SEARCHING FOR KNOWLEDGE IN THE CONSTRUCTION EXTENSION TO THE PMBOK GUIDE (THIRD EDITION)

F. Zhang[1,2], J. Zuo[1], S. Pullen[1] and George Zillante[1]

[1]School of Natural and Built Environments, University of South Australia, Australia
[2] Kunming Metallurgy College
Correspond to Jian.zuo@unisa.edu.au

ABSTRACT: The application of knowledge management concepts as a way to improve project success is an emerging topic for project management researches around the world. The Construction Extension to the PMBOK® Guide Third Edition documents the knowledge and practices that are generally recognized as good practices for managing engineering and construction projects. However, it is not unusual to see that engineering and construction projects suffer from poor performance. Based on a critical literature review, a theoretical framework is developed for the application of knowledge management in engineering and construction projects. This framework is subsequently applied as a lens to examine the construction extension to the PMBOK® Guide, aiming to identify the key characteristics of knowledge management in this standard. This research also aims to highlight those aspects of the construction extension to the PMBOK® Guide that can be improved from the knowledge management perspective. Recommendations are made to improve this standard by means of applying knowledge management concept so that better project outcomes can be achieved.

Keywords: project management, knowledge management, PMBOK® Guide

1. INTRODUCTION

Project management (hereafter called as PM), as a relatively new profession, is becoming recognized by more practitioners and academics [1, 2]. One fundamental element of a profession is the ownership of a body of knowledge (hereafter called as BOK) that is distinctive to the professional group [3]. The bodies of project management knowledge (hereafter called as PMBOKs) focus primarily on what PM professionals need to know to perform effectively [4].

The PMBOKs is not the BOK. PMBOKs defines the project management body of knowledge as "all those topics, subject areas and intellectual processes which involved in the application of sound management principles to…… projects" [5]. In the past decades, PMBOKs, as a knowledge standard or guide with different models from each other [6], are developed around the world [7, 8]. PMBOKs have separate key attributes of objective, approach, content, and structure that determine the similarities and differences between various PMBOK documents developed by PM organizations [9, 10]. Majority of these studies focused on the identification of the body of knowledge which is the traits of the PM profession [11, 12].

2. PMBOKs and PM professional

The first PMBOK been published by PMI almost 15 years ago as a prerequisite for the development of a distinct project-management profession [10]. Since then, continuous efforts have been made to update the PMBOK® Guide, such as a retitling of the document, modifications to key definitions, a description of PM in terms of its component process, and recognition of the need for application-area extension [5]. In the meaning time, other bodies of knowledge of PM have been developed around the world, notably in the United Kingdom, Europe and Japan [4, P15]

The existence of various PMBOK documents with different structures and contents indicate that extensive researches have been conducted on what topics should be included in the PM, while this discussion may lead to a common PMBOK [9, 4]. PMBOK is increasingly recognized as one of the fundamental characteristics of PM professionalization.

However, a number of weaknesses exist in the previous studies on PMBOKs. Authors regarded the PMBOKs as a trait of PM profession that is forming across the world, whereas the literature basically dealt with the content, structure of PMBOKs and based their analysing on the purely subjective discussion and practice experience, not being guided by theory.

To fill this gap and to promote the further utilization of PMBOKs, this research selects the Construction Extension to the PMBOK® Guide (Third Edition) (hereafter called as EC-PMBOK) as an example to discuss the knowledge management practices in project management context. EC-PMBOK is selected in this research as the practices and management of construction projects [13] and EC-PMBOK is kept consistent with PMBOK® Guide in structure [14].

In particular, this research focuses on the following objectives:

- To identify knowledge characteristic of EC-PMBOK.

- To identify KM practices embedded within the EC-PMBOK.
- To evaluate the rationality of KM practices in EC-PMBOK from the KM perspective.

