

# Effective Knowledge Management in Projects: Characteristics and Integration

Omar Alqaryouti    Adi Alqudah    Prof. Khaled Shaalan  
Faculty of Engineering & IT, The British University in Dubai, United Arab Emirates

## Abstract

The integration of effective Knowledge Management (KM) in projects is founded on numerous factors. These factors include available resources, KM tools, leadership, organizational culture, and project objectives and goals among others. It is very important to set priorities for these considerations and factors in order to ensure effective KM integration into projects. Despite the fact that Project Knowledge Management (PKM) is characterized by numerous beneficial implications, it is also associated with risks. These risks include potential delays in project implementation and budget deficits. The Project Knowledge Management Life Cycle (PKMLC) includes five main stages: the knowledge creation, knowledge storage, knowledge dissemination, knowledge learning, and knowledge improvement. Each phase is essential towards the attainment of overall efficiency in the integration of KM into projects.

**Keywords:** Knowledge Management (KM); Project Knowledge Management Life Cycle (PKMLC); Project Knowledge Management (PKM); Project Knowledge Management Integration (PKMI); Project Knowledge Management Risks and Mitigations; Project Knowledge Management Tools and Techniques.

## 1. Introduction

Projects play an integral role towards the attainment of organizational objectives and long-term goals. In the modern world, most organizations are increasingly aligned to Project Management (PM) whereby some are 100% project-based (Neumann and Tome, 2010). The extent to which projects are successful is dependent on numerous factors. Among these factors, KM is one of the outstanding influencers. KM encompasses the development and harnessing of knowledge and subsequent integration into the operational framework and decision-making systems of an organization. In recent years, KM has been widely employed in projects for numerous purposes. For instance, it serves as a platform on which project managers can identify and implement successful interventions for different problems encountered at different stages of project formulation and implementation (Project Management Institute, 2008).

In projects, KM is also important in that it goes a long way towards ensuring that the different project deliverables are achieved within the stipulated timeframe (Ghani, 2009). In essence, the difference between a successful and an unsuccessful project can always be partially or wholly linked to the extent to which KM has been integrated into the different stages or phases of PM. This emphasizes the importance of KM as far as project success is concerned. This paper will discuss the effective KM in projects with emphasis on characteristics and integration.

## 2. Literature Review

KM is an integration of various fields of study that does not deal with a single discipline; those fields of study deal with the aspect of using knowledge productively using practical examples as both an activity and an object (Ghani, 2009). KM involves the process of knowledge generation, changing it to useful information and transferring or sharing through different means. KM is important in enhancing organization productivity and performances of different departments; this is made possible by designing tools, innovating processes, developing systems and coming up with cultures that will contribute towards sharing of knowledge to help in decision making in the organization (Ghani, 2009). Most organizations are investing in sustainable resources that will help improve their businesses by identifying and sharing knowledge within different levels in the organization. However, the problem is that most of these organizations are faced by various challenges that make full and successful implementation of KM failure. Some of these challenges include lack of advanced technology, lack of suitable culture that governs the organization's implementation of KM process, lack of proper knowledge content, and lack of enough reasons to use PM approach in their projects (Ajmal, Helo and Kekale, 2010).

### 2.1. Project Knowledge Management Integration

The PKM process or life cycle refers to the different stages or phases that create the integration of KM into a project. The effectiveness of KM alignment and integration with a project is strongly dependent on the effective implementation of different phases of PKM life cycle.

Evans, Dalkir and Bidian (2014) came up with a simple and comprehensive model of a general KM life cycle model by integrating previous studies and models of KM processes. The KM model includes six phases: identify/create, store, share, use, learn, and improve. Identifying and creating knowledge are the initial processes

