Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2007 Proceedings

Americas Conference on Information Systems (AMCIS)

December 2007

An Exploratory Study of Capturing and Reusing Project Knowledge from a Stage-based Perspective

I-Chin Wu
Fu-Jen Catholic University

William Wang
University of South Australia

An Exploratory Study of Capturing and Reusing Project Knowledge from a Stage-based Perspective

I-Chin Wu

Department of Information Management
Fu-Jen Catholic University
Taipei, Taiwan
icwu.fju@gmail.com

William Yu Chung Wang

Division of Information Technology, Engineering, and the Environment
University of South Australia, SA, 5095, Australia
yuchung.wang@unisa.edu.au

Abstract

In the modern business environment, knowledge capture and reuse are regarded as the keys to successful knowledge management (KM), which in turn increases a company's competitive advantage. For a professional project in a knowledge-intensive domain, improving the capability of knowledge supported functions in computer systems for decision-making is of the utmost importance. Through content analysis, the context of important clues can be utilized to improve the understanding of perceived information about a project/task-at-hand that involves computer systems. Because projects are often associated with long-term processes, each project normally requires unique decision points, i.e., milestones or project status check-points to monitor its performance. This study proposes a stage-based framework to facilitate the capture and reuse of project-specific information within and across organizational boundaries to reduce transaction costs and streamline knowledge flow by adopting XML technology. The framework adapts pilot research models proposed in the literature that are related to accumulating and disseminating task-related knowledge items at project check-points. Specifically, this research defines a project-in-context model based on task-stages and annotates the information according to XML standards in order to provide effective decision support in organisations.

Keywords: *Information Search Process, Knowledge Intensive Domain, Stage-based and Project-specific Information, XML Technology,*

Introduction

Knowledge management (KM) has gained a great deal of attention in recent years because it enables business enterprises to increase and/or maintain their competitive advantage in the business environment. The key to successfully deploying knowledge management systems (KMS) is the provision of relevant and codified information to meet the needs of knowledge workers as they conduct business operations and implement projects. Contemporary

KMS employs information technologies (IT) to build up a knowledge silo, such as a documentation system or a workflow management system, to facilitate the access, sharing, and reuse of knowledge assets within and across organizations (Davenport & Prusak, 1998; Liebowitz, 1999; Nonaka, 1994). Generally, IT applications in this area focus on two dimensions, explicit and tacit dimensions, to support knowledge management activities (Bloodgood & Salisbury, 2001; Kankanhalli, et al., 2003; Nonaka & Konno, 1998). The first dimension is achieved by a codified approach. It has been suggested that intellectual content codified in an explicit form can facilitate knowledge retrieval and reuse (Markus, 2001; Zack, 1999). Knowledge repositories, knowledge-based systems, and knowledge maps are used to support the storage, organization, and dissemination of knowledge (Davenport & Prusak, 1998; Zack, 1999). The second dimension emphasizes utilizing social networks to facilitate knowledge sharing. Knowledge expert directories, yellow pages, communities of practice, and chat rooms are examples of networks that support interpersonal communications and facilitate rapid knowledge sharing (Agostini et al., 2003; Brown & Duguid, 1991; Koh & Kim, 2004). Given the project-based business environment, where knowledge workers perform various tasks to achieve goals, organizations have placed great demands on KMS to support the execution of project-related tasks.

Completing a business project involves the use of multiple resources, such as the labor force, documentation, tools, techniques, and budgets. Historical information about each resource is stored in an associated database and can be be used to support workers as they implement a project or perform a task. However, despite the importance of extracting and reusing historical information, there is a shortage of integrated and generalized models that could form the logical basis for developing KMS. A number of works suggest that project-specific information is a critical component that can be utilized to improve the effective capture of relevant knowledge and facilitate the use of contextual information in a KMS database. Information retrieval (IR) techniques coupled with workflow management systems (WFMS) are normally used to support the proactive delivery of task-specific knowledge according to the context of tasks in a process (Abecke, et al. 2000; Fenstermacher, 2002). This approach differs from applications in traditional workflow management systems, (e.g., accounting systems and material resource planning systems), which involve routine work, rather than knowledge capture and dissemination in an information-intensive domain. To facilitate knowledge sharing, Kwan & Balasubramanian (2003) developed a process meta-model that integrates knowledge into workflow systems, and captures and retrieves knowledge within the context of a process. Similarly, Alvarado, et al. (2004) proposed the concept of organizing corporate memory from the perspective of role/job positions, whereby organizational memory, modelled on UML/XML, is used to specify an ontology for job positions, tasks, and application domains. Overall, the above approaches provide an appropriate perspective for specifying the process-context of tasks to support knowledge retrieval. As such, context analysis can be utilized to improve the understanding of relevant knowledge related to business tasks recorded in the KMS.

