



International Journal of Project Organisation and Management

ISSN online: 1740-2905 - ISSN print: 1740-2891
<https://www.inderscience.com/ijpom>

The supporting role of the project management office in the transfer of knowledge between projects - a study of five cases

Brighton Tshuma, Cornelis Cristo van Waveren, Herman Steyn

DOI: [10.1504/IJPOM.2024.10053181](https://doi.org/10.1504/IJPOM.2024.10053181)

Article History:

Received:	19 July 2022
Accepted:	15 November 2022
Published online:	25 January 2024

The supporting role of the project management office in the transfer of knowledge between projects – a study of five cases

Brighton Tshuma,
Cornelis Cristo van Waveren* and
Herman Steyn

Department of Engineering and Technology Management,
University of Pretoria,
Pretoria, South Africa
Email: tshucksly@gmail.com
Email: corro@up.ac.za
Email: herman.steyn@up.ac.za

*Corresponding author

Abstract: Project management offices (PMOs) play both mediating (facilitating) and moderating (supporting) roles in knowledge transfer (KT) between projects. The *mediating* role of the PMO has been addressed elsewhere while this article investigates the *supporting* role of the PMO in the transfer of tacit and explicit knowledge. The article thus contributes to the scant literature on the supporting role of PMOs in KT. Cases of five PMOs were investigated through 15 semi-structured interviews and three KT enablers were identified namely: 1) creation of awareness and importance of KT; 2) establishment of trust amongst project personnel; 3) creation of an organisational KT culture. Their embedment into organisational routines ensures a sustainable and seamless KT process through the PMO's supporting role. This improves the transfer of knowledge with different levels of articulability and the usability of the transferred knowledge and can provide a competitive edge for PBOs.

Keywords: knowledge articulability; knowledge management; knowledge transfer; knowledge usability; supporting role of the project management office; case study research; PMOs.

Reference to this paper should be made as follows: Tshuma, B., van Waveren, C.C. and Steyn, H. (2024) 'The supporting role of the project management office in the transfer of knowledge between projects – a study of five cases', *Int. J. Project Organisation and Management*, Vol. 16, No. 1, pp.102–132.

Biographical notes: Brighton Tshuma holds a Master's in Civil Engineering in the field of structural engineering (University of Johannesburg, South Africa, 2015) and PhD in Project Management (University of Pretoria, South Africa, 2022). He is the Director of Projectneers Consulting Engineers and Project Managers. His current research interest includes project management offices and knowledge transfer in project-based organisations. He is professionally registered with the Engineering Council of South Africa and the South African Council for the Project and Construction Management Professions.

Cornelis Cristo van Waveren holds a Master's in Mechanical Engineering in the field of structural mechanics and fluid power (1990), Master's in Engineering Management (2003, Cum Laude) and PhD in Engineering

Management (2022), all degrees were obtained from the University of Pretoria, Pretoria, South Africa. He is a Senior Lecturer in the Department of Engineering and Technology Management, at the Graduate School of Technology Management at the University of Pretoria. His current research interest includes knowledge management within project environments. He is registered as a Professional Engineer in South Africa and member of the South African Institute of Mechanical Engineers.

Herman Steyn is a Practical Engineer and Project Manager who is currently pursuing his academic interests. Prior to joining the University of Pretoria as a Professor specialising in Project Management, he worked for 22 years in industry where he held senior positions, managed large and small projects and assumed responsibility for the management of organisational divisions as well as for project portfolios. His qualifications include two engineering degrees, an MBA and a PhD in Engineering Management, and his publications on project management have been cited more than 2,800 times.

1 Introduction

In a globally competitive project management environment, knowledge transfer (KT) has become a basis for competitive advantage (Quintas et al., 1997). However, in most project-based organisations (PBOs), project personnel view KT as a secondary function (Van Waveren et al., 2014). Project personnel's primary priorities are normally short-term driven (delivering projects on time, within budget and in conformity with scope and quality specifications) (Shenhar et al., 2001; Aubry et al., 2007; Darling and Whitty, 2016). Project personnel therefore often fail to recognise the significance of KT between projects as an enabler for increasing the organisation's competitive advantage or for providing important long-term benefits to PBOs (Van Waveren et al., 2014). The importance of KT is also reflected in new business trends such as the increased numbers of joint ventures and collaborations, which yield a much needed competitive advantage (Powell et al., 1996).

Projects produce a considerable amount of new knowledge (Tshuma et al., 2018). Due to their unique and temporary nature (Dvir et al., 2006; Aubry and Hobbs, 2010; Lindner and Wald, 2011; Bell et al., 2016; Project Management Institute, 2017), projects often do not support KT between and within projects (Lindner and Wald, 2011). This makes KT a significant nightmare for most PBOs (Louw et al., 2017). KT in PBOs enables learning from project to project, leading to the implementation of up-to-date good practices to address new challenges experienced in current and future projects, to prevent the repetition of costly mistakes (Pretorius and Steyn, 2005). Since both tacit and explicit knowledge is produced by projects further exacerbates the problem as each type of knowledge requires specific knowledge management (KM) infrastructure and process capabilities.

Knowledge articulability (the extent that tacit knowledge is made more explicit) is one of the important factors that influences KT (Fernie et al., 2003; Owen et al., 2004; Kulkarni et al., 2007; Anand et al., 2010; Bellini et al., 2016; Tshuma et al., 2018). It is the ability of the knowledge source to transfer knowledge in a clearly expressed way (Prinsloo et al., 2017) or the extent to which knowledge can be articulated – verbalised,

written or drawn (Bresnen et al., 2003; Cummings and Teng, 2003; Fernie et al., 2003). Literature shows that articulate knowledge is more easily transferable than less-articulate knowledge (Cummings and Teng, 2003). The articulability of knowledge has an important impact on the ease of transfer (Szulanski, 2000). Poorly articulated knowledge is difficult to learn, teach and transfer (Fernie et al., 2003), and this hinders knowledge usability and success in KT (Tshuma et al., 2018). KT success, therefore, increases as the articulability of the knowledge increases (Cummings and Teng, 2003). Despite the realisation of remarkable increases in performance through KT, successful KT is still difficult to achieve in PBOs, and requires a specialised approach or concerted effort (Argote et al., 2000).

In PBOs where process dynamics and information and knowledge flow are concentrated around projects, the role of the project management office (PMO) becomes even more relevant (De Lucca et al., 2020).

1.1 PMOs and KT

PMOs play two distinctly different roles in the transfer of knowledge between projects: on the one hand PMOs *mediate* (facilitate, coordinate, and control) the transfer of knowledge between projects and on the other hand PMOs *support* (moderate) the transfer (Julian, 2008; Tshuma et al., 2018). The *mediation* role has recently been investigated by Tshuma et al. (2022) but literature on the PMO's support role is still scarce. This article contributes to this scant literature by exploring the support role in the transfer of knowledge (with different levels of articulability) to improve the usability of the transferred knowledge.

PMOs support PBOs in simultaneously managing multiple projects (Spalek, 2012). They are used as a tool in the management of organisational knowledge (De Lucca et al., 2020). The vast technological advances and the ever-changing organisational strategic priorities in PBOs necessitate the establishment and the continuous reimagination or reconfiguration of PMOs (Hurt and Thomas, 2009; Aubry et al., 2010; Dietrich et al., 2010; Pinto et al., 2010; Spalek, 2012), whose primary function is to serve the needs of an organisation's projects (Dietrich et al., 2010). Therefore, the alignment between strategic organisational priorities and PMO functions supports the achievement of PMO benefits (Dietrich et al., 2010).

KT is a KM process and one of the strategic functions of the PMO (Argote and Ingram, 2000; Argote et al., 2000). It is the process through which one unit is influenced by the experience of another (Argote and Ingram, 2000), or the exchange of systematically organised information and skills between entities (Duan et al., 2010). PMOs play primarily two roles in KT between projects, namely mediation and support (also known as moderation). Knowledge and expertise are assets to any organisation and a critical source of competitive advantage in PBOs (Argote and Ingram, 2000; Lubit, 2001; Shenhar et al., 2001; Chen et al., 2009). Projects produce explicit (systematic and formal) knowledge and tacit knowledge (embedded in people's expertise, experience, instinct and know-how) (Malone, 2002; Fernie et al., 2003; Dhanaraj et al., 2004; Blumenberg et al., 2009; Mezghani et al., 2016). Both explicit and tacit knowledge are crucial in the creation and re-use of knowledge and contribute positively to project success (Owen et al., 2004).

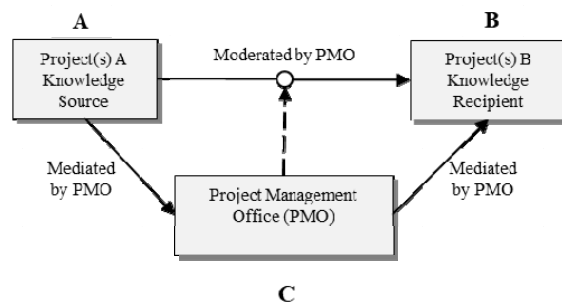
1.2 Knowledge articulability

Knowledge articulability is the extent to which knowledge can be verbalised, put into perspective, and/or written. It deals with the tacitness or explicitness of knowledge (Cummings and Teng, 2003). Knowledge has *different levels* of articulability (Ferne et al., 2003; Tshuma et al., 2018). The transfer of tacit knowledge requires people (personalisation), while explicit knowledge is best transferred through tools and systems (codification) (Kasvi et al., 2003; Karlsen and Gottschalk, 2004; Pretorius and Steyn, 2005; Carrillo et al., 2006). The transfer of knowledge with different levels of articulability, to the right project, at the right time, to improve the usability of the transferred knowledge, can be effective when supported by the PMO. This is because most project team members only focus on the short-term goals of the project (Van Waveren et al., 2014) and neglect the medium-to-long-term goals.

1.3 The supporting role of the PMO

The support role of the PMO, in the context of this paper, is a process through which an existing system and/or process is strengthened and improved by a third party, for example, a PMO. The PMO ensures that knowledge (with different levels of articulability) is transferred through the right process, at the right time by the right methods/tools and the right people, to improve the usability of knowledge. Figure 1(a) illustrates the typical flow of knowledge between projects while Figure 1(b) shows the PMO's supporting role in KT, where the supporting variable C influences the path relating A to B. This supporting role differs from the mediating role described by Tshuma et al. (2022) where knowledge is transferred from the sending project via the PMO to the receiving project(s). The role of the PMO in this case is limited to support while the knowledge is transferred directly from the sender to the receiver. The difference between the two roles is illustrated in Figure 1.