in the model which includes discovering existing knowledge sources inside or outside the organization, as well as identifying the concealed knowledge within data and information. The requirement of new knowledge is triggered by a request of creating new knowledge asset through practice, collaboration and expert interviewing, interaction, and technologies like idea management software, so the different knowledge types are shared and converted. Knowledge creation also includes creating new knowledge from existing knowledge. The second process is storing knowledge, which is involved in the analysis and assessment of the identified and created knowledge. The storing process results in classified, organized, archived and optimized knowledge which is easy to search and retrieve whenever required. Once the knowledge is created and stored, the knowledge can be disseminated and communicated internally within the organization or externally outside the organization through the knowledge sharing, which is the third phase of PKM. The knowledge sharing is about making the right knowledge available to the right people at the right time. This knowledge can then be available for use to support effective decisions, resolve problems, and encourage innovative thinking. Following the sharing and using knowledge, a major process involves the knowledge learning. The fifth process is the learning process which is involved in the identification of additional knowledge sources which empowers the employees' experience. The learning process is about identifying the gaps in knowledge and triggering the identification and processes creation to create new knowledge. The last process is knowledge improvement in which the knowledge is being refined and improved as a result of the learning process.

The key knowledge dimensions in projects consist of two main scales: Micro Knowledge, which is used to solve a problem or perform any specific task by a person. The second dimension is Macro Knowledge, which is the total knowledge that is required by the involved team members to execute a successful project and deliver a final product. Macro knowledge life cycle in project level includes four major phases: knowledge analysis, knowledge preparation, knowledge execution, and knowledge summarization. The knowledge analysis phase contains three main elements which involve the knowledge about the environment, knowledge about organization resources, and the knowledge about strategy and the organization business goals. The output of this phase is the project initiation (Gasik, 2011). The second phase is Knowledge preparation, is mainly concerned of project understanding and the related planning of KM, those sub processes that can be responsible in producing the plan of PKM. Project understanding can help in performing any specific tasks through Micro Knowledge. The Micro Knowledge can be addressed and combined to provide the Macro Knowledge to start the execution phase (Gasik, 2011). On the other hand, Beiryaei and Vaghefi (2010) believed that the first phase of the KM integration in projects is creation phase, and consider this phase as the most important phase in the KM integration in projects since it contains massive amount of created information. In the creation phase, the project managers prepare, define and create the project plan which guides both executing and controlling the project.

Gasik (2011) suggested that during the execution phase of a project, knowledge mobilization and development processes can be performed, so the team members with adequate knowledge can be assigned directly, while other team members with lower level of knowledge can be trained and guided to access the knowledge repository that can include manuals, articles, and lessons learned from previous projects. The target of knowledge development is to create specific knowledge that can help to solve the potential and expected problems during the execution phase. Conversely, Beiryaei and Vaghefi (2010) claimed that KM is accomplished through the following stages during the project execution phase: (1) Acquisition (2) Refinement (3) Storage. Knowledge will be enhanced due to the requirements defined in different areas project plan. Therefore, new knowledge is not created from scratch. The knowledge can be gained from multiple resources like the internal organization database, external databases, experts, benchmarking, standards and best practices. In the refinement and storage stages, knowledge is being codified and categorized to classify the knowledge in a way that can be stored to provide effective and organized KM that can be easily shared. Additionally, within the project execution phase, the knowledge share and transfer take place to ensure that the right individuals get the accurate knowledge whenever required (Beiryaei and Vaghefi, 2010).

Addressing the last phase, knowledge summarization can help in collecting the new knowledge that is produced and gained over the project phases, and is required in the project closure. Different techniques can be used in the summarization phase considering project review as the most used technique to collect the new knowledge and help to document it (Gasik, 2011). Similarly, in project closure and evaluation, enormous amount of information is brought up including but is not limited to: budget, time, resources knowledge, project deliverables, and other documents produced throughout the project (Beiryaei and Vaghefi, 2010).

Beiryaei and Vaghefi (2010) pointed out the importance of KM alignment with project PM, the reasons related to KM application in projects behind the failure of projects, and the most important of all the presence of a framework or a model that integrates the KM processes and PM processes.

## 2.2. Influencers

Many factors can affect the effectiveness of KM processes in any organization, especially the project based organizations (Zheng, Yang and Mclean, 2009). One of the most important factors is incentives factor.

Incentives can be addressed as an essential factor to discover, capture and share the knowledge within projects. Incentives can also help to enhance the level of sharing knowledge within an organization or project team which can improve the business processes of the whole organization. Lessons learnt is an example that can be shared with the team members at the last stage of any project (Ajmal and Koskinen, 2008).

