

An Analysis of Knowledge Management in PMBOK® Guide

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Introduction

PMBOK® Guide, as the very title of this book says, contains the basic, canonical knowledge pertaining to project management. This document may be analyzed from many points of view. The most important is its usefulness for the project management community – practitioners as well as methodologists. But PMBOK® Guide’s approach to knowledge is also worth analyzing, all the more as the time for developing the new edition of PMBOK® Guide is getting closer. This paper is devoted exclusively to the subject of knowledge management in PMBOK® Guide.

In the first chapter I analyze the very concept of knowledge in PMBOK® Guide 5th Edition – how it is defined. After that I analyze PMBOK® Guide project management activities. And I conclude with suggestions about the approach to knowledge management in future editions of PMBOK® Guide.

What is knowledge?

There is no explicit definition of the concept of knowledge in PMBOK® Guide. This is probably the biggest shortcoming of PMBOK® Guide in this area, the cause of most of the other mistakes, errors and inconsistencies. You cannot apply any concept correctly when you do not know what it is. In some places in PMBOK® Guide (like section 3.8 Project Information; see below) you may get the impression that their authors were afraid of defining knowledge precisely. But there are some statements which suggest the meaning that this concept has there.

Knowledge is not related to project information

There are sections that are new to PMBOK® Guide 5th Edition: 3.8 Project Information and X1.5 describing the well known DIKW (Data, Information, Knowledge, Wisdom) hierarchy in the project environment. PMBOK® Guide defines what work performance data and work performance information are, but instead of defining the third level of this hierarchy – knowledge – it suddenly defines “work performance reports”. So probably just these reports contain knowledge. Yes, the description of work performance reports (“information (...) intended to generate decisions or raise issues, actions or awareness”) reminds one of some definitions of knowledge, such as that knowledge is “the application and productive use of information” (Davis, Botkin, 1994). But we must note that, according to PMBOK® Guide, the third level of DIKW, originally intended for knowledge, has only “physical or electronic representation”. So there may be no knowledge residing in human brains, according to PMBOK® Guide (!). Another obvious weakness of this modification of the DIKW hierarchy is neglect of the fact that knowledge needed for project execution does not have to be created in a particular project. There are plenty of sources of external knowledge: written, stored in

repositories, brought into projects by their team members, without which execution of any project would be simply impossible.

On the other hand, there is no formal reference to knowledge (except in the explanation of the DIKW hierarchy on page 466). There is no sentence structured like “Knowledge is ...”. The readers have to induce that “work performance reports” are just knowledge by matching the DIKW hierarchy and the bullet points at the beginning of page 467. So, looking at the matter formally, data, information and reports are not related to knowledge, according to PMBOK® Guide. And “work performance reports” are described in section 3.8 titled Project Information, suggesting that they are a kind of information. Total chaos.

Knowledge is information

There are some phrases which suggest that knowledge in PMBOK® Guide is equivalent to information.

The most obvious evidence for this is perhaps the explanation of the content of Corporate Knowledge Base (2.1.4.2), in which it is explicitly stated that this is the “organizational knowledge base for storing and retrieving information (...)”. When talking about the corporate knowledge base, it worth noting that, according to PMBOK® Guide, it does not contain knowledge possessed by the organization’s staff. This is totally inconsistent with the overwhelming majority of current opinions expressed by theoreticians and practitioners of organizations, which assert the exact opposite: that human knowledge is one of the most important factors influencing any organization’s value.

In the definition of one part of organizational process assets, the input to process 4.6 Close Project or Phase is defined as: “(...) Historical knowledge and lessons learned knowledge base (e.g. project records and documents, all project closure information and documentation, information about both the results of previous project selection decisions and previous project performance information, and information from the risk management effort).” This means that knowledge is equivalent to information (a knowledge base, according to PMBOK® Guide, contains information).

The same may be found in point 4.6.3.2, where Organizational Process Assets Updates contain, among others, “**Historical information.** Historical information and lessons learned information are transferred to the lessons learned knowledge base for use by future projects or phases”.

