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AN INVESTIGATION INTO THE TOOLS AND TECHNIQUES WITHIN THE PMBOK (4TH EDITION) THAT SUPPORT TRANSACTIVE MEMORY SYSTEMS

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ABSTRACT

Transactive memory is the process of using other people as external memory aids. Research indicates that transactive memory enhances several functions that improve project performance, such as knowledge transfer, knowledge integration, and knowledge coordination. The PMBOK is a leading text used to train and inform project managers. Surprisingly, a content analysis found that only 2 of 179 tools and techniques listed in the PMBOK (4th ed.) support the development and utilization of transactive memory systems. Based on an analysis of similar studies, it is argued that the practitioner literature for project managers should provide greater support for transactive memory systems. Accordingly, a process is proposed to develop personalized and codified transactive memory systems within project teams.

Keywords: Transactive Memory, Project Management, Knowledge Management

INTRODUCTION

Organizations increasingly use information technology (IT) projects to achieve organizational objectives. Although project management is a widely used methodology, the ability to execute IT projects remains elusive. Jørgensen and Moløkken Østold [12] found that IS projects overrun their budgets by 33% on average. Glen [9] states that "even by optimistic estimates, about 75% of projects are late, over budget, missing major functionality or canceled outright" (p. 39). Based on this research, IT projects continue to be a costly problem that merit research attention.

By their nature, IT projects are knowledge intensive activities [8]. The complexity of projects and the demands placed on project teams are expected to increase with time [33]. In order to achieve their goals, project teams need to manage knowledge effectively. The planned development and utilization of transactive memory systems (TMS) may improve project performance by increasing the knowledge management capabilities of project teams.

The literature provides theories, guidelines, and practices to assist project managers. One of the most prominent references used to train and inform project managers is the PMBOK (Project Management Book of Knowledge) [25]. A cursory review of the PMBOK [24] found that none of its 42 processes explicitly support TMS. These initial findings led to the following research question:

> To what extent does the PMBOK provide tools and techniques to increase the awareness team members have of the knowledge possessed by other team members?

To answer this question, I conducted a content analysis of the PMBOK [24] using the assistance of two experienced coders. The analysis found that 2 of 179 tools and techniques listed in the PMBOK support the development and utilization of TMS. An analysis of similar studies suggests the practitioner literature, as exemplified by the PMBOK, should provide greater support for TMS. Accordingly, I propose a process that is designed to develop personalized and codified TMS within project teams.

LITERATURE REVIEW

Transactive memory explains the process of people sharing the cognitive load of remembering expertise in dyadic relationships [31], groups [3; 10], project teams [25], organizations [11], distributed project teams [22], and virtual project teams [2; 13]. The theory of transactive memory extends the concept of memory beyond the traditional psychological perspective of memory being limited to an individual. Accordingly, transactive memory occurs when a person recalls and uses a memory stored by someone else [30].

Transactive memory is developed through social transactions—hence its name—where people learn about the expertise of other people [30]. During their interaction, people negotiate labels used to store and retrieve memories. The labels serve a function similar to an entry in an index.

The creation of shared labels among team members results in shared cognition [32]. By maintaining label and location information, a person can access memories stored by others. Wegner [30] describes the concepts of label and location information as meta memory, or memories of memories. The sum of meta memories provides the team members with a map of the knowledge and expertise held by other members within a team [7; 17; 17]. By maintaining markers on externally held expertise, a team member tracks knowledge resources that he or she may apply to achieve a goal.

According to Wegner [30], transactive memory provides several advantages. First, it extends individual cognitive capacities by providing organized access to the memories held by others. Second, it enables people to specialize, which enhances group functioning by allowing group members to focus on storing memories that align with their interests and talents. Third, the use of storing multiple memories under a single label provides a unifying view of expertise held within a team. Fourth, it facilitates analysis by clustering information, which results from the use of labels.