Contemporary KMS' provide users with search functions to retrieve task-oriented documents. However, few of them are designed to utilize knowledge sharing techniques in the context of supporting project implementation. Recent studies have advocated that it is important to integrate the context features into the knowledge retrieval process (Ahn, et al. 2005; Fenstermacher, 1999, Kwan & Balasubramanian, 2003). Moreover, since a project usually involves a long-term implementation process, it ought to have several decision points, i.e., milestones or project status check-points. To this end, Kuhlthau (1993) and Vakkari (2003) proposed accumulating and disseminating task-related knowledge items at specific points of a project by applying a few pilot research models (e.g., the

Information Search Process (ISP). Nonetheless, there is still a need to establish a general framework for capturing and reusing knowledge effectively in the changing business environment for the long-term knowledge delivery.

This study investigates issues regarding the deployment of a stage-based meta model to streamline the capture and exchange of project knowledge at different status check-points. Generally, stage-based models can be divided into those that deal with static processes for routine work and those that consider the dynamic processes of knowledge-intensive tasks. The former emphasize supporting 'context-based' knowledge access and retrieval in organizations. The concept of context-based knowledge delivery is very effective when applied in a process-based workflow system because the knowledge context model can capture and utilize the business process context to support a task's execution. The second type of stage-based approach considers information access activities or search processes in terms of a specific problem solving context, generally information-intensive domains (e.g., patent management applications) (Hansen & Järvelin, 2005). The stage-based approach adopted in this work, refers to systems that can capture and deliver project-related knowledge based on status check-points and task-stages. The check-points can be predefined based on project management requirements, whereas task-stages are identified by observing workers' information search processes (Wu, et al., 2005). Thus, a new project can reuse knowledge about similar projects/tasks based on the progress of the task and the system can deliver project or task-related knowledge to knowledge workers based on their task status. Herein, the term "reuse" means a new project can benefit by referencing existing knowledge, such as know-how and experience. Accordingly, a meta-model comprised of three levels – project, task, and task-stage levels – is designed to facilitate the capture and exchange of project-related knowledge. The model puts a project into a meaningful context from a staged-based perspective and annotates the information according to XML standards to achieve effective contextual knowledge delivery in a timely manner. That is, we adopt the specifications of the W3C XML/XML Schema, which integrates work processes/tasks with the business context and project scenarios for preserving, maintain and exchanging knowledge easily. We focus on the capture and reuse of project/task information in knowledge-intensive domains, such as research projects in academic institutions and product development projects in R&D departments.

The Literature and General Framework

A project involves a number of processes performed over an extended period, including project initialization, planning, execution, control, and completion (PMI Standard, 1996). Generally, there are two types of tasks in a project: routine tasks and knowledge-intensive tasks. The phrase "knowledge-intensive" generally refers to knowledge-intensive work, knowledge workers, and knowledge-intensive firms. Knowledge-intensive firms need well-educated and qualified knowledge workers as the major part of their workforce because such firms process their expertise into knowledge products or services for their customers or system users (Alvesson, 2000; Swart & Kinnie, 2003).

We adapt the Collaborative Information Retrieval (CIR) framework proposed by Hansen and Järvelin (2005). The framework is generated by empirical studies on the stages of information seeking and retrieval processes to support collaborative information retrieval in an information-intensive domain. It provides us with an appropriate perspective on how to support information search processes via the analysis of a task's performance. Similar to CIR, the knowledge context model (KC-V) was developed to accumulate knowledge in line with collaborative activities during the implementation period of projects related to the Virtual Workgroup Support System (VWSS) (Ahn, et al. 2005). Each project has several status check-points, which are used to identify and store knowledge items associated with the task at hand. In their study, Ahn, et al. developed a prototype system to demonstrate how the features of the proposed KC-V model facilitate the operation of a virtual collaborative work system within a project. The CIR and K-CV models provide a practical view of users' search behaviour. However, neither of them has established a general platform based on open standards to achieve effective knowledge capture and exchange among users. To resolve the problem, we use the XML/XML Schema, a type of meta language, to describe project context information to facilitate the capture and exchange of project-specific information. The stage-based framework of the project-specific information model applied in a knowledge-intensive domain is illustrated in Figure 1.