3. THEORETICAL FRAMEWORK

EC-PMBOK is a collection of knowledge of PM profession in the construction context. The PMBOK® Guide is considered as being consist of explicit, codified knowledge objects [15]. As the EC-PMBOK is the consistent with the PMBOK® Guide, this research adopts the Zack's knowledge principles to classify codified knowledge [16]. According to Zack, Knowledge is "we come to believe and value on the basis of the meaningfully organized accumulation of information (messages) through experience, communication, or inference".

Zack [16] Differentiated knowledge object from tacit or explicit objects:

- **Tacit knowledge** is subconsciously understood and applied, difficult to articulate, developed from direct experience and action, and usually shared through highly interactive conversation, storytelling, and shared experience.
- **Explicit knowledge** is more precisely and formally articulated, although removed from the original context of creation or use (e.g. an abstract mathematical formula derived from physical experiments).

In addition, explicit knowledge objects are categorized into the following three types of knowledge [16]:

- **Declarative knowledge** is about describing something. A shared, explicit understanding of concepts, categories, and descriptors lays the foundation for effective communication and knowledge sharing in organization.
- **Procedural knowledge** is about how something occurs or is performed. Shared explicit procedural knowledge lays foundation for efficiently coordinated action in organization.
- **Causal knowledge** is about why something occurs. Shared explicit casual knowledge, often in the form of organizational stories, enables organizational to coordinate strategy for achieving goals or outcomes.

To analyze the EC-PMBOK, two amendments are made to Zack's knowledge framework in order to establish a knowledge classification framework. According to the definitions of the general knowledge and specific knowledge, we refer to Zack's "general knowledge" as the "project management knowledge", and refer to Zack's "specific knowledge" as the "construction project domain knowledge" in the context of project management, each type of knowledge is important to the successful completion of the project [15].

In this research, the following definitions are adopted:

- **Project management knowledge**: "Project Management Knowledge is the sum of knowledge within the profession of project management… (It) includes proven traditional practices that are widely applied, as well as innovative practices that are emerging in the profession, including published and unpublished material" [14, *p.3*].
- **Construction project domain knowledge**: Common knowledge and practices found in construction projects and generally accepted as "good practices" for ''most construction projects most of the time.'' [13, *P.3*]

In this research, Lubit's [17] classification and definition of tacit knowledge is selected to modify Zack's knowledge classification to extend the scope of identifying knowledge practices in the EC-PMBOK so that tacit knowledge is covered as well. In this research, tacit knowledge is classified into:

- **Procedure-based Knowledge** shows how something occurs or is performed, and cannot be fully explained in words;
- **Culture-based knowledge** includes the belief and value that shows us how the world is constructed, which elements are central, and how the parts are related;
- **Solution-based Knowledge** concerns how people approach problems;
- **Routines-based Knowledge** is usually included in organizational routines, and Routines solidify as standard operating procedures and roles are developed and enforced.

4. RESULTS:

A total of 340 objects were identified in EC-PMBOK. One object is identified as data, which is "6.3.2.3 Published Estimating Data". 8 objects are identified as information. 331 objects are identified as knowledge objects. The overall profile of the knowledge objects was:

- 150 Knowledge objects, found in PMBOK® Guide, can also be found in EC-PMBOK with changes, which are classified as construction project domain knowledge as containing both construction project domain knowledge and project management knowledge, accounting for about 45.3% of total knowledge objects;
- 62 knowledge objects, accounting for about 18.7% of total knowledge objects, are found in EC-PMBOK, which are classified as unique construction project domain knowledge objects;

- 119 knowledge objects, found in PMBOK® Guide, are found in EC-PMBOK without any changes, accounting for about 36% of total knowledge objects, which are classified as project management knowledge objects;

During the knowledge classification process, it is found that 159 knowledge objects are mainly explicit. 11 explicit knowledge objects are found in the tools and techniques of processes in EC-PMBOK whereas 148 knowledge objects are found in inputs and outputs in every process in EC-PMBOK. Table 1 shows the details of explicit knowledge objects found in EC-PMBOK.

