Knowledge management processes and operational efficiency: The impact of the size of public sector organizations

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Abstract

Purpose: The study aims to investigate the impact of the organizational size of public sector organizations in the implementation of knowledge management processes and subsequent operational efficiency derived from its implementation.

Design/methodology/approach: A structured country-wide survey of UAE public sector organizations was conducted. The 383 completed responses obtained were then analysed to assess the hypothesized differences in the implementation of knowledge management processes (knowledge acquisition, knowledge creation, knowledge capture, knowledge storage, and retrieval, knowledge sharing, knowledge utilization) and its impact on the operational efficiency across small and medium, large, and very large public sector organizations.

Findings: The results show the extent of implementation of all six knowledge management processes, and operational efficiency are high for large public sector organizations, followed by small and medium, and very large organizations. In general, all knowledge management processes had a significant positive impact on the operational efficiency of the public sector, while the strength of the relationship was found to differ across the different size categories.

Practical implications: The novel findings are useful for practitioners and policymakers, especially those overseeing a country's knowledge management programs to devise strategies, policies and support mechanisms to ensure public sector organizations, regardless of their size, can implement efficient and effective knowledge management processes to improve their operational efficiency.

Originality/value: The study is arguably the first comprehensive attempt to understand the impact of firm size on knowledge management in the public sector.

Keywords: Knowledge management, Operational efficiency, Public sector, Public Sector Organizations, United Arab Emirates.

1. Introduction

Knowledge management is increasingly becoming critical to public sector organizations as it is to private sector organizations (Al Yami and Ajmal, 2019). A country's transition towards a knowledge-based economy warrants an efficient and effective implementation of knowledge management programs at all government organizations/entities (APO, 2013). However, different public sector organizations/entities have varying sizes. Organizational size is an important contingency variable in macro-organizational studies that can affect an organization's knowledge management strategy, processes, and performance (Daud, 2012; Oyoo, 2019). Yet, all or the majority of the studies that have investigated the impact of firm size on knowledge management have been in the private sector. There exists a significant gap with regard

to how organizational size impacts the implementation of knowledge management processes in public sector organizations.

Further, today, public sector organizations are increasingly held accountable for their actions and therefore, are forced to change their traditional bureaucratic approaches to more managerial ones (Al Yami and Ajmal, 2019). Citizens are expecting the service offered by public sector entities (such as health care, education) to be above or at least at par with private sector organizations. According to Massaro et al. (2015), the public sector entities are facing higher pressures for representativeness, accountability, and responsiveness than private-sector firms. Moreover, they face scrutiny and budgetary pressure to reduce spending and wastage of resources, without diluting the standards of service. This general lack of "operational efficiency of the public sector" in the face of diminishing budgets is a concern that needs to be addressed (Massaro et al., 2015). Implementation of efficient and effective knowledge management programs is now considered as a way forward for public sector entities at various levels such as international government agencies, the federal government, state governments, and local government entities at the municipal level to improve its operational efficiency (APO, 2013). For instance, Butler et al. (2008) highlighted that knowledge management processes in the public sector would lead to better operational efficiency in the services offered.

But differences in the size of different public sector entities leads to the fundamental question of this study: Could the organizational size of public sector entities be a factor in determining the success or failure of knowledge management programs in these entities? The aim of this paper, therefore, is to explore the effects of organizational size on knowledge management processes implementation and its subsequent impact on operational efficiency.

Specifically, the study will seek to know the following:

- First, we need to know whether different-sized public sector entities (small and medium entities, large entities, and very large entities) differ in terms of the extent of knowledge management process implementation, with the understanding required at the individual process level as it could differ for each. Policymakers and practitioners could then support the implementation-wise deficient organizational-size category for each knowledge management process.

- Secondly, it is important to know from an operational efficiency perspective; whether the operational efficiency derived from knowledge management process implementation differ for different-sized public sector entities. Entities belonging to a specific size category that are lagging in operational efficiency could then be specifically supported to enable entities to bridge the gap.

- Finally, to better manage knowledge management programs, it is critical to understand how individual knowledge management processes have translated into operational efficiency improvements. The weak links that exist between any knowledge management processes and operational efficiency could then be selectively improved.

Hence we propose the following research questions (RQ) of this study:

1) What is the impact of the organizational size of public sector entities on the extent of implementation of knowledge management processes?

2) What is the impact of organizational size on the operational efficiency of public sector entities?

3) What is the impact of the organizational size of public sector entities on the intricate relationships between knowledge management processes and operational efficiency?

The findings of this study are therefore expected to provide significant insights for the concerned authorities/bodies to enact effective strategies and policies to ensure all public sector organizations, regardless of their size, can implement efficient and effective knowledge management processes and achieve their desired operational efficiency targets.

The significance of this study is even more for countries that are striving towards a knowledge-based economy. We have purposefully selected United Arab Emirates (UAE) for the investigation because UAE is one of the few countries in the region where different levels of government have supported knowledge management programs 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 $10 billion endowment fund is perhaps one of the significant government initiatives taken to advance knowledge management in the Arab region (Al Yami and Ajmal, 2019). The efforts of UAE towards knowledge management is 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). Therefore, the UAE provides a perfect context to compare the knowledge management processes and subsequent operational efficiency of different-sized public sector entities.

2. Review of Literature and Hypotheses Development

To date, we have not come across any studies that have investigated the impact of firm size on knowledge management in the public sector. Given that different public sector organizations have different-sizes, organizational size could impact knowledge management implementation as each public sector entity is likely to have different structure and governance mechanisms based on its size. Hence, to examine the impact of organizational size on knowledge management, this study classifies public sector organizations into three, namely, 'small and medium entities', 'large entities' and 'very large entities'. The following sections discuss each of the knowledge management processes, operational efficiency, and their relationships relevant to the public sector.

2.1. Knowledge management processes

Knowledge management processes are vital activities that an organization performs in processing and manipulating its knowledge resources (Holsapple & Joshi, 2000). The relevant knowledge management processes for the public sector can be classified as knowledge acquisition, knowledge creation, knowledge capture, knowledge storage and retrieval, knowledge sharing, and knowledge utilization (Cong et al., 2007; Adam and Reid, 2000; Lawson, 2003; Lee and Choi, 2003). This closely aligns with the UAE government definition of knowledge management, which is: 'The systematic management of knowledge assets at the entity, in order 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).