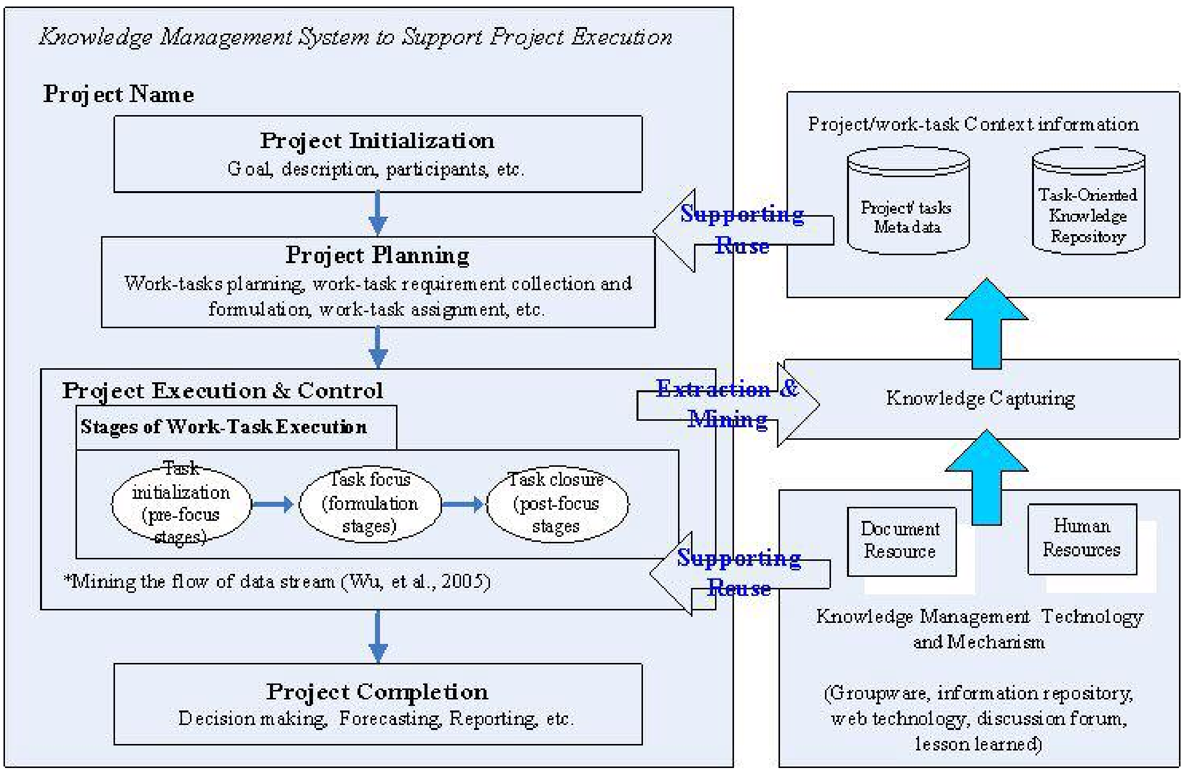

Figure 1. Stage-based Framework for Research Project Domain

Features of Stage-based Framework for Managing Project Knowledge

The idea of accumulating stage-based knowledge was expounded in the Vakkari (2003) studies. It focuses on a user's information seeking activities during a task's performance (e.g., writing a proposal, or executing a project) and demonstrates that information needs vary according to different task stages. Vakkari classified the stages of the search process according to Kuhlthau's (1993) search process model, namely pre-focus, focus formulation, and post-focus stages. Kuhlthau's model is based on a longitudinal study of library users who sought information to complete assigned projects. Both studies suggest that a worker's information needs and information seeking behaviour depend on the progress of the task and the task stages. The studies laid the foundation for refining and extending previous frameworks related to human search behaviour and project context analysis.

As mentioned earlier, we adapt the CIR framework proposed by Hansen & Jarvelin (2005). Our framework is shown in Figure 1. The right-hand side of the figure shows the procedures for extracting relevant information from data in textual format, storing and organizing the data in meta format in the knowledge repository, and then outputting the data in the context of the project. Following the methods proposed by Davies, et al. (2003) and Staab & Schnurr (2000), an open standard as the amendment is required to preserve and represent information for exchange within the framework, and then deliver and share accurate task-relevant information. To this end, we have developed a three-level meta-data structure to enhance the proposed model by referencing the IEEE Standard for Software Project Management Plans (IEEE Std. 1058-1998). The left-hand side of Figure 1 shows a project's stages, namely initialization, preparation, execution, control, and completion. Each stage is predefined dynamically based on the worker's progress in performing a task (Wu, et al., 2005). Note that, in our framework, a task refers to the activities during a project's implementation period. Because of the nature of knowledge-intensive tasks, it is difficult to extract intangible knowledge based solely on static descriptions of the information, e.g., the task's title, goal, and participants, during a task's execution. A task usually consists of a number of small sub-tasks, which form the different stages of the project. Therefore, since a worker's task-needs vary according to the context of the task-stage, supplying knowledge to meet those needs requires long-term knowledge support.

The Project-in-context Model

One of the main challenges of Knowledge Management (KM) is to design KM mechanisms and deploy KM infrastructure to support the KM related activities (processes). Obviously, knowledge that has not been captured cannot be reused, thus, knowledge capture is one of the most fundamental task of KM related activities (processes). Accordingly, capturing knowledge from previous (historical) projects will govern how knowledge can be reused for the current project. Herein, we introduce the project-in-context (named PIC) meta model from the stage-based perspective. We describe the PIC model from two perspectives, which are organizational perspective and information perspective. Moreover, the Object Modelling Technique (OMT) is adopted to describe the proposed meta model (Rumbaugh, et al., 1991). Logically, three-level meta-data structure is designed based on XML/XML Schema to describe the proposed model completely.

Organizational and Information Perspectives

As mentioned previously, the project-in-context model is classified into two parts: one is the information perspective and the other is the project execution perspective. The former describes the hierarchical relationship among information objects in the knowledge repository. The information objects are codified knowledge to support the operation of research project within the organization. The project execution perspective describes the relationship among project-in-context information that defines the interrelationships among objects in a project. For developing a stage-based project support framework, we analyse the characteristics of this research domain, types of project and its associated attributes.