Among 331 knowledge objects, 172 objects are tacit knowledge. 168 knowledge objects are identified in the tools and techniques of processes in EC-PMBOK, 4 tacit knowledge objects are found in inputs or/and outputs of processes in EC-PMBOK. The detailed summaries are showed in table 1.

	From EC-PMBOK	From Tools			From inputs or outputs		
		Count	Rate(of total EKO or TKO)	Rate(of Total knowledge Objects)	Count	Rate(of total EKO or TKO)	Rate(of Total knowledge Objects)
Explicit Knowledge Objects (EKO)	159	11	6.9%	3.3%	148	93.1%	44.7%
Tacit Knowledge Objects(TKO)	172	168	97.7%	50.8%	4	2.3%	1.2%

Table 1 the Details of Explicit and Tacit Knowledge Objects Separately from Tools and Inputs/Outputs

119 of total 331 knowledge objects are project management knowledge, and 212 of 331 knowledge objects are construction project domain knowledge.

As shown in Table 2, more tacit knowledge objects than explicit knowledge objects are found from project management knowledge.

	From EC-PMBOK	From PM knowledge			From Construction project domain knowledge		
		Count	Percentage (of PM Knowledge objects)	Percentage (of Total Knowledge objects)	Count	Percentage (of Construction Project Domain Knowledge	Percentage (of Total Knowledge objects)
Explicit Knowledge Objects (EKO)	159	52	43.7%	15.7%	107	50.5%	32.3%
Tacit Knowledge Objects(TKO)	172	67	56.3%	20.2%	105	49.5%	31.7%

Table 2 Details of Separately PM Knowledge Objects and Construction Project Domain Knowledge

5. DISCUSSION AND IMPLICATION

5.1. Project management Knowledge vs. Construction Project Domain Knowledge

A large number of knowledge objects are identified in the EC-PMBOK. These knowledge objects are classified as two groups, i.e. generic project management knowledge and construction project domain knowledge (See table 3). 119 knowledge objects are generic project management knowledge that can be applied in sectors other than the construction industry. 212 construction project domain knowledge are identified, of which 62 knowledge objects are not identified from the PMBOK. The rest of 150 knowledge objects are adapted from those located in the PMBOK. General project management knowledge of PMBOK® Guide extracted from different context is converted and adapted to construction context is usually addressed and described as "recontextualisation" [18, 19].

Source of knowledge objects	Number of knowledge objects
Generic project management knowledge	
Original objects from the PMBOK	119
Construction project domain knowledge	
Adapted from the PMBOK	150
Exclusively from the EC-PMBOK	62
Total	331

Table 3 Source and knowledge objects and numbers

The results showed that the EC-PMBOK contains a large proportion of construction project domain knowledge. This is consistent with the aim of EC-PMBOK which describes knowledge and practices that are ''generally accepted as good practices'' for

''most construction projects most of the time'' [14]. As an extension, this standard builds upon the PMBOK® Guide, by describing additional knowledge and practices with some modification.

These characteristics of EC-PMBOK provide constructive guideline for and the professional development of project managers in the construction industry, i.e.

- Project managers may be selected directly from team members with relevant experiences in the construction industry. Their construction-related technological experiences can shorten the time for them to become a competent project manager.

- It seems logical for project managers to learn from practices enacted within other industrial sectors which are especially prevalent amongst project managers in the construction industry [20]. However, the impact of construction context on learning of project management knowledge should be taken into consideration thoroughly.

- In terms of construction project management training, the training course focusing on the basis of the general project management knowledge is not sufficient. The training course should cover the construction context as well in order to fully meet the demands from potential project managers in construction industry.