Figure 1 Difference between PMO roles in KT



1.4 Objective of the study

To support KT between projects, systematic KM infrastructure and processes need to be in place (Duffield and Whitty, 2016; Tshuma et al., 2018). The role of PMOs in PBOs is a well-researched topic in literature (Dietrich et al., 2010; Tshuma et al., 2018; De Lucca et al., 2020), and effective KT is generally viewed as central to the success of PBOs

(Argote et al., 2000), with a few exceptions. PMOs support and mediate the transfer of tacit and explicit knowledge between projects (Spalek, 2004; Dietrich et al., 2010; Tshuma et al., 2018). PMOs are better placed to set up KM infrastructure and processes that stimulate and enable the transfer of knowledge between projects. However, to the best of our knowledge, no previous empirical studies have been conducted on the supporting role of the PMO in the transfer of knowledge (with different levels of articulability) to improve its usability. This study therefore seeks to develop a model that illustrates the supporting role of the PMO in the transfer of tacit and explicit knowledge between projects. The model will assist PBOs to successfully transfer knowledge (with different levels of articulability) between projects, thereby creating a competitive advantage necessary for conducting business in highly contested environments (Argote and Ingram, 2000; Argote et al., 2000; Susanty et al., 2012; Bellini et al., 2016; Tshuma et al., 2018).

1.5 Structure of the article

Section 1 of this article provided a background to the study and introduced the topic. It draws an overall portrait of the existing literature in relation to the research objective, while a conceptual model of the PMO's supporting role in the transfer of knowledge (with different levels of articulability) is presented in Section 2. An overview of the cases investigated and the research design and methodology are detailed in Section 3 and Section 4, respectively. The results are presented and analysed in Section 5. Finally, discussions and conclusions contained in Sections 6 and 7, respectively, provide insights into the PMO's supporting role in the transfer of knowledge and also identify the limitations of this study, as well as suggestions for future research.

2 Conceptual model

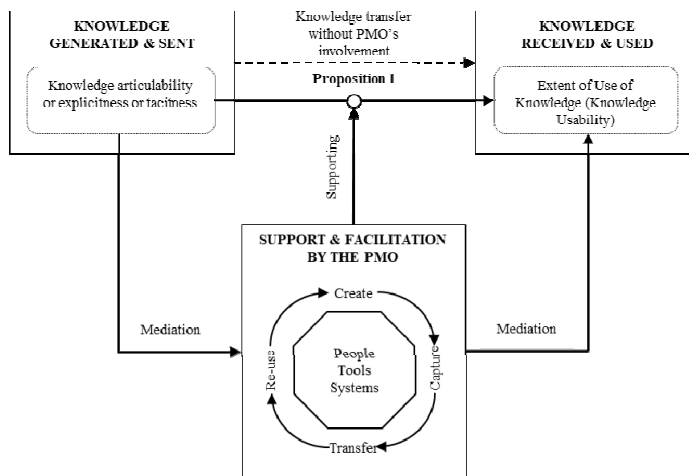
The development of KT originally took place under the assumption of relatively stable organisational settings (Lindner and Wald, 2011). However, projects as temporary organisations are characterised by precise elements which pose explicit challenges for KT (Schindler and Eppler, 2003; Fong and Kwok, 2009), namely

- a The uniqueness and temporariness of projects hinder the advent and development of organisational routines and memory and therefore hampers organisational learning and KT (Bresnen et al., 2003).
- b Discontinuation of project teams leads to disintegration of individual and organisational knowledge (Kasvi et al., 2003).
- c Projects lack natural mechanisms of learning and transfer, thus KT between projects is challenging (Fong and Kwok, 2009).
- d Projects usually have a short-term orientation with a focus on immediate deliverables, whereas KT often requires a long-term perspective – this conflict of goals may result in ineffective KT.

Tshuma et al. (2018) developed a conceptual framework on the role of PMOs in the transfer of knowledge between projects, where they argued that PMOs play an important

role in the transfer of knowledge by supporting and mediating the transfer of knowledge between projects to improve its usability. They further contended that, without the PMO, this function cannot be effectively managed since project team members usually focus on the short-term goals of the project and often fail to see capturing and transfer of knowledge between projects as beneficial for long-term benefits (Van Waveren et al., 2014). This article focuses on the PMO's supporting role in the transfer of knowledge (with different levels of articulability) between projects to improve its usability. It aims at responding to the research question, 'how does the PMO's supporting role help in transferring knowledge with different levels of articulability to improve the usability of knowledge'. A conceptual framework suggesting that the PMO supports and mediates the transfer of knowledge (with different levels of articulability) to improve its usability, is proposed and presented in Figure 2. This article however, focuses on the PMO's supporting role in KT between projects, and therefore leads to the research proposition – *The PMO's supporting role assists in transferring knowledge with different levels of articulability at the right time, to the right recipients to improve the usability of knowledge.*

Figure 2 Conceptual framework



Source: Adapted from Tshuma et al. (2018)

PMOs establish KM infrastructure and process capabilities that support the transfer of knowledge (with different levels of articulability) at the right time, to the right recipient(s), to improve the usability of knowledge (Lee et al., 2012; Tshuma et al., 2018). This corresponds to the supporting role of PMOs as mentioned by various scholars (Desouza and Evaristo, 2006; Kerzner, 2006; Unger et al., 2012; Pemsel and Wiewiora, 2013). Although both tacit and explicit knowledge are crucial in the creation and re-use of knowledge and contribute positively to project success (Pretorius and Steyn, 2005), less articulated knowledge is difficult to diffuse among project personnel, and thus hinders the successful transfer and usability of knowledge (Cummings and Teng, 2003; Fernie et al., 2003). Codification and personalisation are the two strategies used by organisations to manage explicit and tacit knowledge respectively (Pretorius and Steyn, 2005; Kulkarni et al., 2007; Fong and Kwok, 2009; Anand et al., 2010; Horner et al.,

2014; Todorović et al., 2015). It is, therefore, *what the PMO does to knowledge (with different levels of articulability), through its supporting role*, that determines the usability or extent of use of the transferred knowledge. The proposed PMO's supporting model will assist PBOs in achieving a competitive advantage.

Table 1 Overview of cases investigated

<i>Case number</i>	<i>Division</i>	<i>Type of PMO (centralised or de-centralised)</i>	<i>No. of BUs supported by PMO</i>	<i>Lowest value of projects supported (US\$ – millions)</i>	<i>Highest value of projects supported (US\$ – millions)</i>	<i>*Age of PMO (Years)</i>
Case 1	Power and gas	De-centralised	3	0.3	142	4
Case 2	Energy	De-centralised	6	0.3	59	6
Case 3	Mobility	De-centralised	1	2.7	267	3
Case 4	Industry	De-centralised	6	0.1	84	4
Case 5	Power generation services	De-centralised	1	0.3	50	12

<i>Case number</i>	<i>*Experience of PMO manager (Years)</i>	<i>No. of project directors</i>	<i>No. of senior PMs</i>	<i>No. of PMs</i>	<i>*PMO head count</i>	<i>No. of current projects</i>
Case 1	10	2	2	2	7	10
Case 2	22	0	2	14	20	125
Case 3	14	1	0	6	12	7
Case 4	19	0	4	14	20	61
Case 5	17	0	3	6	10	9

Notes: Age of PMO, experience of PMO manager and PMO head count refers to the number of years that the decentralised PMO has existed; number of years of experience of the PMO manager in the project management industry; and the total number of employees reporting to the PMO, respectively.

3 Cases investigated

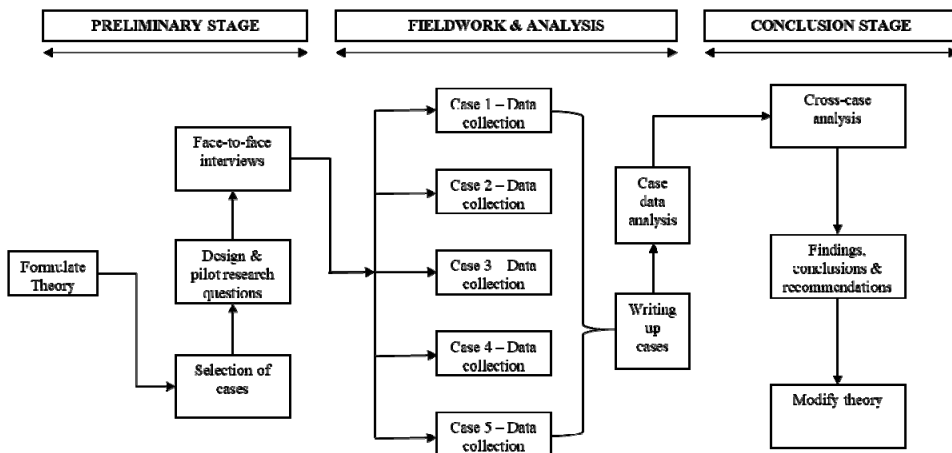
A multiple case study was conducted in a PBO based in South Africa and headquartered in Europe. The PBO was chosen as its set-up is most suited to assist in answering the research questions. The PBO has five divisions namely, *power and gas*, *industry*, *power generation services*, *energy and mobility*. Each division has various business units (BUs) ranging from 1 to 6, and a decentralised PMO. According to Curlee (2008) and the Project Management Institute (2017), a decentralised PMO is where project managers share responsibility with the functional managers for assigning priorities and for directing the work of individuals assigned to the project which supports the respective BUs of the division. The value of the projects executed by these various BUs range between 100,000 US dollars and 267 million US dollars. All five divisional PMOs are unique in their own way, from their age (ranging between 3 and 12 years), maturity, size and experience of the PMO manager's (ranging between 10 and 22 years) viewpoint as shown in Table 1, rendering the cases suitable for triangulation and multiple-case study analysis. Fifteen

respondents (three respondents per case) were interviewed. The questionnaire and demographic details of the respondents is shown in Annexure A and B.

4 Research design and methodology

As the research had to answer ‘why and how’ questions (Rowley, 2002; Yin, 2014; Rose et al., 2015; Yazan, 2015), and that the research involves purposeful use of describing, explaining and interpreting or analysing collected data (Williams, 2007) makes the study a qualitative work. A case study became an almost obvious research option since the objective was to comprehend a modest scale research project based on the workplace (Rowley, 2002; Yin, 2014). Although case study research remains contentious for both theory building and theory testing, various researchers (Eisenhardt, 1989, 2010; Rowley, 2002; Flyvbjerg, 2011; Yin, 2014; Rose et al., 2015) provided significant evidence that case study research can be very handy, especially where quantitative evaluations or investigations are not feasible. The application of multiple sources of information such as interviews, archival documents, observations and physical artefacts allows for effective triangulation of findings (Yin, 2014). Building from Yin’s (2014) multiple case study protocol and Eisenhardt’s (1989) process of building theory from case study research, the multiple-case and holistic design (Yin, 2014) has been adopted. The research built on the strength of case study research while their weaknesses (Eisenhardt, 1989; Moody, 2002; Rowley, 2002; Yin, 2014; Rose et al., 2015) were circumvented by implementing countermeasures established after the results of the pilot case study that was conducted. The adopted multiple case study research methodology adapted from Seligman (2013) is shown in Figure 3.