In section 6.4.1.4 Resource Calendars it looks as if information is just a synonym of knowledge, these concepts being used interchangeably: “(...) Resource calendars specify when and how long identified project resources will be available during the project. This information may be at the activity or project level. This knowledge includes consideration of attributes such as resource experience and/or skill level (...)”.

All these statements and many others are evidence that knowledge is a synonym for information in PMBOK® Guide. This is inconsistent with current understanding of the “knowledge” concept, which generally treats knowledge as something substantially different from information (e.g., a discussion of the concept of knowledge that may be found in Jakubik, 2007). Karlsen and

Gottschalk (2004), for instance, define it as “information combined with experience, context, interpretation, reflection, intuition, and creativity”, just to give one of many definitions of knowledge. This definition seems to be adequate for the case of the lessons learned knowledge base: to treat it as knowledge one must compare historical information with the context of a certain project, the PM’s experience etc. And it is just on this basis that the right solution in a situation, for which knowledge is searched, may be developed.

Knowledge is more than information

But there are some places in PMBOK® Guide where knowledge is treated as something substantially different from information.

In the initial description of the Perform Quality Control process (8.3) one can read: “The project management team may have a working knowledge of statistical control processes (...).” And this looks like a reference to van Donk’s and Riezebos’ (2004) definition of knowledge, in which it is defined as “understanding plus the ability to transform it into actions (skills), which yields performance”.

In the definition of the Estimate Activity Resources (6.4) process it is stated that “[t]he requisite knowledge might be obtained by hiring a consultant, by sending designer to seminar on robotics, or by including someone from manufacturing as a member of the project team.” It really refers to knowledge possessed by people, which probably includes their experience, creativity and reflection.

And in section 7.4.2.2 Forecasting it is stated: “Forecasting the EAC involves making projections of conditions and events in the project’s future based on current performance information and other knowledge available at the time of forecast.” Here it looks as if information and knowledge are two different concepts.

In most cases the term “knowledge” in PMBOK® Guide refers to knowledge stored in repositories in codified form. But there is one place where personalized knowledge is explicitly referred to. This is the Develop Project Team process (9.3). Its objectives are, among others, “Improving knowledge and skills of team members (...)” and “Creating a dynamic and cohesive team culture to (1) improve individual and team productivity, team spirit, and cooperation, and (2) allow cross-training and mentoring between team members to share knowledge and expertise”. This is also a reference to the community perspective (Jakubik, 2007) on knowledge management.

Are procedures part of an organization’s knowledge?

Organizational Process Assets (2.1.4) are divided into two separate sections. Processes and procedures contain assets related to all projects performed in an organization. The second section, corporate knowledge base, contains knowledge produced by projects performed in the organization. This partitioning suggests that processes and procedures are not a component of the corporate knowledge base – but in fact this is one of the most important components of the base.

Does PMBOK® Guide contain knowledge?

But there are some statements which may make one doubt that PMBOK® Guide contains knowledge at all. Let us analyze where the PMBOK® Guide itself is, in its own estimation, located in an organization's project management environment.

As the name of PMBOK® Guide refers to knowledge, you will probably search for it in Corporate Knowledge Base (2.1.4.2). But this base contains information produced by previously executed projects, so PMBOK® Guide may not be placed there. According to its own definition, PMBOK® Guide should be classified as one of the Enterprise Environmental Factors (2.1.5), which include, among others, "government or industry standards (e. g., regulatory agency regulations, codes of conduct, product standards, quality standards, and workmanship standards)". But this is not a component of the corporate knowledge base as defined by PMBOK® Guide. An explicit reference to knowledge is made in one of the next bullet points, in which knowledge of human resources is mentioned. Probably, if an organization tailors and implements processes based upon PMBOK® Guide, they will be a part of processes and procedures (point 2.1.4.1), and yet this is not a component of the corporate knowledge base (point 2.1.4.2). So let us summarize. According to PMBOK® Guide, which claims to describe knowledge about project management, neither this document nor processes implemented in accordance with it are a part of the corporate knowledge base¹.