5.2. Explicit Knowledge Vs Tacit Knowledge

In EC-PMBOK, almost all inputs and outputs are explicit objects except the enterprise environmental factors. There are 159 explicit knowledge objects in EC-PMBOK, which has strong emphasis on the creation and usage of explicit knowledge, such as plans documents as input or output in different process. The characteristic of EC-PMBOK is consistent with PMBOK® Guide which has strong emphasis on explicit knowledge according to [15]. With respect to explicit project management knowledge, the EC-PMBOK mainly consists of declarative and procedural knowledge—that is, what to do and how to do it. In its current form, little causal knowledge is contained—that is, why to do a particular process or action. It also does not give the project manager guidance as to "who" should be involved in project processes. Emphasis on the explicit knowledge in EC-PMBOK is helpful to sharing of construction project management knowledge in construction industry, which is reflecting the mainly American emphasis on the distribution and re-use of explicit knowledge in knowledge management literature [21].

Similarly, almost all tools and techniques are identified as tacit knowledge with implicit knowledge except for those showed in table 7. 172 tacit knowledge objects in EC-PMBOK are identified. Tacit knowledge mainly contains procedure-based and solution-based, that is, how something occurs or is performed and how people approach problems, only a few tacit knowledge contains routines-based knowledge and culture-based knowledge.

5.1.2.2 Templates, Forms, Standards\5.3.2.1 Work Breakdown Structure Templates\6.1.2.2 Templates\6.2.2.3 Schedule Network Templates
4.1.2.2 Project Management Methodology
4.1.2.1 Project Selection Methods
4.1.2.3 Project Management Information System
4.4.2.1 Project Management Methodology(changed)
4.4.2.3 Partnering
12.6.2.1 Closed Contracts
12.2.2.1 Standard Forms
6.7.2.2 Percentage Calculation
4.4.2.3 Partnering
4.3.2.4 Company Procedures

Table 7 Tools and Techniques Identified as Explicit Knowledge Objects

Majority of construction related literature made the assumption that knowledge can be codified, captured and manipulated (e.g. [22, 23, 24]). In fact, much effort has been expended on the codification of project management into "bodies of knowledge" [25]. Previous research on the PMBOK® Guide has reported that PMBOK® Guide has strongly emphasis on the explicit knowledge. However these studies examined inputs or outputs as knowledge objects, while the tools and techniques were not covered [26, 15, 27]. Whilst codified explicit knowledge may lend itself easily to sharing, the sharing of tacit knowledge is arguably a more importance to project management practicing. Most project managers would readily concede that there is little substitute for experience; thereby implying that knowledge derived from experience cannot easily be codified [18]. The knowledge contained in tools and techniques is such knowledge that cannot easily be codified. In this research, techniques and tools are examined, and identified as tacit knowledge, which indicates that the knowledge contained in the tools and techniques is personal. However, such knowledge is overlooked in the development of "Bodies of Project Management Knowledge". In this sense, this research highlighted a significant weakness in the EC-PMBOK.

6. CONCLUSION

The PMBOK® Guide emphasizes strongly on the explicit objects whereas the tools and techniques are not classified as knowledge objects [15]. It will be a same story for the EC-PMBOK if tools and techniques are not considered. However, if tools and techniques are examined as knowledge objects, almost tools and techniques are identified as being tacit. The management of such tacit knowledge residing within project team members involved in construction projects should be considered as an important issue that can be the key to sustainable competitive advantage of a project organization.

REFERENCES

[1] Morris, P.W.G., *The Management of Projects.* Thomas Telford, London, 1994.

[2] Webster, F.M., What project management is all about. In P.C. Dinsmore (Ed.), *The AMA Handbook of Project Management.* American Management Association, New York, 1993.

[3] Morris, P. W. G. et al., Research updating the APM Body of Knowledge 4th edition. *International Journal of Project Management*, 24, pp.461-473,2006.

[4] Stretton, A.M., Bodies of Knowledge and Competency Standards in Project Management. In *P.C.* Dinsmore (Ed.), A. Strtton (ED.), *The AMA Handbook of Project Management* (Second Edition). American Management Association, New York, pp.15-24, 2006.

