Evaluating the Quality of Project Planning:

A Model and Field Results

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Abstract

Faulty planning will result in project failure, whereas high-quality project planning increases the project's chances of success. This paper reports on the successful development and implementation of a model aimed at evaluating the quality of project planning. The model is based on both the abilities required of the project manager and the organizational support required for a proper project management infrastructure. The model was validated and applied by 282 project managers in nine organizations, where strong and weak planning processes were identified and analyzed.

Introduction

Carrying out a project according to its plan does not necessarily ensure a successful outcome. If the planning is faulty, the project will not result in the expected outcome and vice versa; high-quality planning increases the chances that the project will be properly executed and successfully completed. Researches have identified planning as a critical success factor in a project (i.e. Pinto & Slevin, 1988; Johnson et. al., 2001 etc.). Moreover, the fact that planning is the first process being performed by the project manager allows him to make significant changes as well as to improve the baseline for future control purposes. Although its importance is recognized, no focused tool has yet been developed for measuring the quality of project planning.

Project planning is defined as the establishment of formal plans to accomplish the project's goals (Meredith & Mantel, 1995). Responsibility for planning lies entirely with the project manager, who must ensure that it is carried out properly to the complete satisfaction of all relevant stakeholders. Therefore, he or she should make sure not only that executions are carried out according to the plan's base line, but that this base line is a reliable one.

Meredith & Mantel (1995) find six planning sequences – preliminary coordination, a detailed description of tasks, deriving project budget, deriving project schedule, precising description of all status reports and planning the project termination. Russell & Taylor (2003) identify seven other planning processes, which include defining project objectives, identifying activities, establishing precedence relationships, making time estimates, determining project completion time, comparing project schedule objectives and determining resource requirements to meet objectives.

Since there is no available model exists for assessing the quality of planning, the research will benefit from identifying models that are used in similar environments, so that they may help in structuring the desired model. One group of models, known as maturity models, evaluates the overall ability of organizational processes. These models describe a framework used for evaluating the maturity level of an organization (Paulk et. al., 1995). Improving the maturity of the organization was found to be highly correlated with the success of projects (i.e. Harter, et. al., 2000). The first maturity model (Crosby, 1979), which concentrates mainly on quality, does not treat planning as a significant component that has to be evaluated. Even the most important maturity model, SW-CMM (Software Capability Maturity Model), includes only one planning process among 18 key processes areas (Paulk et. al., 1995). Since the development of the SW-CMM model, dozens of other maturity models, in which planning plays a role as well, were developed and implemented in several industries. These models establish a management organizational support body of knowledge, which is relevant to the project environment as well.

Yet, the quality of planning is not influenced only by the quality of organizational processes, but also depends on processes performed by a project manager. Project management literature specifies processes such as schedule development or cost estimating that should be performed by a project manager. The Project Management Body of Knowledge, which is referred to as PMBOK, is the recognized body of knowledge of the Project Management Institute (PMI Standards Committee, 2000). It was also recognized as a standard by the American National Standard Institute (ANSI). PMBOK lists the processes that should be performed by a project manager. Out of the 39 processes identified by the PMBOK, 21 (54%) are planning processes. In other words, a significant portion of the project manager's work is of a planning nature.

It is important to point out that PMBOK deals with processes that should be implemented mostly by the project manager. It does not deal with other project management related processes, which should be supported by other functions within the organization. However, there are tasks that cannot be carried out by the project manager, since he has neither the authority nor the responsibility to do so. For example, the SW-CMM questionnaire, which is used for evaluating organizational maturity, includes the following question: "Does the project follow a written organizational policy for planning a software project?" (Zubrow et. al., 1994), expecting the organization to create a process in which project procedures are written and refreshed. Therefore, a model that evaluates the quality of project planning must include processes performed by both the organization and the project manager.

Some maturity models have followed the PMBOK processes and include some of the 39 processes specified there, but they do not include organizational support elements, required for proper project management infrastructure (i.e. Ibbs & Kwak, 2000). Only a proper mix of project manager's know-how and organizational support will improve the quality of planning and project results. A model which includes these two components should be used to evaluate the quality of the project planning processes in an organization.

The model

The development of the model for assessing the quality of project planning is based on knowledge areas from the fields of Project Management, Control, Organizational Maturity and Organizational Support. The model, called Project Management Planning Quality (PMPQ) consists of the two following components:

Project manager's know-how – includes processes for which a project manager is responsible (directly or indirectly). These processes were derived from the PMBOK and were grouped according to its nine knowledge areas.

Organizational support – includes processes which should be offered by the organization in order to properly support project processes. These processes were identified mostly from existing maturity models which represent activities that should be performed by the organization. These processes were grouped according to the mapping offered by the PMBOK.

The 21 Project planning know-how processes were derived from the 39 processes included in the PMBOK. A typical objective of processes is to obtain a specific deliverable. The success of a process depends on the quality of its deliverables, while each process may result with one or more products. However, an analysis of processes, which have more than one product, reveals that it is always possible to identify one major product.