Figure 2 illustrates the meta model of the proposed project-in-context model. The association among objects are mainly in terms of *aggregation* and *generalization* relationships. If two objects with tightly part-whole relationship, it is aggregation relationship which is a strong form of association. In Figure 2, a project is an aggregation (superclass) of its sub-tasks, which are in turn aggregations (superclasses) of their task-stages. The diamond notation, "◊", in the Figure 2 denotes the superclass of their subclasses. With generalization, an abject is an instance of the super class. That is, a generalization tree is composed of classes that describe an object. A generalization relationship can be expressed by a rectangle notation, "△". In Figure 2, a project type is classified into different subclasses: method, system, and survey which describe the types of the each research project in the information-intensive domain. A project type may be a method, system, or a survey research. Likewise, a task stage may be in the pre-focus, focus, or post-focus stage. A generation is often called "*is-a*" relationship, whereas the aggregation is often called "*a-part-of*" relationship. Not that the bold circuit, "•", in the figure denotes many side in the relationship. For example, a research topic with many documents and each document may also belong to many topics.

Information Perspective

The information perspective is presented to model the content information of the application domain in this work. The domain ontology, a shared conceptualization of a specific domain, is often used to specify the working domain of an organization (Park & Hunting, 2003). Organizing knowledge items into ontological structure based on the domain ontology is promising to support knowledge retrieval in business environments (Fensel, et al., 2003).To organize and manage project-relevant information, the repository is constructed with support from domain ontology (i.e., topic-based taxonomy) to effectively utilize codified knowledge. A topic-based domain ontology is generated and adopted to analysis the needed knowledge while task performance. The topics in the domain ontology are the mining result without experts taking effort to predefine the important topics in each task (Wu, et al., 2004). Herein, we introduce the hierarchical relationship among information objects in the knowledge repository. Note that the information object mainly refers codification-based information created, accessed, and manipulated during the project performance.

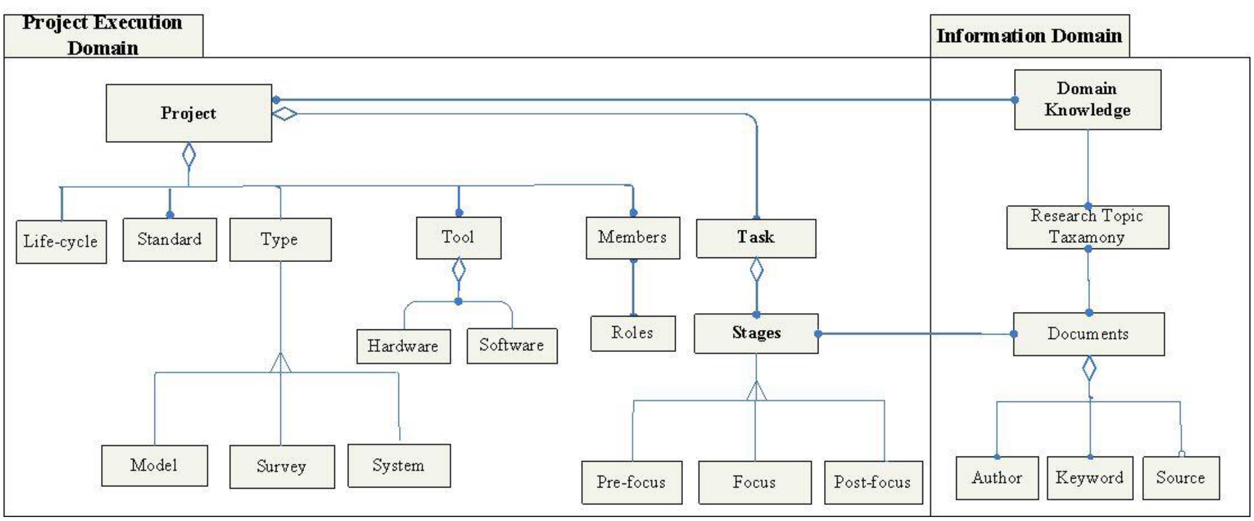

Figure 2. The meta-model of project-in-context mode

- **Domain Knowledge:** Domain knowledge represents the main subjects of projects in the organizations. The domain knowledge is predefined by the experts and experienced workers of the targeting research domain.
- **Research Topic Taxonomy:** The research topics in the investigating domain are structured into the hierarchy structure. The topics near the leaf nodes of the hierarchy tree are the specific topics in the domain; otherwise, the general topics in the domain. Notably, this work labelled name of general topics according to the schema of ACM Computing Classification Systems (1998) and name of the specific topics based on the important keywords extracted from the task set.
- **Documents:** It is the basic information objects in the information domain. In our proposed framework, we will collect and store textual data from various sources during each project/task execution and then extracting knowledge embodied in textual data by content analysis technique (Baeza-Yates & Ribeiro-Neto, 1999).

