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CONTENTS

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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

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KNOWLEDGE CAPTURE SYSTEMS IN SOFTWARE MAINTENANCE PROJECTS

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ABSTRACT

Knowledge Management has emerged as a very promising area to assist the software maintenance practice. It is an activity that requires lots of knowledge. For example, maintainers must know what changes should do to the software, where to do those changes and how those changes can affect other modules of the system. This knowledge is difficult and costly to gather and usually stays on the minds of the person who worked in a particular project. Availability of tools to capture and document this knowledge is also sparse. In this paper a system that would facilitate maintainers to have a peek on the minds of the maintainers is presented by leveraging on the existing knowledge, capture tacit as well as explicit knowledge while easing out the task of navigating through the various other utilities in the project is presented.

KEYWORDS

Knowledge Management, software maintenance, knowledge, capture, tool, tacit, explicit knowledge, project.

1. INTRODUCTION

To maintain legacy software systems, software engineers Need knowledge on many different domains: application domain, system's architecture, particular algorithms used, past and new requirements, programming language, development environment, etc. One could argue that software development suffers from the same knowledge needs, however these needs are more difficult to fulfill during maintenance. It is not uncommon in software maintenance to have a very vague knowledge of what were the exact requirements for the system, whereas during software development, one is expected to have access to the requirements relatively easily.

The constant quest for knowledge is one of the prominent problems of software maintenance and should be dealt with accordingly for example, using knowledge management methods. Adopting a knowledge management point of view on software maintenance could bring in a new light on the problem and may help improve the conditions in which it is performed. In this paper, presented are some experiments performed on software maintenance projects in the industry to capture the knowledge gained during the maintenance.

KNOWLEDGE MANAGEMENT (KM)

Knowledge management is crucial in software Maintenance organizations to provide an environment to create and share knowledge. SMT environment is complex, knowledge-driven and highly collaborative. Issue such as inadequacy of knowledge is still regarded as a major challenge in SMT.

Knowledge management efforts typically focus on objectives such as enhanced performance, competency, innovation, making known the lessons learned to all, integration and continuous improvement of the organization. KM efforts foster sharing of knowledge. It is seen as an enabler of organizational learning.

SOFTWARE MAINTENANCE

Software maintenance (SMT)consumes a large part of the overall lifecycle costs .The incapacity to change software quickly and reliably causes organizations to lose business opportunities. Thus, in recent years we have seen an increase in research directed towards addressing these issues. On the other hand, software maintenance is a knowledge intensive activity. This knowledge comes not only from the expertise of the professionals involved in the process, but it is also intrinsic to the product being maintained, and to the reasons that motivate the maintenance (new requirements, user complaints, etc.) processes, methodologies and tools used in the organization. Moreover, the diverse types of knowledge are produced in different stage of the Maintenance process. During the software maintenance activities different people intervene. Each person has partial information that is necessary to other members of the group. If the knowledge only exists in the software engineers and there is no system in charge of transferring the tacit knowledge (contained in the employees) to explicit knowledge (stored on paper, files, etc) when an employee leaves the organization a significant part of the intellectual knowledge goes with him/her. Another well-known issue that complicates the Maintenance process is the scarce documentation that exists related to a specific software system, or even if detailed documentation was produced when the original system was developed, it is seldom updated as the system evolves. For example, legacy software written by other units often has little or no documentation describing the features of the software.

KNOWLEDGE CAPTURE SYSTEM IN SOFTWARE MAINTENANCE

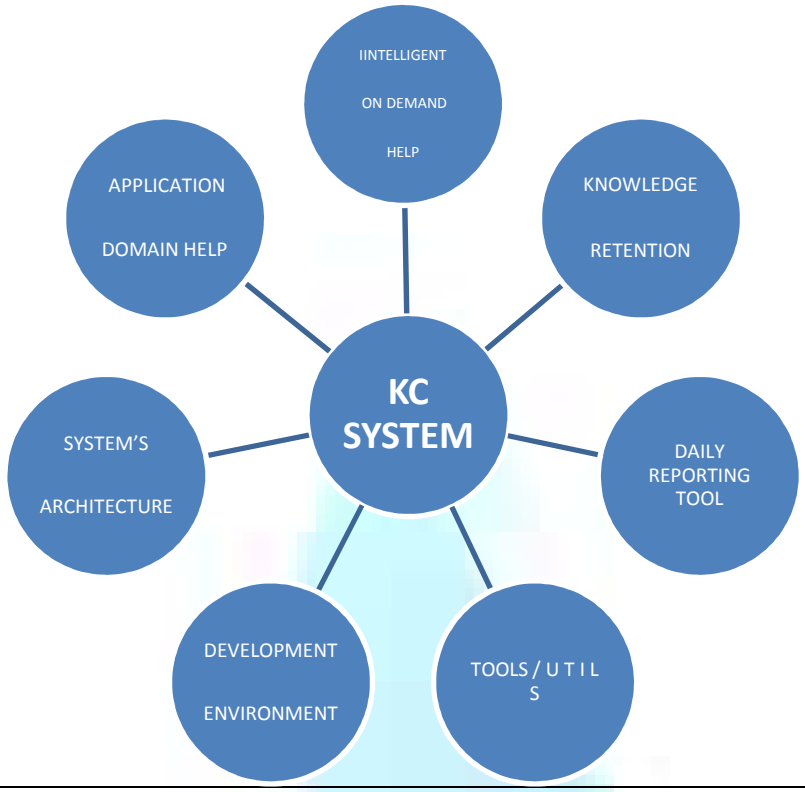
Using a KM system the diverse kinds of knowledge generated may be stored and shared. Moreover, new knowledge can be captured, obtaining the maximum benefit from the current information. By reusing information and producing relevant knowledge the high costs associated with software maintenance could also be decreased.