Transactive memory supports several functions that increase the performance and efficacy of project teams. Many studies found a causal link between transactive memory and project performance. For example, Moreland and Myaskovsky [18] studied 63 three-person teams and found that performance gains due to training resulted from improvements in transactive memory rather than from improved group communications. Ren, Carley, and Argote [26] developed a computational model to assess the relationship between transactive memory and team performance. They found that transactive memory reduced the group response time by decreasing the time it takes to find expertise. Oshri, van Fenema, and Kotlarsky [22] investigated the role of transactive memory in globally distributed teams using an interpretive case study approach. They uncovered evidence that indicates that transactive memory aids knowledge transfer and coordination despite time and space differences. Kotlarsky and Oshri [14] conducted an in depth ethnographic study of two successful enterprise resource planning (ERP) projects using globally distributed teams. They observed that transactive memory promotes knowledge coordination and collaborative work. Akgün, Byrne, Keskin, and Lynn [1] surveyed 79 new product development teams from 18 different firms. They found that transactive memory improves learning and reduces the time needed to develop new products and deliver them to market. Faraj and Sproull [7] collected data from a large scale technology firm. In total, they surveyed 333 respondents from 69 different project teams. They reasoned that knowledge coordination requires team members to be sufficiently familiar with the expertise of other team members. They also found that knowledge coordination is necessary to produce performance gains from the knowledge stocks held by firms. Lewis, Lange, and Gillis [16] performed a longitudinal study of 100, three-person project teams. The teams consisted of students that participated in the study for extra credit. They observed that transactive memory positively influences team learning and knowledge transfer. Wegner [30] reasoned that transactive memory extends individual capacity by leveraging other people as memory aids. An increase in the expertise available to the team as a whole, by virtue of transactive memory, would increase the team’s ability to assimilate knowledge [6]. In turn, the ability to assimilate knowledge would enhance the ability to transfer knowledge. Kanawattanchal and Yoo [13] studied 38 teams over an 8 week period and noted that transactive memory increased performance of virtual teams.

Since transactive memory promotes several functions that enhance the performance of project teams, transactive memory may be viewed as a “leverage” point for increasing team performance [28, p. 114]. The principle of a leverage point, as explained by Senge, is to locate and use tools and techniques that provide large returns from small inputs. As discussed previously, transactive memory strengthens many functions that enhance team performance, such as knowledge transfer, knowledge integration, and knowledge coordination. The promise that transactive memory provides for improving project performance motivates this study. Given the potential to improve the performance of project teams, it is expected that the practitioner literature would provide substantial guidance on developing and utilizing TMS. On the contrary, a review of the PMBOK failed to identify a single process out of the 42 processes that explicitly support TMS. This preliminary finding prompted a more detailed and rigorous analysis. This leads to the purpose of this study, which is to determine the extent to which the practitioner literature, as represented by the PMBOK [24], provides tools and techniques that support TMS.

OVERVIEW OF THE PMBOK

There are various texts used to inform and train project managers. One of the most prominent texts is “A Guide to the Project Management Body of

Knowledge (PMBOK® Guide) Fourth Edition" [24]. This work was selected as the focus of this analysis because it provides a recognized standard for the practice of project management [24], and it is considered to be "the most influential book in the field of project management" [25]. The guide traces its roots back to a paper that was published in 1983 that outlined the standards and ethics for the practice of project management [24]. Since that time, four editions of the PMBOK have been published.

The PMBOK is organized into 5 process groups, 12 knowledge areas, and 42 processes, as illustrated in *Figure 1*.

	Process Groups				
Knowledge Areas	Initiating	Planning	Executing	Monitoring and Controlling	Closing
04. Integration Management	1	1	1	2	1
05. Scope Management		3		2	
06. Time Management		5		1	
07. Cost Management		2		1	
08. Quality Management		1	1	1	
09. Human Resource Management		1	3		
10. Communication Management	1	1	2	1	
11. Risk Management		5		1	
12. Procurement Management		1	1	1	1

The number in the cells indicate the number processes per process group and knowledge area section. For example, there are 3 processes in the "Scope Management" and "Planning" section.

Figure 1. Summary of the Process Groups, Knowledge Areas, and Processes.