Figure 3 Case study research methodology



Source: Adapted from Seligman (2013)

As shown in Figure 3, in the preliminary stage of the research, the theoretical framework was developed, decision taken on what and how many cases to investigate, and the case study procedure/protocol developed. To sharpen focus and test the effectiveness of the case study procedures, a pilot case study was conducted. The case study protocols were

then fine-tuned before interviews were undertaken. Data collection for all the five cases, case write-up and case data analysis were conducted during the fieldwork and analysis stage. A comparative analysis of all the cases was conducted and findings and conclusions drawn.

The unit of analysis of this research is a decentralised PMO. In-depth, semi-structured interviews with five PMO heads and two project managers or other senior project personnel from each PMO were carried out. The main aim was to reach both code saturation (range of thematic issues identified) and saturation of meaning (richly textured understanding of issues) (Hennink et al., 2017). Code saturation means researchers have ‘heard it all’, while meaning saturation is needed to ‘understand it all’ (Hennink et al., 2017). All interviews were conducted in line with the recommendations of Jacob and Furgerson (2012) and Crouch and McKenzie (2006), and recorded, transcribed and captured in *ATLAS.ti*, a computer-aided qualitative data analysis software (CAQDAS) application.

Data collection was underpinned by triangulation, case study database and chain of evidence (Rowley, 2002; Baxter and Jack, 2008), and overlapped with data analysis to speed up analysis and adjust where necessary as recommended by Eisenhardt (2010). Each case was analysed separately before a comparative analysis of all cases was conducted. Thereafter, an iterative process of comparing the emergent theories with the initial study propositions commenced. The analysis of the enfolding literature (Carlile and Christensen, 2005; Eisenhardt, 2010) paved way for the development of the supporting model and presentations of its limitations and opportunities for further studies.

5 Presentation and analysis of results

In this section, each case’s data is analysed based on examining, categorising and tabulating evidence to assess whether the evidence supports the initial propositions of the study or not and if there are any theories and/or patterns emerging. Codes linked to a theme for each case are noted for ease of comparison and analysis. A comparative analysis (cross-case analysis) per theme amongst the five cases is also conducted to identify trends, similar concepts and relationships. The search for similarities and patterns in seemingly different cases can lead to a more sophisticated understanding which often results in the development of new theories (Eisenhardt, 1989). As possible relationships emerge in some cases, they are tested in each of the other cases – replication logic (Eisenhardt, 2010). Once several relationships begin to emerge across most or all cases, underlying logical arguments are initiated. The generated codes and themes are shown in Annexure C.

5.1 *Creating awareness and importance of KT*

While the importance of KT within PBOs is regularly emphasised in the recent project management literature (Wu and Wang, 2006; Blumenberg et al., 2009), in practice, KT only takes place to a rather limited extent (Eslerod and Skriver, 2007). This necessitates the importance of the creation of awareness and importance of KT amongst project personnel for it to receive the priority it deserves. Most project personnel do not regard KT as an important function for the success of projects (Van Waveren et al., 2014). The creation of awareness and importance of KT by the PMO, through its supporting role,

could change this perception, thereby improving the transfer of knowledge between projects and ultimately, its usability. Once an awareness of KT and its importance has been created, the subsequent processes will be quite easy to accomplish. One way that the importance of KT could be emphasised is by demonstrating the link between KT and the success of the project(s) (Bellini et al., 2016) as well as the competitive advantage of PBOs through successful KT.

Due to their uniqueness and short-term orientation, projects face various obstacles in their KM and KT initiatives. After a project is completed, project teams are dissolved, with subsequent loss of capturing or transfer of the gained project knowledge (Lindner and Wald, 2011). In contrast to permanent organisations where departments and divisions act as knowledge silos, in temporary organisations routines and organisational memory hardly emerge (Lindner and Wald, 2011). It is these challenges that projects face that make the creation of awareness and importance of KT in PBOs a necessary exercise if competitive advantage is to be achieved. The results from the analysis of all five cases show that there is good corroboration both from a transfer method and activity/process point of view. All respondents emphasised on the importance of timeous project reviews, incentives and interaction with people in the creation of awareness and importance of KT. Showing project personnel benefits of KT is one of the effective ways to create awareness and importance of KT. This results in a flawless and sustainable KT as people are not forced to do it but do it for the sake of making their lives easy in the process.

Respondents from 4 of the 5 cases noted that training and assistance from experts, as well as mentoring/coaching and peer assistance, are also vital in the creation of awareness of the importance of KT. Without training, it will be difficult to get project stakeholders to fully understand the importance of KT. As an element of training, KT workshops were cited in three of the cases. Although management involvement and support were only cited in two cases, their importance cannot be over-emphasised. Top management support ensures the success and executability of any project and also includes the PMO's support role (Lee et al., 2012). Collaboration, best practice directory (standards and templates) and knowledge creation were cited in all five cases while timeous KT and knowledge alignment were cited in four cases. Three cases cited knowledge adapting and integration and effective application and sharing. These are core processes to aid the creation of awareness of the importance of KT, to support the transfer of knowledge.

5.2 Improving trust and reducing insecurity

There is a perception that transferring and sharing knowledge may lead to a loss of ownership and associated power (Alsharo et al., 2017). This increases insecurity and leads to hoarding of knowledge by project personnel. Trust is a complex construct made up of emotional, ethical and competence aspects (Hartman, 2000), and the foundation for KT (Fong and Kwok, 2009). It positively influences team collaboration (Alsharo et al., 2017), reduces insecurity amongst employees and often leads to effective KT (Bellini et al., 2016). Where trust is lost, collaboration is lost as well (Turner and Müller, 2004). Trust includes elements of risk, vulnerability, and uncertainty that team members must overcome to work collaboratively (Alsharo et al., 2017). It has many benefits to organisations such as increasing team productivity, facilitating the resolution of conflicts and disagreements, and improving effectiveness. In addition, trust supports the relationship between collaboration and team effectiveness (Alsharo et al., 2017). Trust

and the power of influence resides in relationships and not in individuals (Iqbal, 2013), therefore, the PMO need to focus on relationship building if trust and influence are to be improved. Establishing trust amongst project personnel is the responsibility of the PMO and a recipe for successful KT between projects and lasting synergy (Iqbal, 2013; Prinsloo et al., 2017). The PMO must build trust and credibility first before winning over their clients (projects). The PMO should provide clarity, be trusted and influence its clients for lasting synergies to be built (Iqbal, 2013). Effective communication builds trust while poor communication destroys trust (Turner and Müller, 2004). PMOs should therefore establish and use proper information and communication technology (ICT) as part of their KM infrastructure to communicate effectively, thereby supporting the transfer of knowledge between projects.

Building trust between project participants (PMO included) is essential for the improvement of KT (Bellini et al., 2016). However, despite its strong relevance, trust can be difficult to define, measure, and implement in practice because of its subjective and intangible nature (Bellini et al., 2016). A balance of frequent formal and informal communication reduces mistrust amongst project personnel and increases collaboration (Turner and Müller, 2004; Atkinson et al., 2006; Bond-Barnard et al., 2013). Such balanced communication should therefore be adopted by the PMO to boost their supporting role in KT. One-to-many communication is formal and creates mistrust, while one-to-one communication is informal and promotes trust and knowledge building (Bond-Barnard et al., 2013). This supports the notion that trust usually exists where informal communication is used (Turner and Müller, 2004). Since interpersonal trust is a prerequisite for KT (Ipe, 2003), and trust cannot be built over a short period of time (Atkinson et al., 2006) – contrary to projects that are temporary in nature, PMOs should consider existing relationships when designing a project team's composition. For successful KT, there must be trust amongst the transmitter, the supporter and the receiver. The supporter (PMO) should establish KM infrastructure and processes that close the trust deficit amongst all parties. These could include enabling relationships, storytelling forums/promoting conversations, communities of practice, town hall/roundtable/breakfast sessions and knowledge cafes (Duffield and Whitty, 2016). KT is most effective where trust and senior management support exist (Wong et al., 2020).

Respondents from all the five cases validated each other with respect to the PMO's supporting role in transferring knowledge with different levels of articulability at the right time, to the right recipients, to improve the usability of knowledge, through improving trust and reducing insecurity. Trust amongst various project team members determines the KT performance (Nielsen, 2005; Bellini et al., 2016; Higuchi and Yamanaka, 2017) and is essential for collaboration and corporation (Bond-Barnard et al., 2013, 2018). PMOs create an environment conducive for interpersonal trust – a prerequisite for KT (Fong and Kwok, 2009). The importance of human factors in the transfer of knowledge depends much on openness, trust, willingness to share and transparency (Gold et al., 2001; Perkins and Bennett, 2012; Ho and Wang, 2015). The improvement of trust and reduction of insecurity, based upon openness and transparency provides perfect conditions for KT (Bellini et al., 2016). These sentiments were echoed by the respondents of all five cases. Incentivising KT players also came out strongly in all the cases as respondents suggested that it would improve trust and reduce insecurity thereby ensuring that tacit and explicit knowledge is transferred and utilised.

Respondents from four cases cited management involvement and support, as well as mentoring/coaching and peer assistance, while respondents from the three cases

mentioned persuasion and team building through communal knowledge areas as transfer methods to be adopted by the PMO. Although only respondents from two cases named communities of practice and growing people/training, they were very direct and explicit on the contribution of these transfer methods in improving trust and reducing insecurity. Building trust, honesty, relationships and credibility, knowledge creation, and knowledge alignment through team meetings, teamwork and team building were cited by respondents of all five cases. The analysis of a series of lessons learnt in a sequence of projects can yield better performance of projects and leads to competitive advantage (Perkins and Bennett, 2012). Project team meetings create an interactive platform for project team members (Anand et al., 2010). It is therefore through these platforms that relationships and trust are built and improved. When trust is built, KT is improved (Bellini et al., 2016). Collaboration, effective application and sharing of knowledge and trust tend to reduce insecurity amongst project personnel and enable effective transfer of knowledge with different levels of articulability. While knowledge is managed through codification and personalisation (Liebowitz and Megbolugbe, 2003; Pretorius and Steyn, 2005), it is through the effective management of these strategies that trust is born. Trust in turn improves KT.