It should serve to be be a one shop for all purposes within the project , be it traversing the extensive existent knowledge available, the application domain, shared vision, since they are brought to the same page and misunderstanding in staff communications may be avoided

With all the sources of knowledge located and traversing in different repositories via different tools, keeping track of information useful for both users and maintainers could be a nightmare. One of the main goal of a Knowledge Capture (KC) system is to automate, as much as possible, the tasks of acquiring, disseminating and storing of knowledge. The system aims to integrate the following systems

1. Application Domain
2. Development Environment
3. Tools and Utilities
4. Knowledge Retention
5. On Demand Help
6. Development Environment
7. Daily Reporting tool

KNOWLEDGE CAPTURE SYSTEM



OBJECTIVES OF THE STUDY

1. To provide an insight into the necessity of knowledge management in software maintenance projects.
2. To recognize the need for a knowledge capture system in such projects.

REVIEW OF LITERATURE

There are various propositions of mental models to describe how software engineers go about doing maintenance [Rugaber and Tisdale 1992], [von Mayrhauser and Vans 1994]. They offer little interest since they concentrate on the process of doing maintenance rather than on the knowledge used

In [Ramal et al. 2002], one of us started to study the knowledge used during software maintenance. This earlier work contained a very crude identification of various knowledge domains connected with this activity. The domains identified were: Computer Science Domain, Application Domain and General Domain (common sense knowledge). The current research is a follow-up on the preceding paper and describes the result of our efforts to formally and completely identify the knowledge useful during software maintenance

Deridder 2002, proposes to help maintenance using a tool that would keep explicit knowledge about the application domain (in the form of concepts and relations between them) and would keep links between these concepts and their implementation. He follows a trend of thought very similar to ours, but concentrates exclusively on application domain knowledge whereas we identified four other sub-ontologies that had useful concepts in them. Also, he concentrates on how to acquire and use this knowledge rather than extensively identify it (which would actually depend on every single application domain).

Aurora Vizcaíno(2007) describes a system to manage the information (and knowledge) generated during the software maintenance process which consumes a large part of the software.

Kitchenham et al. in [Kitchenham et al. 1999] designed an ontology of software maintenance. In this ontology, they identified all the concepts relevant to the classification of empirical studies in software maintenance, these concepts are classified along four main axes: the People, the Process, the Product, and the Organization. These four axes correspond respectively to our Skills, Modification, System, and Organizational Structure sub-ontologies. This was one of the most inspiring work for us and we reused many of its concepts, however due to the particular focus they had when identifying these concepts (providing a framework to help categorize empirical studies on software maintenance), we felt that many concepts were either over or under detailed. The most striking evidence of this is the idea of application domain which we developed as a sub-ontology, whereas it is only included in Kitchenham's work as an attribute of the software system lifecycle costs.

Mohd Zali Mohd Nor(2010) KM is envisaged to contribute to the organizations in the following manners (KPMG, 2003):

- Bring synergies among different teams, units or departments
- Accelerate innovation and boosting revenues for market development.
- Improve quality in operational and functional processes
- Reduce costs and exposure to business risks.

Becerra-Fernandez, et al – Knowledge Management 1/e -- © 2007 Prentice Hall. Knowledge capture systems support process of eliciting explicit or tacit knowledge from people, artifacts, or organizational entities.

Knowledge Capture and Collaboration Systems , An Automae White Paper

Lindval et al. (2003) and Lawton (2001) elaborate the above various tools, and group the tools into document and content management, collaboration services, data and knowledge discovery, expert networks, expertise/competence management .

A common perception of maintenance is that it merely involves fixing defects. However, one study indicated that the majority, over 80%, of the maintenance effort is used for non-corrective actions (Pigosky 1997).

NIESSINK, F. AND VAN VLIET, H. 2000. Software maintenance from a service perspective. *Journal of Software Maintenance and Evolution : Research and Practice* 12, 103-120.

Software maintenance and evolution of systems was first addressed by Meir M. Lehman in 1969. Over a period of twenty years, his research led to the formulation of Lehman's Laws (Lehman 1997)

RESEARCH GAPS

As for suggestions for further research the review of the literature brought forward an issue that calls for attention. The absence of a system that would integrate all modules of a maintenance project with the knowledge capture system is brought to the fore.

Another gap that was evident is in the fact that tools and utilities considered are disparate and it allows future research to explore the possibility of having them integrated.

CONCLUSION

Software Maintenance is a knowledge intensive activity and need to go a long way to make sure that this knowledge is trapped and could be put to good use. Software maintainers need knowledge of the application domain of a legacy software. All this knowledge may come from diverse source experience of the maintainers, knowledge of users, documentation, source code, Most of the time however, the knowledge once acquired stays in someone's head as opposed to be formally documented for later retrieval and reuse. When a maintainer leaves the organization, all the knowledge he/she gathered on the various systems he/she worked on, should not be lost for this organization. The presence of a knowledge capture system to assist in knowledge capture, retention of the knowledge and also to provide the maintainer with the necessary information at the right time is recognized here.

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