Application of Knowledge Management to System Development

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Fujitsu is currently undertaking the project management advocated by PMI Co. of the U.S. based on PMBOK and a development management based on SDEM/SDAS. Given this background, FSI-BOK/PM is set as a practical benchmark for achieving both types of management. To effectively manage projects based on these standards, it is important to share specific development information among management activities supervised by project managers and other leaders, as well as those conducted by all development staff members in order to make these activities practical. For these reasons, Fujitsu is promoting efficient on-site activities to improve software through a mechanism called SolutionNET, which is a knowledge management concept established in 1997 that enables a systematic spiral for restructuring business operations. This paper introduces the implementation of ProjectWEB, which is the support tool used to practice these activities, to system development.

1. Introduction

In a system development project, it is important that not only the project manager but also all the members share the progress and status of the scope, delivery date, quality, and cost of the project so members can work according to the schedule.

Moreover, in addition to visualizing the project management done by project managers and project offices, it is considered more effective to visualize the system development at each phase, for example, at requirements definition, design, development, verification, and maintenance. To realize visualization at each phase, we decided that a new approach was necessary: improve system engineering activity by visualizing the work breakdown structure (WBS) of every project member.

Therefore, Fujitsu developed SolutionNET,[1)] which is a knowledge management[2)] concept that realizes a business restructuring spiral through the use of expertise and experience. Fujitsu has been promoting in-house use of SolutionNET since its introduction in 1997.

We have developed several SolutionNET tools for our in-house use. By applying these tools to our system development projects and improving the efficiency and reliability of these tools through repetitive evaluation, we have promoted the use of SolutionNET throughout Fujitsu's entire systems engineering organization.

In this paper, we describe our approach to using ProjectWEB, which is the tool that plays the most important role within SolutionNET.

2. Focus of knowledge management application

This section describes the focal points when applying knowledge management to systems engineering activities.

2.1 Sharing workplace is key to improving project efficiency

In system development projects, there is a tendency that the project status at the site is not accurately reported to the project managers and/or the organizational managers.

Moreover, it tends to take time to transfer information from the organizational managers to project members, and it is difficult to confirm whether information has been transmitted correctly.

In these cases, project managers and the project offices positioned between them must relay information accurately.

Therefore, we considered it insufficient to simply improve communication between people and decided that the key to accurate information transfer is to establish a common workplace in which every project member (e.g., development staff, project managers, and project office members) can communicate directly with each other on a daily basis in get-togethers on a network. Because there are various contractual relations within the IT business sector, members from multiple companies are always involved in any system development project, and we considered that frank exchanges of information among those members will lead to successful results.

2.2 Recognition and tacit knowledge is true know-how

One way to transfer the skills of good engineers is to create manuals; that is, to formalize their knowledge.

However, instead of using manuals or formally scripted deliverables, it is more effective and also faster to make use of deliverables of similar projects during development in order to understand the background of actions to be taken and why they are necessary.

On the other hand, in the typical workplace, information is exchanged daily among members in network get-togethers using concise jargon, some of which is meaningless to non-members.

In fact, valuable know-how is hidden as tacit knowledge within these get-togethers and within deliverables that are still being created. We considered that recognition of important knowledge is derived from similar hints obtained from previous projects and that the key to improving project efficiency is to draw on previous experiences.

2.3 In the typical workplace, information is not collected, but automatically accumulates

This is also true of information in project management. Project members report the project status and issues to project managers and project offices, but if the development status can be shared in the workplace, daily reporting is unnecessary and project managers and project office members can obtain information whenever required.

Moreover, project review can be done at an earlier stage by having the project members share each other's development status, which helps prevent reworking. Therefore, knowledge management that creates a shared workplace can also be applied to project management.

3. ProjectWEB realizes workplace sharing

ProjectWEB is a Web system that is the core tool for implementing SolutionNET activity (**Figure 1**).