As per a conceptual model that was developed by Ajmal, Helo and Kekale in 2009, incentives and technology are the most significant factors that impact the success of knowledge initiatives and leads to project based organizations. Such result is a finding for the examination of the developed conceptual model that contains six factors with an impact on KM leads and initiatives. These factors are: (1) Familiarity with KM: it is important to have a level of familiarity level of KM within the employees and departments to ensure the success of any KM initiative, (2) Coordination: Coordination between the project stakeholders is a key to motivate people to share the best practices and how it could be applied, (3) Incentives: it can be material reward like money or moral like considering added value of an employee. Many studies since 1998 consider the incentives as a major factor that influence knowledge initiatives (Davenport et al., 1998; Jarvenpaa et al., 1998; Liebowitz, 1999; Alavi and Leidner, 2001; Massey et al., 2002), (4) Authority: giving the power to the employee within an organization is important to enhance the knowledge discovery and capture processes, (5) System: Technology helps gain and maximize the value in capturing the knowledge, share it, and reuse it, and (6) Culture: in general, project teams involve experts and consultants from different countries and backgrounds; so, it is essential to understand the culture differences to ensure the effectiveness of the knowledge application.

On the other hand, some studies claimed that the influence of different cultures is the most significant factor in the success of projects knowledge sharing. However, the top management commitment systems and technology factors should be considered a very important factors to enhance the knowledge sharing and application in order to ensure PKM success (Lindner and Wald, 2010)

Moreover, lack of addressing the differences in culture of any project is considered a main factor for failure in knowledge initiatives. Moreover, the lack of technology and systems factor cannot be ignored and considered as a trivial issue in the terms of failure in KM initiatives. Such factors can lead to risks in any project or knowledge initiative and must be mitigated (Chua and Lam, 2005).

### 2.3. Risks and Mitigations

Risk Management turned to be a key factor in the organizations to be used to minimize the threats impact in the projects and maximize the possibility to capture opportunities that can be available through any project life cycle, specifically the IT project life cycle (Holsapple and Joshi, 2002). Through any project or initiative, it is possible to plan risk responses if the risks are known and analyzed. Whereas, unknown risks can turn to serious issues if the project team did not create a contingency plan to respond to those risks (Project Management Institute, 2008). KM can be the heart of the risk management strategy (Scott, 2002). As per Shaw (2005), Risk Management in projects can be related to KM in terms of data and information management and the risk knowledge sharing.

In 2012, Alhawari et al. developed a framework to explore the Risk Management field in relation with KM. The Knowledge Based Risk Management framework (KBRM) suggests a tool or instrument that can help to enhance the planning of the risk responses in IT projects. The instrument design was built based on the risk management processes and how they can be integrated to KM elements. The discussed RM processes and cycle include: (1) Risk Scope Establishment to identify the information systems and the related boundaries, the environment, key stakeholders and the main objectives, (2) Risk Identification that addresses the key risks that can impact the various cycles through a project (Project Management Institute, 2008), (3) Risk Analysis which is used to transform the risk data into information that helps in the decision making process (Higuera and Haimés, 1996), (4) Risk Response planning to help in producing actions and assign priorities for those actions based on the translation of risk information (Higuera and Haimés, 1996), (5) Risk Execution which is using different tools to mitigate the risks: risk reduction, risk avoidance, accepting the risk as a risk retention or risk transfer by passing the risk to another party to take the responsibility (Mees, 2007), and (6) Risk monitoring to monitor the risks, update the priorities and the required actions.

