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Evaluation of Knowledge Management in the Project-Oriented Information Technology Services Sector

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Abstract

Rationale of Study – The purpose of this study was to explore how knowledge management (KM) in information technology (IT) companies that install, configure, develop, deploy and support IT software for mid- to large- size corporates, plays a key role in sustaining their businesses in an ever-evolving IT market. The study identifies five commonly researched knowledge management processes; knowledge creation, knowledge acquisition, knowledge sharing, knowledge storing and protection as well as knowledge utilisation and studies how these processes contribute to the success of software implementation projects.

Methodology – Information was gathered by both qualitative and quantitative methods. Data was collected using structured questionnaires and interviews. Analysis of the collected data was done using data analysis methods in SPSS.

Findings – The findings revealed that all the five knowledge management processes studied show a positive linear relationship to the success of projects implemented, as well as a positive linear relationship to the overall success of organisations that participated in this study.

Implications – The findings of this research will be of benefit to researchers as it adds to the body of knowledge of KM research specific to project-oriented companies in the IT in the utilities space. Corporates may also benefit from the insights generated by this research.

Originality – The study was an original research conducted on software implementation partners for large software corporations with well established brands and a global geographic spread.

Keywords

Knowledge management, knowledge management processes, IT services, information technology, IT Projects, KM models, KM cycles

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1 Introduction and Background to the Research Study

With the advent of computers, IT and recently the boom in big data, companies have strived to become more competitive. Globalization has introduced competition to businesses that in the past would not have had access to the same markets. KM, though relatively young as a discipline, has become a key differentiator for organisations (Gaviria-Marin et al., 2019). KM has possibly and progressively been a critical component for IT companies' ability to operate profitably and efficiently. Instead of leaving success to chance, it is imperative that any knowledge needs to be managed so as to safely guide operations to a more certain path to success (Garcia-Sanchez et al., 2017), hence the term KM.

KM has attracted the attention of many researchers in academia and also in the business sector, each describing it from their viewpoint. This has resulted in a variety of perspectives, philosophies and debates, with no consensus on the direction of future lines of research (Gaviria-Marin et al., 2019). It is not surprising that KM does not have a globally accepted definition, but scholars have generally agreed that KM is a collection of interrelated systems. By some, it has been described as the process of capturing, storing, sharing and using knowledge (Toinpre et al., 2018; Lee, 2001).

Every organisation harnesses data, information, methods, mechanisms, processes, structures, policies and procedures, strategies, human resources to come up with a system by which it is run. As more data is generated, there has been need for more sophisticated information systems to manage the flow of data. These information systems have evolved from indexed filing cabinets to software databases sitting within a heterogeneous network of applications orchestrated through middleware with interfacing protocols. A contemporary definition of Information systems is a combination of devices, computing software, information, communication, and connectivity technologies, that enables data, information or knowledge to be acquired, stored, shared and utilised for financial management, decision support, manufacturing needs, sale of products and or services, and so forth Al-Emrana et al., 2018).

While the growth of software-based information has been the modern-day fascination of much research work, attention in this research is more towards the IT companies implementing these systems. With the rise in demand for companies to be "connected" many small-to-medium enterprises have turned to providing software related services to

meet this growing demand. The study aims to investigate how KM in IT companies has helped to sustain their businesses in an ever-evolving market of information technology.

In order to understand this vital intangible asset, knowledge and its management, it is necessary to look into the relationships among data, information and knowledge (Istrate & Herghiligiu, 2016). In practice, there is an overlapping understanding of data, information and knowledge as they interact in complex ways. There is an interdependency of one to another. Therefore, it is common for data in some instances, to be referred to as information, and in turn, information to be understood as knowledge in some contexts and vice versa.

Data is simple objective facts with limited use in its primary form and would therefore need someone or something to decipher its meaning so it can be used effectively (Davenport & Prusak, 2000; Bennet & Bennet, 2014). Information is data endowed with relevance, meaning, and significance and are organized for a specific purpose. Data is converted into information through condensation, contextualization, calculation, categorization and correction (Davenport & Prusak, 2000). Knowledge is a complex mix of values, experiences, contextual information and intuition, which provides a framework for evaluating and incorporating new experiences and information. Knowledge is based on information summarized and organized to increase the understanding; these are the basis of decisions (Davenport & Prusak, 2000; Quintas et al., 1997; Bennet & Bennet, 2014). Skills may be narrowly defined as task-based aptitudes and capabilities that constitute a component of wider knowledge attributes (Dalkir, 2013; Wood & Bischoff, 2020).

