sector, there are no established and validated measurement scales available in the literature to capture the KM processes in the public sector. Also, a well-established and validated instrument to capture operational efficiency and SD in the public sector is also not available. The first objective of this study, therefore, is to develop measures to capture the current state of KM processes, operational efficiency and SD in the public sector. Next, given that these constructs (KM processes, operational efficiency and SD) have not been tested and validated previously, the second objective is to empirically test and validate the constructs to ensure that these constructs can accurately measure what they were intended to measure. The final objective is to empirically test and validate the KM framework comprising KM processes, operational efficiency and SD, and assess the relationships between them.

The findings from this study are expected to help UAE public sector organizations devise strategies and policy interventions to improve their KM processes and its impact on the operational efficiency and SD. The rest of the paper is structured as follows. Section 2 discusses the literature synthesis carried out to develop measures for KM processes, operational efficiency and SD for the public sector. Section 3 discusses the KM framework and relevant hypotheses proposed in this study. Section 4 details the research methodology adopted in this study. The analysis and findings of the study are presented in Section 5. Section 6 concludes with the discussion of key findings, research and practical implications, along with limitations and suggestions for future research.

2. Review of literature

In line with the research objectives, the aim of the literature review is to identify measuring items for KM processes, operational efficiency and SD. The review used leading databases such as Scopus, Web of Science, Elsevier, Emerald and Science Direct to identify the relevant studies in the domain, in addition to industry reports and official government websites.

Following steps were included in the literature search process:

- Keyword search in leading library databases such as Scopus, ProQuest, EBSCO, Science Direct, Emerald, Elsevier, Taylor and Francis, Springer, Wiley and Inderscience were used to ensure comprehensive coverage of the literature. The main keywords used for the search include KM, KM practices, KM processes, knowledge acquisition, knowledge creation, knowledge capture, knowledge storage, knowledge retrieval, knowledge sharing, knowledge utilization, knowledge transfer, knowledge dissemination, knowledge application, knowledge use, KM and public sector, KM and UAE, KM and sustainable development, KM and operational performance/efficiency, SD and public sector, sustainable development and UAE, public sector and UAE, operational efficiency and sustainable development.
- Internet search engines through Google and Google Scholar were used to identify and access the relevant books, media reports, industry reports, working papers, blogs and presentations.
- Periodic access and review of leading journals that have frequently published articles in KM such as *Journal of Knowledge Management*, *Journal of Management Information Systems*, *Management Science*, *Sustainability*, *International Journal of Public Sector Management*, *Journal of Public Administration Research and Theory*, *Strategic management Journal*, and *California Management Review*, *Journal of Operations Management* and *Journal of Management Information Systems* were conducted to include the most relevant and up to date studies which could have been missed on the keyword search.

The underlying items within each construct for the public sector identified from the literature are provided in [Table I](#). Though it can be argued that a host of other items could be found in the literature, no other items appeared to be as consistent and relevant in the public sector than those presented in [Table I](#). These constructs and items are discussed in the following sections.

2.1 Knowledge management processes

According to [Newman and Conrad \(2000\)](#), KM is a discipline that seeks to improve the performance of individuals and organizations by maintaining and leveraging the present and future value of knowledge assets. [Jasimuddin \(2006\)](#) explored the disciplinary roots of KM and found that it has roots to information systems, organization theory, strategic management and human resources management. Given the multidisciplinary nature of KM, it is important for organizations to develop an all-encompassing effort to reap benefits from it. The UAE Federal Government Knowledge Management Guide defines KM as “The systematic management of knowledge assets at the entity, to create added value and meet the strategic needs; it includes all initiatives, processes, and systems that contribute to knowledge production, acquisition, classification, storage, dissemination, and use/re-use” ([GKMFG, 2017](#)).

KM processes are defined as the “fundamental actions that an organization performs in processing and manipulating its knowledge resources” ([Holsapple and Joshi, 2000](#)). This KM process entails several stages, namely knowledge acquisition, knowledge creation, knowledge capture, knowledge storage and retrieval, knowledge sharing and knowledge utilization ([McAdam and Reid, 2000](#); [Lawson, 2003](#); [Lee and Choi, 2003](#)).

The following section discusses each of these KM processes.

Table I.
Constructs and items
identified from the
literature

Knowledge management processes	References
<i>Knowledge acquisition</i>	
My organization actively gather information on the best practices and trends in the sector (KACQ_01)	Gold <i>et al.</i> (2001), Jantunen (2005)
My organization actively gather information on their competitors (KACQ_02)	Lee and Yang (2000), Gold <i>et al.</i> (2001); Lee and Choi (2003)
My organization actively gather information from all departments (KACQ_03)	Gold <i>et al.</i> (2001)
My organization actively gather information on the internal operations (such as what succeeded and what failed) (KACQ_04)	Gold <i>et al.</i> (2001)
My organization actively gather information on the market/customer needs (KACQ_05)	Yli-Renko <i>et al.</i> (2001); Lee and Choi (2003)
My organization encourages employee suggestions and feedback (KACQ_06)	Lee and Choi (2003)
My organization encourages customer suggestions and feedback (KACQ_07)	Yli-Renko <i>et al.</i> (2001)
<i>Knowledge creation</i>	
My organization rewards employees for new ideas and knowledge (KCRT_01)	Lawson (2003)
My organization facilitates development of new ideas through constructive dialogue among employees (KCRT_02)	Alavi and Leidner (2001), Parjanen (2012)
My organization encourages employees to experiment with new ideas and concepts (KCRT_03)	Dermol (2013)
My organization has mechanism in place to evaluate the value of new ideas and concepts (KCRT_04)	Gold <i>et al.</i> (2001)
My organization has mechanisms in place to combine existing and new concepts in a meaningful way (KCRT_05)	Gold <i>et al.</i> (2001; Lawson (2003)
<i>Knowledge capture</i>	
In my organization, existing knowledge is captured in the form of department reports, meeting minutes, training manuals, handbooks etc. (KCAP_01)	White and Cohan (2016)
In my organization, employees are required to document their work (KCAP_02)	Hari <i>et al.</i> (2004)
In my organization, mechanism are in place to capture employee work documents and communications (KCAP_03)	Hari <i>et al.</i> (2004)
In my organization, any new knowledge is documented in written form (KCAP_04)	Hari <i>et al.</i> (2004)
In my organization, mechanisms are in place to patent and copy right new knowledge (KCAP_05)	Lawson (2003)
<i>Knowledge storage and retrieval</i>	
In my organization, captured knowledge is codified and is stored in company's knowledge repositories (KS&R_01)	Alavi and Leidner (2001; Lee and Wong (2015)
In my organization advanced databases are used for storage (KS&R_02)	Alavi and Leidner (2001)
In my organization, new knowledge is regularly added into the knowledge database (KS&R_03)	Hari <i>et al.</i> (2004)

