An Application to Select Collaborative Project Management Software Tools

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Abstract. In an increasingly competitive market the use of project management techniques can help controlling scope, time, and cost in an efficient way. Either due to size or complexity that may exist in a project, it may be essential to use project management software tools. Some projects involve teams of people who may be geographically dispersed, being essential to exchange information among project stakeholders, hence the need for collaborative tools, best known as groupware. In this paper, we present an overview of project management and collaborative project management techniques and tools. Next, we present a framework, based on ISO 9126 and ISO 14598, to classify collaborative project management software tools. Finally, we present a model and an application to help on the selection of this type of tools.

Keywords: Project Management, Collaborative Management, Collaborative Tools for Project Management.

1 Introduction

Today, Project Management (PM) is a key area for organizations, because without PM techniques the effort to implement a project would summarize to the common sense of the project manager, being difficult to effectively monitor deadlines, manage resources and costs and keep the scope controlled.

It is important, before defining more precisely what PM is, to establish what a project is. A project may be defined as a temporary endeavor that is progressively developed, aiming to create a unique product or service [1].

The PM paradigm has changed over the years, mainly due to the increasing number of projects that are geographically distributed, in which the teams are in different places and cultures, and so the present and future PM becomes more concerned with information and with knowledge [2]. Increasing competitive pressures are driving organizations to use collaborative technology to improve its effectiveness and efficiency. The use of groupware technology is being adopted by organizations to improve collaboration and knowledge sharing [3].

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For a project to succeed it is important to use software tools that support PM, especially in complex projects being subject to time and budget uncertainties. All users should be supported by tools, since it is almost impossible to manage complex projects using manual planning techniques [4].

2 Project Management and Collaboration

Project Management can be defined as the planning and control of integrated tasks in order to successfully achieve the goals for the benefit of the project participants [5]. According to Brian (1995) PM is a science of organizing, planning and controlling to create changes in products with a predictable cost, within the defined time and with the desirable quality. This definition has been the starting point for many of the PM techniques and methodologies used over the last 25 years. However Brian poses the question "What can we do better?". Although in the last years, PM techniques have improved, projects became harder to manage. The reasons for this fact are difficult to identify, but may be related to the increasing complexity of projects and the difficulty to apply PM techniques effectively. To deal with these problems Brian speaks of the importance of the interaction and communication between individuals involved in the project. There is an increasing need for collaboration [6].

The focus on the trends of today's PM is to find technology that allows the creation of a professional environment for geographically dispersed teams, similar to the expected one if these teams were in the same geographical space.

The collaboration is an added challenge when it involves the participation of individuals who are geographically dispersed. The need for collaboration is seen as an alignment between stakeholders from various parts of the organization so that they show an attitude of cooperation and focus on achieving project objectives [7].

The collaborative project management can be understood as a method that is used to plan, coordinate, control and monitor complex projects that are geographically distributed [2].

In recent years there has been an increasing demand for technology that allows collaboration between users who share common work. In an attempt to adapt to this kind of situation, software has been developed that aids collaborative work, best known as Groupware (or collaborative systems), which includes mechanisms to support interaction among members of a workgroup, manipulating objects, in shared workspaces [8].

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Technological artifacts such as collaborative systems can be useful for knowledge gathering, which should be placed in appropriate repositories, so that every people belonging to the organization have access to it [9].

Collaborative systems allow teams that are geographically dispersed perform communication, coordination and cooperation effectively and efficiently. There are two dimensions in collaborative systems that allow describing when and where the interaction occurs: (1) the horizontal dimension, which means having collaborative

tools that allow to detect where (on the same site or on different sites) the participants are; and the (2) vertical dimension, which distinguishes between synchronous communication (at the same time) or asynchronous communication (communication at different times) [10].

3 Software Tools for Collaborative Project Management Support

An initial search on the web was done in order to find the Collaborative Project Management Tools (CPMT) to be analyzed. This search was done using a search engine (Google) that had links to the official pages of several tools, forums and scientific papers. However, given the wide range of choices, first it was necessary to understand the essential characteristics of a CPMT. There are several desktop and web-based tools which offer resources for organizing tasks, defining goals and support team work. The following characteristics considered essential in a CPMT were defined:

- Correctly planning a project based on the realization of inter-related tasks;
- Evaluate and assign resources (human and material) needed to carry out a project, in accordance with identified needs;
- Manage the project calendar;
- Reporting;
- Generate Gantt charts;
- Accept precedence relations between tasks (end-start, start-start, end-end, start-end).
- Establish hierarchical levels, creating a work breakdown structure.
- Define scheduled dates for the tasks.
- And besides the previous functionalities, allow collaboration (file sharing, emails, forums, chats or wikis).