Returning to the proposed framework, the KBRM framework can produce the following knowledge elements based on the above mentioned risk management processes: (1) Knowledge Essentials, which contain Knowledge infrastructure concerned about the users and their relation with the knowledge sources. Knowledge essentials also include KM techniques to support the modeling of risk knowledge processes, (2) Risk capture-based knowledge is related to the risk scope establishment and identification processes that are focused to collect the tacit and explicit knowledge from the stakeholders in and outside the organization, (3) Knowledge risk discovery does also support risk scope establishment and identification processes, this help to develop the collected knowledge and help explore the tacit data and transform it to explicit one, (4) Knowledge risk examination focuses on the risk analysis to examine risk accuracy and data correctness through a project, (5) Knowledge risk sharing is focused on risk analysis and risk response planning processes; stakeholders can help to share their knowledge to mitigate any identified risks, (6) Knowledge risk evaluation is responsible to assess

the progress of risk execution which assists the level of accuracy in executed actions and plans, and (7) Knowledge risk repository concerns about the documentation of past experiences, forms, manuals, and lessons learnt. There should be an ongoing update process for the knowledge risk repository.

#### **2.4. Tools and Techniques**

The integration and sharing of KM in projects are accomplished through various tools and techniques. Technology is among the most notable tools for both sharing and integrating KM in projects. In essence, technology facilitates for the creation of knowledge through research and gathering evidences through practices of KM. Advancements in modern technology have been instrumental towards the enhancement of the effectiveness with which Knowledge Management is integrated into projects.

Rao (2012) asserted that one of the most important systems tools introduced by many of the companies is the Content Management Systems (CMS). CMS covers many areas in terms of internal and external knowledge of the organization, customer knowledge, business intelligence, web content, documents, manuals, news feeds, and workflow design. Organizations need to establish CMS that enhance the application of best practices, products knowledge, human resources knowledge, lessons learned from various projects.

Enterprise portals is a choice for e-workspace. The enterprise portals information technology (IT) platforms represent the main gate for the organizations systems, knowledge, wide range of applications, services, and can target multiple consumers at the same time. The enterprise portals from knowledge perspective provide single and central point of collaboration and interaction. The beauty of the enterprise portals is that it can provide knowledge regardless of the device used, location and time as a unified delivery channel. Enterprise portals can be customized to serve as knowledge portals with getting benefit of using the portal features that allows the user personalization, security, communication cross the media, and can be quickly adopted to any changes.

Ghani (2009) stated that KM is not a single exercise but more into integration with different fields of sciences; it comprises of several types of knowledge and each type has its own tool. Particularly, explicit knowledge can use system tools and data warehousing to facilitate knowledge sharing, while sharing tacit knowledge can be applied through video conferencing, and face to face meetings. Additionally, “know how” knowledge can be utilized through collaboration tools, and emails, whereas, know who can be used through Customer Relationship Management (CRM) tools, and social network analysis.

### **3. Discussion**

This study mainly focuses on proposing a conceptual framework that can be implemented. This framework is responsible for integrating the processes of KM with the process groups of PM. To come up with an integration and new framework, a review was conducted to identify the KM processes that can be integrated into PM processes. Additionally, another study was conducted to identify the process groups and the knowledge areas in each PM process group based on the Project Management Body of Knowledge (PMBOK), which is considered as the most well-known standard reference in PM. This new framework is discussed in this section.

PM processes are organized into five main groups that can be repeated in each project. These process groups are independent and can be used in any project regardless of its nature, such as IT Infrastructure, software development, construction projects, or marketing initiative.

These process groups cannot be considered as project phases but they split the project into five stages: (1) Initiation stage: that mainly focuses on addressing the main objectives of the project and the concerned stakeholders, (2) Planning stage: it is concerned mainly with the development of the project plan, addressing the scope of work (SOW), determining the budget and identifying the risks, (3) Execution stage: includes the execution of the project, performing the initial quality assurance processes that can help to identify more risks, and updating the existing risk log, (4) Control stage: used to control project schedule and cost and report the performance to the key stakeholders, and (5) Closing stage: focuses on the closing of the project and performing the required project paper work along with updating the collected knowledge repository (Project Management Institute, 2008).

The successful integration of KM in projects consists of five integrated phases, as shown in Figure 1, that is: Knowledge creation, Knowledge storage, Knowledge dissemination, Knowledge learning, and Knowledge improvement. These phases are discussed below.