As shown in Figure 2, each type of domain knowledge contains one or more domain topics and each domain topic may belong to one or more domain knowledge. For example the topic "*Office Automation*" may belong to "*Business Intelligence*" domain and "*Workflow Management*" domain at the same time. Furthermore, each research topic has many relevant documents. Moreover, we also employ information extraction techniques to extract meta-information from document sets and analyse the important authors, knowledge source and concepts in the document sets of each task-stage.

Project Execution Perspective

We design three-level meta data to describe the project domain, which are project, project sub-tasks, and task-stage of each task. Thereby, the system can accumulate and utilize the project/task related knowledge in alignment with the project checkpoints and task-stage. The three-level project activities domain are shown in Figure 2 and explained as below:

- **Project and task:** Each project has the project status checkpoints, which are project initialization, planing, execution, controlling and closuring processes. In addition, we define three types of the project which are model and methodology, system, and survey. Figure 2 shows each project belonging to one of the three types. There are several tasks need to be performed while the project execution. Current study focuses on the non-routine and knowledge-intensive tasks in this work. Project accomplishment involves multiple project resources, which are project members, tools, standards and method based on the specification of SPMP in IEEE standard. The members in each task are the subset of the project it belongs to. Each project belongs to a field of information domain with associated topics and documents, as shown in Figure 2.
- **Task and task stage:** Each project involves many sub-tasks and they can be divided into three stages, which are pre-focus, focus formulation and post-focus stages. The stage information is extract and analyse based on the task-stage identification technique (Wu, et al., 2005). Consequently, the system could capture the project knowledge into different level of context, i.e. project, task and task-stage. On the other hand, the system can support the workers based on his/her work context and his search behaviour. It is confidence that the system can streamline the project execution with the aid of the proposed project-in-context model.

Three-level meta-data structure of the Project-in-Context Model

The term "project-in-context" refers to putting the project data or attribute into the meaningful context. Moreover, 'context' can be addressed at different levels and it is useful to distinguish among "levels" of context. Logically, three-level meta-data structure is designed based on XML/XML Schema to describe the proposed model completely. Table 1 illustrated the important meta-tag of the designed specification in the current study.

The first level is the project level which includes the meta data of checkpoints, the project type, task set, member, tool, domain knowledge and so on. The second level is the task level which includes task-stages, members in each task and the task-related topics which are defined in the domain ontology. That is, to organize and manage information, the repository is constructed with support from domain ontology (i.e., topic taxonomy) to effectively utilize codified knowledge. As addressed previously, knowledge workers who engage in knowledge intensive tasks (e.g., research projects in academic organizations, project management in firms, etc.) have different information needs during the long-term task performance. Thus, a stage identification technique is proposed to identify a worker's task-stage (e.g., pre-focus, focus formulation, and post-focus task stages) (Wu, et al., 2005). The third level is the task-stage level which includes documents and task-related topics defined in the domain ontology and the stage profile. Notably, there are two kinds of stage-profiles, feature-based task stage profile and topic-based task stage profile, maintained to depict the collective information needs at each stage of a specific task. The feature-based profile describes the key features of a task-stage, whereas the topic-based task profile describes the important and specific topics of a task-stage. The identified topics of the stage profile are the subset of the topics in the presented topic taxonomy. Using profile to filter information updates to a group of user with common information needs is a useful technique in knowledge capturing and reusing (Belkin & Croft, 1992, Fenstermacher, 1999).

```xml
<?xml version="1.0" encoding="big5" standalone="no" ?>
<project id="P0000000001" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:noNamespaceSchemaLocation="XMLSchema1.xsd">
  <lifeCycle></lifeCycle>
  <tasks>
    <task id="T0000000001">
      <task-stages>
        <task-stage id="00001">
          <documents>
            <document id="D0000000001" />
            <document id="D0000000123" />
            <document id="D0000000125" />
            <document id="D0000000189" />
            <document id="D0000000192" />
          </documents>
          <topics>
            <generalTopic>Organizational Impact</generalTopic>
            <specificTopic>Workflow Process, Access Control</specificTopic>
          </topics>
        </task-stage>
      </task-stages>
      <documents>...
      <taskMembers>
        <member id="00001">
          <firstName>Annie</firstName>
          <lastName>Wu</lastName>
        </member>
```