(continued)

Knowledge management processes	References
Organizations regularly delete useless and iterative knowledge in the database (KS&R_04)	Chaudhury and Bhattacharya (2004)
Employees can access the database and repository conveniently (KS&R_05)	Lawson (2003)
<i>Knowledge sharing</i>	
My organization uses latest files sharing systems to share knowledge efficiently (KSHR_01)	Al-Alawi <i>et al.</i> (2007), Lin (2007)
My organization facilitates creative and constructive conversation among employees (KSHR_02)	Gold <i>et al.</i> (2001)
My organization employees are encouraged to share their new ideas and concepts with others (KSHR_03)	Lawson (2003), Al-Alawi <i>et al.</i> (2007)
My organization sends out timely reports and newsletters to employees, customers and other relevant organizations (KSHR_04)	Lawson (2003)
My organization conducts regular symposiums, lecturers, conferences and training sessions to share knowledge (KSHR_05)	Lawson (2003)
My organization cross-functional teams from different departments are created to facilitate knowledge sharing (KSHR_06)	Al-Alawi <i>et al.</i> (2007)
My organization encourages team outing, department lunches etc. to encourage informal knowledge sharing (KSHR_07)	He <i>et al.</i> (2014)
<i>Knowledge utilization</i>	
My organization has mechanisms in place to match sources of knowledge to problems (KUTL_01)	Lawson (2003)
My organization has mechanisms in place to correctly assigns tasks to employees that matches with their expertise (KUTL_02)	Reagans <i>et al.</i> (2016)
My organization utilizes knowledge to respond to the changing competitive environment (KUTL_03)	Greiner <i>et al.</i> (2007)
My organization utilizes knowledge to improve efficiency (KUTL_04)	Greiner <i>et al.</i> (2007)
My organization is not reluctant to use new knowledge into product/services (KUTL_05)	Lee and Wong (2015)
My organization employees are encouraged to apply their new ideas into practice (KUTL_06)	Lee and Wong (2015)
My organization employees are encouraged to apply their knowledge to solve problems (KUTL_07)	Lee and Wong (2015)
<i>Operational efficiency</i>	
Service delivery cycle time has reduced (OPRE_01)	Curristine <i>et al.</i> (2007)
Utilization of assets has improved (OPRE_02)	Zhu <i>et al.</i> (2005)
Time lost because of maintenance/repair (downtime) has reduced (OPRE_03)	Fore and Zuze (2010)

(continued)

Table I.

Table I.

	References
Knowledge management processes	
Duration of departmental projects has reduced (OPRE_04)	Rusinko (2007); Zacharia <i>et al.</i> (2009)
Day to day organizational expenses has reduced (OPRE_05)	Cong and Pandya (2003), Curristine <i>et al.</i> (2007)
The employee productivity has increased (OPRE_06)	Curristine <i>et al.</i> (2007)
Customer service level has been improved (OPRE_07)	Wang and Wang (2012)
Value generated to our customers has increased (OPRE_08)	Rusinko (2007); Zacharia <i>et al.</i> (2009)
Sustainable development	
Transparency in the services offered has increased (SUSD_01)	GCPSE (2018); OECD (2017, 2018); APO (2013)
Trust in the services offered has increased (SUSD_02)	GCPSE (2018); OECD (2017, 2018); APO (2013)
Reliability in the services offered has increased (SUSD_03)	GCPSE (2018); OECD (2017, 2018)
Accountability in the services offered has increased (SUSD_04)	GCPSE (2018); OECD (2017, 2018)
Stakeholder engagement has increased (SUSD_05)	GCPSE (2018); OECD (2017, 2018)
Innovation in the services offered has increased (SUSD_06)	GCPSE (2018); OECD (2017, 2018); APO (2013)
Quality in the services offered has increased (SUSD_07)	GCPSE (2018); OECD (2017, 2018)

2.1.1 Knowledge acquisition. This process is oriented toward obtaining knowledge (Gold *et al.*, 2001). This includes both internal and external knowledge acquisition. According to Bloodgood (2019), knowledge acquisition is important for firms to benefit from new understandings. A firm may improve its competitive positioning if it acquires the knowledge of what their competitors are doing (Bloodgood, 2019). On the other hand, lack of knowledge acquisition could cause a firm to miss potential opportunities. According to the knowledge-based view, innovative firms must leverage their acquisition capabilities to update their knowledge capital constantly to match new environmental conditions (Algezauai and Filieri, 2010).

The organizations' ability to recognize and evaluate pertinent knowledge is key to the acquisition process (Yli-Renko *et al.*, 2001). This is important because, some new knowledge may be flawed, inappropriate or irrelevant for the firm's context (Bloodgood, 2019). The study found that acquiring highly distinctive and pertinent knowledge can gain competitive advantage through unique opportunity capture.

This includes gathering knowledge on the best practices internally and externally, as well as those practices that succeeded and failed (Yli-Renko *et al.*, 2001). According to Grimpe and Kaiser (2010), balancing internal and external knowledge acquisition is important. External knowledge acquisition include the process of engaging in dialogue with external stakeholders such as competitors, suppliers and customers, the stakeholders that are key to the knowledge acquisition process, whereas internal knowledge acquisition involves acquiring knowledge within the organization such as from employees (Lee and Choi, 2003; Yli-Renko *et al.*, 2001).