5.3 Creating a KT culture

Organisational culture consists of the beliefs, visions, values, assumptions and expectations of an organisation (Fong and Kwok, 2009) and is an enabler for effective KT (Schindler and Eppler, 2003; Lindner and Wald, 2011; Bellini et al., 2016; Louw et al., 2017). Its main elements are collaboration, trust and learning (Lee et al., 2012). Moreover, the success of partnering projects strongly depends on the creation of a shared collaborative culture between partnering organisations for effective KT since knowledge is embedded in cultures (Mowery et al., 1996; Simonin, 1999; Cummings and Teng, 2003; Nielsen, 2005; Julian, 2008; Duan et al., 2010; Bellini et al., 2016). There is a general consensus in the literature that organisational culture is one of the elements that affect successful KT (Adenfelt and Lagerström, 2006; Choi et al., 2008; Fong and Kwok, 2009; Shannak, 2009; Lee et al., 2012; Susanty et al., 2012; Duffield and Whitty, 2016). The organisational culture-KT enabling factor is built on the establishment of an appropriate culture that encourages individuals to create and share knowledge as well as defining what knowledge is valuable for the corporation (Adenfelt and Lagerström, 2006).

In their case study aimed at promoting KT among project managers, Eskerod and Skriver (2007) identified basic underlying assumptions in the PBO's culture that limit KT, and suggested that to promote KT, top management must focus on basic assumptions embedded in the organisational culture and not merely on direct KT between project managers. Gold et al. (2001) suggested that collaborative organisational culture and KM process capabilities directly affect KT effectiveness. The creation of a KT culture by PMOs makes the transfer of knowledge between projects a flawless and seamless process that does not require too much effort to implement. A strong KT culture can be achieved by openness, sharing stories and exchanging ideas, building relationships and communities, aligning culture and business, managing change and linking KT culture to organisational objectives (Duffield and Whitty, 2016). By investing in social structures [communities of practice meetings, storytelling forums, special interest groups and social

media (Yammer) subgroups] that enable KT, the PMO supports the transfer of knowledge with different levels of articulability (Duffield and Whitty, 2016). Culture and sub-cultures shape assumptions about what knowledge is worth transferring define relationships between individual and organisational knowledge, determine who controls and shares knowledge, create the context for social interaction, and shape the processes by which knowledge with different levels of articulability is created, legitimated and transferred in PBOs (Karlsen and Gottschalk, 2004). Karlsen and Gottschalk (2004) argued that most information technology (IT) projects could have been more successful if the organisation's culture supported the KT and sharing process. Therefore, a culture that supports KT is very important for project success (Owen et al., 2004) since total project success relates to how well the culture for KT is developed in the organisation.

A cross-case analysis of all the cases from a transfer method point of view shows that incentives, interaction with people and frequent/timeous project reviews were cited in all cases. This indicates that the PBO as a whole is strong in these transfer methods but does not necessarily mean that these are the fundamentals for every PBO. KT workshops, training and assistance from experts, and efficient and user-friendly knowledge repositories were cited in 4 out of the 5 cases. This indicates the uniqueness and independence of the divisional PMOs even though within the same organisation. An interesting and strong contradiction is that of the target setting method preferred by a respondent of one case. The respondent felt very strongly that persuasion sometimes does not work, especially where people have vast differences in opinions. Therefore, using some form of force through target setting could help in achieving the anticipated objective. However, respondents from four of the cases, and two other respondents from the fifth case, vividly denounced force and preferred either persuasion and/or incentivising project personnel to create a KT culture. Respondents from 2 out of 5 cases thought growing people/training and communities of practice would aid the creation of a KT culture which in turn supports the transfer of knowledge (with different levels of articulability) and the usability thereof. Although KT tools alignment, the fusion of KT into organisational policies and effectively applying and sharing were cited in only three cases, respondents who cited them came out very strong about them and regarded them as the core processes and transfer methods that aid the creation of a KT culture in PBOs.

5.4 Alignment of KM infrastructure to support KT

Organisational culture and structure, trust, ICT and management and employees' support are fundamental elements of KM infrastructure (Rowley, 1999; Knowledge Research Institute, 2000; Kasvi et al., 2003; Owen et al., 2004; Pretorius and Steyn, 2005; Lee et al., 2012). They are the backbone for KM as well as enablers of KT in PBOs (Cummings and Teng, 2003; Heisig, 2009; Lee et al., 2012; Jafari and Charband, 2016). The creation, establishing, availing and alignment of KM infrastructure, therefore, become critical if a successful KT is desired. Without the appropriate KM infrastructure, managing and transferring knowledge could be a nightmare. Therefore, the involvement of the PMO in establishing the required KM infrastructure is vital for successful KT. The PMO establishes structures and aligns KM infrastructure to ensure that knowledge with different levels of articulability is transferred at the right time, to the right recipients, to improve the usability of knowledge. The primary role of a PMO is to integrate, manage and improve the systematic interaction of KT infrastructure and processes within an organisation (Heisig, 2009). In this research, it is important that the role of the PMO in

establishing and aligning different KM infrastructure is explicitly outlined especially seeing that the 'one size fits all' approach does not work for tacit and explicit knowledge because of the vast differences in the level of articulability of the knowledge. Not only does KM infrastructure improve knowledge creation, it also improves the knowledge process capabilities including KT (Gold et al., 2001). This stresses the need for appropriate KM infrastructure for a successful transfer of knowledge with different levels of articulability.

Respondents of all the five cases cited frequent/timeous project reviews, interaction with people, collaboration and incentives as KM infrastructure needed to improve the transfer of knowledge. While post-project reviews offer PBOs an opportunity to systematically improve performance in subsequent projects (Liu and Yetton, 2007), frequent/timeous project reviews offer a further opportunity to learn both within a project, outside of the project, and to correct any shortcomings before they derail the progress of the project (Von Zedtwitz, 2002; Williams, 2004). Similarly, frequent/timeous project reviews offer an opportunity to learn and transfer knowledge between projects as echoed by respondents of all the cases. One way to persuade people into doing something is to show them the benefits that come with doing it. If project personnel, through the supporting role of the PMO, are shown the benefits of KT, they will be persuaded into practising and implementing successful KT. Incentivising people through financial and non-financial incentives is one of the supporting functions that the PMO can introduce to ensure effective KT.

Respondents from the 4 of the 5 cases all agreed that KT workshops, efficient and user-friendly knowledge repositories and training and assistance from experts form part of KM infrastructure that improves the transfer of knowledge between projects. KT workshops aid the transfer of both tacit and explicit knowledge depending on the presentation methods used in the workshop. For example, the use of presentation slides and the use of storytelling support the transfer of explicit and tacit knowledge, respectively (Anand et al., 2010). Respondents emphasised the need for the knowledge repositories to be readily available and/or accessible, user-friendly, and up to date to contribute to the improved KT. Training or assistance from subject matter experts does not only ensure that people stay up to date with the market and industry trends but also supports the transfer of both explicit and tacit knowledge (Argote and Ingram, 2000; Kaewchur et al., 2009).

Double fills/job rotation and shadowing, mentoring/coaching and peer assist, team building through communal knowledge areas, intranet availability and accessibility, and management involvement and support were corroborated by respondents from 3 of the 5 cases. After action reviews, communities of practice, internships, job aids, knowledge fairs/workshops, learning games, mentoring, on-the-job training, job rotation, job shadowing, exit interviews, storytelling and training are systematic approaches that aid the transfer of knowledge with different levels of articulability (Perkins and Bennett, 2012). Although respondents from 3 cases cited communities of practice, respondents from the other two cases mentioned that communities of practice are not possible since project teams are formed and stay together for a very short-term before moving to another project. From the respondents of all the cases, it can be seen that various approaches exist that the PMO can implement to ensure that knowledge (with different levels of articulability) is transferred to the right project, at the right time, to improve the usability

of the transferred knowledge. The alignment and prioritisation vary from organisation to organisation depending on the articulability of the knowledge in question.

5.5 Alignment of KM processes to support KT

KM processes are made up of creation capturing, transferring, and reusing (Kasvi et al., 2003; Liebowitz and Megbolugbe, 2003; Sokhanvar et al., 2014). KM infrastructure and processes are intertwined in the sense that, for KM processes to be effective there needs to be an appropriate KM infrastructure to support the KM processes. Like KM infrastructure, KM processes need to be aligned to the type and level of articulability of knowledge for them to be effective and improve the transfer of knowledge with different levels of articulability. The PMO's role is to integrate, manage, align and improve the systematic interaction of KT infrastructure and processes in a PBO (Heisig, 2009) to improve the transfer of knowledge with different levels of articulability.

The alignment of KM processes to support KT does not only improve KT but also ensures that the right KM infrastructure has been put in place by the PMO to support the transfer of knowledge with different levels of articulability and improve its usability. Respondents from all the 5 cases cited knowledge creation, timeous KT, and knowledge alignment through team meetings, teamwork and team building as KM processes that are used by the PMO to improve KT. Knowledge creation through lessons learnt is vital for PBOs to achieve competitive advantage. Without lessons learnt from other projects, PBOs would not have any relevant knowledge to transfer and face challenges in executing projects successfully. On the other hand, learning ensures that organisations stay abreast of the ever-changing project environment (Terzieva, 2014) to ensure that they do not become victims of change and to keep transferring the relevant knowledge. Respondents emphasised the need to transfer knowledge timeously since in most cases, projects require knowledge immediately and not at a later stage.

Knowledge alignment was noted by respondents as the most critical KM process undertaken by the PMO to ensure that knowledge with different levels of articulability is transferred at the right time and to the right recipient to improve its usability. Knowledge alignment is the principal goal of KM within a project and requires that they be congruent to produce successful business outcomes (Reich et al., 2014). KT happens through communication (Pretorius and Steyn, 2005) and the communication method is usually prescribed by the type of knowledge to be transferred (tacit and/or explicit). Without effective application and sharing, KT would not be successful as cited by the majority of respondents. However, too much detail, confidentiality detail and peculiarities of messages often hinder effective communication (Pretorius and Steyn, 2005), thus should be avoided wherever possible without compromising the knowledge protection protocols that could see organisations lose their competitive advantage. To increase the effectiveness of communication, organisations need to do away with centralisation as it prevents interaction and frequency of communication amongst project personnel of various BUs (Susanty et al., 2012).

6 Discussion

The PMO's supporting role in KT between projects is not a straightforward role as it involves embedding the following KT enablers to enable the transfer of knowledge with different levels of articulability:

- a the creation of awareness and importance of KT
- b establishment of trust amongst project personnel
- c creation of an organisational KT culture
- d interface management
- e integration, coordination and alignment of KM infrastructure and KM processes (Lindner and Wald, 2011; Lee et al., 2012).