Each process consists of inputs, tools and techniques, and outputs. In total, there are 206 inputs, 179 tools and techniques, and 130 outputs associated with the 42 processes. A tool is defined as "[s]omething tangible, such as a template or software program, used in performing an activity to produce a product or result," [24, p. 443]. A technique is defined as a "systematic procedure employed by a human resource to perform an activity to produce a product or result or deliver a service, and that may employ one or more tools," [24, p. 443]. The tools and techniques intermediate the inputs and outputs. Since the tools and techniques provide the means, or "process," for achieving desired outputs, I reasoned they would primarily contain the codified guidance offered in the PMBOK. For that reason, they were selected as the unit of analysis for this study. At the discretion of the coder, the inputs, outputs, and other contextual material drawn from the PMBOK were used in assessing the purpose of a tool or technique. The inputs and outputs could have been included explicitly as units of analysis. I reasoned that including them would have distracted from the focus of the coders.

I located two studies that analyzed the content of the PMBOK [4; 25]. Besner and Hobbs [4] surveyed 953 practicing project managers to identify the most valued project practices. They limited their study to the tools and techniques in the PMBOK to ensure the participants understood the questions on their survey. They also noted that the tools and techniques express the practices used by project managers to transform inputs into outputs. Their study did not assess the existence of processes or tools and techniques within the PMBOK that support TMS.

Reich and Wee [25] performed a content analysis to determine the existence of knowledge management concepts within the PMBOK (3rd ed.) [23]. Specifically, they organized knowledge objects found in the PMBOK according to established knowledge management frameworks that they adapted for their study [19; 30; 32; 34]. They found that the PMBOK [23] was biased to explicit and declarative knowledge objects and largely overlooked tacit knowledge objects. Specifically, they found 48 knowledge objects within the PMBOK. Of those 48 objects they identified, Reich and Wee classified 47 as explicit knowledge objects, 0 as tacit knowledge objects, and 1 as a mixed knowledge object, which possessed both explicit and tacit components. They did not find a knowledge object that supported transactive memory.

Given the importance of locating expertise, they recommended the PMBOK could be improved by adding "a tacit knowledge object called a Knowledge Map, which represents an individual's understanding of who knows what within the team," [25, p. 24]. In comparison to the study performed by Reich and Wee, this study extends their study by examining a later version of the PMBOK. In addition, this study focuses on identifying the existence of tools and techniques that support transactive memory.

METHODOLOGY

A worksheet was prepared to facilitate the coding process. The worksheet stated the title of the tool or technique, listed the location of the tool or technique within the PMBOK, and provided check-boxes to record the coder's assessment. The form also provided comment boxes that allowed the coders to record comments and questions.

Two raters were chosen to code the tools and techniques. The raters were selected based on their experience and their familiarity with the PMBOK. Each rater had more than 15 years of project management experience, completed courses that covered the material in the PMBOK, and held current Project Management Professional (PMP) certification.

At the outset of the study, the coders were briefed on its purpose. The coders were provided with a definition of transactive memory, which was sourced from the literature [30]. The definition was also stated on the cover page of the coding worksheet. To ensure the coders had an understanding of the construct being measured and expectations of them, they were asked to code the first three tools and techniques and provide rationales for their decisions during their initial briefing. After the coders demonstrated a serviceable understanding of the exercise and the construct being measured, they were each given a worksheet to complete. The coders performed the coding exercise independently. An exit interview was performed with each coder after they returned their completed worksheet. Field notes of the briefings and exit interviews were maintained.

The results of the coding were transcribed into a spreadsheet for analysis. Inter-rater reliability was assessed using Cohen's Kappa (κ), which provides a more robust measure than percent agreement since it accounts for agreements that may occur by chance [5]. Inter-rater reliability was assessed as κ=0.797, which indicates substantial agreement between the raters [15].

***** Insert Table 1. here.**

Validity and reliability of the study were assessed. A study attains internal validity when it measures what it purports to measure and the evidence and interpretations are not biased. To ensure internal validity, the instrument used to code the data was evaluated by a disinterested third-party who possessed significant background in the disciplines of project and knowledge management. Based on feedback from the reviewer, the instructions were modified to increase their specificity. The value of Cohen's kappa relating to this study indicates significant objectivity [27].