This system is a groupware uniquely developed based on the knowledge management concept. It has communication features that realize workplace sharing and a project management support function that supports project management and also engineering activities based on Solution-oriented system Development Engineering Methodology (SDEM).

ProjectWEB includes various communication features such as bulletin board systems (BBSs), forums, and schedulers, but the core features are the ToDoList (To Do list) and the Library.

The ToDoList is a Web mail system that

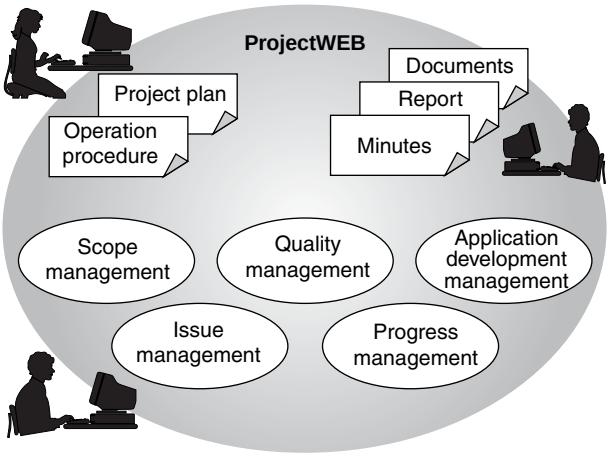

Figure 1
ProjectWEB.

enables users to know who has seen a message, when the message was opened, and when a request was completed.

In addition, message recipients can add their comments to a ToDo message so project members can exchange information in the workplace.

Project managers and project office members can comment about the members' opinions, which ensures communication within the project.

The Library is a place where the interim results of daily activities (tacit knowledge) are stored. It enables members to mutually review documents so troubles can be avoided at an early stage.

4. Project visualization and management

SolutionNET is designed to foster the practice of realtime management by visualization.

The three basic points of realtime management are as follows:

- Deliverables are stored daily so people can immediately check them and comment about them.
- Plans are made based on the management template.
- Work is done according to prearranged procedures and is traceable.

4.1 Communication is core feature in small-scale projects

Daily communication between project managers and project members is an important activity in many small-scale projects. In ProjectWEB, this communication is supported through communication-based project management in which status management and quality management are done using Excel. Also, deliverables such as design documents and other information can be stored in a library and project managers can check this information, give advice, and make approvals on a daily basis.

4.2 All members share the plan and information on daily basis

Medium-scale and large-scale projects must be managed based on a project plan and operation guideline. We therefore decided to develop a system in which daily reports from members can be captured and used to create information for status management and quality management and to share these reports among each member.

1) In ProjectWEB, these features are provided above the communication feature by a project management support function called PMPACK/C (Project Management Pack/Communication and Collaboration). PMPACK/C provides functions for milestone management, WBS progress, program progress, issue control, quality management (incident control, requirements change control, review report control), and quality planning and management.
2) In PMPACK/C, an individual or team is allocated to each task (WBS or electronic form provided by the tool) and plans and work progress can be checked at a glance to see who should do what.
3) Members store their deliverables such as design documents in the Library on a daily basis. The deliverables are linked to each WBS, so project managers and project office members can review them directly and

determine their earned value (EV).

4) This information can be checked mutually by the members, and such checks made in the earlier stage of a project help prevent the need for reworking.

5) There are eight management layers: project, sub-project, phase, WBS1, WBS2, WBS3, process, and program. The names of menus and items in each form can be customized.

4.3 Development standard tailoring by SDEM and SDAS

SDEM and SDAS are standards for carrying out IT projects such as system development. Tailoring these planning standards onto ProjectWEB based on project characteristics is positioned as planning work.

For example, the reliability of deliverables can be improved by selecting the appropriate WBS from SDEM and by defining prototype deliverables or quality metrics using SDAS templates.

Moreover, SolutionNET uses templates for Library structures. These templates make the sharing and reuse of information between projects and support by experts easier.

5. Choosing appropriate tools

Projects have various features, for example, project scale; system integration (SI), solution, package application, and maintenance features; domestic or global location; and features related to long-standing practices with customers.