Organisational knowledge can be categorised as either tacit or explicit knowledge. Tacit (subjective) knowledge is when thoughts and ideas are fetched, created, and mixed resulting in an action, on the other hand, explicit knowledge can accurately be converted to text or any other visual forms (Bennet & Bennet, 2014). This research discovers how KM in IT companies that install, configure, develop, deploy and support IT software for mid- to large- size corporates plays a key role in sustaining their businesses in an ever-evolving IT market.

2 Literature and Theoretical Review

Current literature on KM is diverse. A great many scholars have researched on the subject and linked its effect to organizational competitiveness (Istrate & Herghiligiu, 2016; Hamoud et al., 2016; Bennet & Bennet, 2014; Gaviria- Marin et al., 2019). Luca et

al. (2016) link KM to the management of intellectual capital with the aim of ensuring that the organisation's goals and objectives are met. Donate and Sánchez de Pablo (2015) affirm that effective KM practices make firms more innovative. It has been projected that interest in KM can only grow as its objective of maximizing organisational value through collaboration between clients and human capital increases (Lyu et al., 2016; Gaviria-Marin et al., 2019). However, the absence of an overall KM theory, makes it almost impossible for new KM practitioners to be trained in this field as there is no consensus or an integrated approach on the content of such training material. The same practitioners will not be able to replicate results, when there are no commonly recognised standards (Bennet & Bennet, 2014). Knowledge practitioners emerge from different disciplines and as such, the field of practice from which KM practitioners emerge impact their choice of theory for their work. Some rely on work that may not be KM in nature, but is closely related to the theories found within KM (Bennet & Bennet, 2014).

Some of the old models in KM that set a good foundation for ensuing KM approaches are; the Socialization, Externalization, Combination and Internalization (SECI) Model by Nonaka and Takeuchi (1995) and the Data, Information, Knowledge, Wisdom (DIKW) Hierarchy by Cleveland (1982). According to Bennet and Bennet (2014), these became basic frameworks for KM and were popular in academic research and conferences. The wide adoption of these theories did not seem to be stopped by the fact that they were backed by little empirical study. Their simplistic nature made them popular. The DIKW relates to data, information, knowledge, and wisdom as four layers in a pyramid. Data as the foundation of the pyramid, information as the next layer, then knowledge, and wisdom as the apex. Davenport and Prusak (2000) also explained this while describing the differences between data, information and knowledge.

The SECI model describes the four ways in which knowledge is created and provides a broad view of KM. It offers a practical rather than a philosophical approach to the definition of KM (Dalkir, 2017). Again, its simplicity caused its wide acceptance and use. The model has received some criticism as some researchers are concerned that it is based on studies in a specific industry (manufacturing) and may have been greatly culturally biased towards the Japanese, therefore questioning its effectiveness in other industries and cultures. Other KM models considered are; Choo Sense-making, Wiig and Boisot (Choo, (1996), Dalkir, (2017) and Boisot (1998). Generally, models proposed by scholars have the following stages: identification of the new knowledge, collection, analysis, distribution of information, interpretation, application and storing knowledge in the

corporate memory (Dalkir, 2017). For the purposes of his research, knowledge creation is found to be an important component in describing KM activities within an organisation. It is this simple yet profound model upon which this research is rooted.

A practical way of understanding the impact of KM in day to day operations in organisations is obtained from a review of a few practice concepts (also known as KM cycles) that researchers have unpacked in KM. This research views this practical application of KM from the standpoint of IT and Information Systems. Knowledge management cycle (KMC) is a process of transforming information into knowledge within an organization, which explains how knowledge is captured, processed, and distributed in an organisation. For improved performance, organisations require a practical and coherent strategy and comprehensive KMC.

Literature has identified a series of KM processes in a bid to describe how knowledge is managed in an organisation. However, it has not been consistent, owing to a diverse amount of research that has so far been done (Bennet & Bennet, 2014). This has given rise to multiple KM process groups, dependent on each author's approach to the subject. These processes are broadly the life cycle of knowledge as it moves in an organisation from its inception (acquisition/creation) untilit is retired (stored/archived) (Dalkir, 2017). This is applicable to organisations that take an information systems-oriented approach as well as to those that tend to rely on more informal aspects of knowledge. KM and its processes have been instrumental in the deployment of many Information Systems (Al-Emrana et al.,2018).