Knowledge acquisition: This process is oriented toward obtaining/acquiring knowledge (Gold et al., 2001). This includes both internal and external knowledge acquisition. According to Bloodgood (2019), knowledge acquisition is essential for firms to benefit from new understandings. According to the knowledge-based view (KBV), innovative firms must leverage their acquisition capabilities to update their knowledge capital regularly to match new environmental conditions (Alguezaui 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). It 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 essential. External knowledge acquisition includes the process of engaging in dialogue with external stakeholders such as suppliers and customers, whereas internal knowledge acquisition involves acquiring knowledge within the organization such as from employees (Lee and Choi, 2003; Yi-Renko et al., 2001).

Knowledge creation: This process is oriented towards 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). According to Bhatt (2000), organizations can always put together the pieces of knowledge that exist within using the strategy of "imitation, replication, and substitution." 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) 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 ideas and concepts can boost the knowledge creation process.

For the public sector, knowledge creation is essential, given that governments are often at the forefront of needing to adopt new approaches (APO, 2013). It can take many forms such as the discovery of new techniques and methods for problem-solving, borrowing of ideas or practices externally, and contextualizing and integrating them into the organization (Biygautane and Al-Yahya, 2010). However, this process requires collaboration, discussions, and articulation of new knowledge among individuals. For example, at Dubai courts, to foster knowledge creation, judges and employees at the Courts are incentivized to be innovative in handling the cases they deal with (Biygautane and Al-Yahya, 2010). Al-Khouri (2014) highlighted the importance of rewards and employee suggestion system for improving knowledge creation in the case of the Emirate Identity Authority.

Knowledge capture: Studies have shown that even if a firm creates new knowledge, it may not necessarily result in capture (Argote et al., 1990). Therefore, it is important to capture such knowledge and make it available for the organization in the future (Stein & 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 encouraging or coercing 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 experiences 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, and also avoid time and resource wastage in recreating knowledge which is available and in avoiding past mistakes (Shafia et al., 2011).

For the public sector, knowledge capture is important because it is known for its underutilization of knowledge and skills of employees, especially in the region including UAE, Oman, and Saudi Arabia (Al-Yahya, 2009). Accordingly, almost half of the available organizational skills and knowledge are not captured and stored. According to Biygautane and Al-Yahya (2010), the 'know-how' and 'know-what' that employees have gained through the years of experience is not well recognized, captured, or documented in the public sector. This implies that when employees leave the organization, they take with them the valuable tacit knowledge they have accumulated over the years. Increasing efforts are taken by public sector entities to capture and store knowledge. For example, in Dubai police, police officers are strongly encouraged to write about the new cases they have encountered, and how they have solved them. Financial incentives are offered for those employees who regularly write articles (document) about their experiences (Biygautane and Al-Yahya, 2010).

Similarly, in the Dubai Aviation, pilots are required to document their experiences and mistakes they make, and to explain how they solved problems (Biygautane and Al-Yahya, 2010). Similarly, in the case of International Enterprise Singapore (IES), a government agency driving Singapore's external economy, programs such as storytelling were developed to capture employees' overseas experiential knowledge (APO, 2013). Emirates Identify Authority in the UAE has utilized numerous information technology systems to capture knowledge management in real-time (Al-Khouri, 2014).

Knowledge storage and retrieval: Knowledge storage involves the collection and preservation of organizational knowledge (APO, 2013). Also, this knowledge has to be stored in such a way that it can be retrieved quickly and easily by the users (APO, 2013). Studies have shown that even if a firm capture knowledge, it doesn't necessarily become available for the organization for future use (Stein & 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 that is easy to access for employees. Effective storage of knowledge facilitates quick retrieval of knowledge with the use of advanced search engine (knowledge mining within the databases) (Al-Khouri, 2014).

In the case of the public sector, it is important that employees document and store knowledge electronically, which is then classified, indexed, and stored in an electronic data management system. For example, in the case of the Dubai Courts, when a judge finalizes a case and announces the verdict, the judge is required to electronically store the case details and explain how they reached a verdict (Biygautane and Al-Yahya, 2010). According to Al-Khouri (2014), one of the knowledge storage mechanisms used by Emirates Identity Authority (EIA), one of the successful public sector entities in UAE, is mandating reports such as project close-out reports, final research reports, seminar reports, staff experience report, and best practices/lessons learned report.

Knowledge sharing: It refers to the organization's ability to transfer or disseminate 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 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 conservation (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, lecturers, 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.

For the public sector, promoting knowledge sharing is especially important given that the public sector appears to have an embedded culture of not sharing information and knowledge between departments (Bate and Robert, 2002). Even if knowledge sharing is made mandatory, studies have shown that public sector staff is likely to pretend to share knowledge, or not share what they think is their more significant or valuable knowledge (APO, 2013). Hence, public sector entities have to come up with innovative ways to promote knowledge sharing. For example, in IES, storytelling is used to share knowledge and experience of employees (APO, 2013). Dubai police have adopted a Japanese model to promote knowledge sharing in which they have used several mechanisms such as establishment of cross-organizational and self-managing teams; mandatory weekly employee meeting in the last working day of

the week in which employees are required to meet for two hours to discuss the new techniques they have learned and explained them to the newly joined employees; and organizing regular workshops and lectures for employees to share their experiences and ways in which they dealt with a specific issue (Biygautane and Al-Yahya, 2010).

Dubai Courts also have adopted a very efficient process to share knowledge. For instance, senior judges are required to meet regularly to discuss cases and share their experiences and opinions with others, especially with new judges, to facilitate skills and expertise of older and more experienced judges to newer ones (Biygautane and Al-Yahya, 2010). In the case of Dubai Roads and Transport Authority (RTA), a state of the art electronic data management system (EDMS) was created to facilitate the sharing of documents and knowledge among the employees (Biygautane and Al-Yahya, 2011a). RTA also uses mentoring, coaching, and informal meetings with external consultants they hired for their projects to maximize knowledge sharing between the external source (consultants) and the employees (Biygautane and Al-Yahya, 2010). In the case of Emirates Identity Authority, to facilitate knowledge sharing, they use a "gamified" knowledge sharing process in which employees can earn points for sharing best practices or lessons learned or any content piece they share (Al-Khouri, 2014).