This last point was very important since the goal was to study tools that allow some form of collaboration, and have at least one of the features mentioned above.

Next, we present the sixty tools selected for evaluation in this study. Due to space limitations, just the name of the CPMT will be presented (see table 1).

Table 1. Software tools for collaborative Project Management analyzed

2-plan	Clarizen	Freedcamp	LibrePlan	PHProjekt	Teambox
5pm	Collabtive	Ganttic	LiquidPlanner	ProjectManager	TeamLab
AceProject	Comindware Tracker	GanttProject	Mavenlink	Project.net	Teamwork
ActiveCollab	Comindwork	Genius Inside	Merlin	Projectplace	Ubidesk
AjaxWorkspace	ClockingIT	GroveSite	Clientspot	ProjectPier	Vkolab
AtTask	Dooster	Goplan	Open Workbench	Projecturf	Web2project
Basecamp	Deskaway	GroupCamp	OnStage	ProWorkflow	Work Zone
Celoxis	DotProject	HyperOffice	OpenProj	QuickBase	Workspace
Central Desktop	Easy project	IManageProject	OneDesk	Redmine	Wrike
Cerebro	E*Groupware*	InLoox	PhpGroupware	Smartsheet	Zoho Project

According to Waltano Júnior (1992) [11], ISO 14598 provides requirements and recommendations for practical implementation of the evaluation of software products. The evaluation process is based on ISO 9126, which defines software quality metrics and can be used both to evaluate finished products and products in development. This standard can be used by evaluation entities, software vendors, software buyers and users, each with their goal [12].

The standard is divided into six parts, which are: 14598-1: Overview; 14598-2: Planning and Management; 14598-3: Process for the Development Team; 14598-4: Process for Customer; 14598-5: Process for the Assessor and 14598-6: Assessment Module. The assessment process according to ISO/IEC 14598-1 is defined by: establish assessment requirements (establishing the purpose of the assessment, identify types of products to be evaluated, specify the quality model); specify the evaluation (select metrics, establish levels of scores for the metrics, establish criteria for judgment); design evaluation (produce the assessment plan) and perform assessment (obtain measures, compare criteria, judge the results) [11].

ISO 9126 is divided into two subtypes: internal and external quality, and quality in use. The internal and external quality is the sum of the characteristics of the software product, and the quality in use is the view of the quality of the software product from the point of view of the user [13]. The internal and external quality of the software is perceived in the six characteristics, but only their sub-characteristics can be measured using metrics, Figure 1 [14].

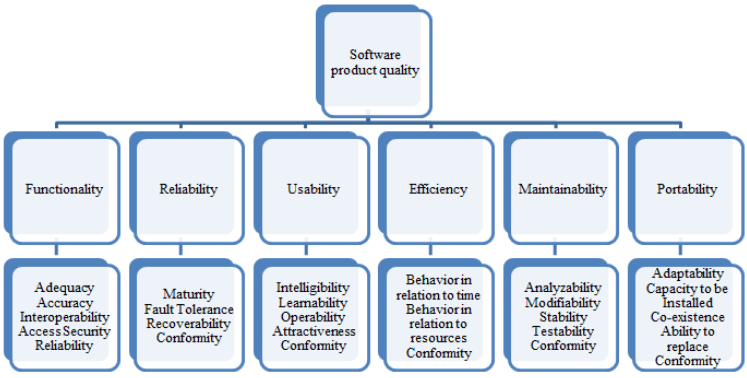

Fig. 1. Quality Model - ISO 9126 (Internal and external quality) [15]

4 Comparative Evaluation of Collaborative Project Management Software Tools – Model Developed

After a literature review about project management and document analysis (theses, official documents of tools, scientific articles and forums), we proceeded to the definition of the group of requirements based on characteristics and sub-characteristics of the ISO 9126, presented in section 3. Afterwards, we have

developed an evaluation model that can support project managers to choose the best tool that fits their needs. Based on the requirements, we defined a set of criteria and metrics to be used in the evaluation process. This section summarizes the proposed model and the results of the evaluation process of the sixty tools.