A systematic review of the impact of KM processes on information systems, identified KM processes that are commonplace in both theory and practice research (Al-Emrana et al. 2018). KM cycles provide direction for carrying out KM work in an organisation (Napoleão et al., 2021). While there is no standardisation in the terms used to describe each of the processes in the cycles discussed, there is an inextricable similarity in the broad sense. The KM cycles widely used in literature are tabulated below:

Table 1: Summary of KM cycles identified in literature (1993 – 2012)

KM Processes	**References**
Creation, Acquisition, Capture and Sharing	Cheruiyot (2012)
Obtain/Get, Filter/Refine, Share/Supply, Utilize/Apply, Storage/Stock, Delete/Remove	Kayani and Zia (2012)

Assess, Knowledge sharing and dissemination, Contextualize, Knowledge acquisition and application and update	Dalkir (2011)
Get, Use, Learn, Contribute, Assess, Build/sustain and Divest	Bukowitz (2003)
Planning, Creating, Integrating, Organising, Transferring, Maintaining and Assessing	Rollet (2003)
Acquisition, Organisation, Specialisation, Store/access, Retrieve, Distribution, Conservation, Disposal	Nickols (1999)
Individual and group learning, Knowledge-claim validation, Information-acquisition Validation and Integration	McElroy (1999)
Acquisition, Refinement, Store/retrieve, Distribution and Presentation	Zack (1996)
Creation, Sourcing, Compilation, Transformation, Dissemination, Application and Value realisation	Wiig (1993)

Processes in these cycles are synthesised into the five KM processes identified and used in this research. The chosen processes are an adaptation of Evans Max et al. (2013) and Istrate and Herghiligiu (2016). Although there is not overarching KM cycle that scholars have agreed to represent the KM processes in the IT industry, the studied cycles represent the KM cycles frequently referred to in IT related research (Al-Emrana et al., 2018). From a systematic review of the past KM research in IT, the following KM processes were discovered in the order of their significance/frequency: - knowledge sharing; knowledge acquisition; knowledge application; knowledge storage; knowledge protection and knowledge creation.

The KM processes start with knowledge acquisition (KA). The activities associated with KA are identifying the source of knowledge, collecting the knowledge and transferring it to a primary knowledge environment. Deliberate and systematic processes inside the organisation as well as informal processes can be used to acquire knowledge. In both cases employees gain a better understanding of processes and systems, making them better equipped for the job. In order to improve job performance and to solve problems, knowledge acquired can be combined and modified resulting in superior and usable new knowledge (Istrate & Herghiligiu, 2016).

Literature proposes several models that make a distinction between knowledge acquired by employees for themselves in an organisation and knowledge acquired by companies as part of their organisational knowledge acquisition process. The knowledge acquisition

cycle remains generally similar (Dalkir, 2017) and learning is closely associated with KA (Bennet & Bennet, 2014; Istrate & Herghiligiu, 2016). The process of learning involves appropriate information, mixed with context rich situational information to bring understanding of the outcomes of the decision taken (Bennet & Bennet, 2014). It is therefore undeniably true that in learning knowledge is acquired. In the context of a software implementation partner knowledge is acquired from a vast number of sources (Istrate & Herghiligiu, 2016).

According to Nonaka and von Krogh (2009), knowledge creation (KC) is the act of making knowledge created by individuals available, amplifying it in social contexts, and selectively connecting it to the existing knowledge in the organization. From the existing tacit and explicit knowledge, new insights can be gained with the capacity to change the way products or services are delivered. An IT organisation can achieve its objective of continuous improvement and innovation through new ideas, processes and practices (Tan & Wong, 2014) in KC. Literature has defined a strong association between KA and KC to the extent that the latter is considered to be part of the KA process. This study considers KC separately as this is a very significant and active process in the preparation and deployment of IT systems (Nonaka & Takeuchi, 1995). KC is competitively close to KA and together form the foundation for organisational innovation.

For an IT implementation company to provide value service delivery sustainably, it must stimulate its employees at all organisational levels to learn, grow and innovate. This can be achieved by creating a culture of continuous adaptation, innovation and growth by the organisation. As such, KC aligns to this objective (Dalkir, 2017). Over time an implementation partner organisation will develop its own set of documents, templates, management plans, roadmaps, methodologies that best meet the objectives of the organisation and have been proven to increase the chances of success over time (Istrate & Herghiligiu, 2016).

Knowledge utilisation (KU) is defined as the appropriate application of existing knowledge (Wang et al., 2021). Some software companies work with a model where they engage and accredit partner organisations to customise, train and deploy their proprietary software on their behalf, and prescribe implementation methodologies with processes, procedures and templates to be used together with their software (Dalkir, 2017). The utilisation of existing content, methods, processes and practices yields faster time-to-value for the customers as well as profitability for the IT company. For a project oriented

IT company and any company, KU improves the ability to innovate, increase in efficiency and results in organisational profitability (Wang et al., 2021). Active utilisation of knowledge leads to the successful use of management information systems in organisations, increasing the success of projects and organisational performance.