2.1.2 Knowledge creation process. This process is oriented toward the organizations' ability to create new ideas and solutions (Marakas, 1999) not only from scratch but also the reconfiguration of existing pieces of knowledge to create new knowledge (Gold *et al.*, 2001; Lynn *et al.*, 1996). According to Nonaka's (1994) dynamic theory of organizational knowledge creation, knowledge creation is an interplay between tacit and explicit knowledge. Therefore, organizations must encourage the exchange of ideas between individuals and groups such as through participative decision-making processes (Locke *et al.*, 1997) and/or brainstorming sessions (Hutchinson and Quintas, 2008). Also, studies have shown that organizations that encourage employees to work together in a team, as well as organizations that reward employees for new ideas, are more efficient at creating new knowledge (Altinay *et al.*, 2008; Chong *et al.*, 2011). Similarly, Dermol (2013) reported that encouraging employees to experiment with new idea and concepts can boost the knowledge creation process.

2.1.3 Knowledge capture. Studies have shown that even if a firm creates new knowledge, it may not necessarily result in storage (Argote *et al.*, 1990). Therefore, it is important to capture such knowledge and make it available for the organization in the future (Stein and Zwass, 1995). The knowledge capture involves a systematic process of documentation of experiences and lessons learned (Shafia *et al.*, 2011). This includes converting tacit knowledge into explicit knowledge by obliging employees to document and store their work in the form of reports, procedures and technical know-how. For example, in the case of projects, it is important to document both positive and negative experience such as reasons for the failure of certain parts of the project (Shafia *et al.*, 2011).

For instance, Lawson (2003) highlighted the importance of having mechanisms in place to patent and copyright new knowledge. Also, organizations should encourage knowledge capture in the form of department reports, meeting minutes, training manuals, handbooks and other means (White and Cohan, 2016). Hari *et al.* (2004) highlighted the importance of employees documenting their work, communications and any new knowledge that is

created. Similarly, in the case of retirement of the employee or resignation or termination of employee, if their knowledge is not systematically captured, the organization will not be able to leverage the contributions made by them during their tenure (Shafia *et al.*, 2011).

2.1.4 Knowledge storage and retrieval. Studies have shown that even if a firm captures knowledge it does not necessarily become available for the organization for future use (Stein and Zwass, 1995). The captured knowledge needs to be codified and stored in such a way that it can become a part of the existing knowledge base of the organization. Now, with increasing advancements in technology, organizations can easily codify, digitalize and securely store knowledge with redundancy (Alavi and Leidner, 2001; Lee and Wong, 2015). Hari *et al.* (2004) highlighted the importance of regularly adding new knowledge in the database, while Chaudhury and Bhattacharya (2004) mentioned the importance of deleting useless and outdated knowledge in the database. Lawson (2003) stressed the importance of having a knowledge database which is easy to access for employees.

2.1.5 Knowledge sharing. It refers to the organization's ability in transferring or disseminating knowledge from one person, group or organization to another (Lee, 2001). It includes the sharing of both tacit and explicit knowledge. While the latter can be shared in formal, systematic language among employees (Nonaka and Takeuchi, 1995) such as through the intranet, electronic email and shared databases, the former poses a challenge because tacit knowledge sharing is typically voluntary/non-compulsory (Lin *et al.*, 2008). Therefore, to promote employees willingness to share tacit knowledge with colleagues, Gore and Gore (1999) mentioned that the interaction which takes place within a team environment such as collaborative problem-solving provides an excellent platform for the efficient externalization of an individual's tacit knowledge into organizational knowledge. Studies have shown that informal meeting sessions, where employees are free to share their knowledge, ideas and information with others (Coyte *et al.*, 2012) and informal face-to-face social interactions can encourage the sharing of tacit knowledge (Chong *et al.*, 2011).

To facilitate efficient knowledge sharing, it is important for the organization to use the latest file sharing system which is fast and convenient to use (Al-Alawi *et al.*, 2007; Lin, 2007). Organizations should encourage and facilitate employees to share new ideas and knowledge through constructive conversation (Gold *et al.*, 2001; Lawson, 2003). Also, it is important for organizations to share reports and newsletters internally with employees and externally to customers and other external stakeholders, as well as to conduct regular symposiums, lectures, conferences and training sessions to share knowledge (Lawson, 2003). Organizations should also encourage cross-functional teams to promote interdepartmental knowledge sharing (Al-Alawi *et al.*, 2007). He *et al.* (2014) highlighted the importance of team outing and department lunches to encourage informal knowledge sharing.

2.1.6 Knowledge utilization. It refers to the organization's ability to use knowledge for a purpose, i.e. putting knowledge into action for decision-making or policy-making. Organizations, therefore, should encourage employees to use and apply what they know and what they have learned and to use or combine accessible information from the organization's knowledge repository to both solve existing problems and to come up with new products and services to bolster the organization's competitive advantage (Chan and Chao, 2008). Lawson (2003) highlighted the importance of having a mechanism in place to match sources of knowledge to problems. Greiner *et al.* (2007) stressed the need to use knowledge to improve efficiency and competitive advantage. Similarly, Lee and Wong (2015) highlighted the need to encourage employees to apply their knowledge into the development of new products and services or to solve problems. Reagans *et al.* (2016) mentioned the importance of correctly assigning tasks to employees that matches with their expertise.

However, only very limited studies in the public sector have investigated all or several of the above KM processes. Most of the studies have been largely fragmented and *ad hoc*, investigating only a sub-set of issues in isolation such as knowledge sharing (Sandhu *et al.*, 2011; Vong *et al.*, 2016; Tangaraja *et al.*, 2015) or knowledge creation (Iacono *et al.*, 2012; Vlasov and Panikarova, 2015) rather than considering all aspects together.

