A 'state of the art' Evaluation of PM – Systems exploring their missing Functionalities

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Abstract

Project management (PM) is crucial to successfully accomplished projects within their predefined goals. To support this process, project management tools are required to foster project members to minimize overruns in time and budget. The presented work is part of a three years project to add semantic technologies to project management for increasing its efficiency.

To study the functionalities of current PM systems and for developing a semantically enriched software system, an evaluation of four open source PM tools was carried out. For this work, we started with an online research to obtain a list of the most common/available open source PM systems. Afterwards, we chose the four most common mentioned systems.

In addition, qualitative face-to-face interviews with eleven companies, mainly operating in the IT domain, were conducted to reveal missing functionalities as well as usable information about lacks of current project management solutions. The questionnaire contained 27 questions concerning different category groups, such as "general information", "tools & functionalities" and "(reusing) stored information". This paper outlines strengths, weaknesses and problems related to current PM (tools). Results have shown that inconsistent data storage and incomplete up-to-date information of ongoing projects are critical issues, which are not completely covered by existing systems.

Keywords & Phrases: interviews, strengths and weaknesses, knowledge, semantic, archive

1. Introduction

Successful project management (PM) contains predefined constraints, such as time, budget and resources. But very often, projects fail or are cancelled due to certain shortcomings. According to [5] it is estimated that 11,5%-15,5% of IT-projects fail. Reasons stated are (i) senior management is not adequately involved, (ii) scope and requirements change repeatedly, (iii) projects are over budget and (iv) a lack of necessary management skills is given.

In addition, the Chaos Report [10] argues that the most common factors of project failure are related to a lack of user input, incomplete and changing requirements as well as specifications and lack of executive support. It states that 31,1% of all projects are cancelled while the success rate is only 16,2%.

In [4], 70 failed projects were analyzed to identify the most common failure factors. In total, they received questionnaires describing more than 300 projects, conducted in the U.S, Australia and Chile. Nearly 93% of all projects failed due to time constraints. Other factors are that the projects had a wrong estimation of project duration, long hours were not rewarded and that risks were not adequately controlled and managed.

[5], [10] and [4] refer to a statistical overview of failures and identify a different set of the factors mentioned above. In [7], Pinto and Mantel describe a study, including 97 projects with a view to identify controllable factors of project failures. They identified ten factors which are relevant for successful project: project mission, top management support, project schedule/plan, client consultation, personnel, technical tasks, client acceptance, monitoring and feedback, communication and trouble-shooting.

In our work we accomplished a survey to detect problems in project management as well as functionalities in current systems. To assess current challenges we conducted interviews with eleven companies mainly operating in the IT domain. Based on the results of the interviews and on the literature research, a functional analysis of PM systems was done. Main purpose of this analysis was to identify which functionalities current PM systems offer and which requirements are tackled by them.

By the use of the identified failures we want to solve them by employing semantic technologies. Therefore we will enhance an existing open source system. This work is part of the project SemProM – Semantic based Project Management. There, we try to tackle the problems outlined in this paper by enhancing a project management system with semantic technologies [9]; especially with ontologies and ontological reasoning.

The paper is structured as follows: Section two provides a description of our project management evaluation framework. Thereby, it describes the methodological approach adapted for the interviews, the evaluation and the description of some use cases. In Section three the results of the interviews and the evaluation will be

discussed. The last Section provides the conclusion and future research issues. Appendix A contains the questionnaire of the interviews.

2. Project Management Evaluation Framework

To get a starting point for the work we defined certain statements, why projects tend to miss their goals.
- Most companies do not use a standardized archiving (system) for their finished projects (information).
- Work is done twice ore more often, because
  - already stored information cannot be found,
  - information is not stored correctly (e.g., no keywords or wrong identification) or
  - nobody knows that (similar) work has already been done in other projects.
- Time and budget get lost, because resource management, especially regarding responsibility assignments, is not used in an optimal way.

To check the statements mentioned above, interviews with companies, working in different domains, were conducted. Furthermore, problems in current PM solutions were highlighted.

