A Web-Based Project Office System Supporting Lesson-Learned

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ABSTRACT

It is a common belief that the lessons learned from previous projects, if utilized, can help to increase the chance of success for a project. However, this would not happen unless sufficient organized data was captured while previous projects were running, allowing useful lessons to be built. This paper presents a cost effective project office system which allow data to be captured in real time to support building lessons to benefit future projects. The system is an Internet-based B@B application which allows geographically dispersed project team members to centrally log data relating to Incidents and Problems experienced during a project in real time. Besides creating a database for supporting lesson-learned function, the data captured on Incidences can help to identify the sources of a problem better thereby helping project team members to solve it faster and more effectively. This system forms the basis for building a Case-Based Knowledge Management System enabling effective utilization of learned-lessons in future projects.

PREAMBLE

Today, leading organizations, including the U.S. Government, AT&T, Motorola, are experiencing great success with Project/Programme Management Offices (PMO) in lowering their IT project failure rates. A PMO, often operating at the organizational level, enhances communication, standardizes policies and procedures, and encourages consistency in the use of tools for project management and control. Therefore, it is not surprising a PMO can reduce IT project failure rate. Of course, the reduction in failure rate is linked to the maturity of a PMO and not merely to its pure existence (Zarrella and Tims, 2003).

Black (1998) describes a PMO as "a static repository of project management information controlled at a high level within the organization". As such, a PMO can be used to facilitate knowledge transfer. One aspect of knowledge transfer is that the lessons learned from a project can be used to help future projects and increase the competence of project managers involved. Many large organizations, prompted by their successful experience, have begun to share the lessons they have learned, not only internally but with outside organizations. For example, NASA implements a public accessible Lesson Learned Information System (LLIS) to share their experience from projects within its space program (NASA, 2004). The United States Department of Transport has a web portal publishing web papers which detail lessons learned (Federal Transit Administration, 2004).

PMI's Project Management Maturity Model (PMMM) framework includes the requirement that "lessons learned are not gathered and passed onto another project" as one of the criteria to determine whether the level of an organization's project management maturity is "ad hoc" (Robertson, 2004). Utilizing lessons learned from one project in another is therefore one of the essential conditions for an organization to migrate its capability level up the PMMM. As such, As such, a tool to capture data to facilitate knowledge transfer between projects will help the organization to move to the second level. Furthermore, if learned lessons are being used consistently, it can help the organization to promote its PMMM level to the third level. This motivates the author to develop a system supporting lesson-learned.

Emerging technologies, such as the Internet, have now brought changes to our business systems. Web based B@B (business@business: see Jantavongso and Li, 2003) applications such as work flow systems, e-form systems and Application Services Providers are now helping managers of large enterprises as well as SMEs to manage their operations faster, better and cheaper. These applications also provide solutions to handle changes bought about by Globalization. The manager can now manage their business independent of the geographical locations of their staff and customers. Similarly, project managers, nowadays, can utilize web-based applications such as Microsoft Project 2003 server to manage projects of theirs that scattered around the world and also to handle project team members and stakeholders who are geographically dispersed (a virtual project team).

A project office can now be implemented as a virtual project office utilizing web server technology. A virtual project is defined as "a collaborative effort towards a specific goal or accomplishment which is based on 'collective yet remote' performance" (Krill and Juell, 1997). The proposed system is also targeted at virtual projects. In order that the proposed system can target virtual projects with virtual project teams supported by virtual project office, the proposed system is implemented as a web based B@B system for the monitoring and logging of project data from geographically dispersed project team members and other stakeholders to facilitate learned lessons transfer. This system is expected to work in conjunction with and be part of an existing virtual project office.

DATA LOGGING

Three types of data related to Incidents, Problems and Change Requests will be logged by the system. Other data such as those derived from the tracking of the processes that deal with Incidents, Problems and Change Requests will also be captured into the database. These data are considered to be important for building a lesson-learned knowledge base. Problems provide cases to build lessons, Incidents help to identify sources of problems and resolution actions such as Change Requests provide example solutions to the Problems.

An Incident, in the context of this paper, is defined as something which has happened that is of concern to some stakeholders. It may or may not immediately affect the progress of the project and therefore, may not require a decision for some sort of action to resolve the Incident. An example of an Incident is a personal grind between two team members.

A Problem, in the context of this paper, is defined as a tangible outcome that has a negative impact on the project and therefore requires decisions and subsequent actions to address it. Actions include Change Requests.