Knowledge utilization: It refers to the organization's ability to utilize knowledge for a purpose, i.e., putting knowledge into action for decision-making or policy-making. In other words, it is the use and reuse of knowledge in the organization (APO, 2013). It translates knowledge into action. Unfortunately, much knowledge remains underutilized. Knowledge only adds value when it is utilized for improvement. 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 utilize knowledge to improve efficiency and competitive advantage. Similarly, Lee and Wong (2015) highlighted the need to encourage employees to apply their knowledge to 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 match their expertise.

As mentioned earlier, the public sector is known for its underutilization of knowledge (Biygautane and Al-Yahya, 2010). According to Al-Yahya (2009), the underutilization levels of knowledge were at 47% in Saudi Arabia, 45% in Oman, and 42% in UAE. Therefore, it is crucial for the public sector that employees leverage the knowledge shared with them or access the stored information from knowledge repositories. For example, in the case of Dubai Courts, when judges face a similar case, they examine electronically how previous judges reached a decision on a similar case and build on that (Biygautane and Al-Yahya, 2011a).

However, only minimal studies in the public sector have investigated all or several of the above knowledge management processes. Most of the studies have been mostly fragmented and ad-hoc, investigating only a sub-set of issues in isolation 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 critical 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 due to 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 essential 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 reform (TGS, 2013). As mentioned earlier, UAE, like other governments around the world are 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). The "OECD Government at a Glance 2011" report shows that the operational efficiency of the public sector is on the decline (TGS, 2013). Unfortunately, no comprehensive effort has been taken yet to measure the operational efficiency of the UAE public sector.

The underlying items within each construct for the public sector identified from the literature are summarized in Table 1. 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 1.

Table 1: Constructs and items identified from the literature

Knowledge Management Processes	References
Knowledge Acquisition	
My organization actively gather information on the best practices and trends in the sector (KACQ_01)	Gold et al. (2001); Jantunen (2005)
My organization actively gather information on their competitors (KACQ_02)	Lee and Yang (2000); Gold et al. (2001): Lee and Choi (2003)
My organization actively gather information from all departments (KACQ_03)	Gold et al. (2001)
My organization actively gather information on the internal operations (such as what succeeded and what failed) (KACQ_04)	Gold et al. (2001)
My organization actively gather information on the market/customer needs (KACQ_05)	Yli-Renko et al. (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 et al. (2001)
Knowledge Creation	

My organization rewards employees for new ideas and knowledge (KCRT_01)	Lawson (2003)
My organization facilitates the 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 mechanisms in place to evaluate the value of new ideas and concepts (KCRT_04)	Gold et al. (2001)
My organization has mechanisms in place to combine existing and new concepts in a meaningful way (KCRT_05)	Gold et al. (2001; Lawson (2003)
Knowledge Capture	
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 et al. (2004)
In my organization, mechanisms are in place to capture employee work documents and communications (KCAP_03)	Hari et al. (2004)
In my organization, any new knowledge is documented in written form (KCAP_04)	Hari et al. (2004)
In my organization, mechanisms are in place to patent and copyright new knowledge (KCAP_05)	Lawson (2013)
Knowledge Storage and Retrieval	
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 to the knowledge database (KS&R_03)	Hari et al. (2004)
Organizations regularly delete useless and iterative knowledge in the database (KS&R_04)	Bhattacharya and Chaudhury (2004)
Employees can access the database and repository conveniently (KS&R_05)	Lawson (2003)
Knowledge sharing	
My organization uses the latest files sharing systems to share knowledge efficiently (KSHR_01)	Al-Alawi et al. (2007); Lin (2007)
My organization facilitates creative and constructive conversation among employees (KSHR_02)	Gold et al. (2001)
My organization employees are encouraged to share their new ideas and concepts with others (KSHR_03)	Lawson (2003); Al-Alawi et al. (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 et al. (2007)

My organization encourages team outing, department lunches, etc. to encourage informal knowledge sharing (KSHR_07)	He at al. (2014)
Knowledge utilization	
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 match with their expertise (KUTL_02)	Reagans et al. (2016)
My organization utilize knowledge to respond to the changing competitive environment (KUTL_03)	Greiner et al. (2007)
My organization utilize knowledge to improve efficiency (KUTL_04)	Greiner et al. (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)
Operational Efficiency	
Service delivery cycle time has reduced (OPRE_01)	Curristine et al. (2007)
Utilization of assets has improved (OPRE_02)	Zhu et al. (2005)
Time lost due to maintenance/repair (downtime) has reduced (OPRE_03)	Fore and Zuze (2010)
Duration of departmental projects has reduced (OPRE_04)	Rusinko (2007); Zacharia et al. (2009)
Day to day organizational expenses has reduced ((OPRE_05)	Cong and Pandya (2003); Curristine et al. (2007)
The employee productivity has increased (OPRE_06)	Curristine et al. (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 et al. (2009)

2.3. Firm size impact on knowledge management and operational efficiency

2.3.1. Firm size impact on knowledge management processes

As mentioned earlier, we have not come across any studies that have investigated firm size impact on knowledge management in the public sector anywhere, let alone UAE. Limited evidence from the literature from the private sector that looked at firm size impact on knowledge management has reported mixed findings. For instance, Štrach and Everett (2006) reported that organizational size positively influences knowledge distribution. On the contrary, Serenko et al. (2007) in Canada found that, as the size of an organizational unit increases, the effectiveness of internal knowledge flows dramatically diminishes and the degree of intra-organizational knowledge sharing decreases. Similarly, Connelly and Kelloway (2003) found a negative relationship between organizational size and knowledge sharing. However, a comparative study by Xu et al. (2005) between large organizations and SMEs in Australia found no difference in the knowledge management implementation across different-sized firms. This is echoed in the findings of Kruger & Johnson (2013) on South African firms, who found no significant difference in knowledge management between organizations of different sizes.