Figure 3: An Example of XML Instance

Table 1. Multiple Levels of Meta data Structure

Entity	Meta-data	Description
Level 1:Project <project>		
Status check points	*<lifeCycle>*	A project performs a group of processes within a particular period, including initialization, planning, execution, control, and completing processes. Adopted from PMI Standard (1996) and CIR framework for the patent domain of Hansen and Järvelin (2005)
Task	*<task>**	The sub-tasks of the project they belong to. Adapted from the knowledge context model of Ahn, et al. (2005)
Member, standard, tool	*<member>*,<standard>*, <tool>**	Each project: this includes the plans, members, tools, activities, standard, documents, etc. Synthesized from IEEE Std. 1058-1988 (1988)
Type	*<type>*	It designs three types of project templates to classify the projects. The system classifies the business projects based on the types they belong to. Synthesized from Ahn, et al. (2005)
Domain knowledge	*<domain knowledge>*	The Domain knowledge of the targeted research domain. Adopted from Wu, et al. (2004)
Level 2: Task <task>		
Task-stage	*<stage_num>*	A stage identification technique is proposed to identify a worker's task-stage (e.g., pre-focus, focus formulation, and post-focus task stages). Adapted from Kuhlthau (1993), Vakkari (2003), and Wu, et al. (2005)
Task-member	<$Member_t$>	The knowledge workers are responsible for executing different tasks with different roles, as shown in Fig. 2.
Topics in the domain ontology, comprising general and specific topics	*<General topics>* *<Specific topics>*	The genera and specific topics are defined in the proposed task-based domain ontology, i.e., multiple level of topic taxonomy. Adopted from Wu, et al. (2004)
Level 3: Task-stage <task-stage>		
Document	*<document>**	Documents in the knowledge repository which generates from previous projects.
Topics in the domain ontology	*<Specific topic>**	The specific topics are defined in the proposed task-based domain ontology, i.e., multiple level of topic taxonomy.
Profile	*<keywords>** *<topics>**	There are two kinds of stage-profiles, feature-based task stage profile and topic-based task stage profile

The notation * denotes multiple instances.

The Scenario based Model

Generally, the project/task in the knowledge intensive domain spans a long period. Therefore, huge amount of documents are accessed and generated during the project execution. The research model addresses the issues of supporting project related documents as well as the organizational activities, e.g., exchange of project execution experiences, workflow activities, etc., based on the context of each stage. A sample situation is described as below in order to illustrate the model.

"Mary was a new worker of an industry analyzer in a project management institution. She was assigned to a survey task, 'the Opportunities of Sensor Network in Healthcare' and needed to write a proposal to initialize a project. Since Mary was a novice of sensor network, she had difficulties in understanding the assigned task. She sought for help from an expert or an experienced colleague to overcome the encountered problem or guide her to the right direction while understanding the perceived task. Unfortunately, workers who had relevant knowledge were to give a hand. Hence, Mary came up with the idea of finding the possible solutions from the document management systems and the information repository. However, tremendous amount of data frustrated Mary. It is hard for Mary to have a generic view of information structure or taxonomy of the document management system or information repository."

Similar situation often occurs in the organizations, especially for the industrial analysts in project management institution. When a worker in an organization has information needs for executing project/task, he/she needs the knowledge support to accomplish the task. Naturally, the worker may seek helps from someone who has similar experiences. Additionally, the worker can try to find the relevant knowledge from the organizational repository. The standard functions of the most extant applications mainly adopt document classification and some searching tools without considering the work context and the project/task statuses.

Capturing knowledge from previous (historical) projects will govern how knowledge can be reused for the current project. Empirical studies points out that knowledge capture has several important aspects need to be addressed in building the KM systems. The aspects are form, accessibility, context and resource linkage (Fenstermacher, 1999, p. 154) extract knowledge embedded in procedures, activities and are developed via experience over time and guide further decisions or actions (Levitt & March, 1988). Furthermore, the context of project/task/document is important for knowledge workers to retrieve meaningful and relevant project knowledge. Our model can preserve the content of project knowledge and strengthen the reuse of project context, such as the events and activities associated project implementation, adopting solutions, and skills for a specific problems by applying the XML/XML Schema The metadata techniques can distinguish documents by their attributes to overcome the limitation of keywords search technique. The functionalities in the presented workspace can be further designed based on our proposed model.

A Suggested Workplace for Project Creation and Management

Our research model provides a workplace of supplying project related knowledge based on the stage based perspective instead of the previous presented task-based workspace to organize the task-related documents (Wu, et al., 2004). It can be further illustrated by a three-level view of project management to structure and classify the project knowledge items. Figure 4 is the interface of creating a project workspace by the designed meta model and the presented framework. In the given example, a "*Recommendation in Composite e-service*" project is initialized by selecting an appropriate project type by the project leader. Furthermore, the system will display the similar project, document, and discussion workspace to assist the project member obtain help form the past project knowledge. Accordingly, the explicit knowledge such as key documents, tools, and know-how, and tacit knowledge such as key authors, and domain experts can be easily accessed, retrieved, and found from the extant workspaces. For example, a star-up project may require the project workspace of the "*Web service in Composite e-service*" or discussion workspace of "*Topic Map in the Knowledge Management*". The idea is sightly similar to cotemporary commercial project management and portal set-up applications. For managing a workspace, our model provides the search options of multiple views of a particular project. In the past studies, we focus on delivering task-relevant knowledge based on the adaptation of the worker's task profiles without considering the context information of the work-task. In addition, the workplace is organized and presented the task-related knowledge solely from the task perspective (Wu, et al., 2004). According to the empirical investigation, it is too abstract to present the knowledge only form the view of the task or document. In this study, we design view with different granularities, i.e., project, task and document to organize the project-related knowledge, as shown in Figure 4. Furthermore, in our another ongoing work, we also demonstrated that provide task-relevant knowledge from a stage-based view, i.e., a specific view can deliver more precisely knowledge than that of from a task view, i.e., a general view (Wu, et al., 2005). Accordingly, it is believed that capture extant project knowledge from a stage-based view can effectively reuse past project knowledge within the organization.