2.2 Operational efficiency

In a public sector context, several aspects make up the operational efficiency. Curristine *et al.* (2007) highlighted service delivery cycle time, productivity and reduction in day to day organizational expenses as key measures of operational efficiency for the public sector. The other operational efficiency measures identified from the broader literature but relevant for the public sector context are asset utilization (Zhu *et al.*, 2005), lost time because of downtime (Fore and Zuze, 2010) and reduction in departmental project duration (Rusinko, 2007; Zacharia *et al.*, 2009). The other customer-centric measures for operational efficiency are the increase in customer service level (Wang and Wang, 2012) and value generated to customers (Rusinko, 2007; Zacharia *et al.*, 2009).

According to the study conducted by APO (2016), in selected Asian countries on measuring public sector productivity, reduction of turnaround times to complete activities is highlighted as a key factor of operational efficiency. The other important measures for operational efficiency highlighted in the report include minimizing overall costs, efficient assets management, labor productivity and customer orientation such as customer needs, satisfaction and problems (APO, 2016).

In the UAE, improving operational efficiency is a core component of government reforms (TGS, 2013). As mentioned earlier, UAE like other governments around the world is continually searching for ways to improve their operational efficiency. This is to avoid wastage of public expenditure and spending and avoid scrutiny from audit bodies, central agencies, expenditure review programs, political decision-makers, media and think tanks (TGS, 2013). Although no comprehensive effort has been taken yet to measure the operational efficiency of the UAE public sector, the “OECD Government at a Glance 2011” report shows that operational efficiency of the public sector is on the decline (TGS, 2013).

2.3 Sustainable development

According to the World Commission on Environment and Development (WCED, 1987), SD is the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Several studies have reported the importance of KM as a critical factor for SD (Laszlo and Laszlo, 2002; de Sousa, 2006; Sheng and Sun, 2007), which includes economic, environmental and social aspects of sustainable development (Mohamed *et al.*, 2009). Therefore it is important for firms to make a considerable effort in leveraging their KM processes to achieve SD goals. Also, it is important to assess the proportionality of the contribution of each of the KM process to sustainability (Mohamed *et al.*, 2009).

As evident from the review of 180 papers in KM by Massaro *et al.* (2015), none appear to have explicitly focused on the public sector SD agenda. There is a clear gap in the literature with regards to the usefulness of KM for SD of the public sector.

The public sector needs to demonstrate several aspects to promote SD. This includes trust, which is important for the success of a wide range of public policies that depend on behavioral responses from the public (OECD, 2018). Similarly, integrity is key for the strong public sector and it assures citizens that the government is working in their interest, not just for the select few (OECD, 2018). Likewise, now more people are demanding transparency,

reliability, accountability, access to information and competent service delivery from their governments (OECD, 2018). In short, integrity, trust, reliability and accountability are important to increase the willingness of citizens, businesses and other stakeholders to respond to public sector policies and contribute to SD (OECD, 2018). Also, governments are increasingly considering ways in which to improve public sector service quality (UKCeMGA, 2007), as improving the quality of the service offered is an important part of SD. Finally, innovation in the public sector context, which can be defined as “the introduction of new elements into a public service – in the form of new knowledge, a new organization, and/or new management or procedural skills, which represents discontinuity with the past” (De Vries *et al.*, 2015) are key to the SD goals.

3. Conceptual framework and hypotheses development

Theoretical frameworks provide a way to conceptualize these complex relationships. Assessing these interrelationships is important to better understand the scope of both the problems and the opportunities associated with running successful KM programs in the public sector. This is because, considerable investment is required for implementing KM processes. For public sector, implementation of KM processes will not add value if it fails to provide the desired outcomes.

Therefore, first, it is important understand the relationship between KM processes and operational efficiency. It captures the success of KM programs in creating an efficacious operational environment. For example, knowledge sharing is expected to improve employee productivity as employee will learn new ways of working from others. Similarly, better knowledge retrieval system can enable employees to solve customer queries faster and hence improving customer service and reduce service delivery cycle time. Likewise, efficient knowledge utilization is expected to reduce departmental project duration. Previous several studies in the private sector have investigated and found positive relationships between KM processes and operational efficiency (Fugate *et al.*, 2009; Tan and Wong, 2015; Chen, 2016). However, this relationship has not been explored previously in the public sector. This leads to our first hypothesis:

- H1.* Knowledge management processes will have a positive impact on the operational efficiency of public sector organizations.

Next, it is important to understand the extent to which the operational efficiency is translating to SD. Improving operational efficiency without the consideration for SD will be not “sustainable” in the long run. Ideally, improvement in operational efficiency should improve SD of the public sector. For example, improvement in service delivery cycle time should be achieved without compromising on reliability and quality of services. Similarly, improvement in customer service level and value generated should translate into improved trust, reliability and accountability in the services offered. Likewise, day-to-day reduction in operational expenses and improved utilization of assets is expected to improve accountability of public sector among citizens of not wasting allocated funds unnecessarily.

Despite the importance, how organizations can harmoniously achieve both operational efficiency and SD has not been explored with the exception of Borza (2014). None of the studies in the public sector appear to have investigated this, and therefore, we propose our next hypothesis:

- H2.* Operational efficiency will have a positive impact on the sustainable development of public sector organizations.

Finally, it is important to understand the relationship between KM processes and SD. This is because firms who concentrate solely on being excellent in improving operational efficiency from KM processes could run the risk of disequilibrium in their long-term SD. Therefore, there is a need for KM processes to achieve sustainable development alongside operational efficiency. For example, knowledge acquisition and knowledge creation is expected to improve innovation and quality in the services offered. An efficiency knowledge storage and retrieval system is expected to improve reliability in the services offered. Similarly, knowledge sharing with customers is expected to improve transparency and trust in the services offered.