Figure 1 presents the planning product within the knowledge area of "Scope", which includes two planning processes – "Scope Planning" and "Scope Definition". The "Initiation" process is performed before the formal start of project planning, while "Scope Verification" and "Scope Change Control" are part of the controlling processes.

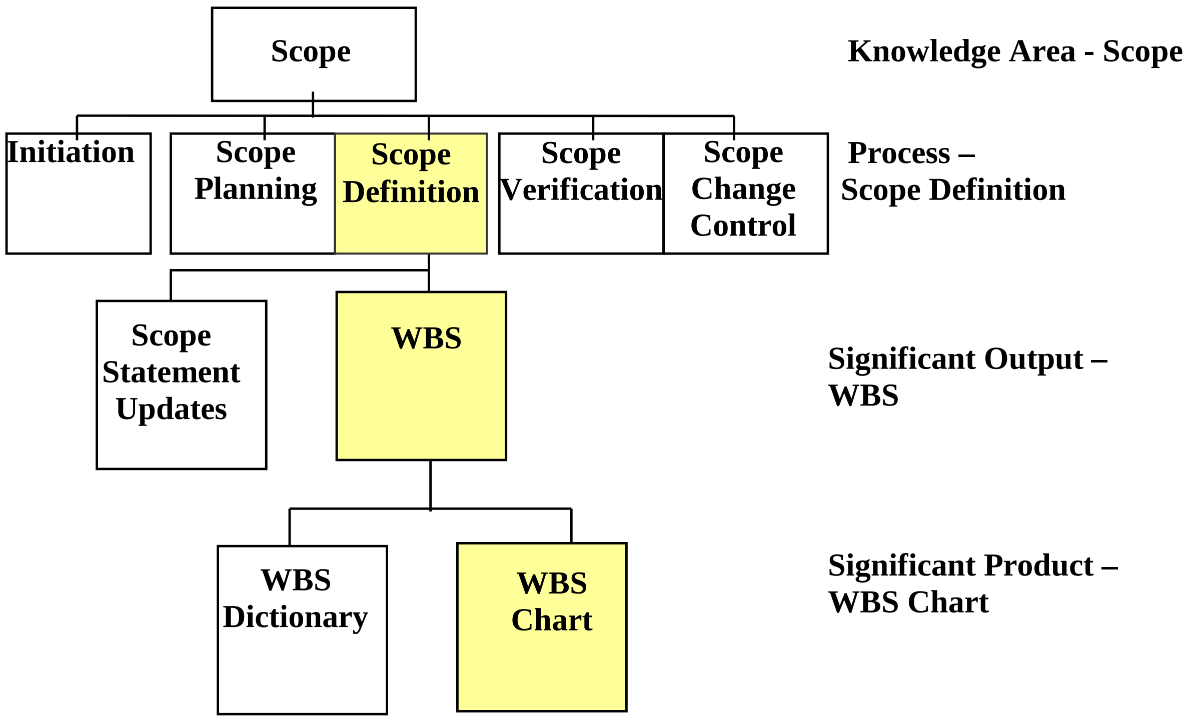

Figure 1 – Planning Processes and Products within the Scope Knowledge Area

The example presented in figure 1 focuses on the planning process called “Scope Definition”, which is explained later on. A major assumption used in this model is that the quality of the output is a function of the frequency in which this output is generated. The justification for this assumption is based on learning theory; “Learning Curve” research has shown that there is an ongoing improvement of performance as a function of the number of times the operation is repeated (e.g. Yiming & Hao, 2000; Snead & Harrell, 1994; Griffith, 1996; Watson & Behnke, 1991). Furthermore, the “Expectancy Theory Model” claims that one will not repeat a process that has no significant added value to one’s objectives (Vroom, 1964). Tatikonda and Montoya-Weiss (2001) found that achievement of operational outcomes in 120 development projects aids the achievement of market outcomes. Finally, although much is said today about controlling the processes rather than the outputs (for instance, see the entire ISO9000 series), some control models suggest “output oriented control” when it comes to operational processes, such as project management (Veliyath et. al., 1997).

In light of the above, an evaluation of the quality of planning processes in this model is based on the frequency of generating the desired outputs and the desired products derived from them. For example, there are two outputs in the “Scope Definition” process: the “WBS” (Work Breakdown Structure) and the “Scope Statement Updates” (see Figure 1). The “WBS”, which deals with the identification of the components from which the project consists of, is a new output, which has not been generated as an output of another process. The same is not true with regard to “Scope Statement Updates”, whose output updates an entity that has already been generated by another process. Moreover, there are two products included in the “WBS” output - the “WBS Chart”, which breaks down the project into manageable work packages and the “WBS Dictionary”, which specifies the content of each work package. The "WBS Dictionary" is actually a blow up of the "WBS Chart". Therefore, one may say that the "WBS Chart" is the major product, from which the other is derived. Following that methodology, one major product was defined for each of the 21 planning processes included in the PMBOK.