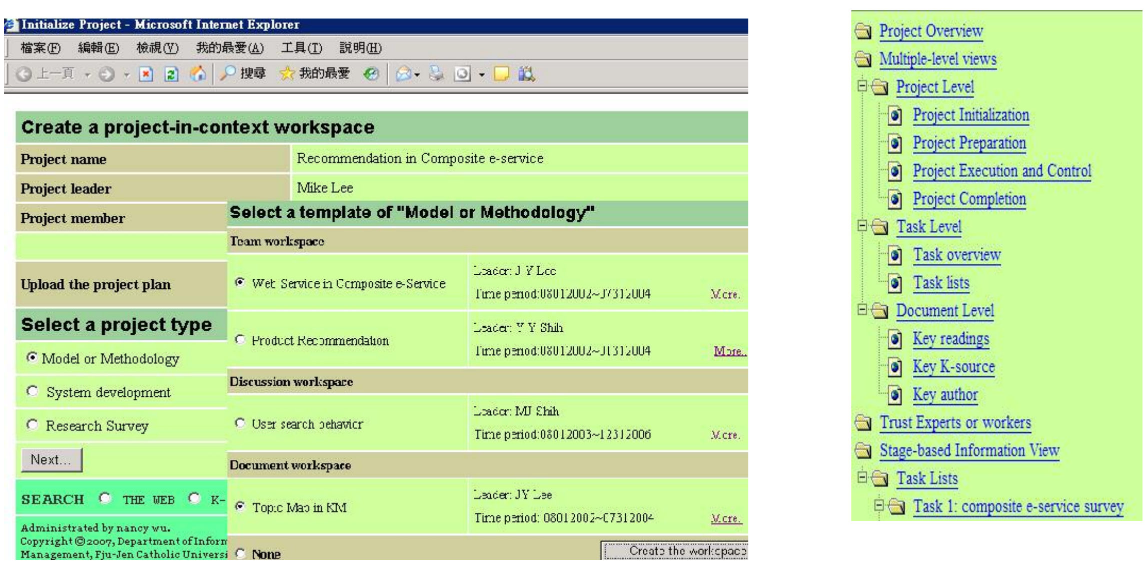

Figure 4: Interfaces of Project-in-context Workspace and Multiple Views

Conclusions and Future Directions

Organizations implement Knowledge Management Systems (KMS) to maximize the effectiveness and reuse of knowledge assets in order to increase productivity and profitability. Thus, industries place great demands on knowledge management solutions that can support and streamline the execution of project-related tasks. This paper contributes to the academia by proposing a stage-based framework to enable the capture and reuse of project-specific information. It can facilitate to extract information from historical project sets and knowledge silo through interfaces designed by the W3C XML/XML Schema specification. The project-in-context model is defined as a three-level meta model encompassing project, task, and task-stage for facilitating the capture and exchange project-related knowledge. Accordingly, project types and the associated attributes based on the project-in-context model is analysed in advance. We also define the stage-based approach as the project/task related knowledge project status check points; thereby, the system could capture and reuse project specific knowledge within the stage-context. Our research is limited to evaluate the effectiveness and utility of the proposed stage-based model for project management. It is suggested that the ongoing research can cover the topics of utilizing the context information to deliver project/task related information according to workers' search behaviour and work-context in the proposed stage-based framework. Future research can also reside on developing possible applications, evaluating the fitting degrees, and utilities of the capturing and reusing the project extant knowledge.

Acknowledgements

This research was practically supported by the National Science Council of the Taiwan Government under the grant NSC 95-2416-H-030-012.

References

Abecker, A., Bernardi, A., Maus, H., Sintek,. M., and Wenzel, C., "Information Supply for Business Processes: Coupling Workflow with Document Analysis and Information Retrieval," *Knowledge Based Systems*, (13:1), 2000, pp.271-284.

Agostini, A., Albolino, S., De Michelis, G., De Paoli, F., and Dondi, R., "Stimulating Knowledge Discovery and Sharing," *Proceedings of the International ACM Conference on Supporting Group Work*, Sanibel Island, Florida, USA, November, 2003, pp.248-257.

Ahn, H. J., Lee, H.J., Cho, K., and Park, S.J. "Utilizing Knowledge Context in Virtual Collaborative Work," *Decision Support Systems,* 39, 2005, pp. 563-582.

Alvarado, M., Romero-Salcedo, M., and Sheremetov, L. "A Corporative Memory based on the User Profiles," *Expert Systems with Applications*, (26:1), 2004, pp. 87-94.

Alvesson, M. "Social Identity and the Problem of Loyalty in Knowledge-intensive Companies'. *Journal of Management Studies*, (37: 8), 2000, pp. 1101-1123.

Baeza-Yates, R., and Ribeiro-Neto, B., *Modern Information Retrieval*, New York: The ACM Press, 1999.