Again, minimal studies have looked at the impact of KM on sustainable development for the public sector. For instance, [Linger et al. \(2013\)](#) proposed an action-oriented task-based KM framework aimed specifically for SD. However, the review did not come across any empirical investigation to assess the direct impact of KM on SD in the public sector. This leads to our third hypothesis:

H3. Knowledge management processes will have a direct positive impact on the sustainable development of public sector organizations.

The proposed hypotheses are conceptualized in the form of a framework in [Figure 1](#). The next section will discuss the research methodology adopted in this study.

4. Research methodology

A survey-based research methodology was used to test the framework and hypotheses proposed in this study. The underlying items within each construct identified from the literature ([Table I](#)) were organized in the form of a self-administered survey questionnaire. A five-point Likert measurement scale ranging from strongly agree (5) to strongly disagree (1) was used to evaluate the main constructs in the study. The survey instrument was then pre-tested with six experts (three academics and three senior employees) in the field. This met the condition outlined by [Ghauri and Gronhaug \(2002\)](#), who recommended that a questionnaire should go through a pre-test of at least three to five respondents. The pre-test process with the participants involved checking the appropriateness of the questions, evaluating the readability/choice of terminology, assuring clarity/ease of understanding and the relevance of the items in real-world situations. The suggestions from the pre-test respondents were then incorporated into the study. After the pre-test, a pilot test was conducted to identify and address issues that might affect the completion of the final questionnaire during the main study ([Dillman, 1978](#)). The pilot survey provided insights to several aspects such as “the time take to complete the survey,” “the response rate,” “the completion rate,” “the questions skipped” and “comments/feedback” for improvement. The insights were useful in the planning and administration of the main survey.

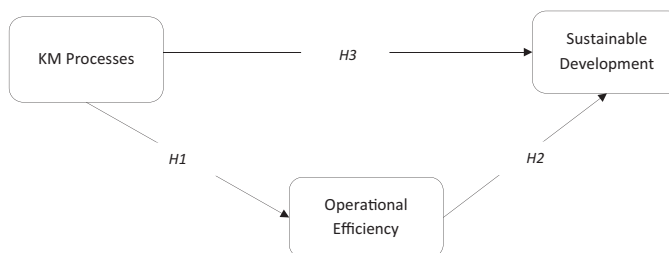


Figure 1.
Conceptual
framework

The main survey was administrated for a period of four months starting from December 2018 to March 2019, using Qualtrics, an online survey system. After getting necessary approvals, the country-wide survey was sent to more than 30 public sector organizations in the UAE, which include both federal and state level entities. These include all 15 federal government entities such as Ministry of Health and Ministry of Economy, who are responsible for the UAE 2030 Agenda for SD ([National Committee on Sustainable Development Goals, 2018](#)). In addition, efforts were taken to target mid-level to senior-level managers in the organization. A total of 438 responses were received. However, after close scrutiny of the 438 responses, 55 were removed because of incompleteness, leaving 383 valid and usable responses for data analysis. The demographic characteristics of the final responses are shown in [Table II](#).

As mentioned earlier, to enhance generalizability, we have included all the lead public sector entities responsible for the SD agenda.

As seen in the table, a comparable representation of Federal Government (53 per cent) and State Government (45 per cent) were received. Also, a comparable split of responses was received with regards to firm size (less than 250 employees – 52 per cent; and greater than 250 employees – 48 per cent). Further, with regard to the experience of the respondents, as seen in [Table II](#), 67 per cent had more than 10 years of experience in the public sector and 84 per cent had 6 or more years of experience. This was not surprising given that effort has been taken during data collection to target managers. Finally, with regards to the experience of the respondents in the current organization, more than 60 per cent of the respondents had six or more years of experience. Given the wealth of experience of the respondents in the

	Responses	(%)
<i>Firm ownership</i>		
Federal government	202	53
State government	170	45
Semi-government	8	2
Total	383	100
<i>Size (employees)</i>		
Less than 250	200	52
251-500	106	28
501-2,000	38	10
Greater than 2,000	39	10
Total	383	100
<i>Respondents experience (in year) in the public sector</i>		
0-2	25	7
3-5	36	9
6-10	67	17
>10	254	67
Total	383	100
<i>Respondents experience (in year) in the current organization</i>		
0-2	79	21
3-5	70	18
6-10	126	33
>10	108	28
Total	383	100

Table II.
Classification of
survey respondents

public sector, and in the current organization, the quality of responses, in general, was presumed to be high.

The following section discusses the analysis and findings of this study.

5. Analysis and findings

Before proceeding with the main analysis (testing the hypotheses), it is important to ensure the validity of the survey data and constructs considered in the study.

5.1 Data validation

To ensure validity of the survey data, the data were tested for non-response bias and common-method bias, two main issues that can arise in survey research (Bryman, 2016). To test for non-response bias, the responses of early respondents were compared with the responses of late respondents, with the assumption that the responses of late respondents are representative of the responses of theoretical non-respondents (Rogelberg and Stanton, 2007). The independent sample *t*-test showed no statistically significant difference between the early and late respondents, indicating that non-response bias is not a problem in this study (Armstrong and Overton, 1977).

For common-method bias, in prior anticipation of this potential threat, before collecting data, procedural measures recommended by Podsakoff *et al.* (2003) such as conducting a pre-test and a pilot test of the survey instrument before the main survey to ensure the questions were easily understood, and also including a cover letter assuring respondents that their opinions are anonymous, and that results will be reported only in aggregated form were undertaken. Still, post data collection, common-method was tested using commonly used Harman's single factor test (Podsakoff *et al.*, 2003). As per the test, the constrained one-factor exploratory factor analysis (EFA) should not account for more than 50 per cent of the variance. In this study, the unconstrained one-factor EFA accounted only for 30.3 per cent of the variance, whereas the unconstrained eight-factor model explained 76.9 per cent of the variance, thereby demonstrating that common-method bias was not a problem in this study.