Literature (Atkinson et al., 2006; Unger et al., 2012; Tshuma et al., 2018, 2020), and the results of this case study, support the proposition: *the PMO's supporting role assists in transferring knowledge with different levels of articulability at the right time, to the right recipients to improve the usability of knowledge.*

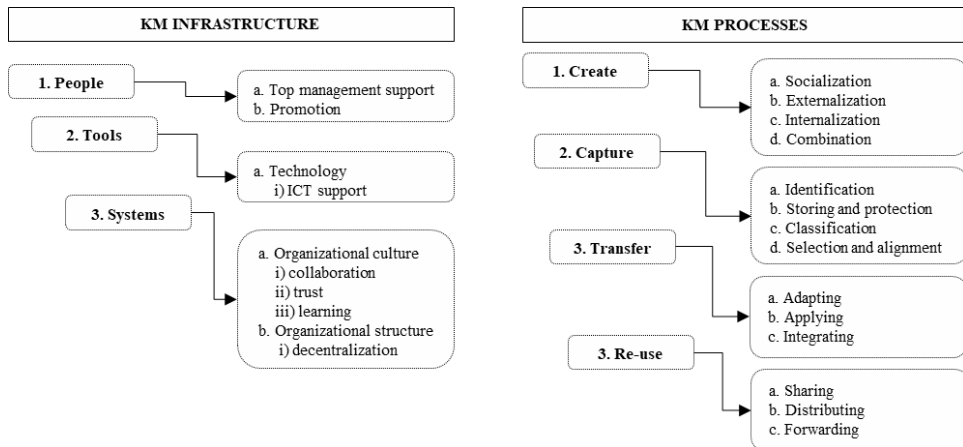
Other studies have investigated the KM infrastructure and processes as enablers of KT in isolation (Lee et al., 2012), whereas these cannot be separated as one affects the other. The challenge that most PBOs face is that most project team members focus on the short-term goals of the project(s) due to time constraints and fail to recognise and prioritise the importance of KT as an enabler of long-term benefits to the organisation (Van Waveren et al., 2014). To overcome this challenge, the findings of this study show that the PMO must embed KT enablers (creation of awareness and importance of KT, establishment of trust amongst project personnel, and creation of an organisational KT culture) into organisational routines, thereby making it compulsory, seamless and effortless for every project personnel to implement/practice these KT enablers. It is also very important to note that these KT enablers are enabled by KM enablers (KM infrastructure and processes) (Lee et al., 2012). Figure 4 shows an overview of the KM infrastructure and processes (confirmed by literature and the study findings) used by PMOs to support the transfer of knowledge with different levels of articulability to improve its usability.

The study findings show that the creation of awareness and importance of KT goes a long way in changing the mindset of project personnel including top management, and that the PMO is best positioned to establish a link between short-term and long-term objectives of the organisation as alluded to by Lindner and Wald (2011). There is consensus between research respondents and literature that the PMO should make use of the following to create a lasting awareness of the importance of KT within PBOs.

- a timeous project reviews (Newell, 2004)
- b financial and non-financial incentives (Rowley, 1999)
- c encouraging people by showing them the benefits of KT
- d training and assistance from experts
- e mentoring/coaching and peer assistance

- f KT workshops (Perkins and Bennett, 2012)
- g getting buy-in from top management (Lee et al., 2012)
- h collaboration with other stakeholders (Huang and Newell, 2003)
- i use of best practice directory/templates (Pollack, 2012)
- j lessons learnt and continuous learning (McClory et al., 2017)
- k fusion of KT into organisational policies
- l effective applying and sharing, and continuous integration (Pollack, 2012).

Figure 4 Overview of Km infrastructure and processes supporting KT



Although trust is a key enabler of KT and a crucial factor in forming and maintaining social relationships, Alsharo et al. (2017), state that building trust among project team members is a very challenging exercise. Trust impacts knowledge dissemination in projects (Prinsloo et al., 2017) and building trust between the project participants is essential for partnering success and it enhances KT (Bellini et al., 2016). The problem is further exacerbated by the fact that trust cannot be built over a short period of time whereas most projects usually have a short time span (Prinsloo et al., 2017). Therefore, the task of the PMO is to overcome these challenges, ensure that trust is improved, and insecurity amongst project personnel is reduced. The case study results show that improved trust and reduced insecurity can be accumulated through;

- a incentivising (financial and non-financial rewards) project participants. This supports the findings of Lee et al. (2012)
- b involvement of top management
- c persuasion
- d team building through communal knowledge areas
- e communities of practice
- f training and growing people

- g building honesty and credible relationships
- h team meetings and teamwork
- i clarification of roles and responsibilities, confirming findings of Terzieva (2014)
- j collaboration amongst various stakeholders
- k effective communication, confirming the findings of Bellini et al. (2016)
- l effective lessons learnt, confirming the findings of Duffield and Whitty (2016).

The research findings show that the effective implementation and management of these methods and processes by the PMO to improve trust and reduce insecurity support the transfer of knowledge with different levels of articulability to improve the usability thereof.

A study by Susanty et al. (2012) showed that KT effectiveness is influenced by organisational culture. The outcomes of the research show that cultivating the right organisational culture to encourage KT among project networks should be advocated by the PMO. The following initiatives aid the creation of a KT culture that, in turn, supports the transfer of knowledge with different levels of articulability, and the usability of the transferred knowledge as confirmed by the study findings.

- a incentives and interaction with people
- b frequent/timeous project reviews, confirming findings of Newell (2004)
- c KT workshops
- d training and assistance from experts, confirming the findings of Blumenberg et al. (2009)
- e efficient and user-friendly knowledge repositories, confirming the findings of Owen et al. (2004)
- f target setting
- g persuasion
- h communities of practice
- i best practice directory (standards and templates)
- j collaboration, and knowledge alignment through team meetings
- k teamwork and team building
- l alignment of KT tools
- m fusion of KT into organisational policies
- n effective applying and sharing, and integration.

Once the KT enablers have been embedded into organisational routines, the next hurdle will be to integrate and align KM infrastructure and processes to support the transfer of knowledge with different levels of articulability to improve its usability (Tshuma et al., 2020). The case study findings as well as established literature concur on the importance of KM infrastructure to support the transfer of knowledge with different levels of

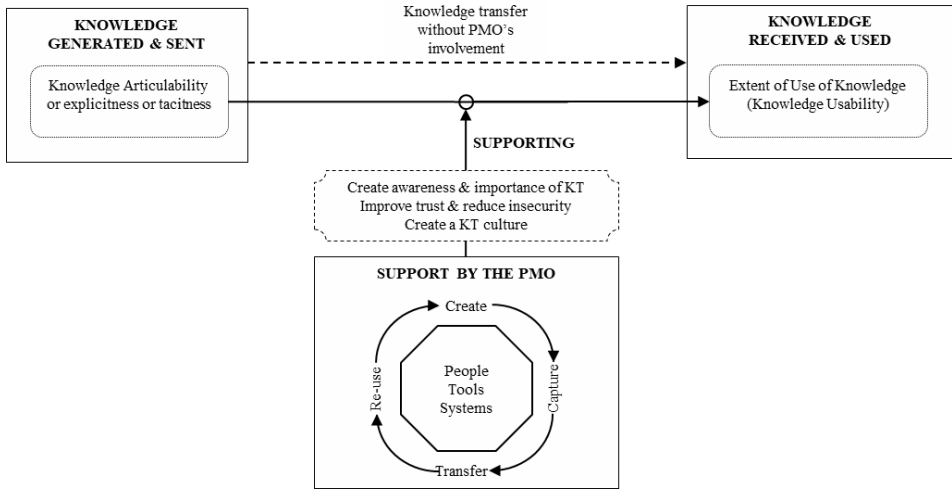
articulability to improve its usability. They show that the priority of the infrastructure to be established will vary from organisation to organisation and is dependent on the level of articulability of knowledge to be transferred.

Therefore, the PMO, through its supporting role, should use the following knowledge process capabilities to ensure knowledge with different levels of articulability is transferred at the right time to the right project, and protection to prevent abuse and retain a competitive advantage as also supported by the findings of Lee et al. (2012).

- a acquisition to enable knowledge retention
- b conversion to allow the present knowledge to be useful to PBOs
- c application to enable the realisation of a competitive edge
- d alignment to ensure the right KM infrastructure is assigned to the respective KM processes.

Based on the study findings, an updated model of the PMO's supporting role in the transfer of knowledge (with different levels of articulability) is presented in Figure 5. The model supports the proposition: *the PMO's supporting role assists in transferring knowledge with different levels of articulability at the right time, to the right recipients to improve the usability of knowledge.*

Figure 5 Updated model for the PMO's supporting role in transferring knowledge between projects



7 Conclusions

A model illustrating the supporting role of the PMO in the transfer of knowledge with different levels of articulability to the right recipient(s), at the right time, to improve its usability and create a competitive advantage for PBOs has been developed. Three KT enablers have been identified, namely:

- 1 creation of awareness and importance of KT
- 2 establishment of trust amongst project personnel
- 3 creation of an organisational KT culture.

It is proposed that these KT enablers be embedded into organisational routines to ensure a seamless and effortless KT process. Successful KT improves innovation, collaboration, and understanding in the business, and assists PBOs in attaining competitive advantage.

Through the use of KM infrastructure and process capabilities, the PMO integrates, manages, aligns and improves the systematic interaction of all the KT enablers to ensure that knowledge with different levels of articulability is transferred to the right recipient(s) at the right time to improve the usability of transferred knowledge. Various elements of KM infrastructure that aid the transfer of both tacit and explicit knowledge have also been identified. Knowledge creation, application, sharing, integration, adapting, alignment, classification, selection, and transfer have been identified as KM process capabilities needed to improve the transfer of knowledge with different levels of articulability to improve the usability of transferred knowledge. The findings of this study support the research proposition.

The study findings show that the PMO can be used as an instrument for organisational KT (De Lucca et al., 2020). The model should assist PBOs in successfully transferring knowledge with different levels of articulability to improve the usability of transferred knowledge. Such successful transfer of knowledge should create a competitive advantage necessary for PBOs to remain sustainable and competitive (Argote and Ingram, 2000; Argote et al., 2000; Susanty et al., 2012; Bellini et al., 2016; Tshuma et al., 2018). Van Waveren et al. (2014) indicated that most project team members focus on the short-term goals of the project, and often fail to see capturing and transferring project knowledge across projects as a priority, or as important for long-term benefits to the organisation. The model contributes to closing this gap between the short-and long-term objectives of projects.

The study is one of the first to examine the supporting role of the PMO in the transfer of knowledge, thus contributing to the practice of PMOs. For the practitioner involved in a PMO, this study presents a framework for the supporting role of the PMO in the transfer of knowledge with different levels of articulability to be considered for the improvement of the usability of knowledge. The study illustrates the merit of the PMO's supporting role in the successful transfer of tacit and explicit knowledge, to improve the usability of transferred knowledge.

The study has certain limitations. It does not compare KT in PBOs with a PMO and PBOs without a PMO. Although the model recognises that some KT takes place without the involvement of the PMO, the investigation of this process is beyond the scope of this paper. Further studies to adjust the model to include organisations other than PBOs, and studies to compare KT between PBOs with a PMO and PBOs without a PMO are recommended.