For the evaluation of the project management systems we defined a framework that contained functional and non-functional requirements as well as simple use cases. It also included, e.g., several project addicted requirements such as the latest forum entry concerning the community behind the open source system. The evaluation framework is a mixture on approaches based on the literature, such as [2] and [6], and requirements already mentioned. The work of [2] describes a software system evaluation framework and its level of categorization as well as examples of project classifications. The work of [6] deals with a study to test a combination of methodologies for system evaluation.

Due to this framework we (i) compared the PM systems and (ii) came to a decision which PM system will be used for our further work.

2.1. Interviews

To get usable information about lacks of current project management (solutions) as well as strengths and weaknesses we decided to follow a qualitative approach [3] doing eleven face-to-face interviews with companies based on a questionnaire with 27 questions (the questionnaire is shown in Appendix A). As we were doing these interviews we were able to ask interposed questions to improve the quality of results. For our research purpose, the focal point refers to IT projects. This purpose implies the reason, why the majority of the interviewees are acting in the domain of IT. However, to get a broader view, refining the evaluation results we also invited interviewees of other domains. In addition, the size (number of employees) of the companies varies to consider different PM solutions within diverse enterprise sizes.

Basic groundwork of the questionnaire was a discussion within the working group of our university as well as meetings with a PM company, which sells a project management system focusing on PM handbooks. Based on this information a first questionnaire was designed and tested with a business manager. Afterwards, the questionnaire was finalized.

Company	Number of employees	Sector
1	~ 1000	Bank sector
2	35 (Austria)	Health care
3	~ 470	Public / IT sector
4	~3000	IT sector
5	~ 270	Bank / IT sector
6	~ 800 – 900	Public sector
7	~ 5000	IT & services
8	~ 200 – 300	IT & insurances
9	~ 160 (Austria)	IT & services
10	~ 3000 – 35000	Oil industry
11	125	IT / architecture

Table 1: Overview of the interviewed companies

Table 1 gives an overview of the interviewed companies including their sectors and sizes. As the interview results cover sensitive information, the company names have been anonymized.

2.2. Evaluation of Open Source PM Tools

For our evaluation we considered open source PM tools only. The reason for this relies in the strategy to extend a PM system with semantic technologies to improve current PM solutions. But there is already some work in the field of evaluation of commercial project management systems, such as the work of Ahlemann [1]. He evaluates in "Project Management Software Systems Requirements, Selection Process and Products" 34 products.

After an online validation we obtained a list of the most common/available open source PM systems. Afterwards, we chose four systems: dotproject (http://www.dotproject.net), WebCollab (http://www.webcollab.sourceforge.net), Projectpier (http://www.projectpier.org) and PHProjekt (http://www.phprojekt.com).

Based on the interview results and existing PM evaluation frameworks, different requirements as well as simple use cases were defined. For instance, use cases include "a simple keyword search" or "insert a new task related to a project". We decided to take these basic use cases as we wanted to obtain a general overview of the features and functionalities of the evaluated systems. As already mentioned above the requirements are separated into functional, non-functional and project processes, while use cases are related to the main functionalities. Non-functional requirements include, for example, (i) the latest release (version and date) or (ii) the date of the latest forum entry (related to the community behind the system). Functional requirements are, for instance,

- "edit a project",
- "define a milestone",
- "document upload and download" and
- "edit multiple projects".

These requirements are used to evaluate the "powerful functional range" of the systems and to investigate the main focus of the evaluated applications. The non-functional requirements should identify, for example, the community behind the systems regarding, e.g., help (while using the system or installing) or further development. The functional requirements dealt with the most common features in project management systems. An overview of the functionalities is given in the next section.

3. Results

The results contain the outcome of the interviews on the one hand and of the evaluation of the four chosen open source PM tools on the other hand. While the outcome of the interviews is valuable for our future work regarding project management, the evaluation of the systems depicts that current PM solutions have lacks regarding data storage, processing and retrieving stored information. The result of the interviews reveals that certain features are desired by project members, but not provided by current PM tools. Companies stated that they would like to have a general overview of up-to-date information.

3.1. Interviews

As mentioned in Section 1, our statements regarding project failures are as follows:
- most companies do not have any standardized archive or data storage,
- work, such as documentation, is done twice or more often and
- time and budget get lost, in fact resource management is not used in an optimal way.