5.2 Construct validation

As multi-item measures were used to assess the constructs, it is important to ensure the statistical appropriateness of these constructs. First, the unidimensionality of the constructs was assessed using convergent validity and discriminant validity. Cronbach's alpha was used to evaluate the reliability of the constructs, a method that measures the consistency, precision and repeatability of the items within the constructs.

5.2.1 Convergent validity. It ensures that the items expected to be related in the constructs are in fact related. First, confirmatory factor analysis (CFA) comprising eight first-order constructs was conducted using AMOS 24 software. The standardized factor loadings of CFA indicating the correlation between the individual items and the corresponding construct is given in Table III. As seen in the table, all the underlying items within each of the eight constructs had a first-order factor loading of >0.5 , with a corresponding critical ratio above 1.96, thereby demonstrating strong convergent validity (Anderson and Gerbing, 1988). Further, average variance extracted (AVE) (exhibited in Table V) for the eight first-order constructs was more than 50 per cent (Fornell and Larcker, 1981), which further demonstrated convergent validity.

Next, the operationalization of "knowledge management processes" as a higher (second)-order latent construct was tested using second-order CFA. This is important as the main hypotheses proposed in this study involves assessing the relationships between second-order KM processes and operational efficiency and SD. Table IV shows the convergent

Table III.
First order-
confirmatory factor
loadings of KM
processes, operation
efficiency and SD

Constructs and items	KACQ	KCRT	KCAP	KS&R	KSHR	KUTL	OPRE	SUSD
<i>Knowledge acquisition (KACQ)</i>								
KACQ_01	0.76							
KACQ_02	0.60							
KACQ_03	0.78							
KACQ_04	0.81							
KACQ_05	0.75							
KACQ_06	0.83							
KACQ_07	0.85							
<i>Knowledge creation (KCRT)</i>								
KCRT_01		0.82						
KCRT_02		0.90						
KCRT_03		0.91						
KCRT_04		0.90						
KCRT_05		0.91						
<i>Knowledge capture (KCAP)</i>								
KCAP_01			0.80					
KCAP_02			0.73					
KCAP_03			0.82					
KCAP_04			0.89					
KCAP_05			0.77					
<i>Knowledge storage and retrieval (KS&R)</i>								
KS&R_01				0.86				
KS&R_02				0.87				
KS&R_03				0.93				
KS&R_04				0.84				
KS&R_05				0.84				
<i>>Knowledge sharing (KSHR)</i>								
KSHR_01					0.85			
KSHR_02					0.89			
KSHR_03					0.86			
KSHR_04					0.79			
KSHR_05					0.74			
KSHR_06					0.80			
KSHR_07					0.72			
<i>Knowledge utilization (KUTL)</i>								
KUTL_01						0.82		
KUTL_02						0.86		
KUTL_03						0.90		
KUTL_04						0.92		
KUTL_05						0.84		
KUTL_06						0.91		
KUTL_07						0.89		
<i>Operational efficiency (OPRE)</i>								
OPRE_01							0.67	
OPRE_02							0.78	
OPRE_03							0.69	
OPRE_04							0.71	
OPRE_05							0.72	

(continued)

									Knowledge management in public sector
Constructs and items	KACQ	KCRT	KCAP	KS&R	KSHR	KUTL	OPRE	SUSD	
OPRE_06							0.88		583
OPRE_07							0.82		
OPRE_08							0.87		
<i>Sustainable development (SUSD)</i>									
SUSD_01								0.88	
SUSD_02								0.88	
SUSD_03								0.82	
SUSD_04								0.79	
SUSD_05								0.76	
SUSD_06								0.82	
SUSD_07								0.87	
									Table III.

validity and AVE of the second-order KM processes construct. As shown in the table, the second-order factor loadings are well above the 0.5 and also the AVE was above 50 per cent, demonstrating strong convergent validity.

5.2.2 Discriminant validity. It refers to the degree to which measurement items of constructs that theoretically should not be related to each other are, in fact, not related to each other (Trochim, 2006). According to Kline (2005), the correlation of items representing different constructs should be below the upper threshold of 0.85. In this study, correlation between the items representing different constructs was well below 0.85 in most cases. Also, as seen in Table V, the square root of the AVE was either above or comparable with each pairwise correlation between the constructs (Fornell and Larcker, 1981). Both the results show reasonable discriminant validity. However, according to Hair *et al.* (2014), the square root of the AVE of each construct should be higher than the highest correlation with any other construct. As seen in table, there are few problematic pairs, namely, knowledge capture (KCAP) and knowledge storage and retrieval (KS&R); KCAP and knowledge sharing (KSHR); KCAP and knowledge utilization (KUTL); KSHR and KUTL; and operational efficiency (OPRE) and sustainable development (SUSD). Hence, additional tests were conducted as suggested by Anderson and Gerbing (1988). For these identified pair of constructs with high correlation, a series of pair-wise CFAs were conducted by forcing measurement items of each pair of constructs into a single underlying construct to check for any significant deterioration of model fit relative to a two-factor model. The pair-wise tests

Constructs (no. of items)	Cronbach's alpha	Second-order factor loadings	AVE	Table IV. Reliability, second-order factor loadings and AVE
Knowledge management processes			0.76	
KACQ (7)	0.91	0.87	0.60	
KCRT (5)	0.95	0.87	0.79	
KCAP (5)	0.90	0.86	0.65	
KS&R (5)	0.94	0.80	0.75	
KSHR (7)	0.93	0.88	0.65	
KUTL (7)	0.96	0.94	0.77	
OPRE (8)	0.93	–	0.59	
SUSD (7)	0.96	–	0.69	

results showed significant deterioration in the model fit for all cases, thereby demonstrating discriminant validity.

5.2.3 Construct reliability. Reliability is the degree of consistency, precision and repeatability of the measures in the construct (Kline, 1998). Cronbach's alpha, one of the most widely used measure for reliability is used in this study (Cronbach, 1951). The Cronbach's alpha value ranges from 0 to 1, with higher values indicating higher reliability. According to Nunnally and Bernstein (1994), the acceptable threshold for reliability is 0.70. As seen in Table IV, the reliability of our constructs was well above 0.7, indicating strong reliability of constructs.