References

- Adenfelt, M. and Lagerström, K. (2006) 'Enabling knowledge creation and sharing in transnational projects', *International Journal of Project Management*, Vol. 24, No. 3, pp.191–198, DOI: 10.1016/j.ijproman.2005.09.003.
- Alsharo, M., Gregg, D. and Ramirez, R. (2017) 'Virtual team effectiveness : the role of knowledge sharing and trust', *Information & Management*, Vol. 54, No. 4, pp.479–490, Elsevier B.V., DOI: 10.1016/j.im.2016.10.005.
- Anand, G., Ward, P.T. and Tatikonda, M.V (2010) 'Role of explicit and tacit knowledge in Six Sigma projects: an empirical examination of differential project success', *Journal of Operations Management*, Vol. 28, No. 4, pp.303–315, Elsevier B.V., DOI: 10.1016/j.jom.2009.10.003.
- Argote, L. and Ingram, P. (2000) 'Knowledge transfer: a basis for competitive advantage in firms', *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp.150–169, DOI: 10.1006/obhd.2000.2893.
- Argote, L., Ingram, P., Levine, J. and Moreland, R. (2000) 'Knowledge transfer in organizations : learning from the experience of others', *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp.1–8, DOI: 10.1006/obhd.2000.2883.
- Atkinson, R., Crawford, L. and Ward, S. (2006) 'Fundamental uncertainties in projects and the scope of project management', *International Journal of Project Management*, Vol. 24, pp.687–698, DOI: 10.1016/j.ijproman.2006.09.011.
- Aubry, M. and Hobbs, B. (2010) 'A fresh look at the contribution of project management to organizational performance', *Project Management Journal*, Vol. 42, No. 1, pp.3–16, DOI: 10.1002/pmj.
- Aubry, M., Hobbs, B. and Thuillier, D. (2007) 'A new framework for understanding organisational project management through the PMO', *International Journal of Project Management*, Vol. 25, pp.328–336, DOI: 10.1016/j.ijproman.2007.01.004.
- Aubry, M., Muller, R., Hobbs, B. and Blomquist, T. (2010) 'Project management offices in transition', *International Journal of Project Management*, Vol. 28, No. 8, pp.766–778, International Project Management Association, DOI: 10.1016/j.ijproman.2010.05.006.
- Baxter, P. and Jack, S. (2008) 'Qualitative case study methodology: study design and implementation for novice researchers', *The Qualitative Report*, Vol. 13, No. 4, pp.544–559.
- Bell, L., van Waveren, C.C. and Steyn, H. (2016) 'Knowledge-sharing within the project-based organization: a knowledge-pull framework', *South African Journal of Industrial Engineering*, Vol. 27, No. 4, pp.18–33, DOI: 10.7166/27-4-1580.
- Bellini, A., Aarseth, W. and Hosseini, A. (2016) 'Effective knowledge transfer in successful partnering projects', *Energy Procedia*, The Author(s), Vol. 96, No. 1876, pp.218–228, DOI: 10.1016/j.egypro.2016.09.127.
- Blumenberg, S., Wagner, H. and Beimbom, D. (2009) 'Knowledge transfer processes in IT outsourcing relationships and their impact on shared knowledge and outsourcing performance', *International Journal of Information Management*, Vol. 29, pp.342–352, DOI: 10.1016/j.ijinfomgt.2008.11.004.
- Bond-Barnard, T.J., Fletcher, L. and Steyn, H. (2018) 'Linking trust and collaboration in project teams to project management success', *International Journal of Managing Projects in Business*, Vol. 11, No. 2, pp.432–457, DOI: 10.1108/IJMPB-06-2017-0068.
- Bond-Barnard, T.J., Steyn, H. and Fabris-Rotelli, I. (2013) 'The impact of a call centre on communication in a programme and its projects', *International Journal of Project Management*, Vol. 31, No. 7, pp.1006–1016, Elsevier Ltd. and APM IPMA, DOI: 10.1016/j.ijproman.2012.12.012.
- Bresnen, M., Edelman, L., Newell, S., Scarbrough, H. and Swan, J. (2003) 'Social practices and the management of knowledge in project environments', *International Journal of Project Management*, Vol. 21, No. 3, pp.157–166.

- Carlile, P.R. and Christensen, C.M. (2005) *The Cycles of Theory Building in Management Research*, Working Paper.
- Carrillo, P.M., Robinson, H., Anumba, C. and Bouchlaghem, N. (2006) 'A knowledge transfer framework: the PFI context', *Construction Management and Economics*, October, Vol. 24, pp.1045–1056, DOI: 10.1080/01446190600799224.
- Chen, M., Huang, M. and Cheng, Y. (2009) 'Measuring knowledge management performance using a competitive perspective: an empirical study', *Expert Systems with Applications*, Vol. 36, No. 4, pp.8449–8459, Elsevier Ltd., DOI: 10.1016/j.eswa.2008.10.067.
- Choi, B., Poon, S.K. and Davis, J.G. (2008) 'Effects of knowledge management strategy on organizational performance: a complementarity theory-based approach', *International Journal of Management Science*, Vol. 36, pp.235–251, DOI: 10.1016/j.omega.2006.06.007.
- Crouch, M. and McKenzie, H. (2006) 'The logic of small samples in interview-based qualitative research', *Social Science Information*, Vol. 45, No. 4, pp.483–499, DOI: 10.1177/05390184060069584.
- Cummings, J.L. and Teng, B. (2003) 'Transferring R&D knowledge: the key factors affecting knowledge transfer success', *Journal of Engineering Technology Management*, Vol. 20, pp.39–68, DOI: 10.1016/S0923-4748(03)00004-3.
- Curlee, W. (2008) 'Modern virtual project management the effects of a centralized and decentralized project management office', *Project Management Journal*, Vol. 39, pp.583–596, DOI: 10.1002/pmj.
- Darling, E.J. and Whitty, S.J. (2016) 'The Project Management Office: it's just not what it used to be', *International Journal of Managing Projects in Business*, Vol. 9, No. 2, pp.282–308, DOI: 10.1108/IJMPB-08-2015-0083.
- De Lucca, T., Hinnig, P. and Dos Santos, N. (2020) 'PMO as a tool for the organizational knowledge management: case study in a project-based company of the sanitation service sector', *International Journal of Project Management*, Vol. 4, Nos. 1–2, pp.10–35.
- Desouza, K.C. and Evaristo, J.R. (2006) 'Project management offices: a case of knowledge-based archetypes', *International Journal of Information Management*, Vol. 26, No. 5, pp.414–423, DOI: 10.1016/j.ijinfomgt.2006.07.002.
- Dhanaraj, C., Lyles, M., Steensma, H. and Tihanyi, L. (2004) 'Managing tacit and explicit knowledge transfer in IJVs: the role of relational embeddedness and the impact on performance', *Journal of International Business Studies*, Vol. 35, pp.428–442, DOI: 10.1057/palgrave.jibs.8400098.
- Dietrich, P., Artto, K. and Kujala, J. (2010) 'Strategic priorities and PMO functions in project – based firms', *PMI Research and Education Conference*, pp.1–31.
- Duan, Y., Nie, W. and Coakes, E. (2010) 'Identifying key factors affecting transnational knowledge transfer', *Information & Management*, Vol. 47, Nos. 7–8, pp.356–363, Elsevier B.V., DOI: 10.1016/j.im.2010.08.003.
- Duffield, S.M. and Whitty, S.J. (2016) 'Application of the systemic lessons learned knowledge model for organisational learning through projects', *International Journal of Project Management*, Vol. 34, No. 7, pp.1280–1293, Elsevier Ltd. and Association for Project Management and the International Project Management Association, DOI: 10.1016/j.ijproman.2016.07.001.
- Dvir, D.O.V., Sadeh, A. and Malach-Pines, A. (2006) 'Projects and Project managers – the relationship between project managers' personality, project types and project success', *Project Management Journal*, Vol. 37, No. 5, pp.36–49.
- Eisenhardt, K.M. (1989) 'Building theories from case study research', *Journal of Management Review*, Vol. 14, No. 4, pp.532–550.
- Eisenhardt, K.M. (2010) 'Case study research', in *PMI Research and Education Conference*, Washington, DC.

- Eskerod, P. and Skriver, H.J. (2007) 'Organizational culture restraining in-house knowledge transfer between project managers – a case study', *Project Management Journal*, Vol. 38, No. 1, pp.110–122.
- Fernie, S., Green, S., Weller, S. and Newcombe, R. (2003) 'Knowledge sharing : context, confusion and controversy', *International Journal of Project Management*, Vol. 21, No. 3, pp.177–187.
- Flyvbjerg, B. (2011) 'Case study', in *The Sage Handbook of Qualitative Research*, 4th ed., pp.301–316, Sage, Thousand Oaks, CA.
- Fong, P.S.W. and Kwok, C.W.C. (2009) 'Organizational culture and knowledge management success at project and organizational levels in contracting firms', *Journal of Construction Engineering and Management*, Vol. 135, No. 12, pp.1348–1357.
- Gold, A.H., Malhotra, A. and Segars, A.H. (2001) 'Knowledge management : an organizational capabilities perspective', *Journal of Management Information Systems*, Vol. 18, No. 1, pp.185–214.
- Hartman, F.T. (2000) *Don't Park Your Brain Outside*, Project Management Institute, Newtown Square, PA, p.2000.
- Heisig, P. (2009) 'Harmonisation of knowledge management – comparing 160 KM frameworks around the globe', *Journal of Knowledge Management*, Vol. 13, No. 4, pp.4–31, DOI: 10.1108/13673270910971798.
- Hennink, M.M., Kaiser, B.N. and Marconi, V.C. (2017) 'Code saturation versus meaning saturation: how many interviews are enough?', *Qualitative Health Research*, Vol. 27, No. 4, pp.591–608, DOI: 10.1177/1049732316665344.
- Higuchi, Y. and Yamanaka, Y. (2017) 'Knowledge sharing between academic researchers and tourism practitioners : a Japanese study of the practical value of embeddedness, trust and co-creation', *Journal of Sustainable Tourism*, Vol. 25, No. 10, pp.1456–1473, Taylor & Francis, DOI: 10.1080/09669582.2017.1288733.
- Ho, M.H. and Wang, F. (2015) 'Unpacking knowledge transfer and learning paradoxes in international strategic alliances : contextual differences matter', *International Business Review*, Vol. 24, No. 2, pp.287–297, Elsevier Ltd., DOI: 10.1016/j.ibusrev.2014.08.002.
- Horner, B., Gemino, A. and Sauer, C. (2014) 'How knowledge management impacts performance in projects : an empirical study', *International Journal of Project Management*, Vol. 32, No. 4, pp.590–602, Elsevier Ltd., DOI: 10.1016/j.ijproman.2013.09.004.
- Huang, J.C. and Newell, S. (2003) 'Knowledge integration processes and dynamics within the context of cross-functional projects', *International Journal of Project Management*, Vol. 21, pp.167–176.
- Hurt, M. and Thomas, J.L. (2009) 'Building value through sustainable project management offices', *Project Management Journal*, Vol. 40, No. 1, pp.55–72, DOI: 10.1002/pmj.
- Ipe, M. (2003) 'Knowledge sharing in organizations: a conceptual framework', *Human Resource Development Review*, Vol. 2, No. 4, pp.337–359, DOI: 10.16309/j.cnki.issn.1007-1776.2003.03.004.
- Iqbal, A. (2013) 'Trust, credibility and relationships : the secret sauce for the successful PMO Why IT projects fail and some things to think about', *PM World Journal*, Vol. II, No. Xi, pp.1–11.
- Jacob, S.A. and Furgerson, S.P. (2012) 'Writing interview protocols and conducting interviews : tips for students new to the field of qualitative research', *The Qualitative Report*, Vol. 17, No. 42, pp.1–10.
- Jafari, N. and Charband, Y. (2016) 'Knowledge sharing mechanisms and techniques in project teams : literature review, classification, and current trends', *Computers in Human Behavior*, Vol. 62, pp.730–742, Elsevier Ltd., DOI: 10.1016/j.chb.2016.05.003.
- Julian, J. (2008) 'How project management office leaders facilitate cross-project learning and continuous improvement', *Project Management Journal*, Vol. 39, No. 3, pp.43–58, DOI: 10.1002/pmj.