Basically, the interview results validate these statements.

Table 2 shows aggregated answers and table 3 displays exemplary answers of interviewees related to the interview questions (i)"What are the strengths of your current solutions", (ii) "What are the weaknesses of your current solutions" and (iii) "Do you have any kind of archive for information of old/finished projects? Where and how do you archive the information?".

In this way, the columns "Strength" and "Weaknesses" highlight the benefit and problems of current PM systems in practice. The columns "Archive" and "Archive Information" are related to regarding data storage, archiving and information recovering.

Strengths	established standards and processes	simple and consistent approach	structured and clearly defined guidelines for the project structure
Weaknesses	no interfaces between	no "cockpit" for an	no central data storage

		different systems	overview of all projects	
Archive		no central and consistent storage	electronic file systems, DVDs or hardcopies of documents	
Archive information		"lessons learned"	reuse of templates of documents	Wiki: for information about PM and processes

Table 2: Aggregated interview results

Company	1	2	3
Strengths	established standards and processes	structured and clearly defined guidelines for the project structure and documents	central storage and certified manager
Weaknesses	no interfaces between their systems and no "cockpit" for an overview of all projects	consistent project system would be great	no interface between their systems
Archive	documents are stored on an electronic files system and on CDs/DVDs	no central file storage and no rules to store project documents and information	hardcopy, electronic file storage and databases; do not have a "real" archive storage
Archive information	awareness is often too late that already stored information could be used; and they have no structured information	"project jour fix" ➜ "lessons learned"	"lessons learned"

Table 3: Exemplary extract of the interview results

The answers to the questions mentioned above can be summarized as follows:

- **Strengths**
  The (established) standards and predefined processes were the most common statements, independent of the software they are using. The interviewees also mentioned their simple and user-friendly approach to the project management processes. One company stated that they only use Excel files for their project proposals, project execution and the closing reports. Another company has clearly defined standard processes for their projects, an application for the process control and predefined documents for different modules of the project process.

- **Weaknesses**
  The answers concerning the weaknesses of their used PM tool(s) were much more diverse. While some companies complained that they do not have an application programming interface (API) between their systems, others told that they have no central data storage and/or a bad project control. Others again would require a complete solution or more defined project process standards. In addition, some would like to have a "cockpit" in form of an overview of all current projects, their ongoing tasks and milestones. Thereby, they would have the possibility to detect problems related to time schedules, project costs or needs for additional staff for a specific project. But nearly half of the interviewed companies do not have any standardized structured storage system.

- **Archive**
  Half of the interviewed companies do not have a central and structured storage system as well as archive and therefore no search possibility. But a potential reservoir is that already archived information is needed, in case, e.g., customers need a documentation of finished projects.

Another outcome of the interviews is that the most common software used is MS Project and MS Excel for project processing and SAP for the accounting. In general, the companies, which offer IT services and software, utilize more complex PM systems than others.

The results of these interviews are quite important and interesting. While our statements were correct, the results highlight the importance of actual and reliable information about current ongoing projects (e.g. time schedule, cost plans, open tasks) for project manager and members.

In short the key findings of the interviews are

- companies miss a central, well structured and accessible storage and archive,
- project leader as well as project members need a listing of current ongoing projects with milestones and costs; in short, an up-to-date information cockpit with all relevant project items,
- and in case the project management systems consist of several applications, interfaces between different applications are required to guarantee frictionless processes.

20 years ago Pinto and Mantel [7] identified ten factors, which have to be fulfilled for successful projects. Based on our interview results regarding the weaknesses of current project management we can agree on the following factors: project mission, top management support, project schedule/plan and monitoring. Comparing the work of Pinto and Mantel [7] and the outcome of our work, the requirements regarding project management did not change during the last 20 years.

3.2. PM Evaluation Results

In the field of project management there are lots of different commercial as well as open source systems. These systems vary in the number of offered functionalities. The evaluation contained four systems as mentioned in Section 2.2. By using three different use cases (i) "create a new project", (ii) "create a new task related to a project" and (iii) "simple keyword search", the available functionalities and non-functional requirements were analyzed. Table 4 displays a comparison of the functionalities of the evaluated PM systems, while Table 5 shows some non-functional requirements.