Knowledge sharing (KS) is when knowledge that is already in an organisation is disseminated to members of staff and appropriate stakeholders by means of emails, memos, organisational "Town Hall" meetings, social media platforms such as WhatsApp groups created for project team members (Hamoud et al., 2016). This way, all members of a project team are kept updated on information regarding the project and instructions requiring action on their part. Knowledge sharing is induced by the mismatch in experiences (Dalkir, 2017). However, knowledge may flow from a senior resource to a junior resource or vice versa. This is an informal kind of knowledge transfer, where the responsibility of sharing the knowledge is on the two or more individuals interacting. Tan and Wong (2014) describe KS as constituted by two activities: (a) formal and (b) informal activates. Less formal ways of sharing the information and hence knowledge can occur during the interactive discussions between consultants of the implementation organisation and subject matter experts from various departments. Throughout the process of sharing knowledge, knowledge is acquired and also new insights are incepted. This defines the complex, multi-dimensional construct of KM (Alrubaiee et al., 2015; Istrate & Herghiligiu, 2016).

Knowledge generated in a project will need to be stored for multiple reasons such as, knowledge generated during one phase of the project may be a critical ingredient in the next (Dalkir, 2017). Records of knowledge generated during the implementation of the project, may need to be kept for future reference, so that the same pitfalls are not repeated in subsequent similar work. Also, knowledge generated by the project will be used to update the customer's processes and procedures due to the business transformation necessitated by the transition to the new software (Dalkir, 2017; Istrate and Herghiligiu, 2016). Governance systems and procedures that are prepared at the start of the project provide guidelines on how knowledge will be acquired/created, shared and stored. Identified relevant knowledge and their artefacts are typically stored in a location that is readily accessible to the project team, such as network storage, cloud storage and Microsoft SharePoint (Hamoud et al., 2016). It becomes imperative that this knowledge should not be misappropriated.

Knowledge protection looks at ways that the stored knowledge and its artefacts are not unlawfully acquired or unlawfully used against any of the contracting companies. This knowledge constitutes an organisation's intellectual property and has been considered by literature as having tradable value. Knowledge protection is important for an organisation because it ensures that its intellectual property is protected (Tan & Wong, 2014). One way of achieving the knowledge protection has been the non-disclosure agreements between the customer and the software implementation partner. This ensures that although access to confidential information is granted, it is limited to known use (Istrate & Herghiligiu, 2016). The organisation's aim is to convert as much of its knowledge to explicit knowledge which is then stored for future use (Istrate & Herghiligiu, 2016). This knowledge needs to be stored in a structured manner so that it is readily available when needed. Unstructured information is quite difficult to work with and it would be difficult for others to know if it exists, let alone how to retrieve it.

KM literature shows that there are many factors that influence the success of KM systems. Such factors may be viewed as barriers to KM activities and performance. However, there are a few of such barriers that have been mentioned quite often by the researchers and scholars because they have profound implications in KM success. These include; organizational culture, leadership, human resource, informational technology and low KM understanding. Nevertheless, there is no universally agreed list of barriers that are applicable to every and any organisation. There always seems to be a gap-fit analysis driven by key organisational factors such as; industry type, organisational structure, organisation size and organisational culture (Istrate & Herghiligiu, 2016).

There are many perspectives that come into play for a project to be successful. This is compounded by different opinions regarding the measure of success for a project. The triple constraints of project implementation (scope, time and cost) seem to hold a broad view as a measure of project success notwithstanding the many other parameters requiring attention for successful implementation of a project. For an organisation whose core activity is implementation of business solution software, the project teams need to practise KM as an integral part of the project implementation. For any organisation to be competitive, its various departments need to work together towards the common strategic objectives set by top management. It is also important to see how KM as a key contributor, is aligned to corporate strategies, policies and how it has been operationalised.

As such, based on the literature study done for this work, it is evident that KM is a broad and diverse subject that continues to experience growing interest from business management and academic researchers alike. Research has placed KM processes as fundamental in the successful deployment and adoption of information systems (Al-Emrana et al., 2018). Much research has gone into the study of KM theory and processes as they apply to Information Systems (IS) and Information Technology (IT), adding significantly to the body of knowledge on this subject. It has, however, been noticed that there is less research focused on KM processes as they apply to IT services organisations. Therefore, this work identifies commonly researched knowledge management processes and studies how these processes contribute to the efficient implementation and support of information systems by organisations who are either system integrators or software implementation partners. The research aims to make a significant contribution to the KM body of knowledge as it applies to Information Systems and Information Technology by critically analysing the various models and processes in knowledge management. It also provides a pragmatic view on how KM processes have been harnessed by software implementation partners to provide superior performance and results on IT projects. By extending research in this niche segment of IT, new insights are added to this body of knowledge.