Overall, evidence from the limited studies shows that organizational size has a nuanced impact on the implementation of knowledge management processes with studies reporting greater, lesser, and equal levels of implementation at different-sized firms. Given the lack of consensus in the literature with regards to the impact of firm size on knowledge management processes, we have explored meta-reasons from the broader organizational literature to hypothesize the impact of firm size on knowledge management processes. The two main meta-reasons that could affect the implementation are as follows:

Greater resources for large firms' vis-à-vis smaller firms

From a resource-based view (RBV) perspective (Barney, 1991), it could be argued that greater resources of large firms with regards to financial resources, human resources, capabilities, and technical and managerial know-how could lead to greater implementation of knowledge management processes that are both resource and time intensive. Further, smaller firms may also suffer from a lack of specialist professionals, given that employees in smaller firms often perform multiple roles (Kostka et al., 2013). On the contrary, the greater size of large firms facilitates the division of labor and specialization (Earnhart et al., 2014). In other words, large firms have the advantage of 'discretionary slack', the opportunity for managers to use excess time and resources for the implementation of knowledge management processes over smaller firms, who may refrain from allocating their rare and limited resources towards knowledge management processes. In other words, from an RBV standpoint, 'liabilities of smallness' is a deterrent to knowledge management processes.

Greater simplicity, flexibility and innovation propensity of smaller firms vis-à-vis larger firms

Smaller firms' have advantages over larger firms because of their simplified and faster decision-making process, greater structural and strategic flexibility, creativity, and greater innovation propensity (Dean et al., 1998; Noci and Verganti, 1999; Darnall et al., 2010). Also, smaller firms are less bureaucratic than larger firms and therefore have the advantage of greater internal coordination and communication to implement knowledge management processes and are poised to innovate in ways that larger firms cannot (Darnall et al., 2010). On the other hand, large firms are more bureaucratic and therefore suffers from 'organizational inertia' (Aldrich and Auster, 1986), which impedes their creativity and innovation ability and therefore are reluctant to adopt practices they are less familiar with that might disrupt their status-quo (King and Shaver, 2001, Grant et al., 2002).

Based on the meta-reasons mentioned above, it could be argued that knowledge management processes, namely knowledge acquisition, knowledge creation, and knowledge capture, will be higher for large firms vis-à-vis smaller firms given their greater resources and economies of scale and scope. However, it could be argued that knowledge storage and retrieval, knowledge sharing, knowledge utilization will be greater for small firms' vis-à-vis large firms given their structural simplicity, strategic flexibility and greater creativity and innovation propensity. Hence, we make the following hypotheses:

H1a: Knowledge acquisition will be greater for large public sector entities vis-à-vis small and medium public sector entities.

H1b: Knowledge acquisition will be greater for very large public sector entities vis-à-vis large public sector entities.

H1c: Knowledge acquisition will be greater for very large public sector entities vis-à-vis small and medium public sector entities.

H2a: Knowledge creation will be greater for large public sector entities vis-à-vis small and medium public sector entities.

H2b: Knowledge creation will be greater for very large public sector entities vis-à-vis large public sector entities.

H2c: Knowledge creation will be greater for very large public sector entities vis-à-vis small and medium public sector entities.

H3a: Knowledge capture will be greater for large public sector entities vis-à-vis small and medium public sector entities.

H3b: Knowledge capture will be greater for very large public sector entities vis-à-vis large public sector entities.

H3a: Knowledge capture will be greater for very large public sector entities vis-à-vis small and medium public sector entities.

H4a: Knowledge storage and retrieval will be greater for small and medium public sector entities vis-à-vis large public sector entities.

H4b: Knowledge storage and retrieval will be greater for large public sector entities vis-à-vis very large public sector entities.

H4c: Knowledge storage and retrieval will be greater for small and medium public sector entities vis-à-vis very large public sector entities.

H5a: Knowledge sharing will be greater for small and medium public sector entities vis-à-vis large public sector entities.

H5b: Knowledge sharing will be greater for large public sector entities vis-à-vis very large public sector entities.

H5c: Knowledge sharing will be greater for small and medium public sector entities vis-à-vis very large public sector entities.

H6a: Knowledge utilization will be greater for small and medium public sector entities vis-à-vis large public sector entities.

H6b: Knowledge utilization will be greater for large public sector entities vis-à-vis very large public sector entities.

H6c: Knowledge utilization will be greater for small and medium public sector entities vis-à-vis very large public sector entities.

2.3.2. Firm size impact on operational efficiency

We expect greater operational efficiency at larger firms, given that large firms vis-à-vis smaller firms will have clearer specifications of goals, use of more formalized organizational procedures and performance

measures and greater access to resources to monitor, report and control performance (Vijayvargy et al., 2017). Previous studies have shown that the use of performance indicators to track and monitor performance is more profound at larger firms than at smaller firms (Henriques and Sadorsky, 2006). Further, large firms generally have more resources to invest in performance measurement systems as part of their administratively oriented control strategy for the evaluation of managerial performance (Henri and Journeault, 2008). Hence, we propose the following hypotheses:

H7a: Operational efficiency will be greater for large public sector entities vis-à-vis small and medium public sector entities.

H7b: Operational efficiency will be greater for very large public sector entities vis-à-vis large public sector entities.

H7c: Operational efficiency will be greater for very large public sector entities vis-à-vis small and medium public sector entities.

2.3.1. Firm size impact on the relationship between knowledge processes and operational efficiency

Since the high extent of knowledge management processes does not necessarily contribute to high performance, assessing the relationships between knowledge management processes and operational efficiency is important to understand how much variance in operational efficiency is explained by each knowledge management processes. This would help practitioners and policymakers to gauge the efficiency and effectiveness of their knowledge management processes in line with their operational efficiency goals.

Studies have shown that knowledge management processes can improve the operational performance of public sector firms (Al Yami and Ajmal, 2019). For instance, knowledge management programs have improved the internal efficiency and productivity of the Dubai Water and Electricity Authority (DEWA) and Dubai Courts (Biygautane and Al-Yahya, 2011). Also, the Malaysian Agricultural Research and Development Institute has significantly improved productivity through the implementation of knowledge creation, knowledge sharing, and knowledge capture and storage (APO, 2013). These technologies are then shared with farmers to improve their productivity in farming, and employees are also encouraged to document and share their expertise and knowledge through journal publications. In the case of the Korean Customs Service, effective knowledge management programs facilitated the organization to achieve savings of 500 million (in local currency) by developing an active recycling program for counterfeit shoes as well as reduce travelers' luggage clearance time from 50 minutes in 1998 to 28 minutes in 2010 through implementation of an advanced customs and logistics system (APO, 2013).