This inconsistency may be removed easily. In an often cited paper, Conroy and Soltan (1998) divide knowledge needed for project management into three parts:

- Organization Knowledge Base (peculiar to the organizational and industrial environment in which projects are executed),
- Project Management Knowledge Base (knowledge pertaining to the theory and application of project management, including methodologies, processes and procedures),
- Project Specific Knowledge Base (project specific knowledge (...) developed over the project life cycle).

It is easy to see that the first of these parts roughly corresponds to a part of PMBOK® Guide's enterprise environmental factors (2.1.5), the second – to the processes and procedures (2.1.4.1) of organizational process assets, and the third – to the corporate knowledge base (2.1.4.2). PMBOK® Guide's enterprise environmental factors contain elements which are not knowledge – like infrastructure or political climate. This was probably the source of the inconsistency described here: an attempt to treat knowledge as just any other resource. And this provides evidence that knowledge is a specific resource with specific processes, which may not be the same as any other processes.

¹ This is the second major internal inconsistency of PMBOK® Guide, together with the internally inconsistent definition of the very concept of a project (cf. Gasik, 2009).

Suggestions

A precise definition of the concept of knowledge and knowledge management should be placed in PMBOK® Guide and it should subsequently be used in a consistent manner. It is suggested that the definition of Karlsen and Gottschalk (2004) be used: knowledge is information combined with experience, context, interpretation, reflection, intuition, and creativity. Knowledge is more than information. But choosing any of many knowledge definitions is of less importance than using the chosen definition in a consistent manner.

The organizational knowledge base needed for project management should consist of three types of knowledge:

- Environmental knowledge (about the organization's internal and external environment),
- Procedural and methodological knowledge,
- Knowledge produced by the executed project.

How knowledge is managed

PMBOK® Guide deals with knowledge management but it does so in a timid manner. There are some organizational project assets, expert judgments and lessons learned stored as organizational project assets, which in fact belong to the area of knowledge management.

Not all processes require knowledge

Application of knowledge is sometimes referred to explicitly. For instance, in section 6.3.2.2. Discretionary dependencies it is stated that “[d]iscretionary dependencies are established based on knowledge of best practices within a particular application area (...).” Absence of direct reference to knowledge in other processes (there are indirect references through expert judgment) may create an impression that defining discretionary dependencies is just the technique for which some knowledge is needed, while in other processes it is not needed. This is not true. This shows that knowledge is treated in an inconsistent way throughout PMBOK® Guide.

Not all processes require PMBOK® Guide

PMBOK® Guide, according to itself, is an element of (2.1.5) Enterprise environmental factors, as it is one of “government or industry standards”. So the way to implement PMBOK® Guide's knowledge is to position enterprise environmental factors as input to a process. But these factors are input to only 18 processes. So the remaining 29 processes have no way to absorb PMBOK® Guide knowledge. Consequently, project management teams do not have to follow the structure or anything described in 29 PMBOK® Guide processes. PMBOK® Guide knowledge may be also implemented indirectly: processes (an element of organizational process assets) are defined on the basis of PMBOK® Guide and this knowledge is input to project processes. If we think this way, then PMBOK® Guide knowledge is input to processes which have enterprise environmental factors or organizational process assets. But even in this case there are only 36 processes which require PMBOK® Guide. So 11 processes do not require PMBOK® Guide

knowledge. It follows that those 11 (or 29) processes are useless and should be removed from PMBOK® Guide. OK, let's stop joking about the helplessness of the PMBOK® Guide team and the lack of real quality control in the project of developing this document. To guarantee PMBOK® Guide consistency, some general procedure, different from specifying enterprise environmental factors as input to each process, should be developed. Defining separate process delivery knowledge for each place in which it is needed may be an appropriate procedure here.

Where is knowledge created?