3 Proposed model and hypothesis

This proposed model is based on the hypothesis of KM processes as a multi-dimensional construct with these five dimensions (Alrubaiee et al., 2015): Knowledge Acquisition (KA), Knowledge Creation (KC), Knowledge Utilisation (KU), Knowledge Sharing (KS) and Knowledge Storing and Protection (KS&P). Figure 1 below summarises this model and the respective hypothesis.

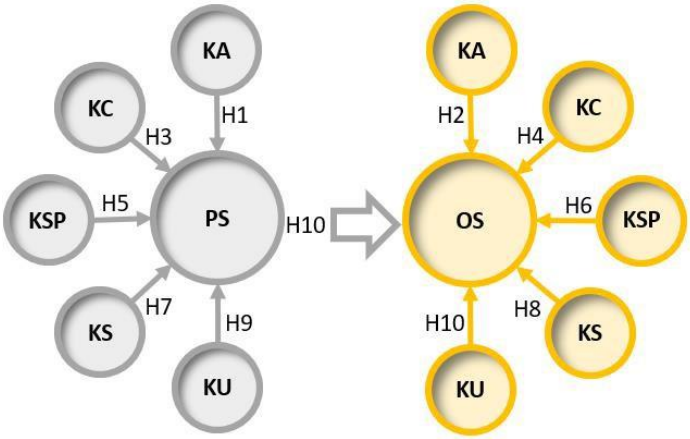

Figure 1: Proposed KM Research Model PS and OS

Hypothesis 1 (H1):

Knowledge Management processes (KA, KC, KSP, KS and KU will positively impact Project Success (PS) and Operational Success (OS)

Hypothesis 2 (H2):

Project Success (PS) will positively impactOrganisational Success (OS)

4 Research Methodology/ Approach

This empirical study uses equal status mixed methods, Johnson (2015). Mixing qualitative and quantitative approaches adds valuable insights to the research questions (Opoku & Ahmed, 2013). A flow diagram of the research path taken is shown in figure 2.

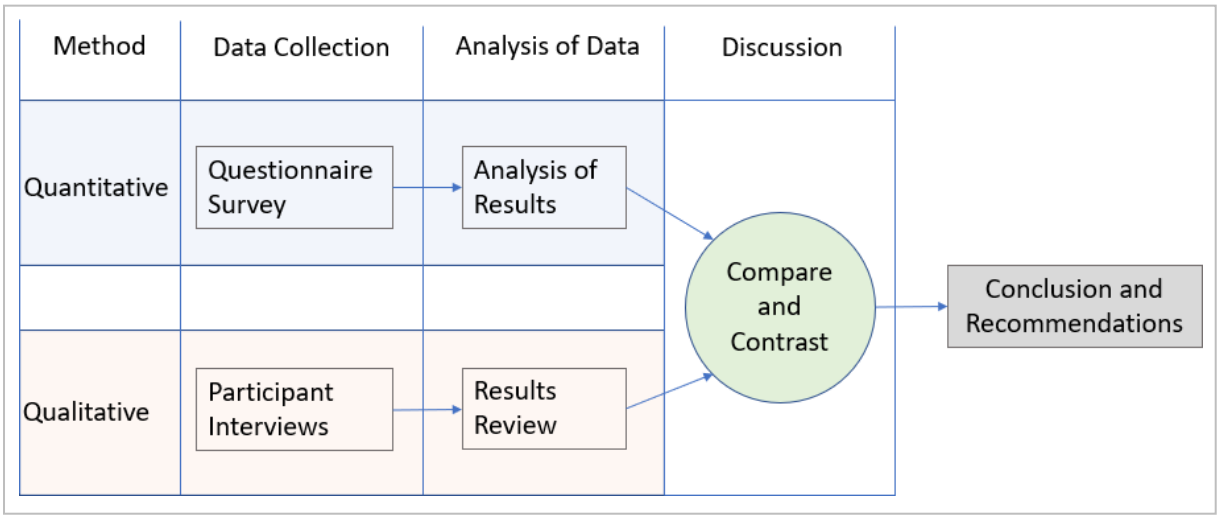

Figure 2: Mixed methods Research Path

(Adopted from Opoku & Ahmed, 2013)

A random sampling technique was used. The research targeted software implementation partners for large software corporations with well established brands. The corporates tend to take a structured approach to increasing their footprint in the enterprise software space. They work through accredited implementation partners to increase their market reach. The partners are accredited to sell software on behalf of the software OEMs as well as implementation, customization, further development and support of the software. Within the participating organisations, there was no geographical limitation to the participants as this ensured a good sample space which represents multiple geographies. This approach was important in maximising the number of participants from the two organisations.