- Kaewchur, O., Anussornnitarn, P. and Pastuszak, Z. (2009) 'The mediating role of knowledge sharing on information technology and innovation', *International Journal of Management, Knowledge and Learning*, Vol. 2, No. 2, pp.227–242.
- Karlsen, J.T. and Gottschalk, P. (2004) 'Factors affecting knowledge transfer in IT projects', *Engineering Management Journal*, Vol. 16, No. 1, pp.3–11, DOI: 10.1080/10429247.2004.11415233.
- Kasvi, J.J.J., Vartiainen, M. and Hailikari, M. (2003) 'Managing knowledge and knowledge competences in projects and project organisations', *International Journal of Project Management*, Vol. 21, No. 8, pp.571–582, DOI: 10.1016/S0263-7863(02)00057-1.
- Kerzner, H. (2006) *Project Management Best Practices: Achieving Global Excellence*, John Wiley & Sons, Hoboken, NJ.
- Knowledge Research Institute (2000) *Knowledge Transfer Processes*, Knowledge Research Institute, Inc. Texas.
- Kulkarni, U.R., Ravindran, S. and Freeze, R. (2007) 'A knowledge management success model : theoretical development and empirical validation', *Journal of Management Information Systems*, Vol. 23, No. 3, pp.309–347, DOI: 10.2753/MIS0742-1222230311.
- Lee, S., Gon Kim, B. and Kim, H. (2012) 'An integrated view of knowledge management for performance', *Journal of Knowledge Management*, Vol. 16, No. 2, pp.183–203, DOI: 10.1108/13673271211218807.
- Liebowitz, J. and Megbolugbe, I. (2003) 'A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives', *International Journal of Project Management*, Vol. 21, No. 3, pp.189–198, DOI: 10.1016/S0263-7863(02)00093-5.
- Lindner, F. and Wald, A. (2011) 'Success factors of knowledge management in temporary organizations', *International Journal of Project Management*, Vol. 29, No. 7, pp.877–888, IPMA and Elsevier Ltd., DOI: 10.1016/j.ijproman.2010.09.003.
- Liu, L. and Yetton, P. (2007) 'The contingent effects on project performance of conducting project reviews and deploying project management offices', *IEEE Transactions on Engineering Management*, Vol. 54, No. 4, pp.789–799, DOI: 10.1109/TEM.2007.906852.
- Louw, I.R., Steyn, H. and van Waveren, C.C. (2017) 'Inhibitors to the transfer of knowledge generated on projects : a case study within a construction company', *Journal of Contemporary Management*, Vol. 14, No. 1, pp.986–1010.
- Lubit, R. (2001) 'Knowledge management: the keys to sustainable competitive advantage', *Organizational Dynamics*, Vol. 29, No. 4, pp.164–178.
- Malone, D. (2002) 'Knowledge management a model for organizational learning', *International Journal of Accounting Information Systems*, Vol. 3, No. 2, pp.111–123.
- McClory, S., Read, M. and Labib, A. (2017) 'Conceptualising the lessons-learned process in project management: towards a triple-loop learning framework', *International Journal of Project Management*, Vol. 35, No. 7, pp.1322–1335, Elsevier Ltd and Association for Project Management and the International Project Management Association, DOI: 10.1016/j.ijproman.2017.05.006.
- Mezghani, E., Exposito, E. and Drira, K. (2016) 'A collaborative methodology for tacit knowledge management: application to scientific research', *Future Generation Computer Systems*, Vol. 54, pp.450–455, DOI: 10.1016/j.future.2015.05.007.
- Moody, D. (2002) 'Empirical research methods', *Research Methods Class*, (8, 15 & 22 March), pp.1–4.
- Mowery, D.C., Oxley, J.E. and Silverman, B.S. (1996) 'Strategic alliances and interfirm knowledge transfer', *Strategic Management Journal*, Vol. 17, No. S2, pp.77–91.
- Newell, S. (2004) 'Enhancing cross-project learning', *Engineering Management Journal*, Vol. 16, No. 1, pp.12–20, DOI: 10.1080/10429247.2004.11415234.

- Nielsen, B.B. (2005) 'The role of knowledge embeddedness in the creation of synergies in strategic alliances', *Journal of Business Research*, Vol. 58, pp.1194–1204, DOI: 10.1016/j.jbusres.2004.05.001.
- Owen, J., Burstein, F. and Mitchell, S. (2004) 'Knowledge reuse and transfer in a project management environment', *Journal of Information Technology Case and Application Research*, Vol. 6, No. 4, pp.21–35, DOI: 10.1080/15228053.2004.10856052.
- Pemsel, S. and Wiewiora, A. (2013) 'Project management office a knowledge broker in project-based organisations', *International Journal of Project Management*, Vol. 31, No. 1, pp.31–42, DOI: 10.1016/j.ijproman.2012.03.004.
- Perkins, R.A. and Bennett, F.L. (2012) *Knowledge Transfer Needs and Methods*, Alaska University Transportation Center, p.121.
- Pinto, A., De Matheus Cota, M.F. and Levin, D.G. (2010) 'The PMO maturity cube, a project management office maturity model', *PMI Research and Education Congress 2010*, Washington D.C., USA, pp.1–43.
- Pollack, J. (2012) 'Transferring knowledge about knowledge management: implementation of a complex organisational change programme', *International Journal of Project Management*, Vol. 30, No. 8, pp.877–886, Elsevier B.V., DOI: 10.1016/j.ijproman.2012.04.001.
- Powell, W.W., Koput, K.W. and Smith-Doerr, L. (1996) 'Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology', *Administrative Science Quarterly*, Vol. 41, No. 1, pp.116–145.
- Pretorius, C.J. and Steyn, H. (2005) 'Knowledge management in project environments', *South African Journal of Business Management*, Vol. 36, No. 3, pp.41–50, DOI: 10.1108/13673270910971897.
- Prinsloo, J.W., van Waveren, C.C. and Chan, K-Y. (2017) 'Factors that impact knowledge dissemination in projects', *South African Journal of Industrial Engineering*, Vol. 28, No. 1, pp.1–11, DOI: 10.7166/28-1-1566.
- Project Management Institute (2017) *A Guide to the Project Management Body of Knowledge PMBOK Guide*, 6th ed., Project Management Institute, Inc.
- Quintas, P., Lefrere, P. and Jones, G. (1997) 'Knowledge management : a strategic agenda', *Long Range Planning*, Vol. 30, No. 3, p.90252, DOI: 10.1016/s0024-6301(97)90252-1.
- Reich, B.H., Gemino, A. and Sauer, C. (2014) 'How knowledge management impacts performance in projects: an empirical study', *International Journal of Project Management*, Vol. 32, No. 4, pp.590–602, Elsevier Ltd., DOI: 10.1016/j.ijproman.2013.09.004.
- Rose, S., Spinks, N. and Canhoto, A.I. (2015) 'Case study research design', *Journal of Management Research*, Vol. 2, No. 4, pp.1–11.
- Rowley, J. (1999) 'What is knowledge management?', *Library Management*, Vol. 20, No. 8, pp.416–420, DOI: 10.1108/01435129910291175.
- Rowley, J. (2002) 'Using case studies in research', *Management Research News*, Vol. 25, No. 1, pp.16–27.
- Schindler, M. and Eppler, M.J. (2003) 'Harvesting project knowledge: a review of project learning methods and success factors', *International Journal of Project Management*, Vol. 21, No. 3, pp.219–228, DOI: 10.1016/S0263-7863(02)00096-0.
- Seligman, J. (2013) 'Dialectical inquiry – does it deliver? A user based research experience', *Qualitative Report*, Vol. 18, No. 39, pp.1–23, <https://doi.org/10.46743/2160-3715/2013.1462>.
- Shannak, R.O. (2009) 'Measuring knowledge management performance', *European Journal of Scientific Research*, Vol. 35, No. 2, pp.242–253.
- Shenhar, A.J., Dvir, D., Levy, O. and Maltz, A.I. (2001) 'Project success: a multidimensional strategic concept', *Long Range Planning*, Vol. 34, No. 6, pp.699–725, DOI: 10.1016/S0024-6301(01)00097-8.
- Simonin, B.L. (1999) 'Ambiguity and the process of knowledge transfer in strategic alliances', *Strategic Management Journal*, Vol. 20, pp.595–623.