Therefore, there are various management styles that match different features, and project managers can choose the most appropriate tools.

Especially, there are a variety of tools for progress management and quality management that suite different industry types and different business types, and ProjectWEB is used in combination with these tools (**Figure 2**).

These tools were developed based on our long experiences in this field, and they can be usefully combined with ProjectWEB, which is mainly designed for grasping the status of an entire project.

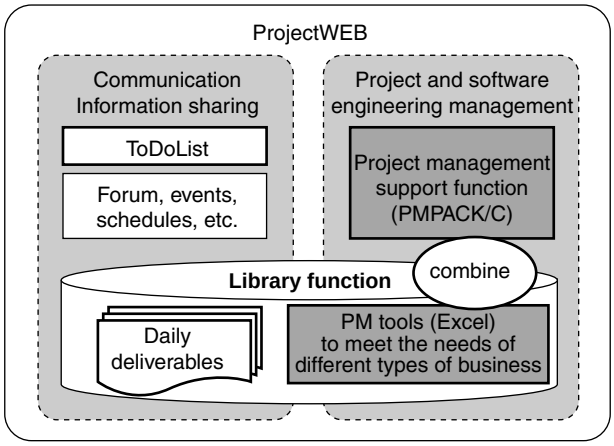

Figure 2
Using multiple tools for project management.

In addition, because reports, forms, and charts tend to be specific to individual projects, we have continuously enhanced the output interface of ProjectWEB.

6. Benefits of applying ProjectWEB and observations on its use

6.1 Benefits of application

ProjectWEB is located in the Extranet zone and can be used in projects that involve contractors and global users.

Moreover, because the system is protected by strong security, it can be safely used over the Internet. Our customers have told us that Fujitsu's activities have become visible, which has increased their sense of trust in Fujitsu.

The following describes some of the benefits we have obtained from using ProjectWEB.

1) Case A

In a systems development project involving multiple contractors, all reports related to quality management (incident control) were issued within the system, and by analyzing the cause classification and taking measures within each development phase, critical problems after project completion were prevented.

2) Case B

ProjectWEB was used for a maintenance project in which customer sites were physically distributed. The contractor staff visited a customer for follow-up and used the Internet version to send reports.

Monthly meeting documents were created based on the reports and deliverables, and Fujitsu won the customer's confidence by using tools for remote sites, providing customer handling records, and submitting reports and related documents.

3) Case C

In a short-term project, a ToDoList was used for communication among members, and the members mutually checked the deliverables stored in the Library every day. As a result, there was no rework in this project.

6.2 Basic role of project managers and management is to advise

When ProjectWEB is used, project managers and project office members receive many ToDo messages. Although it takes a lot of time to respond to these messages, they are all important and none of them can be ignored.

Moreover, bad news travels quickly, so to implement ProjectWEB successfully, it is important to avoid harsh criticism and continue giving advice.

7. Conclusion

We have been enhancing ProjectWEB in a tie-up with project managers who are working with our customers, and we will continue incorporating our know-how of knowledge management into ProjectWEB so we can use it for continuous process restructuring within Fujitsu.

We will also further strengthen our customers' confidence by standardizing our planning procedure, improving the efficiency of customizing WBS and index values to suit the project's features, and making the following enhancements to ProjectWEB: 1) apply earned value management (EVM) to progress management; 2) link the workflow with an application development management that has a consistent flow throughout the design, development, and testing phases; and 3) implement database generation and analysis of project activity achievements.

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Mr. Hosono received the B.S. degree in Applied Physics from Chiba University, Chiba, Japan in 1981. Later that year, he joined Fujitsu Ltd., Kawasaki, Japan, where he was engaged in system engineering of laboratory automation (LA) until 1993. He has also worked to promote the internal practices of knowledge management activities, for both in-house tool development and actual tool implementation in various projects. In 2002, he was qualified as Project Management Professional (PMP) by the Project Management Institute in the USA.