Because the population was quite vast with a global geographic spread, the research has been limited to a study of project-oriented IT services organisation with projects that are mostly implemented in the utilities industry. A questionnaire was created using an online survey tool. Analysis of the collected data was done using SPSS program and results of the analysis discussed. Each KM process was considered to be a logical grouping of items. Questionnaire was divided into three main sections: a general section, KM processes section with five sub-sections representing the five KM processes (KA, KC, KSP, KS and KU) and a section for items related to project success and organisational success. These items reflect on elements used to measure the success of either a project or the organisation. An initial run was done to test if the questionnaire yields the desired results. Pilot test results were used to make further changes or optimisation before the questionnaire was put to wider use.

Interviews were conducted with listed employees from the participating organisations. Targeted individuals were taken from the project management teams because of their experience in planning as well as executing projects while participating in key projects and operational meetings. Other viewpoints were sought from management representatives who interacted with the project teams either within the context of the projects or on operational matters. The management representatives were well acquainted with the strategic operational goals of their organisations. Answers to open-ended interview questions were used to interpret the participants' viewpoints on the effects of KM processes in the two dimensions of project success and operational success. An exercise to arrange the five KM processes in the order of their significance was done using a five- point Likert scale. So, two scales of measurement were used: a binary type scale (either or) and a 5-point Likert scale. of 1 – 5, ranging from negative (1) to positive (5).

5 Results

5.1 Quantitative Survey Data Analysis

All responses to the Questionnaire were captured using an online survey tool called Qualtrics. The data recorded from Qualtrics was exported to Microsoft excel for easier handling. The responses to each question were converted to their equivalent number on the 5-point Likert scale.

The questions that were in the questionnaire belonging to the same group of questions such as the Knowledge Acquisition questions were transformed into a single variable in

SPSS. This was achieved through dimension reduction using Factor analysis. The Factor Analysis method used was the Principal Component. The number of factors was fixed to one so that a single factor score was generated from all the questions in the KA group. This score represented KA as a scaled numeric variable.

This principal component analysis (PCA) was used to extract the factors of the remaining KM processes which are KC, KSP, KS & KU and four more factor scores generated. The same analysis was run on the remaining two groups ofquestions, which represented the two dependent variables Project Success andOrganisational success. These seven numeric expressions were then used for the data analysis.

Kaiser-Meyer-Olkin and Bartlett's Test

Using the Kaiser-Meyer-Olkin's measure of sampling adequacy, variables KA, KC and PS were acceptable, while KSP, KS, KU and OS were much favourably adequate. In Bartlett's test most of the p-values (sig.) were less than 0.001, meaning that they are statistically significant. The only exception was KC with a value of 0.321 which is greater than the statistically significant threshold of 0.05, making it statistically insignificant.

PCA Commonalities and Component Analysis for KM processes

From the component matrix it was observed that:

- KA factor loading is generally high for most items (67%) and 33% with a low proportion
- KC factor loading is generally positively medium-to-high for most items (62,5%), with 12,5% is weak and 25% is negative.
- KSP factor loading is generally high for most items (87.5%) and 12,5% with a low proportion.
- KS factor loading is high for all items.
- KU factor loading is medium- to-high for all items.
- PS factor loading is high for all items.
- OS factor loading is quite high for 80% of the items and 20% a low and negative loading

5.2 Analysis of Qualitative Survey Results

A moderately strong positive linear relationship is observed between PS and the five KM constructs, which are KA, KC, KSP, KS and KU. Comparably high positive linear relationships are from Knowledge storing & protection and knowledge utilisation. This was followed by knowledge acquisition and knowledge sharing. The last was knowledge

creation. A strong positive linear relationship is observed between OS and KA, KSP and KU. Moderate and weak linear relationships to operational success came from knowledgesharing and knowledge creation respectively.

Table 2: Correlation Matrix

KA		KC	KSP	KS	KU	PS	OS
KA	1.000	.616	.850	.698	.848	.533	.754
KC	.616	1.000	.551	.567	.582	.469	.317
KSP	.850	.551	1.000	.811	.936	.633	.750
KS	.698	.567	.811	1.000	.864	.524	.536
KU	.848	.582	.936	.864	1.000	.594	.679
PS	.533	.469	.633	.524	.594	1.000	.664
OS	.754	.317	.750	.536	.679	.664	1.000

Table 2 shows that very strong positive linear relationships exist between the individual KM processes as depicted by the high p-values below:

- 0.936 - knowledge storing and protection ↔ knowledge Utilisation
- 0.864 - knowledge sharing ↔ knowledge Utilisation
- 0.850 - Knowledge acquisition ↔ knowledge storing and protection
- 0.848 - Knowledge acquisition ↔ knowledge utilisation
- 0.811 - knowledge storing and protection ↔ knowledge sharing

Subsequent strong and moderate yet positive linear relationships are also observed through the p-values of the remaining KM relationships as given below.