PM Systems	dotproject	PHProjekt	WebCollab	Projectpier
Projects	✖	✖	✖	✖
Contacts	✖	✖	✖	✖
Tasks	✖	✖	✖	✖
Costs	✖	✖		
Milestones	✖			✖
Document upload	✖	✖	✖	✖
Document download	✖	✖	✖	✖
Users	✖	✖	✖	✖
Groups		✖	✖	
Mails	✖	✖	✖	✖
Search	✖	✖	✖ (forum)	✖
Listing of current projects	✖	✖	✖	✖
Listing of tasks/activities	✖	✖	✖	✖
Multiple projects	✖	✖	✖	✖

Table 4: Overview of the comparison of the functional requirements

In Table 4, the terms "projects", "contacts", "tasks", "costs", "milestones", "users", "groups" apply that they can be inserted as well as edited.

PM Systems	dotproject	PHProjekt	WebCollab	Projectpier
Latest release	29.07.2008	23.01.2008	16.04.2009	10.06.2009
Latest release Version	2.1.2	5.3 beta	2.50	0.8.5.0 beta
Forum (website)	✖	✖	✖	✖
Latest forum entry	today	today	July 8th	yesterday
Open source	✖	✖	✖	✖
Easy to install	✖	✖	✖	✖
Multi-languages	✖ (modules)	✖	✖	no

Table 5: Overview of the comparison of non-functional requirements (Last access to the websites on Wednesday 29th of July 2009, ✖ is available on this pm systems)

While in Table 4 the functionalities of the evaluated systems look quite similar, Table 6 shows some differences.

Table 6 demonstrates the results of the use case "create a new project" and whether the systems provide the needed function activities. Thereby the differences between the systems are clearly shown. The comparison of the use cases highlights the differences regarding the features of the systems. For instance, WebCollab only offers a forum search but no search according to project relevant information items. In contrast, dotproject and PHProjekt provide both simple and advanced search features.

	dotproject	PHProjekt	WebCollab	Projectpier
project name	✗	✗	✗	✗
project owner	✗	✗	✗	
company	✗			
internal division	✗			
start date	✗	✗		
target finish date	✗	✗	✗	
target budget	✗	✗		
priority	✗	✗	✗	
short name	✗			
color identifier	✗			
project type	✗			
status	✗	✗	✗	
actual budget	✗			
URL	✗			
staging URL	✗			
import tasks from	✗			
description	✗	✗	✗	✗
hourly rate		✗		
category		✗		
cost centre		✗		
cost unit		✗		
contractor		✗		
subproject of		✗		
project related times (description, date, hours)		✗		
opening		✗		
members		✗		✗
contacts		✗		
group of users			✗	
send emails	✗	✗	✗	✗
security rules			✗	

Table 6: Overview of the functionalities of the use case "create a new project"

While dotproject and PHProjekt contain several input and information fields, WebCollab and Projectpier include just the most important ones, like project name.

4. Conclusion & Future Steps

While conducting the interviews with the eleven companies, we realized that project management includes a wide range of the interpretation of the term "project management". Some companies just use a MS Excel document for all relevant steps of project processes, others had predefined processes and self implemented systems to handle each kind of project. Another interesting point regarding the interview outcomes is that some interviewee noted that a kind of "cockpit" management would be necessary to survey all relevant information, such as milestones, important dates and costs of projects. A further outcome of the interviews is that most of the interviewed companies do not have a standardized archive and therefore the stored information documents cannot be reused as easily. Hence some work has to be done more often.

In addition to the interviews, a functional evaluation of project management systems was done. An interesting point is that the evaluated tools show large differences regarding the features while operating use cases. While dotproject and PHProjekt offer nearly the same functionalities and processes, WebCollab and Projectpier just provide the most needed features.

As already mentioned above, we will implement a prototype in further work. Therefore, dotproject seems to be most suitable. It has similar functionalities like PHProjekt, but offers a better usability. Furthermore, it contains more features than WebCollab and Projectpier, especially in the field of project processes.