To use the model, the user (the project manager) must follow the following steps: define and group the assessment criteria (requirements group), associate weights to the subcriteria (requirements), assign a level of attainment to each sub-criterion and finally verify the type of solution.

First, we have started by grouping the evaluative criteria, based on the characteristics and sub-characteristics defined in ISO/IEC 9126. The features selected to be evaluated were: "Functionality", "Usability" and "Portability". The grouping of the requirements was defined as represented in the hierarchical structure shown in Figure 2.

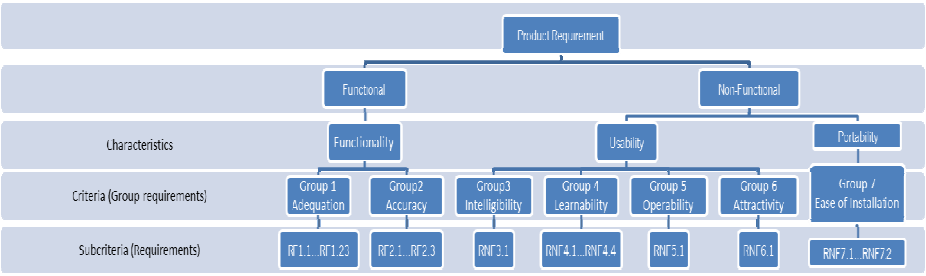

Fig. 2. Grouping of requirements

The sub-criteria considered for evaluations were grouped into three categories: project management, collaborative and others (see table 2).

Table 2. Requirements

Project Management	Collaborative	Others
Subtasks; Definition of task start and end dates; Milestones; Definition of tasks precedence's; GANTT chart; Critical path; Network diagram; Importation of projects; Exportation of projects; Input of work duration (days, weeks, months); Calendar; Event notification; Event log; Highlight important dates; Reporting; Appoint resources (people); Appoint resources (material); Indicate if a resource is overloaded; Input costs of resources; Project budget; Project control.	Chat; Email integration; Online conference; Forum.	User friendly; Help; Tutorials; Tool demonstration videos; Free updates; Shortcuts; Graphical user interface customization; Easy installation in a specific environment; Easy configuration.

After defining and grouping the requirements to assess, we proceed to the assignment of metrics. First, we define the priority or weight of each sub-criterion, which may be essential (weight of 3), important (weight of 2) or desirable (weight of 1). The priority demonstrates the importance of the tool having certain requirement.

After setting the priority or weight of each sub-criterion we have to assign the level of service, using the same analysis method of Cerqueira & Silva (2009) [16] which comprises: total (value=2), partial (value=1) or none (value=0). Total means that the tool has the complete requirement, partial means that the tool has partially the requirement, and none means that the tool does not have the requirement.

Besides the level of attainment and priority, we indicate a note regarding the type of assessment and respective percentage. Using the same analysis method of Marçal & Beuren (2007) [17] we considered the following levels: Excellent (90-100), Good (75-90), Satisfactory (60-75), Regular (50-60) or Poor (0-50). The total score reached by each tool is evaluated, using the set of evaluation criteria established for each characteristic according to equation 1 [16].

$$\text{Total Score} = \sum_{I=1}^{N} (P \times A) \quad \begin{array}{l} N = \text{Feature's number of criteria} \\ I = \text{Identifies the criteria (ranging from 1 to N)} \\ P = \text{Criteria's weight of priority} \\ A = \text{Criteria's level of attainment} \end{array} \qquad (1)$$

5 The Application to Compare CPMT and Results Obtained

In order to use the decision support multicriteria model, we have developed a software application. This allows project managers to define what tools they want to compare, the requirements needed and the respective weights. The developed application allows the introduction of new tools and their respective requirements, as well as to remove tools, and presents as a result the assessment of the tools under analysis. The name of the tool and the respective score are depicted in descending order, as well as the weights assigned to each requirement. When selecting a tool from the list of results, general information about the selected tool is shown. The application was developed using the program Lazarus and Pascal programming language. For constructing the database, SQLite was used. The application interface is shown in Figure 3.

The evaluation of the *functionality* feature shows that the tool Genius Inside obtains the highest score in comparison to other evaluated tools. This tool provides explicit support for multiple project management, resource managing, budgets, risks, schedules and planning. In terms of collaboration it is an excellent tool for professionals who are, for example, familiar with Facebook, Twitter and Linkedin. The tool with the lowest score is the Goplan; it lacks basic functionalities required for project management, namely resource management, budget etc.