External validity is achieved when the study generalizes to circumstances and contexts other than itself. Since this study is based on leading text that specifies the standards used by project managers world-wide [25], this researcher believes the study provides reasonable external validity. However, the reader is cautioned that the PMBOK is not the only standard provided to guide the practice of project management. For example, PRINCE2 also provides standard processes to enhance the practice of project management [20]. The reliability of the study was preserved by providing a structured methodology and by this researcher keeping field notes of the process and briefings he provided to the coders.

FINDINGS AND ANALYSIS

The content analysis uncovered two tools and techniques, "Organization Charts and Position Diagrams" [24, p. 220] and "Networking" [24, p. 222], that support TMS. However, during an exit interview with both raters, one coder stated that the tools and techniques they coded as supporting TMS were designed to support other functions within project management such as "assigning responsibility and developing trust," (Coder 2, personal communication, April 10, 2009). The other coder concurred with that position. In addition, they both agreed that the PMBOK should provide clearly defined tools and techniques that support TMS.

Reich and Wee argue that a knowledge map should appear in the PMBOK at least each time expert judgment is listed as a tool or technique, since a knowledge map would aid expert judgment. This provides a guide to assess the frequency a TMS tool or technique should appear. An examination of the PMBOK [24] shows that "expert judgment" is listed 19 times as a tool or technique. Based on this, an explicit TMS knowledge object should appear at least as many times. As indicated above, a TMS-related tool appears in the PMBOK [24] only two times. This suggests a significant gap between the support for TMS the practitioner literature should provide and what it does provide.

To address this gap, a process consisting of inputs, tools and techniques, and outputs for implementing TMS in project environments is offered. From prior studies, it is known that a TMS system is developed from social transactions, such as networking, team-building, and co-location [30]. It is also known that TMS may be enhanced using organizational process assets, such as organizational charts and resume and job description databases [22]. These inputs can then be converted into a coherent TMS through the tools and techniques of "develop a codified TMS" and "develop a personalized TMS." The existence of these activities ensures that the TMS develops in a structured and directed manner. Although it may be argued that a TMS may develop naturally over time, research indicates that knowledge integration and project team performance may be enhanced through intervention [21]. The outputs of this process would be a knowledge map [17; 25] and personal awareness of expertise held by others. A proposed process to support TMS is described in Table 2. Although this concept is based on an analysis of the literature, further research is recommended to develop an empirically grounded model of a process that efficiently and effectively supports TMS within project environments.

***** Place Table 2. here.**

CONCLUSIONS

A content analysis was performed, which found scant support for the development of TMS in the PMBOK [24]. Specifically, the analysis found that only 2 of 179 tools and techniques described in the PMBOK support TMS. An analysis of the literature suggests that there should be at least 19 knowledge objects that support TMS [25]. In addition, since an analysis of TMS in project environments indicates TMS supports many functions that improve the performance of project teams, such as knowledge transfer, integration, and coordination, TMS may be viewed as a point of advantage [28] to improve the practice of project management.

The findings of this study support a call for more research to explain the application of TMS to improve the performance of project teams. To further the dialogue along these lines, a model process to strengthen TMS in project environments was offered. Future research could empirically test that process, or a similar process, to determine its overall potential with respect to improving the practice of project management. In addition, further research could be conducted to determine the relative value of TMS compared to other tools and techniques already provided in the PMBOK. A study of this nature would extend the study conducted by Besner and Hobbs [4].

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Table 1.

Inter-rater Reliability Measurements and Data

Cohen's Kappa (κ)	Percent Agreement	Number Cases	Number Decisions	Number of Agreements	Number of Disagreements
0.797	99.4	179	358	178	1

Table 2.

Proposed Process to Develop a Personalized and Codified TMS

Inputs	**Tools and Techniques**	**Outputs**
• Organizational Process Assets (such as Organizational Charts, Responsibility Assignment Matrices, Resumes, and Job Descriptions) • Networking • Team-building Activities • Co-location	• Develop a Codified TMS • Develop a Personalized TMS	• Knowledge Map • Personal Awareness of the Expertise Held By Other Team Members