Now that the data and construct validity is established, next stage of the analysis is to assess the current state of KM processes, operational efficiency and SD in the UAE public sector using descriptive statistics, following by testing the hypothesized relationships using structural equation modeling (SEM).

5.3 Descriptive statistics

The current state of implementation of different KM processes, operational efficiency and SD are provided in Table V. As seen in the table, the current state of KM processes in the UAE is moderate, with $\bar{X}$ ranging from 3.62 to 3.96 on a scale of 1-5, with knowledge storage and retrieval receiving the lowest score of 3.62 and knowledge acquisition with the highest score of 3.96. The standard deviation (SD), which shows the degree of variability is relatively low with $SD < 1$ for each of the constructs. This shows that the implementation of KM processes is relatively consistent in the UAE. Next, the current level of operational efficiency and SD is moderate with a mean score of 3.71 and 3.80, respectively. The $SD < 1$ for operational efficiency and SD shows consistency within the public sector in the UAE. The mean and standard deviation of individual items within each construct is given in Appendix. This is useful for UAE public sector to get a more in-depth understanding of the current state of individual KM processes, operational efficiency and SD.

5.4 Structural equation modeling and hypotheses test results

SEM using AMOS 24 software was used in this study for testing the hypothesized relationships. The overall model fit and goodness-of-fit indices are given in Table VI, which are well above the acceptable threshold (Bagozzi and Yi, 1988).

The strength of the hypothesized relationships and their significance are shown in Table VII.

Table V.
Mean, standard
deviation, square
root of AVE and
correlation between
constructs

Construct	Mean ($\bar{X}$)	SD	Square root of AVE	KCRT	KCAP	KS&R	KSHR	KUTL	OPRE	SUSD
KACQ	3.96	0.75	0.79	0.78	0.75	0.68	0.76	0.77	0.74	0.75
KCRT	3.75	0.92	0.89	–	0.79	0.71	0.81	0.82	0.73	0.76
KCAP	3.85	0.80	0.81		–	0.82	0.83	0.85	0.71	0.74
KS&R	3.62	0.90	0.87			–	0.79	0.78	0.67	0.69
KSHR	3.79	0.84	0.81				–	0.89	0.72	0.77
KUTL	3.78	0.86	0.88					–	0.76	0.82
OPRE	3.71	0.76	0.77						–	0.83
SUSD	3.80	0.81	0.83							–

Note: *All correlations are significant at $p < 0.01$

The results of *H1* and *H3* show that KM processes have a significant direct effect on operational efficiency and SD, respectively. Among these direct effects, the impact of KM processes on the operational efficiency is strong and significant ($\beta = 0.900, p < 0.001$), whereas the impact of KM processes on SD is moderate but significant ($\beta = 0.389, p < 0.01$). Besides, *H2* was also found to be significant, i.e. operational efficiency has a direct impact on SD ($\beta = 0.59, p < 0.01$). This implies that KM processes have an indirect, mediated impact on SD with an indirect effect of 0.536. Therefore, the total effect (direct + indirect) of KM processes on SD is 0.925. In summary, all three proposed hypotheses are supported.

6. Discussion and conclusion

The findings of this study show that KM processes can improve the operational efficiency and SD of the public sector. However, the current level of implementation of KM processes in the UAE public sector is moderate, with none of the individual constructs of KM processes having a mean score above 4.00. The concern is even higher for certain practices such as knowledge storage and retrieval, wherein the current level of implementation is 3.62. Next, looking at more in-depth at an implementation level, as seen in [Appendix](#), certain individual items within each KM processes needs significant improvement. For instance, for knowledge acquisition, although the overall construct mean is 3.96, individual aspects such as “Actively gather information on their competitors” and “actively gather information on the market/customer needs” have only a mean score of 3.79 and 3.78, respectively. For practitioners looking to improve on knowledge acquisition in the public sector must prioritize these aspects. Similarly, for knowledge creation, individual aspects, namely, “Rewards employees for new ideas and knowledge” and “Mechanism in place to evaluate the value of new ideas and concept,” were found to have the lowest mean scores of 3.68 and 3.69 respectively. For knowledge capture, “Mechanisms are in place to patent and copyright new knowledge” emerged to have the lowest mean score. For knowledge storage and retrieval, “Organizations regularly delete useless and iterative knowledge in the database” emerged to have the lowest score of 3.51. For knowledge sharing, “the organization

Fit index	Range	Result	Recommended level
Chi-square/degrees of freedom (χ^2/df)	0 (ideal fit)- ∞ (low fit)	1.984	<2
Confirmatory fit index	0 (no fit)-1(perfect fit)	0.986	>0.90
Goodness of fit	0 (no fit)-1(perfect fit)	0.944	>0.90
Normed fit index	0 (no fit)-1(perfect fit)	0.973	>0.90
Tucker–Lewis index	0 (no fit)-1(perfect fit)	0.977	>0.90
Root mean square error of approximation	Typically, 0-0.10	0.051	<0.05

Table VI.
Model fit indices

Hypothesized relationships	β	SE	<i>t</i> -value	<i>p</i>	Hypotheses result
<i>H1</i> KM processes → Operational efficiency	0.900	0.047	14.110	0.000***	Supported
<i>H2</i> Operational efficiency → Sustainable development	0.596	0.197	4.240	0.000***	Supported
<i>H3</i> KM processes → Sustainable development	0.389	0.135	2.937	0.003**	Supported

Notes: ***Significant at $p < 0.001$; **significant at $p < 0.01$; β – standardized coefficients; and SE – standard error

Table VII.
Hypotheses test
results

encourages team outing, department lunches etc. to encourage informal knowledge sharing” emerged with the lowest score of 3.44. Moreover, this aspect is the lowest across all the individual aspects considered across all KM processes. The UAE public sector must take a concerted effort to encourage outing as it is a critical aspect for promoting informal knowledge sharing. For knowledge utilization, “the organization has mechanisms in place to match sources of knowledge to problems” emerged as the one with the lowest mean score (3.63). For operational efficiency, “the duration of department project has reduced” was highlighted as a concern by respondents (3.54). In other words, the duration of projects is taking longer than desired. Finally, for SD, “stakeholder engagement has increased” emerged to have the lowest mean score of 3.72. This shows that the public sector should strive had to improve stakeholder engagement, which is a vital aspect of SD.