The evaluation of the *usability* feature shows that the tools with the highest score are 5pm, Celoxis, and ClockingIT. However, other tools like Cerebro, Comindware Tracker, Easy project, GanttProject, InLoox, TeamLab, and OpenProj are very close to the score of the first; they do not comply with only one assessment criterion.

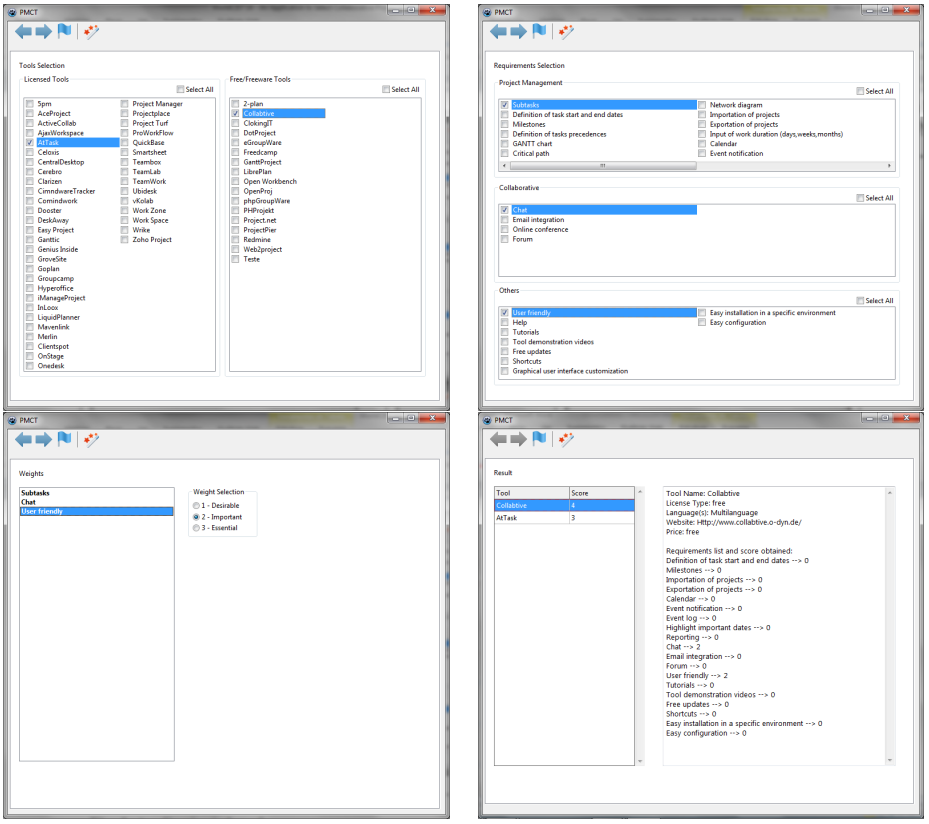

Fig. 3. Application´s Interface

As the results are almost identical, it can be stated that with regard to the *portability* feature, all tools have the desired quality, except ActiveCollab. This is mainly due to the fact that this tool is difficult to install, requiring technical expertise to do it. DotProject, Merlin and phpGroupWare present also lower performance in the *portability* feature. For example, DotProject is difficult to install, demanding a previous installation of MySQL and PHP and requires some specific technical settings.

The tools Celoxis and Genius Inside have the best overall score. The tool Goplan gets the worst overall score. The fact that Celoxis and Genius Inside are quite complete tools, allowing the management of resources, documents, budget, risk, and planning, makes them excellent tools in terms of *functionality*. Regarding the *usability* feature, such prominence does not exist, primarily due to the learning curve that is

needed to deal with the complex modules that these tools include. Hence, some professionals may value the *usability* over *functionality*, in order to save time with the learning process.

Comparative Table

The multicriteria decision model was applied to sixty tools. After evaluating the service levels of the criteria for each tool, a comparative table was constructed. In Table 3, we present a sample of the comparison involving two tools, exemplifying how to determine the score for each tool, taking into account their level of attainment (A) and their weight (or priority) (P). The score of each criterion in the comparative table is the result of multiplying the priority assigned to each criterion with the level of attainment, named Result (P*A). Besides the level of attainment and priority, we indicate a grade considering the type of evaluation. As an example of evaluation and comparison of the sixty tools, the 2–plan tool has a result of 59%, which means that it is considered as a tool with a regular type solution. The tool 5pm obtained a result of 66%, which is considered a satisfactory type solution.