Unfortunately, little is known with regards to the firm size influence on the relationship between knowledge management and operational efficiency in any sector, let alone in the public sector. However, looking at the generic literature on the relationship between knowledge management processes and performance outcomes derived from it, a recent study by Oyoo (2019) found that firm size moderates the relationship between strategic knowledge management practices and non-financial performance. In other words, the study found the relationship to be stronger for large firms vis-à-vis smaller firms. However, Daud (2012) found a more nuanced impact of firm size on the relationship between knowledge

management processes and firm performance. The study on the relationship between knowledge management and firms' financial and non-financial performance shows knowledge acquisition is the main contributor to financial performance for SMEs, while knowledge application is the main contributor for large firms. For non-financial performance, the study found that knowledge application is the main contributor for SMEs while knowledge conversion is the main contributor for large firms (Daud, 2012).

Based on the broader organizational literature, it could be argued that the relationship between knowledge management processes and operational efficiency will be greater for large firms vis-à-vis smaller firms. This is largely due to the 'economies of scale' and 'economies of scope' benefits enjoyed by large firms (Gil et al., 2001; Tambunlertchai et al., 2013). According to Gil et al. (2001), the synergistic effect of economies of scale and scope, and the existence of slack resources are higher for large firms' vis-à-vis smaller firms. On the contrary, the smaller firms may not have the economies of scale benefits with regards to performance improvements to justify investment in knowledge management programs. For instance, for smaller firms, the day to day operational expense reductions may be so insignificant that they provide little incentive to introduce a knowledge management program. Hence, we propose the following hypotheses:

H8a: Impact of knowledge management processes on operational efficiency will be greater for large public sector entities vis-à-vis small and medium public sector entities.

H8b: Impact of knowledge management processes on operational efficiency will be greater for very large public sector entities vis-à-vis large public sector entities.

H8a: Impact of knowledge management processes on operational efficiency will be greater for very large public sector entities vis-à-vis small and medium public sector entities.

Figure 1 summarizes the hypotheses mentioned above and constructs considered in this study in the form of a conceptual framework.
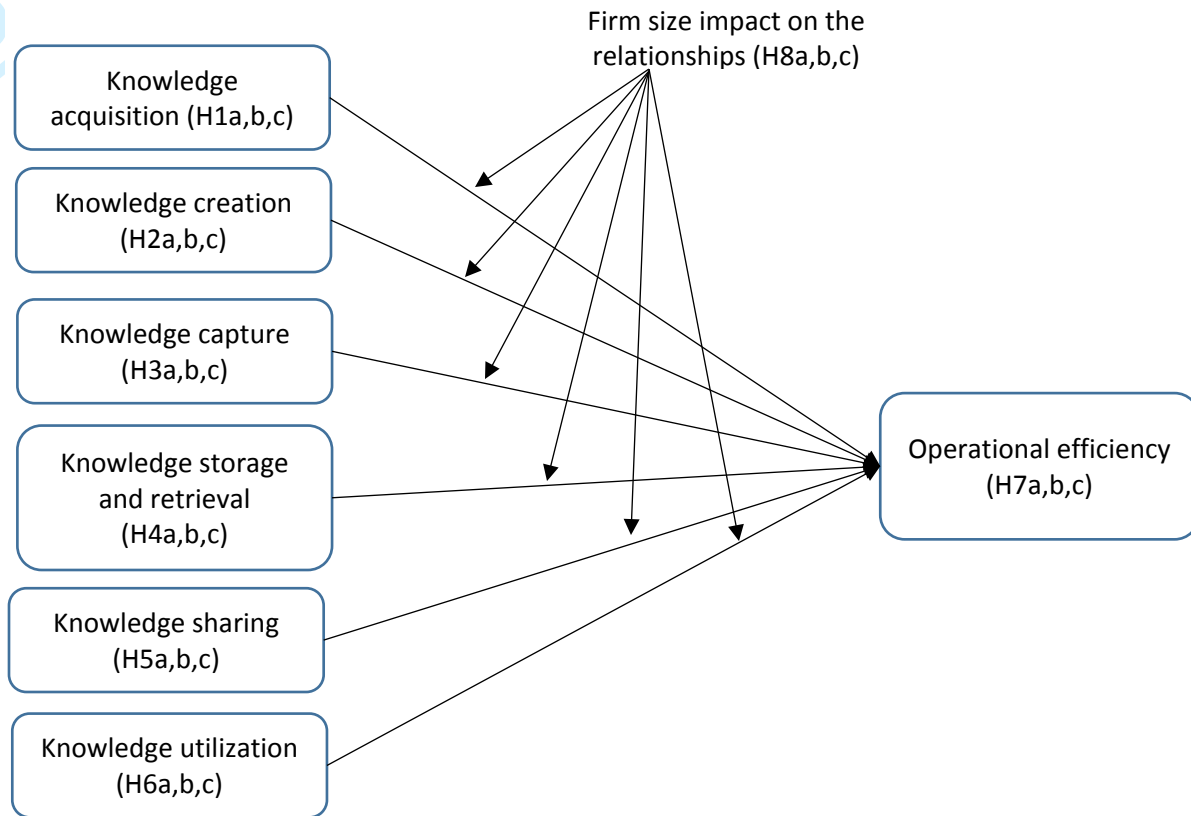
Figure 1 Conceptual model

3. Research Method

A survey-based research methodology was used in this study. The underlying items within each construct identified from the literature (Table 1) 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 into 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.

The main survey was administrated for a period of four months starting from December 2018 till March 2019, using Qualtrics, an online survey system. Initially, more than 100 public sector organizations from the Government.ae website was approached to participate in the study (Government.ae, 2019). After getting necessary approvals, the country-wide survey was sent to 30 public sector organizations in the UAE, which include both federal and state-level entities. Also, efforts were taken to target mid-level to senior-level managers in the organization. A total of 438 responses were received. However, close scrutiny, of the 438 responses, 55 responses were removed due to incompleteness, leaving 383 valid and usable responses for data analysis. The demographic characteristics of the final responses are shown in Table 2.