A Change Request is a formal request to cause a change in scope, network diagram and deliverables of a project. The outcomes usually have impacts on the time, cost and quality aspects of the project.

FOCUS OF THE PROPOSED SYSTEM

NASA defines a lesson-learned as "knowledge or understanding gained by experience. The experience may be positive, as in a successful test

or mission, or negative, as in a mishap or failure" (NASA 2002). The proposed system has, however, focused only on the negative experience. Following are the reasons why a problem-driven approach is being adopted in this research.

- The system relies on the project stakeholders to submit information for logging. As it is much easier for a stakeholder to identify a Problematic situation as soon as it arrives than a situation that will later lead to a positive experience, more information will be submitted in real time to the central repository.
- A successful lesson-learned system requires captured lessons to be utilized in the future projects. Learned lessons that could help project team members to resolve their immediate Problems will definitely be welcomed.

The research presented in this paper is utilized to design a system that would capture relevant information to help with the creation of valuable lessons for future reference. It does not deal with how lessons can be created from data captured in the repository nor triggering mechanisms such as "management decision gate" (Hawker 2003) for the generation of new lessons.

SYSTEM OVERVIEW
To handle the logging of the data, the system will have three modules:

- Incident register and tracking module,
- Problem register and tracking module, and
- Change Request register and tracking module.

These registers allow Incidents, Problems and Change Requests to be registered. The journal entries provided by people involved in resolving them, allow the project manager and other stakeholders to monitor the resolution progress.

From the database, interrelations between Incidents, Problems and Change Requests can be identified and utilized to help better the management of the project.

The success of IT projects often relies on pro-active communication among project stakeholders. Formal communication is often in the form of an Email or a written document such as a report, a memo and a letter. The proposed system provides a central storage for all documents raised by project stakeholders (see Figure 1). A stakeholder can tag it to an Incident, a Problem or a Change Request when s/he uploads the document to the system. These documents together with journal entries provide all project information to facilitate the building of learned lessons.

Figure 1. System Overview
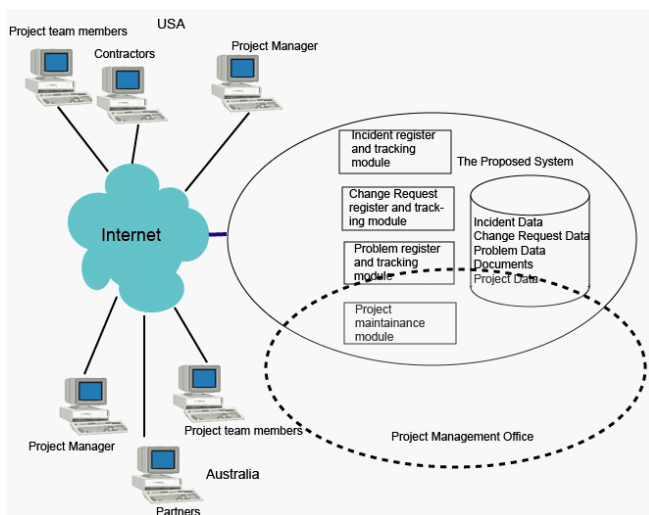
The Project maintenance module allows the administrator of the system to create a project, build project information and assemble data on project teams and other project stakeholders. This module is often provided as part of a Virtual Project Office (see Figure 1).

PROCESS TRACKING
The system provides project managers and other authorized project stakeholders to track Incidents, Problems and Change Requests from their inception to their closure.

The originator of an Incident can use a web-based Incident Registration Form provided by the system to register an Incident and flag its severity. The originator can also specify on the Form the people involved, the project activities it is related to and Incident types (human resource, cost, time, functional specification, statement of requirements, legal agreements, business requirement and Project Charter). Depending on the severity of an Incident, the PM will decide whether to assign people to diagnose the Incident. If assigned, the assignee will then use the web based Diagnosis Form to diagnosis the Incident and then assign others to resolve the Incident if deemed necessary. All actions taken to resolve the Incident will be entered as journal entries to the system by the people involved. Once the Incident is resolved, the assignee will use the Incident Resolution Form to sign off the Incident and notify the originator and the project manager to do the same. The system will then close the Incident in the register.

The originator of a Problem can use a web-based Problem Registration Form to register an occurrence of a Problem. The project manager will assign a person in charge of resolving the Problem (the assignee). The people involved in solving the problem will keep a journal on the system via the Internet on all the actions taken in the process of solving the problem. By inspecting the journal, the assignee can manage the resolution process and the Project Manager can monitor the situation. Once the Problem is resolved, the assignee will use the Problem Resolution From to enter the details of the solutions and their effectiveness. The system will close the Problem in the register as soon as it is signed off by the Project Manager, the originator and the assignee of the Problem.