The knowledge creation process is about discovering, identifying and analyzing knowledge sources to follow-up and closes the knowledge gaps. It also includes the acquisition and analysis of external knowledge sources. The knowledge is formalized and it has a significant value. The knowledge creation process takes places throughout the project initiation and partially in project planning. The initiation process involves building knowledge about the project and project resources by defining the project objectives, purpose, scope, and the expected deliverables. In the planning process, more knowledge processes and activities are performed to ensure successful effective delivery of the project or work product. The planning process comprises creating the project master plan that includes various plans such as scope, resource, quality, organization, risk, communication,



procurement, and socialization planning. These plans will help and guide the project team to build the required knowledge that helps through the execution and closure of the project. As stated in Project Management Institute (2008), the initiating process consists of the processes and activities to define a project to gain the authorization to commence the project, where the scope and resources are defined and committed. While, the planning process consists of establishing the overall scope, activity and resource (financial and human resources) estimates, Work Breakdown Structure (WBS), project plans, and produce project documents.

The Knowledge storage process is a pre-usage for knowledge. The knowledge storage process ensures that it is appropriately prepared in a way that can be retrieved and understood by the consumers. The knowledge storage necessitates proper organizing, classifying, mapping, indexing, and categorizing for apt navigation and retrieval. The knowledge storage process takes place in the planning process and throughout the execution process.

The Knowledge dissemination is about the recovery of the knowledge and making it accessible to the project team internally or the external stakeholders through the proper sharing channels. The knowledge dissemination process takes place throughout the execution process and in the control process. As discussed in the literature review, in the project execution process, the team members with adequate knowledge can be assigned directly, while other team members with lower level of knowledge can be trained and guided to access the knowledge repository that can include manuals, articles, and lessons learned from previous projects. The target of knowledge development is to create specific knowledge that can help solve the potential and expected problems during the execution phase (Gasik, 2011). Likewise, in Project Management Institute, (2008), the project execution process includes the activities and processes required to complete the tasks defined in the project plan to address the specifications of the project. The execution process comprises integrated and performed activities, resources coordination, manage project communication to distribute and manage stakeholder's expectations information, managing project quality, and conducting procurement according to the project plan. On the other hand, the project control process consists of monitoring and controlling the activities by tracking, reviewing, and regulating project progress and performance. The control process draws the project team attention to areas that may have issues or changes, and it monitors the entire project to implement corrective and preventive actions in terms of plans, changes, cost and time which needs to be distributed across the stakeholders.

The knowledge learning process is concerned about identifying the gaps and the development of new knowledge. The knowledge learning process is achieved through the continuous knowledge dissemination combination and conversion of different types of knowledge through user's interactions and collaboration practices and education over the project. This process triggers the knowledge creation process to create the newly identified and developed knowledge through the lessons learnt, gained experiences, new problems and solutions, brainstorming results, and enhancing the existing knowledge. Beiryaei and Vaghefi (2010) pointed out the importance of proper knowledge application in projects, and recognize the difficulties that come across project managers to apply knowledge in projects. Failure in applying knowledge in projects leads to knowledge, experiences, and the loss of lessons learnt during the implementation of projects. The knowledge learning process takes places throughout the project controlling and in project closure. The Project Management Institute (2008) advised to monitor and control project changes to come up with preventive actions that might be caused due to any potential problems.

The Knowledge improvement process goes hand in hand with the knowledge learning process in which the knowledge is being refined, enhanced, and improved. Similar to the knowledge learning process, the knowledge improvement process takes place throughout the project controlling and in project closure. This process determines the improvement areas of strategic and operational needs and changes with respect to KM to ensure proper availability, adoption and usage of revised knowledge with regards to the organization and future projects.

Through the study of different cases, it is obvious that culture, incentives, technology, and systems are the main influences of knowledge initiatives in projects and project based organizations.

Cash rewards that can recognize performance achievement of an Individual or group are one of the important types of incentives to motivate project team members to share knowledge, enhance their level of interest to contribute in the knowledge application and update the knowledge repository. Despite of the importance of cash rewards, a major attention should be drawn to the nature of human being and psychological needs.

The other angle is the self-esteem that is more concerned about the human needs to feel respected with their values and self-actualization as illustrated in Maslow's needs pyramid (Figure 2). Such psychological motivation factors provide a major impact on people with management level, where the monetary factor has no impact on them. Self-actualization can motivate business managers, project managers or lead consultants to capture, share and apply the knowledge through directions to other people within project or organization.