Table 2 Classification of survey respondents

	Responses	**Percentage**
Size (employees)		
Less than 250	200	52%
251-500	106	28%
501-2000	38	10%
Greater than 2000	39	10%
Total	**383**	**100%**
Respondents experience (in year) in the public sector		
0-2	25	7%
3-5	36	9%
6-10	67	17%
>10	254	67%
Total	**383**	**100%**
Respondents experience (in year) in the current organization		
0-2	79	21%
3-5	70	18%
6-10	126	33%
>10	108	28%
Total	**383**	**100.0%**

As seen in the table, organization size based on employee numbers were recorded. These were classified into small and medium entities (0–250 employees), and large entities (> 250 employees) categories. A comparable split of responses was received with regards to firm size (Less than 250 employees – 52%; and greater than 250 employees – 48%). Further, with regards to the experience of the respondents, as seen in the table, 67% had more than ten years of experience in the public sector, and 84% had six or more years of experience. This was not surprising given that effort has been taken during data collection to target senior managers. Finally, with regards to the experience of the respondents in the current organization, more than 60% of the respondents have six or more years of experience. Given the wealth

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

4. Analysis and Findings

However, before proceeding with the analysis, we checked for the following to ensure data and construct validity.

Common method bias: To eliminate common method bias (problem that occurs when one respondent answers all of the self-reported questionnaire involving multiple constructs), prior to data collection, procedural remedies suggested by Podsakoff et al. (2003) such as informing respondents about the data confidentiality and anonymity were used to prompt honest answers from the respondents. Harman's single factor test as recommended by Podsakoff et al. (2003) post data collection shown that common method bias was not an issue in this study.

Non-response bias: To test for non-response bias, responses of early respondents were compared to that of late respondents, with the underlying assumption that the opinions of late respondents were representative of the views of the theoretical non-respondents (Rogelberg and Stanton, 2007). The t-test revealed no significant difference between the two groups for all the items, indicating that non-response bias was not a problem in this study (Armstrong and Overton, 1977).

Construct Validity: Convergent validity and discriminant validity was conducted to test the validity of the constructs (four constructs of knowledge management processes and operational efficiency).

Convergent validity was carried out using confirmatory factor analysis (CFA). The results of CFA showed that factor loadings (which indicate the correlation between the individual items and the corresponding construct) of items were well above the recommended threshold of 0.5, thereby demonstrating strong convergent validity of all constructs (Anderson & Gerbing, 1988). The results of the CFA are given in Appendix A.

Discriminant Validity 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, the correlation between the items representing different constructs was well below 0.85 in most cases. Also, as seen in Appendix B, 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.

Reliability of Constructs: Cronbach's alpha was used to measure the reliability of the constructs. The reliability scores obtained for all seven constructs were above 0.7, the acceptable threshold for reliability (Nunnally and Bernstein, 1994).

Next, in line with the research questions (RQ1 and RQ2), the impact of firm size on each knowledge management processes and operational efficiency was understood by comparing the results of small and medium public sector entities, and large public entities.

Analysis of variance (ANOVA) was conducted to assess the underlying differences in knowledge management processes and operational efficiency between the two size categories. IBM SPSS 24 software was used for the analysis. Table 3 shows the results of ANOVA for RQ1 and RQ2.

Next, in line with RQ3, the impact of organizational size on the relationships between knowledge management processes and performance was assessed using multi-group moderation tests in structural equation modeling. IBM AMOS 24 software was used for the multi-group moderation tests. In this case, Z-score was used to determine the impact of organizational size on the relationships between any two size categories. Previous studies have shown that Z-test is adequate to put into practice of multi-group analysis (Afthanorhan et al., 2014; 2015). The Z-score was computed with the aid of Stats Tools Package (Gaskin, 2016) using AMOS output of critical ratio of differences in parameters and the unstandardized regression coefficients of the two groups (Afthanorhan et al., 2014).

Table 4 shows the strength of the relationships (standardized path coefficients) between knowledge management processes and operational efficiency for small and medium, and large public sector categories. The Z-score values greater than 1.96 (p-values <0.05) shows a significant difference in the relationships between the two size categories (Afthanorhan et al., 2014).

5. Discussion of Findings

The findings related to the research questions and associated hypotheses are discussed in sequence in this section.

5.1. Impact of firm size on knowledge management processes (RQ1 and associated hypotheses H1-H6)

As seen in Table 3, all knowledge management processes implementation were found to be higher for large public sector entities followed by small and medium entities, and very large entities. However, the differences in all the knowledge management processes implementation between small and medium entities and large entities are not significant. Hence, none of the hypotheses H1a-H6a is supported. Also, none of the hypotheses H1b-H6b is supported. This is because, contrary to the proposed hypotheses, knowledge management process implementation is greater for large entities than very large entities. In fact, for two of the knowledge management processes, namely, knowledge acquisition and knowledge creation, this difference was found to be significant. Also, no significant difference in implementation was found between small and medium entities and very large entities, and hence, hypotheses H1c-H6c is not supported. Overall, as seen in Figure 2, the knowledge management processes score (average of individual knowledge management processes)and organizational size follows an inverted 'V' pattern, in which, knowledge management processes was found to increase while transitioning from small and medium entities to large entities, but was found to decrease while transitioning from large to very large entities.