Sufficient attention is not paid to knowledge management in PMBOK® Guide. For instance, in the introduction to Direct and Manage Project Work (4.3) it is stated that its activities include collecting and documenting lessons learned. But knowledge is not mentioned as a resource which must be created. In the whole PMBOK® Guide there is nothing about knowledge creation by the project team, external experts nor by any other stakeholders. The only way to provide it to any activity is by expert judgment (as in the case of directing and managing project work), but it probably refers to **knowledge already possessed by experts**. This is inconsistent with the very definition of a project, which states that the goal of any project is to create something unique. And it is impossible to create anything unique without creating new knowledge. This is another internal inconsistency of PMBOK® Guide.

Knowledge management items

The three main items belonging in fact to the area of knowledge management in PMBOK® Guide are:

- Organizational process assets, containing, among others, the organizational knowledge base,
- Expert judgments,
- Organizational process assets updates.

There are also other items related to knowledge management, like facilitated workshops (5.2.2.3) or group creativity techniques (5.2.2.4), but let us focus on the above mentioned most often used items.

There are 47 processes in PMBOK® Guide. Organizational process assets are input to 34 of them. Expert Judgment technique is present in 21 processes. Organizational process assets updates are output of 13 processes.

For which processes are organizational process assets needed?

Organizational process assets (containing processes and procedures and corporate knowledge base) are input to 33 of 47 processes. It is not clear why they are absent from other processes. The first process for which organizational process assets are not input is 5.2 Collect Requirements. That may suggest that having defined processes and knowledge is not necessary for collecting requirements. It is hard to agree with this – collecting requirements is often a complicated task and analysts undergo long training in the ways of collecting requirements. The

processes of collecting and describing requirements are very important for project success and must be supported by corporate processes and knowledge of, for instance, ways of describing them or analyzing their consistency. Several standards (and CMMI® is probably the best example) devote much space to describing processes related to requirements. The same with 5.5 Validate Scope, from which organizational process assets are absent, too. The procedures for scope verification and acceptance are usually (e. g. in the construction sector) strictly formalized and procedures of verification are stored in organizations' repositories. The same considerations are valid for each process that does not have organizational process assets as its input.

Please note that absence of knowledge at input to any process is internally inconsistent with the PMBOK® Guide itself. All of the processes defined in PMBOK® Guide have been defined with the idea that they will be applied by projects. To put it in other words: those processes which do not have knowledge defined by PMBOK® Guide at input should be removed from this document, as there is no way of implementing this knowledge.

For which processes are expert judgments needed?

Expert judgment is another item (in exact terms: an element of tools and technique) from the domain of knowledge management, used for 19 of 47 processes. This is “judgment provided based upon expertise in an application area, knowledge area, discipline, industry etc. as appropriate for the activity being performed. Such expertise may be provided by any group or person with specialized education, knowledge, skill, experience or training” (p. 539). The first issue is the consistency of this definition with the definitions of PMBOK® Guide processes. If it may be provided to any (probably – precision is again lacking) activity, why is it mentioned explicitly only in 19 processes?

When analyzing the processes, the question arises: why is such judgment not explicitly required for the remaining 28 processes? Don't we need advanced knowledge and expertise for, say, 9.3 Develop Project Team? Or why is expert judgment not proposed for 10.1 Plan Communications Management? Or for 8.1 Plan Quality Management? Some people will tell you what will work and what will not, no matter which techniques are suggested by manuals. Concerning quality planning: on which basis you will select adequate techniques out of the 8 suggested by PMBOK® Guide? Will expert opinion be useless in this case? I claim that advice from knowledgeable persons may be helpful for each project management process. Moreover – knowledge is also needed for technical processes.

In my opinion, the definition of expert judgment placed in the glossary is better than placing this tool only in selected processes. So, to ensure consistency of its definition (in the glossary) with processes, we have two solutions. The first is to add the technique of “expert judgment” to all processes (but it is not elegant).