The study provides several research and practical implications. First, the study was able to identify and validate the key constructs and items of KM processes in the public sector. Also, the study was able to operationalize KM processes as a second-order construct latent construct, which itself is a significant contribution. As construct development and validation is at the heart of theory building (Venkatraman, 1989), this study significantly contributes toward the theoretical advancement of KM in the public sector. Next, the study was able to empirically test and validate a framework that captures the relationships between KM processes and operational efficiency and SD. The empirical examination of KM processes and its impact of SD has not been examined previously, and hence constitutes a novelty.

Practitioners in the UAE and elsewhere could use the framework to assess their current state of KM processes, operational efficiency and SD, as well as the relationship between them. The findings could be used to adapt/modify current KM programs in line with the SD goals of the public sector. Importantly, the study establishes that KM processes, operational efficiency and SD should not be considered as mutually exclusive, instead, these three important pillars should be looked at together. These insights can be used by public sector policymakers and practitioners to work together to devise actions, strategies and policy interventions to ensure the KM processes of the UAE public sector is on a par with the private sector organizations, as well as against other foreign governments.

However, the study is not without limitations. The data for this study were collected only from the UAE public sector, which limits generalizability. Also, data were collected only from 30+ public sector entities in the UAE, although there are more we can target. Future studies with increased participation from more public sector entities is required to further enhance the validity and generalizability of the findings. The proposed constructs and framework needs to be further validated and tested in different contexts. Future studies could adapt/extend this KM framework in different countries. Despite the limitation, the study contributes to the first wave of empirical investigation between KM processes and SD.

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Constructs and items	Mean	Std deviation
<i>Knowledge acquisition</i>		
Actively gather information on the best practices and trends in the sector	4.21	0.78
Actively gather information on their competitors	3.79	0.92
Actively gather information from all departments	4.01	0.90
Actively gather information on the internal operations	3.99	0.97
Actively gather information on the market/customer needs	3.78	0.98
Encourages employee suggestions and feedback	3.99	0.99
Encourages customer suggestions and feedback	3.95	0.94
<i>Knowledge creation</i>		
Rewards employees for new ideas and knowledge	3.68	1.03
Facilitates development of new ideas through constructive dialogue among employees	3.85	1.00
Encourages employees to experiment with new ideas and concepts	3.83	1.00
Knowledge creation - mechanism in place to evaluate the value of new ideas and concepts	3.69	1.05
Mechanisms in place to combine existing and new concepts in a meaningful way	3.72	0.98
<i>Knowledge capture</i>		
Existing knowledge is captured in the form of department reports, meeting minutes, training manuals, handbooks, etc.	4.00	0.89
Employees are required to document their work	4.17	0.82
Mechanism are in place to capture employee work documents and communications	3.87	0.97
Any new knowledge is documented in written form	3.74	1.00
Mechanisms are in place to patent and copy right new knowledge	3.49	1.06
<i>Knowledge storage and retrieval</i>		
Captured knowledge is codified and is stored in companies knowledge repositories	3.58	0.98
Advanced databases are used for storage	3.78	1.00
New knowledge is regularly added into the knowledge database	3.69	1.02
Organizations regularly delete useless and iterative knowledge in the database	3.51	0.97
Employees can access the database and repository conveniently	3.55	1.04
<i>Knowledge sharing</i>		
Uses latest files sharing systems to share knowledge efficiently	3.73	1.01
Facilitates creative and constructive conversation among employees	3.78	0.99
Employees are encouraged to share their new ideas and concepts with others	3.88	0.95
Sends out timely reports and newsletters to employees, customers and other relevant organizations	3.86	0.99
Conducts regular symposiums, lecturers, conferences and training sessions to share knowledge	3.98	0.96
Cross-functional teams from different departments are created to facilitate knowledge sharing	3.84	0.98
Encourages team outing, department lunches etc. to encourage informal knowledge sharing	3.44	1.17

Table AI.
Descriptive statistics
of individual items
within constructs

(continued)

Constructs and items	Mean	Std deviation
<i>Knowledge utilization</i>		
Has mechanisms in place to match sources of knowledge to problems	3.63	0.96
Has mechanisms in place to correctly assigns tasks to employees that matches with their expertise	3.71	1.00
Use knowledge to respond to the changing competitive environment	3.76	0.95
Use knowledge to improve efficiency	3.84	0.96
Is not reluctant to use new knowledge into product/services	3.87	0.89
Employees are encouraged to apply their new ideas into practice	3.83	0.97
Employees are encouraged to apply their knowledge to solve problems	3.82	0.97
<i>Operational efficiency</i>		
Service delivery cycle time has reduced	3.64	0.87
Utilization of assets has improved	3.79	0.85
Time lost because of maintenance/repair (downtime) has reduced	3.69	0.93
Duration of departmental projects has reduced	3.54	0.92
Day to day organizational expenses has reduced	3.60	0.90
The employee productivity has increased	3.72	1.00
Customer service level has been improved	3.82	0.90
Value generated to our customers has increased	3.81	0.89
<i>Sustainable development</i>		
Transparency in the services offered has increased	3.82	0.93
Trust in the services offered has increased	3.85	0.91
Reliability in the services offered has increased	3.76	0.89
Accountability in the services offered has increased	3.73	0.92
Stakeholder engagement has increased	3.72	0.92
Innovation in the services offered has increased	3.79	0.90
Quality in the services offered has increased	3.88	0.91

Corresponding author

Mian M. Ajmal can be contacted at: mian.ajmal@adu.ac.ae