If a formal request for a change is identified at any stage in the project, it must be registered in the Change Request register using a web-based Change Request Form. All details about the change, including the reason for the change (linking to a Problem), the estimated cost and the impact statements, have to be included in the register. The project manager will assign someone to oversee the progress of the Change Request through its various stages:

- Raised – not assigned
- Open – assigned
- Definition – requirements are being defined
- Quotation – quotations are being sorted
- Approving – request is under consideration
- Approved – approved and awaiting scheduling
- Not approved – request has been denied
- Scheduled – requested is being incorporated into the project schedule
- Cancelled – requested has been removed

By monitoring the journal entries entered at various stages, the project manager and other authorized stakeholders can monitor the current status of a Change Request.

SUPPORTING DOCUMENTS
The majority of data generated during a project is often in the form of documents (for example: memos, emails, notes, letters and communication logs) raised by project stakeholders during the project. Without a PMO, these documents often remain in the machines of the senders and will be destroyed once the project is completed. The proposed system allows the user to upload a document to a central server and tag it to an Incident or a Problem or a Change Request.

Incident related documents provide details related to Incidents including the people involved, project activities they were link to, and their diagnosis and resolution actions (if required).

Problem related documents provide insight into Problems including the people involved, actions taken within each stage while problems were being addressed and their impacts on the project.

Change Request related documents provide the reason for raising a Change Request (and its benefit), the signing-off details, the impacts on the project, and the outcomes at each stage of the Change Request process.

INTER-RELATIONSHIPS BETWEEN INCIDENTS, PROBLEMS AND CHANGE REQUESTS

To solve a problem successfully, it is important to identify the root of the problem and solve it there. The Incident register contains some information that is useful to help identify the root of a Problem at hand. By searching the register, the people responsible for resolving a Problem can easily identify those Incidents related to the problematic project activities, the people involved in the Problem and the type of the Problem. If these Incidents are proven to be sources for the Problem, they can then be flagged to be linked to the Problem within the Problem register.

The three registers will now provide the linkages between a Problem, its sources and its solutions. During the project close-up phrase, this integrated information will be useful for the project manager in creating learned lessons for use in future projects.

DATABASE DESIGN FOR THE PROTOTYPE

Figure 2 shows the database supporting the prototype. Each document uploaded to the central repository will be assigned a unique number. The **IncidentDocument** table, for example, allows multiple documents to be linked to an Incident. The entry to the document fields are performed when an Incident is raised or a journal entry is logged for the Incident.

The **IncidentVersion** table facilitates all the journaling of events related to an Incident. The **IncidentActivity** table defines which Incidents are related to which activities within which projects.

The **IncidentEmployee** table captures the people involved in an Incident. These two tables enable the person assigned to handle a Problem, to identify Incidents that may be candidates for the identification of the source for the Problem. The **ProblemActivity** table allows the Problem assignee to specify the linking of a Problem to multiple Incidents (the source of the Problem).
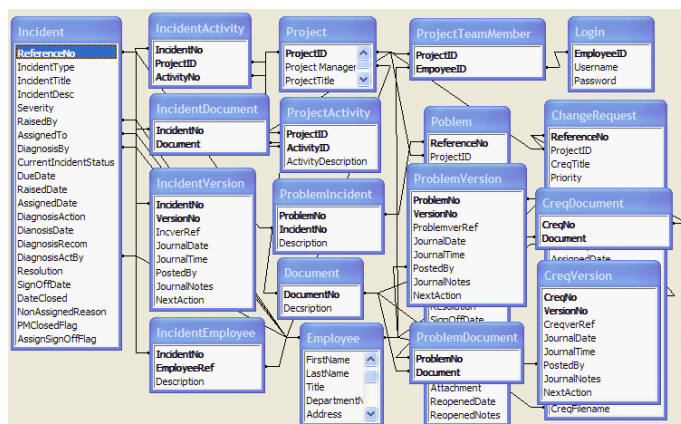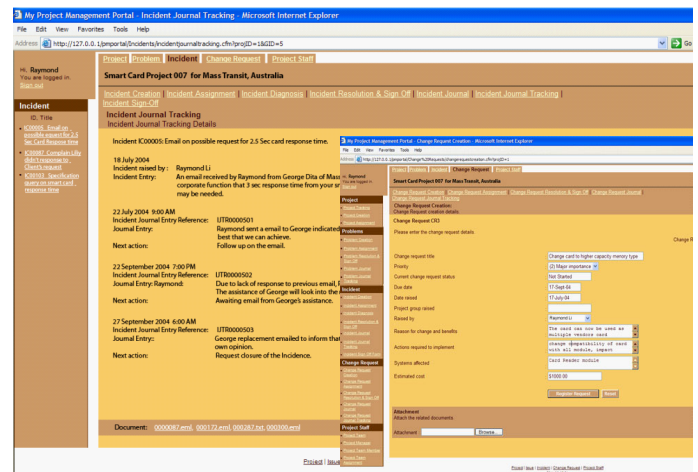
Figure 2. The Database