Table 3 Descriptive statistics and comparison of knowledge management processes, operational efficiency in public sector entities of different sizes

Knowledge management constructs	Group 1 – Small and Medium Size (0-250) (N=200)		Group 2 – Large Size (251-500) (N=106)		Group 3 – Very Large Size (>500) (N=77)		Comparison among three groups				Hypothesis Test Result
							1 & 2	2 & 3	1 & 3	Overall	
	Mean	SD	Mean	SD	Mean	SD	p-value	p-value	p-value	F score	
Knowledge acquisition	3.97	0.69	4.11	0.69	3.74	0.92	0.224	0.031*	0.069	5.514**	H1 not supported
Knowledge creation	3.76	0.91	3.90	0.79	3.51	1.06	0.422	0.013*	0.101	4.091*	H2 not supported
Knowledge capture	3.84	0.81	3.94	0.76	3.75	0.83	0.625	0.280	0.657	1.173	H3 not supported
Knowledge storage and retrieval	3.56	0.94	3.72	0.84	3.65	0.86	0.269	0.858	0.704	1.257	H4 not supported
Knowledge sharing	3.74	0.83	3.90	0.76	3.75	0.96	0.248	0.999	0.431	1.386	H5 not supported
Knowledge utilization	3.79	0.85	3.85	0.81	3.67	0.93	0.810	0.543	0.321	1.051	H6 not supported
Operational efficiency	3.70	0.75	3.79	0.68	3.63	0.87	0.537	0.767	0.304	1.146	H7 not supported

Scale 1 -5; *$p < 0.05$; **$p < 0.01$

Table 4 Comparison of the relationships between knowledge management processes and operational efficiency in public sector entities of different sizes

Structural relationships between knowledge management processes and operational efficiency	Leads to		Group 1 – Small and Medium Size (0-250) (N=200)	Group 2 – Large Size (251-500) (N=106)	Group 3 – Very Large Size (>500) (N=77)	Comparison among three groups		
						1 & 2	2 & 3	1 & 3
			Estimate	Estimate	Estimate	z-score	z-score	z-score
Knowledge acquisition	→	Operational efficiency	0.726**	0.647**	0.846**	-0.223	2.046*	0.544
Knowledge creation	→	Operational efficiency	0.707**	0.631**	0.845**	-0.158	2.144*	1.214
Knowledge capture	→	Operational efficiency	0.723**	0.581**	0.823**	-2.103*	3.312**	1.091
Knowledge storage and retrieval	→	Operational efficiency	0.687**	0.617**	0.744**	-0.112	0.919	0.318
Knowledge sharing	→	Operational efficiency	0.713**	0.663**	0.816**	-0.171	2.222*	0.998
Knowledge utilization	→	Operational efficiency	0.766**	0.670**	0.835**	-0.625	2.088*	0.443
							H8 partially supported	

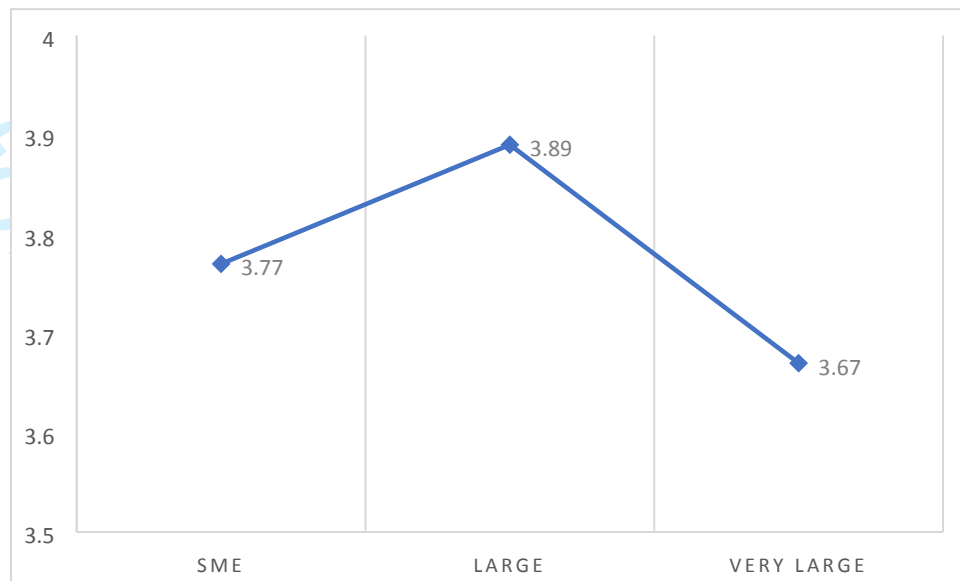* p-value < 0.05; ** p-value < 0.01

Figure 2 Overall Mean Score of Knowledge Management Processes

The likely reason for this could be that, very large firms are more bureaucratic and therefore suffers from 'organizational inertia' (Aldrich and Auster, 1986), which impedes their creativity and innovation ability and therefore are reluctant to adopt practices they are less familiar with that might disrupt their status-quo despite having greater resources (Grant et al., 2002). This implies that small and medium entities and very large entities require more support for improving all their knowledge management processes.

5.2. Impact of firm size on public sector operational efficiency (RQ2 and associated hypothesis –H7)

As seen in Figure 3, an inverted 'V' pattern is witnessed for operational efficiency as well. Operational efficiency was found to be higher for large public sector entities followed by small and medium entities, and very large entities. However, the difference in operational efficiency between small and medium entities and large entities is not significant. Hence, the hypothesis H7a is not supported. Also, hypotheses H7b is not supported. This is because, contrary to the proposed hypotheses, operational efficiency is greater for large entities than very large entities. Also, no significant difference in operational efficiency was found between small and medium entities and very large entities, and hence, hypotheses H7c is not supported. This implies that, again, small and medium entities and very large entities require more support for improving their operational efficiency.
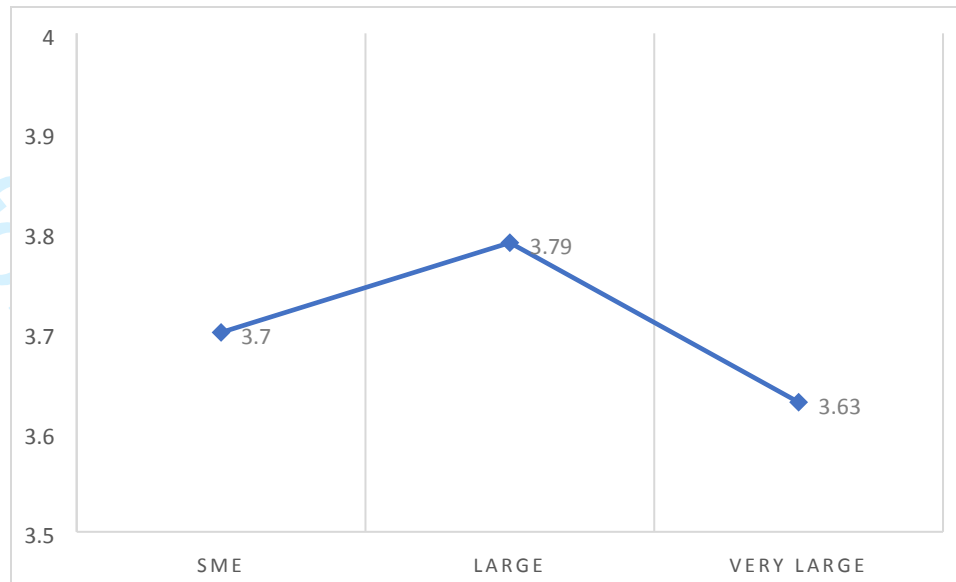
Figure 3 Mean Score of Operational Efficiency