The second, much better, is to define a separate Knowledge Management Knowledge Area, where all of the processes related to knowledge management will be placed. This is similar to introducing, say, the Risk Management Knowledge Area, where all of the processes related to project risk management are grouped. Thus, risks related to each process need not be placed in either input or output of that process.

Where should organizational process assets be updated?

The third often applied item, which in fact belongs to the domain of knowledge, is organizational process assets updates. They are present in 13 out of 47 processes. They contain, among others, lessons learned. But this item covers any knowledge (more precisely: information which may be turned into knowledge) which may be useful for upcoming phases or projects – project files, project documents. And again a question arises: why may solutions developed in any process not be stored in the organization's knowledge repository? For instance, organizational process assets updates are not output from 5.3 Define Scope, nor the 4.2 Develop Project Management Plan process. According to the current version of project integration management, "historical information" from these processes is collected in the process 4.6 Close Project or Phase. But in practice it does not work. Close Project or Phase may be performed long after performing activities which created new knowledge – depending on the particular projects, it may be several months or even years. Team members who developed new knowledge might have quit the project team and be inaccessible for describing this knowledge. Even if they are still members of the project team, they may forget what they had done so long ago. One of the solutions for overcoming this problem might be to add the item of organizational process assets updates to each process. But the solution suggested by many authors (von Zedtvitz, 2002, Schindler and Eppler, 2003, Baird et al., 1999, or Kotnour and Vergoplia, 2005 may be mentioned here) is to implement a separate process of project knowledge review in order to collect new knowledge produced in any process. The ISO 21500 standard also suggests such a solution and it is worth noting that PMBOK® Guide is (or should be?) aligned with this document.

The other error related to updating organizational project assets in PMBOK® Guide is of typically process modeling methodological nature: how they may be updated, like in 8.2 Perform Quality Assurance, when they are not input to this process? An analogous comment is valid for other processes, like 9.3 Develop Project Team, where enterprise environmental factors are updated without having them on input to this process. Moreover, this eventually created new knowledge may not be used in any next execution of these processes – as organizational process assets (enterprise environmental factors) are not input to them. Putting organizational process assets only on output is useless.

When organizational process assets are only on input, the organization will not benefit from any improvements, as organizational process assets will not be updated. When organizational process assets are only on output – the organization will also not benefit, because there is no way to utilize newly created knowledge.

A complete solution for project knowledge management

You may solve many of the issues related to knowledge processing by adding organizational process assets as input, expert judgment as a technique and organizational process updates to each project management process. This may work, though I do not think it is an elegant solution. But there are issues which are hard to solve within the existing framework of PMBOK® Guide. Each project needs some amount of knowledge in order to be executed properly. So this knowledge must be deliberately defined in some process. Which existing PMBOK® Guide

process has a place for it? Communication processes? HR management processes? Scope processes? Integration processes? Probably none of them. Moreover: to initiate a project, an organization must have needed knowledge base. In the current structure of PMBOK® Guide there is no process capable of providing this knowledge.

There are six basic project knowledge management processes which must be present in each project. I describe them in the following sections². They are based on the full model of project knowledge management (Gasik, 2011).

Organizational Knowledge Analysis

Organizational Knowledge Analysis is the process aiming to define knowledge areas needed to perform a project. Knowledge about the internal and external environments, in which the project is to be executed, is collected. The project's statement of work is analyzed in order to identify project knowledge areas which define project knowledge scope. Knowledge resources possessed by the performing organization, in codified form as well as those possessed by organization members, are analyzed in order to compare them with the project knowledge scope. The next element of knowledge dealt with by this process is the knowledge about organization strategy that primarily covers its business goals. These components are used together in order to define Project Areas needed for project execution (Project Knowledge Areas, PKA). Lack of knowledge from one PKA does not have to preclude project execution – when the PKA is aligned with the organization's strategy, executing a project may be the way to acquire this knowledge. The definitions of Project Knowledge Areas are used later for defining the requirements for project staff. The main output of this process is Project Knowledge Scope – the description of the sum of project knowledge areas.