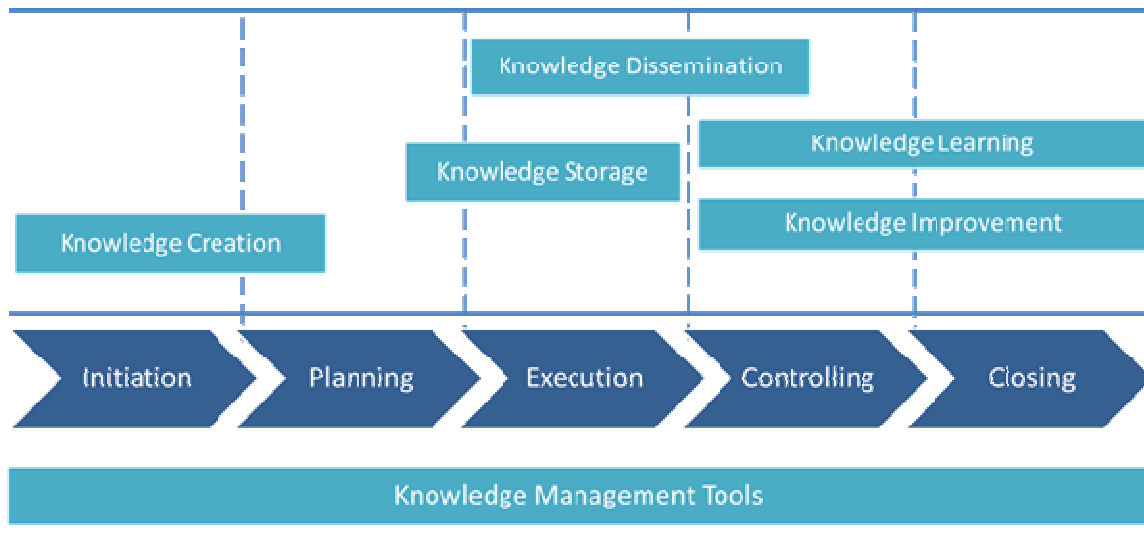


Figure 1: *Project Knowledge Management Conceptual Framework*

Apart from the incentives, no one can deny the importance of studying and addressing the cultural differences as a major factor that can impact the success in projects particularly IT projects. It normally contains team members from different countries and cultures with various backgrounds. Many IT companies rely on virtual team's model to provide different IT services and implement projects. Having an offshore hub of resources can help such IT companies to have various scales of experiences with less resources cost and prevent the cost of mobilizations.



Figure 2: *Maslow's Needs Pyramid*

As indicated by our review, the lack of technology factor has a major impact on the success of knowledge capture and transfer. Document and content management technologies can enhance the contribution of resources in the KM processes. Having a video conferencing tool can support in the knowledge transfer especially in the virtual team's models.

Lack of technology and cultural differences can impact the success of knowledge initiatives in any organization or project. Creating knowledge risk management model can help identify the expected risks, minimize the impact of those risks, enhance the risk mitigation process and help transform the risks into opportunities that can help in the success of a project and its related knowledge initiative.

#### 4. Conclusion and Future Work

Projects play integral role in organizations. Knowledge cannot be considered useful if it is discovered and not disseminated with other people, the reason is that the sharing of knowledge will enhance continuous learning and improvement. KM just like any other function in organizations that should be well governed and controlled to produce desired outcomes. The main outcome of the PKM conceptual framework includes an integration of KM processes and PM process groups to provide effective knowledge implementation in projects.

Organizational leadership has a great role in ensuring the fulfilment of the cultural gaps that support knowledge sharing in the organization and provide their employees with all required support and power to cover the knowledge they have for the attainment of organizational goals and objectives. Knowledge-based incentive program is essential to improve the level of maturity in the KM within projects and organization.

An area of future research is integrating risks and tools with PKM conceptual framework to produce a comprehensive model of PKM. This model is expected to illustrate the integration areas and facilitates each PKM process with the associated process of risks and required tools.

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