5.3. Impact of firm size on the structural relationships between knowledge management processes and operational efficiency (RQ3 and associated hypotheses – H8)

As seen in Table 4, our proposed hypothesis H8 is only partially supported. This is because, contrary to our assumption, the structural relationships between all knowledge management processes and operational efficiency were found to be higher for small and medium entities vis-à-vis large entities. Hence hypothesis H8a is not supported. This could be because of small and medium entities simplified and faster decision making process, greater structural and strategic flexibility, creativity, and greater innovation propensity (Dean et al., 1998; Noci and Verganti, 1999; Darnall et al., 2010). On the other hand, as the organizational size increases, very large firms have the advantage of 'discretionary slack' and greater opportunities to benefit from operational efficiency from knowledge management processes. The impact of knowledge management processes on operational efficiency was found to be greater for very large public sector entities vis-à-vis large public sector entities. Therefore, hypotheses H8b is supported with the exception of knowledge storage and retrieval. Finally, no significant difference was found in the strength of the relationship between the knowledge management process and operational efficiency between small and medium entities, and large entities. Hence, hypothesis H8c is not supported.

6. Implications and Conclusions

Today, knowledge management programs for the public sector is no longer a choice but an imperative if the respective country wishes to stay competitive globally (Misra, 2007). Given that all public sector organizations regardless of their size, are under increasing pressure from society to innovate, reduce spending and maintain or enhance the quality of services provided to citizens, this study is timely and is expected to enhance the application of knowledge management processes and subsequent operational

performance in the public sector. Given that none of the previous studies have assessed the impact of firm size of public sector organizations on the knowledge management processes and subsequent operational efficiency, the findings of this study are both novel and significant.

The study has several practical and theoretical implications. In terms of practical implications, for all six individual knowledge management processes, the extent of implementation was found to be high for large organizations, followed by small and medium, and very large organizations. Practitioners and policymakers in the UAE and elsewhere overseeing national-level knowledge management programs must provide extra attention to ensure both small and medium public sector entities and especially very large public sector entities are implementing knowledge management processes at the same level that of large entities. Similarly, with regards to operational efficiency, again, both small and medium public sector entities and very large public sector entities are behind large entities and hence require strategic intervention to improve their efficiency.

Finally, with regards to the relationships between knowledge management processes and operational efficiency, the findings in general shows that knowledge management processes can improve the operational efficiency of public sector organizations, and therefore should provide an impetus for all public sector organizations regardless of their size to implement knowledge management processes to improve operational efficiency. However, in this case, the relationship is relatively lower for large public sector entities and therefore required more close monitoring and improvement.

Overall, the differences identified in this study across public sector organizations of different sizes is important for practitioners and policymakers to make prioritized actions, strategies and policy interventions to ensure the success of knowledge management programs, and that knowledge all management processes are achieving the desired operational efficiency goals across all different government entities.

While this quantitative investigation was able to understand the impact of organizational size on knowledge management processes and operational efficiency, the study was unable to explain the 'why' and 'how' aspects with regard to the differences identified in the study. An in-depth qualitative investigation is required to unearth the reasons for this difference among different public sector entities.

In terms of theoretical implications, the study raises an important question of "Does the size of public sector entity matter?" Given the difference in size among federal, state-level and semi-government organizations, management initiatives such as knowledge management programs, may not be equally effective unless the size implications are understood and accounted for. The study findings to some extent, support the notion that public sector entity size does matter in the implementation of management practices such as knowledge management and the performance benefits/outcomes realized from its implementation. The findings from this study are expected to generate significant interest within the research community as well as among practitioners to explore further the impact of firm size on public sector management.

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Appendix A – Results of confirmatory factor analysis

First order-confirmatory factor loadings of Knowledge Management Processes and Operation Efficiency

Constructs and items	KACQ	KCRT	KCAP	KS&R	KSHR	KUTL	OPRE	SUSD
Knowledge Acquisition (KACQ)								
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							
Knowledge Creation (KCRT)								
KCRT_01		0.82						
KCRT_02		0.90						
KCRT_03		0.91						
KCRT_04		0.90						
KCRT_05		0.91						
Knowledge Capture (KCAP)								
KCAP_01			0.80					
KCAP_02			0.73					
KCAP_03			0.82					
KCAP_04			0.89					
KCAP_05			0.77					
Knowledge Storage and Retrieval (KS&R)								
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				
Knowledge Sharing (KSHR)								
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			
Knowledge utilization (KUTL)								

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		
Operational Efficiency (OPRE)							
OPRE_01						0.67	
OPRE_02						0.78	
OPRE_03						0.69	
OPRE_04						0.71	
OPRE_05						0.72	
OPRE_06						0.88	
OPRE_07						0.82	
OPRE_08						0.87	

Appendix B – Average Variance Extracted (AVE) and Correlation between Constructs

Construct	Square root of AVE	KCRT	KCAP	KS&R	KSHR	KUTL	OPRE	SUSD
KACQ	0.79	0.78	0.75	0.68	0.76	0.77	0.74	0.75
KCRT	0.89	-	0.79	0.71	0.81	0.82	0.73	0.76
KCAP	0.81		-	0.82	0.83	0.85	0.71	0.74
KS&R	0.87			-	0.79	0.78	0.67	0.69
KSHR	0.81				-	0.89	0.72	0.77
KUTL	0.88					-	0.76	0.82
OPRE	0.77						-	0.83

*All correlations significant at p<0.01