Web System to Aid Project Management

Abstract - This work describes a new web system to aid project management that was created to correct the principal deficiencies identified in systems having a common purpose which are at present available, as well as to follow the guidelines that are proposed in the Project Management Body of Knowledge (PMBoK) and the quality characteristics described in the ISO/IEC 9126 norm. As from the adopted methodology, the system was structured to attend the real necessities of project managers and also to contribute towards obtaining quality results from the projects. The validation of the proposed solution was done with the collaboration of professionals that used the functions available in it for a period of 15 days. Results attested to the quality and adequacy of the developed system.

Keywords - project management; web-based tool; software quality

I. INTRODUCTION

Tough competition existing since the beginning of commercial activities, allied to changes provoked by technological advances, market integration and globalization have increasingly required more efforts from enterprises to find solutions which will guarantee their survival and growth [1]. Due to this, project management has become more important and an indispensible resource to increase competitive potential since it details tools and techniques that enables the organizations to increase their capacity to stimulate internal communication, plan activities, estimate and monitor time and costs, as well as to guarantee the quality of the jobs done, all of which contribute to objectives being successfully fulfilled [2, 3].

In conceptual terms, a project can be understood as being a unique process consisting of a group of coordinated and controlled activities having dates for starting and finishing, to create a product, service or exclusive result, which will satisfy customers [4, 5]. Managing projects involve complexity and celerity to make decisions. Due to this, different systems to aid project management have been developed to supply relevant information to managers in a fast, safe, and consistent manner.

Nevertheless, such systems as are available on the market have a restricted scope of the indispensable managing aspects contemplated by Project Management Body of Knowledge (PMBoK) [5], one of the most reputed guides to project managing. In this context, the objective of this paper is to present a web System to Aid Project Managing (SAPM), and to show that this system is a new solution capable of correcting deficiencies identified in systems that have the same purpose and are available in the market, follow the proposed guidelines in the PMBoK [5] and the software quality characteristics described in the ISO/IEC 9126 [6], besides complying with general requirements from project coordinators and managers from small and medium sized enterprises.

The rest of this paper is organized as follows: Section II shows a general panorama about the tools to aid project management available in the market; Section III shows the methodology adopted to develop the work; Section IV shows the principal results that were obtained; lastly, Section V shows final considerations and future works.

II. SYSTEMS TO AID PROJECT MANAGEMENT

Currently, various software systems are available on the market to supply relevant informations to project managers in a fast, safe and consistent manner [7, 8, 9]. Nevertheless, these systems are functionally restricted in relation to the real project management necessities as described in the PMBoK. For example, the system described in Ref. [7] only aids risks management area, thus making it necessary to use other tools to manage the rest of the areas. A similar situation occurs in other systems described in Ref. [8] and [9] which supply automated aid for specific contexts.

With a view to presenting an overall panorama of the scope of the software systems that aid project managing, Ref. [10] shows a comparative analysis between four desktop systems and five web systems, which were assessed as to their alignment with the PMBoK guidelines and the ISO/IEC 9126 software quality norm. The authors verified that the assessed systems had similar functions, but did not supply aid for all of the project management necessities since they all prioritize some areas in detriment to others. As to the quality criteria of the analyzed software, important limitations were noted. Therefore, it can be concluded that, although various
computational systems have been developed, it can be seen that there is a lack of a wider scope of resources capable of offering an effective environment for activities related to project management. Moreover, it is notorious that existing systems do not have, even indirectly, a resource that instinctively guides the user without him realizing that he is obeying the guidelines stipulated in the PMBoK.

In this scenario, there is a need to develop a new system to aid project management activities based on a quality criteria that will cover real present market necessities.

III. METHODS

The methodological process was divided into three stages:

Analyses and Projects – At this stage, the identification of requirements to be considered by the SAPM was first done. Having the requirements, architecture in layers was structured for the system, improving the organization of the information, as well as supporting incremental development of the system and to guarantee its modularity, maintainability and extensionability [1, 11, 12, 13].

In a recent work, Ref. [10] presents detailed results of this stage, with a specification of identified requirements and an illustration and description of the developed software architecture (see Appendix A).

Implementation – At this stage, an initial version of the system was constructed which reflected the contemplated requirements of the defined software architecture. The construction of the system only used free resources to guarantee an easy access to implemented resources: PHP, JavaScript and HTML languages; MySQL database management system; Apache web server.