Figure 3. Screen Captures

THE PROTOTYPE

The prototype was implemented using Macromedia ColdFusion 4.0 and has over 30 screens. Only two screens are included here for discussion.

To identify the source of a problem, its assignee of can use the system to search for the Incidents that may be related to the Problem. S/he can issue a query to the database to return all the Incidents that match the scope of the Problem. The scope can be defined by activities, people and/or Incident types that the assignee may think the Problem at hand is related to. The assignee can use the Incident Tracking Screen (see Figure 3) to drill down into each Incident for details. This includes the inspection of all the related documents stored in the repository via the *attachment* link. Once related Incidents are identified, the assignee can tag these Incidents to the Problem. The assignee may re-open an Incident for future actions. The linking of Problem to Incidents is also important for supporting the building of the learned lessons.

The smaller picture within Figure 3 illustrates the Change Request Creation Form. Figure 3 also shows the menu systems used for navigation between the Incident module, the Problem Module, the Change Request Module and the Project Module, as well as within each of the modules.

ANALYSIS OF THE SYSTEM

Despites its incompleteness, the prototype demonstrated the feasibility of building a web based virtual project office that is capable of supporting the building of lessons learned from a project to help future projects.

The prototype also demonstrates the possibility of a paper-less project office utilizing a standardized web based template approach for data entry and capturing. Furthermore, it demonstrates a single repository to capture all important information for the monitoring of important processes such as Incident diagnosis, Problem resolution and Change Request processing.

The proposed system added meanings to documents stored in the central repository and thus allowed the project manager to learn from all the failed actions and the right approaches taken to resolve Problems. This can also help the project manager to further their knowledge and competence in the management of their future projects.

CONCLUSION AND FUTURE RESEARCH

This paper demonstrates the feasibility of building a web-based central repository system capable of capturing information from virtual project teams to support the facilitation of lesson-learned. The scope of this project, however, does not cover the evaluation of such a system under a real project setting.

The data captured in the database, together with the related documents in the repository, can be used to develop cases to form the basis for the development of a Case-Based Knowledge Management system. Such a system can help to prevent the occurrence of problems similar to those in previous projects or solve problems better, if prevention is not successful.

Although the proposed system is targeted at the project management environment, it can also be adopted to be used within General Management areas.

The proposed system has not included considerations for the following:

- In the system, the uploading of the documents is to be done manually. As a good tool should not hinder the efficiency of its user, it will therefore be ideal if the email system and the word processing system are modified to include facilities to upload document to the central repository and tag them to a Incident, a Problem or a Change Request without having to leave the environment.
- Security issues have not been considered in the system. Project data such as costs are sensitive and thus only authorized personnel should be allowed to access them.
- The Change Request register has included a few fields to facilitate the tracking of the approval of Change Requests. Ideally, a workflow system linked to a *responsibility matrix* should be implemented to allow automatic flow of a Change Request Form from one stakeholder to another.
- The current system relies on the project manager to log onto the system to identified unassigned Incidents, Problems and Change Requests. The system also requires the project manager to use an external email system to notify the assignments of Incidents, Problems and Change Requests to stakeholders. An automatic emailing module should be added to the system to achieve the automation of the notification processes.
- The database design has not yet been optimized for search efficiency. Further research should be conducted to establish better search strategies and database structure. This will allow easy retrieval of all Incident data and documents relating to a Problem.
- A visual hierarchical structure depicting the inter-relationships between Incidents, Problems and their solutions should be incorporated into the system. Such a visual aid will definitely help the project manager to create learned lessons easier, in particular when the elements within the visual structure can be hyperlinked to their related documents.
- The system should be extended to capture positive experiences (see section on "Focus of the Proposed System").

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