Table 3. Comparative Table

Software	Requirement	RF1.1	RF1.2	RF1.3	RF1.4	RF1.5	RF1.6	RF1.7	RF1.8	RF1.9	RF1.10	RF1.11	RF1.12	RF1.13	RF1.14	RF1.15	RF1.16	RF1.17	RF1.18	RF1.19	RF1.20	RF1.21	RF1.22	RF1.23	RF2.1	RF2.2	RF2.3	FSUM	RNF3.1	RNF4.1	RNF4.2	RNF4.3	RNF4.4	RNF5.1	RNF6.1	USUM	RNF7.1	RNF7.2	PSUM	Ranking	Percentage
	Priority(P)	3	2	3	1	2	3	2	2	1	1	2	3	2	2	2	3	2	2	2	2	2	2	2	2	2	3	55	2	2	1	1	1	1	1	9	2	2	4	136	100%
2-plan	Attainment (A)	2	2	2	2	2	2	0	0	1	1	0	2	2	2	2	2	0	2	0	0	0	0	0	0	0	0	26	1	2	2	2	2	2	0	11	2	2	4		
	Result (P*A)	6	4	6	2	4	6	0	0	1	1	0	6	4	4	4	6	0	4	0	0	0	0	0	0	0	0	58	2	4	2	2	2	2	0	14	4	4	8	80	59%
5pm	Attainment (A)	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	0	2	0	0	0	0	0	0	0	0	30	2	2	2	2	2	2	2	14	2	2	4		
	Result (P*A)	6	4	6	2	4	6	0	0	2	2	4	6	4	4	4	6	0	4	0	0	0	0	0	0	0	0	64	4	4	2	2	2	2	2	18	4	4	8	90	66%

Figure 4 shows the final score obtained (in percentage) for each software tool analyzed. For example, the 2-plan tool obtained a total score of 59% representing the percentage at which to tool meets the full requirements considered. The highest score obtained was 88% for tool Celoxis and Genius Inside.

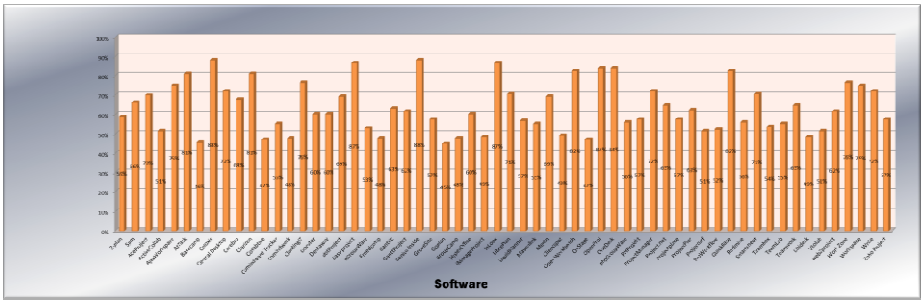

Fig. 4. Final ranking obtained

6 Conclusions

CPMT are an essential support for an effective PM. This is due both to the complexity inherent to PM activities and the increasing tendency for teams to be geographically distributed, requiring strong coordination and control. In addition, project managers are constantly pressured to increase efficiency, and to perform more tasks with fewer resources. CPMT can help to handle and support the various challenges in an increasingly globalized and demanding market. In this research we began to survey a representative sample (sixty CPMT) available on the market. After selecting the tools, we have developed a decision support multicriteria model where we have identified a set of relevant criteria to assist in the evaluation and comparison of CPMT, according to the ISO / IEC 9126 and ISO / IEC 14598. Finally, we developed a computer application that implements the proposed decision support multicriteria model that aims to support project managers in evaluating a set of CPMT, taking into account the predefined criteria. The results obtained for the sixty CPMT analyzed allowed concluding that the tools Celoxis and Genius Inside have the best overall score, mainly due to the *functionality*, *usability*, and *portability* features. The tool Goplan got the worst overall qualification. Besides the comparison of CPMT, it is important to note that a software application was developed allowing the comparison of any CPMT.

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