- 0.616 - knowledge creation ↔ knowledge acquisition
- 0.582 - knowledge creation ↔ knowledge utilisation
- 0.567 - Knowledge creation ↔ knowledge sharing
- 0.551 - Knowledge creation ↔ knowledge storing and protection

5.3 Qualitative Results Review

The results of the interviews are captured in the two sections below under KM in projects and KM in organisations.

Knowledge management in projects

KM is quite a complex concept which undoubtedly is intertwined in the fabric of project governance. Some of the issues that emerged from interview discussions are that KC is limited by constraints of the past. Institutional constraints may be formal or informal. Secrecy within the organisation was viewed by some participants as the cause, this reflects on knowledge as a power base, while others viewed it as a form of safeguarding the competitive edge of an organisation. Competing with this notion is the need to share knowledge with external organisations for the project to be successful.

Of the five KM processes, KC is viewed as a process with great potential, as it is at the heart of innovation and market disruptions. The comments below by respondents reflect on the low usage of KC:

> *"It is the providers of software, not the implementers, who create the knowledge based on what they have learnt from customers."*

One respondent mentioned that KC should be limited to unique requirements in a project.

Identification of all knowledge sources through KA in an organisation or a project structure is viewed by some respondents as extremely important. The comments below were made:

> *"Most knowledge is hidden. If you miss some knowledge, then you could reinvent the wheel. There should be an inclination towards acquiring knowledge rather than creating it."*

KA is viewed to be of much relevance by the respondents compared to KC. Acquiring new knowledge and using it is much more effective in meeting the triple constraint of a project, which are time, cost and scope.

KM processes as an embedded part of the project implementation, can be combined in steps that give the best results while a project is being delivered. This sequence of steps used, takes knowledge and applies it in a project. The comment from one participant below best describes this:

> *"KA followed by KS followed by KU is the most critical set of steps in the project. Collaborative tools such as SharePoint give access to acquire knowledge so that it can be shared and utilised in the proper way."*

Respondents identified the critical role that management in the organisation play to ensure that there is a framework that supports the sharing of knowledge and also creates a culture within the organisation where sharing of knowledge is promoted. Another form of knowledge discussed was the knowledge in people's heads, this tacit knowledge was more difficult to acquire and share.

Knowledge use was described as the appropriate application of existing knowledge. This last step in the three-part step (KA-KS-KU) described above is based on how well the knowledge is shared. Knowledge was viewed as the value of an organisation which creates capacity to be competitive. The need to protect this intellectual property was discussed by respondents.

To sum up this discussion on the importance of KM project implementation there are a few thoughts shared by the respondents as below:

> *The project phases are designed around KM processes yet KM has not been given the recognition and the attention that it deserves. The project may be completed but the deliverables may not meet business expectation. This is an example of KM processes that have not worked correctly during the life cycle of the project. KM must be part of the governance of a project.*

Knowledge management in organisations

Participants were asked to rank the KM processes according to how applicable they were for project and organisational success, from the highest to the lowest. The highest was given a score of five on the Likert scale and the lowest one score. The results are summarised in table 2 below:

Table 3: KM Ranking Opinions

KM Process	**Ranking on Likert Scale (1- 5)**
KA	2
KC	5
KS & P	4
KS	1
KU	3

From table 3, knowledge sharing is the most critical component for success at both project and organisational level. The same consensus applied to knowledge creation

being the least critical. KA got an average ranking of second place followed by KU and KS&P in that order.

The core business for these IT services organisations is the implementation of projects there was therefore a close correlation between the success of projects delivered and the success of the organisation as a whole. KM was viewed by most respondents as a requirement for the organisation to succeed. Some thoughts from respondents are shared below;

> *"If KM is not effective at a project scale, then chaos should be expected at organisational level. Organisations have no idea about KM, yet they make use of it all the time. Small start-ups disrupt the industry because they are able to take advantage of the KM process in a more agile way. Organisations are competing on the basis of knowledge, putting a lot of emphasis on protecting their knowledge from competition."*

The effect of KM in organisation is well accounted for but what is really lacking is the recognition by organisations to start creating organisational structures to handle KM topics. One respondent noted that;

> *"Some global organisations have started having a special team that looks after knowledge but only a small proportion of these organisations do this well."*

The comment above shows a progression towards organisations that are progressively taking advantage of the knowledge capital fuelled by the availability of knowledge andthe exponential growth in the amount of knowledge generated currently.