Validation – At this stage, the system was assessed by professionals involved in project management activities, which sought to refine or confirm requirements identified initially as well as enhance the established architectural design [14, 15]. The validation was done between August and November, 2010, when the system was personally presented to nineteen project managers from fourteen Brazilian enterprises from different sectors: education, administration, consultancy, civil engineering and information technology. At the end of each presentation, the assessors received a form to grade the scope and adequacy of the system using a scale of 0 to 10 points. Moreover, there was an open space on the form so that the assessors could indicate the strong and weak points of the system. The filled in form was returned via email after the assessors had remote experienced the system for 15 days.

IV. RESULTS

The results which were obtained from the implementation and validation stages are detailed below.

A. Implementation

The objective of this stage was to obtain a usable satisfactory web system for later validation by acting project managing professionals.

The system considers the functions shown in Table I, which are organized according to the nine knowledge areas as defined in the PMBoK guide: integration, scope, time, costs, quality, human resources, communication, risks and procurements. Besides that, two complementary functions that are not directly related to any of the areas, but which were considered essential to managing activities, were incorporated to the proposed solution.

Figure 1 (a) shows the SAPM project’s portfolio, from which an identified user can select an existing project to edit or register a new project. Figure 1(b) shows the screen which is exhibited by the system after a project from the portfolio has been selected, evidencing the alignment of the SAPM’s principal menu to the PMBoK guide, as it has the options organized according to the guide’s knowledge areas, thus contributing towards the agile execution of managing activities based on solid concepts.

Besides registering and organizing information, the SAPM is capable of generating and presenting different types of diagrams and graphic indicators which aid decision making processes for project coordinators and managers. Figure 2 shows one of the diagrams generated by the system, Gantt chart, which was configured to exhibit, in different colors, activities having different status, to facilitate the understanding of the general panorama of the project. Figure 3 shows graphic indicators that refer to human resources performance in previous projects which aids coordinators and managers with their process of selecting people to make up the project teams.

B. Validation

The SAPM validation stage allowed refining the previously identified functional requirements, as well as the architecture of the project, leading the system to be adequate for the identified present necessities in the Brazilian market. Ratifying this market demand, during the validation there was a strong interest in acquiring the system with some assessors showing interest in continuing to use the SAPM in their actual projects.

The main evaluated topics in the questionnaire utilized in validation were: usability - the degree of ease to access and use system resources; interface quality – the users’ appreciation of the system’s interface; graph quality – the appearance and representativity of the data; reports quality – the degree of users satisfaction with the type of report information generated by the system; operational efficiency – referring to degree of operational stability.

The histograms in Figure 4 reveal that the general result of the evaluation of the system by the participants was satisfactory. The vast majority of the assessments were in the range of 8 to 10 points. The left asymmetry of the data
TABLE I. FUNCTIONS CONTEMPLATED BY THE SAPM

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<td>1.1</td>
<td>Manage project documents</td>
<td>6.1 List project team members</td>
<td>2.1 Define the scope of the project</td>
<td>7.1 Enable online meetings between those involved in the project</td>
<td>3.1 Include activities</td>
<td>8.1 Management risks</td>
<td>4.1 Produce cost estimates by activity</td>
<td>9.1 List suppliers</td>
<td>5.1 Register management quality plan</td>
<td>Links with other software systems</td>
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<td>1.2</td>
<td>Register events during project execution</td>
<td>6.2 Control personnel availability and prevent conflicting allocations</td>
<td>2.2 Create a Work Breakdown Structure (WBS)</td>
<td>7.2 Production and distribution of custom made reports and warnings</td>
<td>3.1.1 Identify activities</td>
<td>8.1.1 Identify risks related to the project</td>
<td>4.2 Create project budgets</td>
<td>9.2 Plan purchases</td>
<td>5.2 Register audits to be done</td>
<td>Existence of access levels</td>
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<tr>
<td>1.3</td>
<td>Register learnt lessons</td>
<td>6.3 Register and present team member performance graphs</td>
<td>2.3 Create the WBS dictionary</td>
<td>8.1.2 Estimate risk impacts</td>
<td>3.2 Estimate starting and ending dates of the activities</td>
<td>8.1.3 Estimate the probability of risks happening</td>
<td>4.3 Generate project budget graphs</td>
<td>9.3 Register and present supplier delivery performances</td>
<td>5.3 Produce audit reports</td>
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**Figure 1.** Project’s portfolio (a) and main menu SAPM (b).
Figure 2. Gantt chart.

Figure 3. Human resources performance graphs.

Figure 4. SAPM general assessment result.

distribution and the absence of points below 5 reinforce the high degree of satisfaction felt by the SAPM assessors.