Project Understanding

Project understanding is the process of determining which knowledge will be necessary for execution of project work and documenting this knowledge. At the beginning of project planning some knowledge may be possessed by the executing organization, external sources of other knowledge may be known, and some knowledge may not exist at that time. The process of Project Understanding classifies needed knowledge into these three categories. The main output of Project Understanding is the Knowledge Breakdown Structure³ – a hierarchical description of knowledge needed for project execution.

Plan Knowledge Management

Plan Knowledge Management is the process of defining how to conduct knowledge management activities in a project. It describes activities needed to acquire existing (in a project

² The full proposal for Project Knowledge Management Area, defined on the basis of the 4th Edition of PMBOK® Guide, is available at <http://www.sybena.pl/dokumenty/PMBOK-project-knowledge-management-area-Gasik.pdf>.

³ The concept of Knowledge Breakdown Structure has been suggested to the author by Dr. David Hillson, the Risk Doctor.

team, in an organization performing a project and outside of it) knowledge, how to develop knowledge which does not exist and is necessary for project execution, and describes ways of retaining knowledge developed in a particular project for use in other projects. The main output of this process is a Knowledge Management Plan.

Knowledge Mobilization

Knowledge Mobilization is the process of providing a knowledge base for project execution. Potential sources of knowledge are searched for knowledge relevant to project execution. The aim of this process is to prepare the project team to perform activities and solve problems which will arrive during project execution. Knowledge mobilization usually provides more knowledge than will be needed for projects: it operates on the level of knowledge areas. Projects are unique endeavors and usually it is impossible to foresee what detailed knowledge will be needed by a project. After carrying out the knowledge mobilization process, the project team has a common knowledge base. Project staff is ready to work on developing detailed knowledge needed for carrying out activities and solving problems.

The Knowledge Mobilization process creates a potential of knowledge for a project. In many cases this knowledge is sufficient for executing project activities and is provided to persons or teams performing project works.

Knowledge Delivery

The goal of the Knowledge Delivery process is to provide needed knowledge to all project tasks. A task may be a product development or managerial activity, any risk, issue etc. In many cases it is sufficient to deliver knowledge collected or identified in the knowledge mobilization process. If this knowledge is not sufficient, new knowledge is developed for the task. Each task may require several items of knowledge (called micro-knowledge). The knowledge delivery process is performed separately for each such item of knowledge.

While the knowledge mobilization process deals with general knowledge needed for project execution, the knowledge delivery process is focused on particular knowledge needed to perform a particular project task.

Knowledge Summarization

The process of knowledge summarization, which aims to collect the knowledge produced by a project, is performed in all the other phases of project knowledge management. New knowledge may be developed in every project task, but as the project progresses there is more and more knowledge to collect. Project review is the most frequent technique used to collect new knowledge.

Summary

This paper analyzes the approach to knowledge management in PMBOK® Guide 5th Edition. The above examples of treating knowledge in PMBOK® Guide show that instead of systematizing this very important area, it introduces a kind of hodgepodge. There are several

areas of potential improvement to managing the most important project resource. The content of PMBOK® Guide should reflect the current state of knowledge about project knowledge management – or at least should not be contradictory to it. A precise definition of the concept of knowledge should be developed and consistently applied across the whole document. The knowledge possessed by an organization's personnel and project team must be considered the basic component, together with documented knowledge, of an organizational knowledge base. All project activities require input of knowledge, many of them develop new knowledge, and the new knowledge must become an organizational asset. In order to radically improve the quality of project knowledge management there are two options. The first is to add a knowledge management component to each existing management process. But this solution is not elegant, and what is more important, does not address several knowledge-specific issues, like mobilizing knowledge needed for a particular project as a whole, or collecting all the newly produced knowledge. So the paper describes briefly a holistic approach to project knowledge management – managing knowledge as a separate knowledge area.

The minimum of actions needed to improve the area of knowledge management in PMBOK® Guide is removal of all inconsistencies and introduction of precision into this document. But this will be very difficult without introducing a new, separate chapter on project knowledge management.

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