6 Discussion

6.1 Effects of KM Processes on Project Success (PS)

From the results analysis, it is evident that the KM constructs measured and analysed are an active and integral component in the successful implementation of a software solutions by the participating organizations that are focused on software project implementations.

From the quantitative analysis perspective, knowledge storing and protection showed the highest positive linear relationship with PS compared to the other four KM processes. If organisational knowledge is not properly stored it can imply that access to this knowledge may be difficult. On the other hand, the interviews results showed a difference in opinion presented by the participants. KS&P although being discussed as an important element, was ranked fourth. Given that KS was ranked first by the interview participants, it was expected that there would be less emphasis on protection of knowledge as strict controls would negatively impact sharing of knowledge.

According to the questionnaire survey, knowledge utilisation had the second highest positive linear relationship to the success of project implementation for the organisations under study. Since this knowledge is meant to make work easier for the teams there is a high tendency for teams to make good use of all available knowledge. KU was discussed by the participants as the ultimate goal. The higher the utilisation the better an organisation becomes. For this reason, the participants gave it a ranking of third place.

From the analysis of the online questionnaire survey, knowledge sharing and knowledge acquisition were comparable and also showed a moderately positive linear relationship to successful implementation of IT related projects. The interview results show that KS and KA are ranked number one and two respectively by the participants. Effectively getting the knowledge to where it is needed was sighted as the single most important process that was supported by first having to acquire the required knowledge. Heisig (2009) identified knowledge sharing as the most frequently discussed group of KM activities. This is consistent with the feedback received from the participants in the interviews. Knowledge creation is also showing a moderately positive linear relationship with project success. According to the respondents this KM process while it is important, (hence the positive linear relationship) it was not as significant as the other four.

Insights on why the questionnaire surveys yielded such a low ranking for KC was provided by the participants in the interviews. The pressure for delivering the project on time, within budget and also to the expectations of the customers meant that reuse of existing knowledge was the most efficient way of achieving this. This is a key finding in this study.

6.2 Effects of KM Processes on Operational Success (OS)

Questionnaire survey responses reveal that knowledge acquisition and knowledge storing and protection show a comparable high positive linear relationship to the success of an organisation. Also showing a high positive linear relationship with operational success in the questionnaire survey is knowledge utilisation. This places strong emphasis on the utilisation of the knowledge that has been acquired and stored in the organisation. The interviewees gave it an average ranking of three after KS and KA. Knowledge sharing is next in the hierarchy according to the questionnaire survey, where it shows a medium yet positive linear relationship with operational success. The opinions from the interviewees ranked KS highest due to the importance of synergies for innovations, exchange of ideas, knowledge transfer and ultimately the success of the organisation.

There was also a positive linear relationship from the online questionnaire survey, even though it is low in knowledge creation. This shows that there is greater emphasis on reuse of existing knowledge while implementing projects, as customers demand shorter times to value at lower prices. This notion was also confirmed by interviewees who ranked KC as lowest of the five KM processes. They noted that an organisation would rather do mergers and acquisitions and use this as a form of creating new knowledge and in other cases the OEMs are expected to use part of their revenues for research and development, which would benefit these partner organisations.

6.3 The Effects of Project Success on Operational Success

Taking project success as an independent variable, it has also been observed that project success shows a high positive linear relationship to operational success in the studied organisations. Thus, the outcome of projects delivered by employees has a direct linear relationship on the organisation. Interviewees commented that:

> *If KM processes were not running well in the project,then things could only get worse in the organisation as a whole.*

7 Conclusions

According to the organisations studied, all the five KM processes showed a positive relationship to the success of the project being implemented as well as a positive relationship to the overall success of the organisation. It is also clear that once the project runs successfully, the organisation is positively influenced by the outcomes of these projects. From the quantitative methods it was inferred that KS&P as well as KU show highest prominence in influencing the success of projects. However, the interview results show rankings of KS and KA as first and second respectively. It is therefore inconclusive as to which KM process takes the lead in influencing projects and organizational operations.

Both the quantitative and qualitative methods come to the same conclusion that knowledge creation is the least utilised of the five KM processes studied. The explanation for this is based on pressure from customers for cheaper solutions with shorter time to value cycles which leads to the use of ready-made templates and rapiddeployment kits in the project lifecycle.

8 Recommendations

Even though both hypotheses are true as assumed, this work recommends that similar research be carried out on multiple similar organisations across geographies. The findings could then be generalised in this specific field of research by achieving a bigger questionnaire survey response beyond 300 respondents. A research opportunity to study the underlying factors that limit the use of knowledge creation in this sector has arisen from this work. Further insights in this area would be of interest.

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