We propose that semantic technologies are able to tackle the lacks of current project management. Therefore, we propose the project called "Semantic based Project Management" - SemProM - which enables a better

search functionality and reuse of already existing data by using semantic technologies, reducing thus time and costs. In addition, it reduces the effort of project management and increases the probability of project success. Information of already finished projects can be used as input for planning new projects and to monitor progress and risks of projects underway. That is because of better storage of project relevant information. Due to explicitly describing the relationships between various project documents in machine accessible form, better administration of projects and easier identification of relevant information is possible.

By combining semantic technologies and PM, a reduction of the administration effort and an improved control of the progress of a project are possible. Introducing semantic technologies such as ontologies, semantic annotation of content and semantic search addresses the problems outlined above and opens up new ways of delivering the needed insight and experience of past projects. Relevant information of former projects is consolidated in a knowledge base. With the use of ontologies project members can search for concepts and do not have to search for exact keywords. Furthermore, different information items are set in relationship which simplifies and optimises the search process.

For example, Sauermann et al. presents in [8] a Semantic Desktop, which is a Personal Information Management system. The analogy to a project management system is given. While the Semantic Desktop uses semantic technologies, such as ontologies to link and store personal information for a better structuring and reusing of the information the project management system will use them for project related information.

An example, based on the interview results, is the data storage. Up to now lots of companies do not have a central data storage and/or no structured stored information to reuse it. If they use a central data storage and structure and annotate their stored information with the use of ontologies, they will get a knowledge base with nearly all information related to project management. For example, lessons learned, competences and documents, but all information related to projects, while they are related to other projects in fact of, e.g., similar lessons learned.

Another example is the "cockpit". The interviewees wish to have one and current PM solutions do not provide such a function. With the ontology, mentioned in the last paragraph, it is not only possible to show all important information of ongoing projects, but also to show possible reasons why projects are running out of time or budget. This will be possible in fact of the lessons learned and the relations between them and projects.

Acknowledgement

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Appendix A – Questionnaire

General:

1. Information of the company: Name, Size (number of the employees)

General: Projects

2. Do you manage small or big projects? How many projects?
   Which kind of projects do you manage? IT – Projects?
3. Did projects already fail in your company?
   Which ones?
   How much?
   Why? (internal communication, missing control, …)
   Did the company learn of failed projects? Could your project management be improved?
4. Do you have statistics of your projects (success and disappointment)?

Projects: tools & functionalities

5. Do you use project management systems?
6. Why do you use such systems? What were the motives?
7. Which software do you use for project management (MSOffice, MSProject, Client based, Server based…)?
8. Which functionalities does the software have?
9. Are you satisfied with your systems?
   Why?
   What could be better?
10. Do you miss any functionality?
    Which? Why?
11. For choosing your PM system did you design a criteria catalogue?
    Who did the criteria catalog define?
12. Which functionalities do company-wide projects have? Do they have different ones?

Projects: processing & control

13. Do you have rules for the processing of projects?
14. Do you have different project management systems for different projects?
    Or do you use the same system for all projects?
15. Do you have different processes for different projects (small/big)?
    Do you use different project management systems? Why?
16. Do you have special employees as project manager? Why?
    Do they need a special education/training?
17. Do employees have to record their working hours?
18. What are typical processes in your project management?
19. How do you realize company-wide projects?
    Do you use applications?
    Which ones? Why?
20. Do you have rules for company-wide projects?
21. Which categories could be improved in your project managing?
    a. communication
    b. standardized terminology,
    c. faster process handling,
    d. better process quality,
    e. transfer of knowledge,
    f. cost saving,
    g. improvement of the capacity for teamwork,
    h. to be able to fall back on already existing knowledge
    i. better integration between different tasks
22. What are the strengths of your current solution?
23. What are the weaknesses of your current solution?

Projects: „old/existing" knowledge

24. Do you use knowledge of old projects for current ones?
    What information? (results of projects, documents, persons/competences)
25. Do you need (sometimes) information of old projects?
26. Do you have a kind of archive for information of old/closed projects?
    Where and how do you archive the information?
    In what format do you archive the information? (pdf, word, images)

Project management:

27. Do you know project management standards?
    Which one? Do you use such a standard in your company?