- Sokhanvar, S., Matthews, J. and Yarlagadda, P. (2014) 'Importance of knowledge management processes in a project-based organization: a case study of research enterprise', *Procedia Engineering*, Elsevier B.V., Vol. 97, pp.1825–1830, DOI: 10.1016/j.proeng.2014.12.336.
- Spalek, S. (2004) 'How to facilitate the knowledge transfer', in *PMI® Global Congress 2014–EMEA*, Newtown Square PA: Project Management Institute, Dubai, United Arab Emirates.
- Spalek, S. (2012) 'The role of project management office in the multi-project environment', *International Journal of Management and Enterprise Development*, Vol. 12, No. 2, pp.172–188, DOI: 10.1504/IJMED.2012.047891.
- Susanty, A., Utami, N. and Yugi, M. (2012) 'Key success factors that influence knowledge transfer effectiveness: a case study of Garment Sentra at Kabupaten Sragen', *Procedia Economics and Finance*, The Authors, Vol. 4, pp.23–32, DOI: 10.1016/S2212-5671(12)00317-6.
- Szulanski, G. (2000) 'The process of knowledge transfer: a diachronic analysis of stickiness', *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp.9–27, DOI: 10.1006/obhd.2000.2884.
- Terzieva, M. (2014) 'Project knowledge management: how organizations learn from experience', *Procedia Technology*, Elsevier B.V., Vol. 16, pp.1086–1095, DOI: 10.1016/j.protec.2014.10.123.
- Todorović, M.L., Petrovic, D., Mihic, M., Obradovic, V. and Bushuyev, S. (2015) 'Project success analysis framework: a knowledge-based approach in project management', *International Journal of Project Management*, Vol. 33, No. 4, pp.772–783, DOI: 10.1016/j.ijproman.2014.10.009.
- Tshuma, B., Steyn, H. and van Waveren, C. (2018) 'The role played by PMOs in the transfer of knowledge between projects: a conceptual framework', *South African Journal of Industrial Engineering*, Vol. 29, No. 2, pp.127–140, DOI: 10.7166/29-2-1966.
- Tshuma, B., Steyn, H. and van Waveren, C.C. (2020) 'An exploratory case study to validate a method for investigating the role of PMOs in knowledge transfer', *South African Journal of Industrial Engineering*, August, Vol. 31, No. 2, pp.143–155.
- Tshuma, B., Steyn, H. and van Waveren, C.C. (2022) 'The mediation role of the PMO in the transfer of knowledge between projects – a case study of five PMOs', *International Journal of Managing Projects in Business*, Vol. 15, No. 1, pp.150–174.
- Turner, J.R. and Müller, R. (2004) 'Communication and co-operation on projects between the project owner as principal and the project manager as agent', *European Management Journal*, Vol. 22, No. 3, pp.327–336, DOI: 10.1016/j.emj.2004.04.010.
- Unger, B.N., Gemünden, H.G. and Aubry, M. (2012) 'The three roles of a project portfolio management office: their impact on portfolio management execution and success', *International Journal of Project Management*, Vol. 30, No. 5, pp.608–620, Elsevier Ltd. APM and IPMA, DOI: 10.1016/j.ijproman.2012.01.015.
- Van Waveren, C.C., Oerlemans, L.A.G. and Pretorius, M.W. (2014) 'Knowledge transfer in project-based organizations. A conceptual model for investigating knowledge type, transfer mechanism and transfer success', in *2014 IEEE International Conference on Industrial Engineering and Engineering Management*, Bandar Sunway, pp.1176–1181.
- Von Zedtwitz, M. (2002) 'Organizational learning through post-project reviews in R & D', *R and D Management*, Vol. 32, No. 3, pp.255–268, DOI: 10.1111/1467-9310.00258.
- Williams, C. (2007) 'Research methods', *Journal of Business & Economic Research*, Vol. 5, No. 3, pp.65–72.
- Williams, T. (2004) 'Identifying the hard lessons from projects – easily', *International Journal of Project Management*, Vol. 22, No. 4, pp.273–279, DOI: 10.1016/j.ijproman.2003.11.001.
- Wong, S.S.K., Cross, J.A. and Burton, C.M. (2020) 'A quantitative analysis of knowledge collaboration enablers for practicing engineers', *EMJ – Engineering Management Journal*, pp.1–13, Taylor & Francis, DOI: 10.1080/10429247.2020.1780840.

- Wu, J. and Wang, Y. (2006) 'Measuring KMS success : a respecification of the DeLone and McLean's model', *Information & Management*, Vol. 43, pp.728–739, DOI: 10.1016/j.im.2006.05.002.
- Yazan, B. (2015) 'Three approaches to case study methods in education : Yin, Merriam, and Stake', *The Qualitative Report*, Vol. 20, No. 2, pp.134–152.
- Yin, R.K. (2014) *Case study Research: Design and Methods*, 5th ed., Sage Publications Ltd., London, UK.

Annexure A

Table A1 Research questionnaire

<i>Research question (RQ)</i>	<i>Proposition (P)</i>	<i>Questionnaire (interview questions)</i>
RQ1: How does the PMO's supporting role helps in transferring knowledge with different levels of articulability to improve the usability thereof.	P1: The PMO's supporting role assists in transferring knowledge with different levels of articulability at the right time, to the right recipients to improve the usability of knowledge.	a How does the PMO's supporting role create awareness and importance of KT thereby supporting the transfer of knowledge with different levels of articulability to improve the usability thereof?
		b How does the PMO's supporting role improve trust and reduce insecurity amongst project personnel thereby supporting the transfer of knowledge with different levels of articulability to improve the usability thereof?
		c How does the PMO's supporting role create a KT culture to support the transfer of knowledge with different levels of articulability to improve the usability thereof?
		d How does the PMO use KM infrastructure (tools and techniques) and KM processes (create, store, share & apply) to ensure that knowledge with different levels of articulability is transferred at the right time, to the right recipients to improve the usability of knowledge?
		e In your opinion, how does the PMO's supporting role assists in transferring knowledge with different levels of articulability at the right time, to the right recipients to improve the usability of knowledge?
		f Are there any improvements that can be implemented by the PMO to ensure that knowledge with different levels of articulability is transferred at the right time, to the right recipients to improve the usability of knowledge? Please discuss and give reasons why these improvements will make the supporting effect of the PMO better.

Annexure B**Table B1** Details of respondents

<i>Case number</i>	<i>Division</i>	<i>Respondent number</i>	<i>Position</i>	<i>Experience</i>	<i>Highest qualification</i>
1	Power and gas	1	Project Director and Former PMO Manager	32 years	MBA
		2	Country Portfolio Manager	18 years	BSc Electrical Engineering
		3	Project Manager	12 years	BSc Electrical Engineering
2	Energy	1	PMO Manager	35 years	MBA
		2	Senior Project Manager	15 years	BSc Electrical Engineering
		3	Project Manager	9 years	BSc Electrical Engineering
3	Mobility	1	PMO Manager	28 years	MSc Electrical Engineering
		2	Senior Project Manager	17 years	MSc Project Management
		3	Commercial Project Manager	13 years	BCom Accounting
4	Industry	1	PMO Manager	21 years	MSc Civil Engineering
		2	Senior Project Manager	14 years	BSc Electronic Engineering
		3	Project Manager	8 years	BCom Financial Management
5	Power generation services	1	PMO Manager	24 years	BSc Electrical Engineering
		2	Senior Project Manager	27 years	BSc Electrical Engineering
		3	Project Manager	16 years	BSc Electrical Engineering

Annexure C**Table C1** Codes and themes generated

<i>Theme</i>		<i>Codes</i>	
1	Creation of awareness and importance of KT	a Supporting: activity/process: knowledge creation	i Supporting: transfer method: incentives
		b Supporting: activity/process: effective applying and sharing	j Supporting: transfer method: KT workshops
		c Supporting: activity/process: knowledge adapting and integrating	k Supporting: transfer method: management involvement and support
		d Supporting: activity/process: integration	l Supporting: transfer method: mentoring/coaching and peer assist
		e Supporting: activity/process: timeous KT	m Supporting: transfer method: people management (show them benefits)
		f Supporting: activity/process: knowledge alignment	n Supporting: transfer method: training and assistance from experts
		g Supporting: transfer method: collaboration	o Supporting: transfer method: best practice directory (standards and templates)
		h Supporting: transfer method: frequent/timeous project reviews	
2	Improving trust and reducing insecurity	a Supporting: activity/process: knowledge classification and selection	i Supporting: transfer method: growing people/training
		b Supporting: activity/process: effective applying and sharing	j Supporting: transfer method: incentives
		c Supporting: activity/process: knowledge adapting and integrating	k Supporting: transfer method: management involvement and support
		d Supporting: activity/process: knowledge creation	l Supporting: transfer method: mentoring/coaching and peer assist
		e Supporting: activity/process: knowledge creation and transfer	m Supporting: transfer method: openness and transparency
		f Supporting: activity/process: knowledge alignment	n Supporting: transfer method: persuasion
		g Supporting: transfer method: building trust, honesty, relationships and credibility	o Supporting: transfer method: team building through communal knowledge areas
		h Supporting: transfer method: communities of practice	p Supporting: transfer method: collaboration

Table C1 Codes and themes generated (continued)

<i>Theme</i>		<i>Codes</i>	
3	Creating a KT culture	a Supporting: activity/process: knowledge creation	l Supporting: transfer method: incentives
		b Supporting: activity/process: effective applying and sharing	m Supporting: transfer method: ICT
		c Supporting: activity/process: knowledge adapting and integrating	n Supporting: transfer method: intranet availability and accessibility
		d Supporting: activity/process: integration	o Supporting: transfer method: KT workshops
		e Supporting: activity/process: KT tools alignment	p Supporting: transfer method: management involvement and support
		f Supporting: activity/process: knowledge alignment	q Supporting: transfer method: people management (show them benefits)
		g Supporting: transfer method: best practice directory (standards and templates)	r Supporting: transfer method: persuasion
		h Supporting: transfer method: communities of practice	s Supporting: transfer method: target setting
		i Supporting: transfer method: efficient and user-friendly knowledge repositories	t Supporting: transfer method: Team building through communal knowledge areas
		j Supporting: transfer method: frequent/timeous project reviews	u Supporting: transfer method: training and assistance from experts
4	Alignment of KM infrastructure to support KT	k Supporting: transfer method: growing people/training	v Supporting: transfer method: collaboration
		a Supporting: transfer method: communities of practice	i Supporting: transfer method: KT workshops
		b Supporting: transfer method: double fills/job rotation and shadowing	j Supporting: transfer method: management involvement and support
		c Supporting: transfer method: efficient and user-friendly knowledge repositories	k Supporting: transfer method: mentoring/coaching and peer assist
		d Supporting: transfer method: frequent/timeous project reviews	l Supporting: transfer method: people management (show them benefits)
		e Supporting: transfer method: growing people/training	m Supporting: transfer method: physical engagement and involvement
		f Supporting: transfer method: incentives	n Supporting: transfer method: team building through communal knowledge areas

Table C1 Codes and themes generated (continued)

<i>Theme</i>		<i>Codes</i>	
4	Alignment of KM infrastructure to support KT	g Supporting: transfer method: ICT	o Supporting: transfer method: training and assistance from experts
		h Supporting: transfer method: intranet availability and accessibility	
5	Alignment of KM processes to support KT	a Supporting: activity/process: knowledge creation	d Supporting: activity/process: knowledge creation and transfer
		b Supporting: activity/process: effective applying and sharing	e Supporting: activity/process: knowledge alignment
		c Supporting: activity/process: knowledge alignment	f Supporting: activity/process: timeous KT