[5] Duncan, W.R., Developing a project-management body-of-knowledge document: the US Project Management Institute's approach, 1983-94. *International Journal of Project Management,* 13(2), pp. 89-94, 1995.

[6] Morris, P. W. G. et al., Exploring the role of formal bodies o knowledge in defining a profession-The case of project management. *International Journal of Project Management,* 24, pp.710-721, 2006.

[7] Willis, B.E., APM-project-management body of knowledge: the European view. *International Journal of Project Management,* 13(2), pp. 95-98, 1995.

[8] Morris, P.W.G., Updating the project management bodies of knowledge. *Project management journal*, 32(3), p21, 2001.

[9] Wirth, I. and Tryloff, D.E., Preliminary comparison of six efforts to document the project management body of knowledge. *International Journal of Project Management,* 13(2), pp.109-118, 1995.

[10] Allen, W.E., Establishing some basic project-management body-of-knowledge concepts. *International Journal of Project Management* ,13(2), pp.77-82, 1995.

[11] Roach A.S.L. The professionalisation of social work? A case study of three organisational settings. *Sociology,*26, pp.23–43, 1992.

[12] Hugman, R., Professionalization in social work: The challenge of diversity. *Int Social Work,* 39, pp.31–47, 1996.

[13] The project Management Institute, *Construction Extension to The PMBOK® Guide* (Third Edition) Second Edition , 2007.

[14] The project Management Institute, *A Guide to the Project Management Body of Knowledge.* 3rd ed. Newtown Square (PA): Project Management Institute; 2004.

[15] Reich, B. H., & Wee S.Y., Searching for knowledge in the PMBOK® Guide.*Project Management Journal,* 37(2), pp. 11-16, 2006.

[16] Zack, M. H., Managing codified knowledge. *Sloan Management review*, 40(4) , pp.45–58, 1999.

[17] Lubit, R.(2001). Tacit Knowledge and Knowledge Management: The Keys to Sustainable Competitive Advantage. *Organizational Dynamics*, 29(4), pp. 164–178, 2001.

[18] Thompson, P., Warhurst, C., Callaghan, G., Ignorant theory and knowledgeable workers: interrogating the connections between knowledge, skills and services. *Journal of Management Studies,Special Issue: Knowledge Management: Concepts and Controversies 2001*;38(7):923−42, 2001.

[19] Hull, R., *Knowledge management and the conduct of expert labour.* In: Pritchard C, Hull R, Chumer M, Willmott H, editors.*Managing knowledge: critical investigations of work and learning.*London: MacMillan Press; 2000.

[20] Fernie, S., Green,S.D., Weller,S.J., Newcombe, R., Knowledge sharing: context, confusion and controversy. *International Journal of Project Management,* 21, pp.177−187, 2003.

[21] Cohen, D., Toward a Knowledge Context: Report On The First Annual U.C. Berkeley Forum On Knowledge And The Firm. *California Management Review,* 40(3), pp. 22-39, 1998.

[22] Egbu, C.O., The role of knowledge management and innovation in improving construction competitiveness. *Building Technology and Management Journal,* 25, pp.1−10, 1999.

[23] Kululanga, G.K., McCaffer, R., Measuring knowledge management for construction organizations. Engineering, *Construction and Architectural Management* ,8(5/6), pp.346−54, 2001.

[24] Kamara, J.M., Anumba, C.J., Carrillo PM. A CLEVERapproach to selecting a knowledge management strategy. *International Journal of Project Management,* 20(3), pp.205−11, 2002.

[25] Dixon M. *Project management body of knowledge. London*: Association for Project Management; 2000.

[26] Smith, B., & Dodds, R., *Developing managers through project-based learning.* Aldershot/Vermont:Gower. 1997.

[27] Reich, B. H. (2006). Managing knowledge learning in IT Project Management: A Conceptual Framework

and Guidelines for Practice. *Project Management Journal,* 38 (2), pp. 5-17, 2007.