The principal system differentials pointed out by the assessors in relation to existing options were: learnt lessons recorder; storing and organizing project documents; automatic generation of the Work Breakdown Structure (WBS); automatic detection of project activity delays; quality of generated graphs; agenda and record of auditing quality results; control of human resources and project materials availability; availability of environments for online meetings; automatic risks priority; creation of a historical of suppliers and human resources performances.

Besides mentioned differentials, the participants also contributed with some suggestions for future system improvements, among which are: create a correspondence between the chronogram and the WBS; consider holidays and vacations in the estimates; include resources that will allow estimating costs based on statistical analysis; generate graphs and diagrams to aid quality managing, such as the Pareto and Ishikawa diagrams; make available individual calendars for human resources; create mechanisms to aid quantitative risk analyses.

As a fundamental part of the methodological context, the validation exceptionally contributed towards the refinement of functional requirements for Brazilian enterprises, leading to the inclusion of new functions to the system to better serve today’s necessities of small and medium sized enterprises.

To highlight SAPM’s wider scope than those of other web systems on the market that have the same purpose, Table II shows an adaption of the comparative analysis presented in Ref. [10], considering only the five web systems and the SAPM. To attribute qualifications, disc representation indicating the frequency of each analyzed topic in each system was favored: greater the frequency, the larger the portion in black. This comparative analysis sought to highlight the wider scope of the SAPM as to its alignment to the PMBoK and the
Enterprises in their daily activities. Managers and coordinators from said aforementioned make the SAPM capable of fulfilling the necessities of project of clients who are, mostly, well versed in the present scenario described in ISO/IEC 9126, as well as to value the satisfaction in the PMBoK plus the software quality characteristics used in its realization, can increase efficiency and efficacy in the conduction of projects. Despite the limitations identified during the validation, was highlighted the contribution of the proposed system to improve the quality of project results.

As it was projected to incorporate the guidelines proposed in the PMBoK plus the software quality characteristics described in ISO/IEC 9126, as well as to value the satisfaction of clients who are, mostly, well versed in the present scenario of web systems to aid project management, it was possible to make the SAPM capable of fulfilling the necessities of project managers and coordinators from said aforementioned enterprises in their daily activities.

V. Final Considerations and Futures Works

This paper presented the SAPM which had its relevancy attested by market professionals who are involved with management projects in small and medium sized Brazilian enterprises. According to validation results, it may be concluded that the SAPM, due to the conceptual referential used in its realization, can increase efficiency and efficacy in the conduction of projects.

As it was projected to incorporate the guidelines proposed in the PMBoK plus the software quality characteristics described in ISO/IEC 9126, as well as to value the satisfaction of clients who are, mostly, well versed in the present scenario of web systems to aid project management, it was possible to make the SAPM capable of fulfilling the necessities of project managers and coordinators from said aforementioned enterprises in their daily activities.

TABLE II. COMPARATIVE ANALYSIS OF SUPPORT SYSTEMS FOR PROJECT MANAGING AND THE SAPM (ADAPTED FROM REF. [10])

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Systems</th>
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<tr>
<td>1. Register of learnt lessons</td>
<td>Dot Project</td>
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<td>2. Storing documents related to the project</td>
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<td>3. Create WBS</td>
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<td>4. Plan / control costs</td>
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<td>5. Plan / control quality</td>
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<td>6. Plan / control manpower</td>
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<td>7. Control changes</td>
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<td>8. Control / managing risks</td>
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<td>9. Control purchases</td>
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<td>10. Communication between those involved</td>
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<td>11. Control project’s progress</td>
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<td>12. Control scope</td>
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<td>13. Control time</td>
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<td>14. Emit reports</td>
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<td>15. Construct graphics</td>
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Legend: ○ - 0%; ▲ - 12.5%; ▲ ▲ - 25%; ▲ ▲ ▲ - 37.5%; ▲ ▲ ▲ ▲ - 50%; ▲ ▲ ▲ ▲ ▲ - 62.5%; ▲ ▲ ▲ ▲ ▲ ▲ - 75%; ▲ ▲ ▲ ▲ ▲ ▲ ▲ - 87.5%; ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ - 100%

Despite the limitations identified during the validation, was highlighted the contribution of the proposed system to improve the quality of project results.

Future works will seek to cover such limitations and iteratively widen this system, following the exploring evolutionary model [1, 11], which will lead the more refined and complete versions of the system.

REFERENCES

APPENDIX A: SAPM ARCHITECTURAL DIAGRAM (ADAPTED FROM REF. [10])