Belkin, N. J., and Croft, W.B., "Information Filtering and Information Retrieval: Two Sides of the Same Coin? " *Communications of the ACM*, (35:12), 1992, pp. 29-38.

Bloodgood, J.M., and Salisbury, W.D., "Understanding the Influence of Organizational Change Strategies on Information Technology and Knowledge Management Strategies," *Decision Support Systems*, (31:1), 2001 pp.55–69.

Brown, J.S., and Duguid, P. "Organization Learning and Communities of Practice," *Organization Science*, 2:1, 1991, pp.40-57.

Davenport, T.H., and Prusak, L., *Working Knowledge: How Organizations Manage what They Know*, Boston MA: Harvard Business School Press, 1998.

Davies, NJ, Fensel, D., and van Harmelen, F., *Towards the Semantic Web – Ontology-based Knowledge Management.* Wiley, London UK, 2003

Fensel, D., Staab, S., Studer, R., van Harmelen, F., and Davies, N.J., "A Future Perspective: Exploiting Peer-to-Peer and the Semantic Web for Knowledge Management," In Davies, N.J., Fensel, D. van Harmelen, F. (Eds.): *Towards the Semantic Web – Ontology-based Knowledge Management.* Wiley, London UK, 2003, pp. 245-265.

Fenstermacher, K. D., *Managing Knowledge in Context*, Computer Science, University of Chicago, 1999.

Fenstermacher, Kurt D. "Process-Aware Knowledge Retrieval," *Proceedings of the 35th Hawaii International Conference on System Sciences*, Big Island, Hawaii, USA, 2002, pp.209–217.

Hansen P., and Järvelin, K., "Collaborative Information Retrieval in an Information-intensive Domain," *Information Processing and Management*, 41, 2005, pp. 1101-1119.

IEEE Std. 1058-1988 (1988), IEEE Standard for Software Project Management Plans (SPMP), *Institute of Electrical and Electronics, Inc., NJ*.

Kankanhalli, A., Tanudidjaja, F., Sutanto, J., and Tan (Bernard), C.Y., "The Role of IT in Successful Knowledge Management Initiatives," *Communications of ACM*, (46:9), 2003, pp.69-73.

Koh, J. and Kim, Y.G., "Knowledge Sharing in Virtual Communities: An e-Business Perspective," *Expert Systems with Applications*, 26, 2004, pp.155-166.

Kuhlthau, C., *Seeking Meaning*. Noorwood, NJ:Ablex, 1993.

Kwan, M.M., Balasubramanian, P. "KnowledgeScope: Managing Knowledge in Context," *Decision Support Systems*, 35 , 2003, pp.467-486.

Levitt, B. and March, J.G.,"Organizational Learning," *American Review of Sociology*, 14. 1988, pp.319-338.

Liebowitz, J. *The Knowledge Management Handbook*, Boca Raton, FL: CRC Press, 1999.

Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., and Lorensen W., *Object-Oriented Modelling and Design*, Prentice-Hall, Englewood Cliffs,N.J., 1991.

Markus, M.L., "Toward a Theory of Knowledge Reuse: Types of Knowledge Reuse Situation and Factors in Reuse Success, " *Journal of Management Information Systems*, 18:1, 2001, pp. 57-94.

Nonaka, I. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science*, (5:1), 1994, pp.14-37.

Nonaka, I. and Konno, N., "The Concept of "Ba": Building a Foundation for Knowledge Creation," *California Management Review*, (40:3), 1998, pp.40-54.

Park, J., and Hunting, S., *XML Topic Maps: Creating and Using Topic Maps for the Web*, Boston MA: Addison-Wesley, 2003.

PMI Standard, *A Guide to the Project Management Body of Knowledge*, Project Management Institute, Inc, PA, USA, 1996.

Staab, S., and Schnurr, H.-P., "Smart Task Support through Proactive Access to Organizational Memory," *Knowledge-Based Systems, Elsevier*, (13:5), 2000, pp. 251-260.

Swart, J., and Kinnie, N., "Sharing Knowledge in Knowledge-Intensive Firms," *Human Resource Management Journal*, (13:2), 2003, pp.60-75.

Vakkari, P., Pennanen, M. , and Serola S., "Changes of Search Terms and Tactics while Writing a Research Proposal: A Longitudinal case study," *Information Processing and Management,* (39:3), 2003, pp.445-463.

Wu, I.C., Liu, D.R., and Yang, K.S., "K-Support System: Knowledge Support for Disseminating and Sharing Task-relevant Knowledge," *Proc. of the IEEE International Conf. on Information Reuse and Integration*, Las Vegas, USA, 2004, pp.331-336.

Wu, I.C., Liu, D.R., and Chen, W.H., "Task-stage Knowledge Support Model: Coupling User Information Needs with Task Stage Identification," *Proc. of the IEEE International Conf. on Information Reuse and Integration*, Las Vegas, USA, 2005, pp.19-24.

Zack, M.H., "Managing Codified Knowledge," *Sloan Management Review*, (40:4), 1999, pp.45-58.