A questionnaire was built to represent the selected planning products. The following scale was used for evaluating the use intensity of the products:

5 – The product is always obtained

4 – The product is quite frequently obtained

3 – The product is frequently obtained

2 – The product is seldom obtained

1 – The product is hardly ever obtained

A - The product is irrelevant to the projects I am involved in

B – I do not know whether the product is being obtained, or not

Although a single product was identified for each process, it was not clear if project managers differentiate between them and treat them as independent products. Therefore, a pilot study was initiated, with the purpose of evaluating the necessity of every single product. Participants in this pilot study were 26 project managers and other professionals working in a project environment. The results of the pilot study showed that some products are highly correlated with each other. For example, a high correlation was found among all "Risk Management" products (e.g. "Risk Identification", "Risk Quantification", etc.). This means that all these products can be represented by one entity. A similar finding repeated itself within the "Procurement" knowledge area. As a result of the above analysis, correlated planning products were united, and the number of planning products was reduced. Table 1 shows the final list of the 16 planning products included in the model.

Knowledge Area	Planning Process	Planning Product
Integration	Project Plan Development	Project Plan
Scope	Scope Planning	Project Deliverables
	Scope Definition	WBS (Work Breakdown Structure) Chart
Time	Activity Definition	Project Activities
	Activity Sequencing	Pert or Gantt Chart
	Activity Duration Estimating	Activity Duration Estimates
	Schedule Development	Activity Start and End Dates
Cost	Resource Planning	Activity Required Resources
	Cost Estimating	Resource Cost
	Cost Budgeting	Time-phased Budget
Quality	Quality Planning	Quality Management Plan
Human Resources	Organizational Planning	Role and Responsibility Assignments
	Staff Acquisition	Project Staff Assignments
Communications	Communications Planning	Communications Management Plan
Risk	Risk Management Planning	Risk Management Plan
Procurement	Procurement Planning	Procurement Management Plan

Table 1–The 16 Planning Products Included in the Model and their Knowledge Areas

As mentioned before, there are two major groups of processes: processes covered by the PMBOK, which have already been reviewed and organizational support processes. PMBOK identifies four supporting knowledge areas, named "Organizational Systems", "Organizational Cultures and Styles", "Organizational Structure" and "Project Office". PMBOK concentrates mainly on the relevant project manager's know-how and very little on organizational support. Therefore, although the four relevant areas mentioned seem to fit other models, only a few products for the above knowledge areas were offered by the PMBOK.

As mentioned before, a possible source for identifying organizational support processes lies in the dozens of maturity models that have been developed in the past few years. Reviewing maturity models, over a hundred project management processes have been identified. Canceling overlapping processes between models and processes that do not apply to project planning has reduced the number of organizational support processes to 13. The four processes, presented by the PMBOK, were added to the list as well, thus reaching a total of 17 organizational support processes and products. These products were grouped into the four supporting knowledge areas defined earlier, and are presented in table 2.

Supporting Area	Organizational Support Product
Organizational Systems	Project-Based Organization
	Extent of Existing of Projects' Procedures
Organizational Cultures and Styles	Appropriate Project Manager Assignment
	Extent of Refreshing Project Procedures
	Extent of Involvement of the Project Manager During Initiation Stage
	Extent of Communication Between the Project Manager and the Organization During the Planning Phase
	Extent of existence of Project Success Measurement
Organizational Structure	Extent of Supportive Project Organizational Structure
	Extent of existence of Interactive Inter-Departmental Project Planning Groups
	Extent of Organizational Projects Resource Planning
	Extent of Organizational Projects Risk Management
	Extent of Organizational Projects Quality Management
	Extent of On Going Project Management Training Programs
Project Office	Extent of Project Office Involvement
	Extent of Use of Standard Project Management Software (e.g. Ms-Project)
	Extent of Use of Organizational Projects Data Warehouse
	Extent of Use of New Project Tools and Techniques

Table 2 – Grouping the 17 Organizational Support Products Included in the Model

Assuming that the relevant variables required for evaluating the quality of project planning have been identified, there is still a need to structure a model, which will allow converting these variables into an overall quality indicator.

In order to achieve this purpose, relative importance, or weight, has to be assigned to each of the variables. Since there is no prior information concerning their relative importance, it is logical to assume that they all have the same impact. Applying this assumption to our model, we assumed equal weight for the two groups, namely, “Project Know-how” and “Organizational Support”. Using the same logic, areas within each group and products within each area were assigned equal weight as well. For example, the weight of each knowledge area with the “Project Know-how” is 50/9= 5.56%. The weight of a specific process within a certain area depends on the number of processes in that area. Since the “Scope” knowledge area has only two processes, the weight of each is 2.78%.

All together there are 33 products in the PMPQ model, 16 relating to project know-how processes and the other 17 to organizational support processes, as described in figure 2. Since each product consists of a single item in the questionnaire, the PMPQ index, that evaluates the quality of project planning in the organization, is calculated as a weighted average of these 33 items.

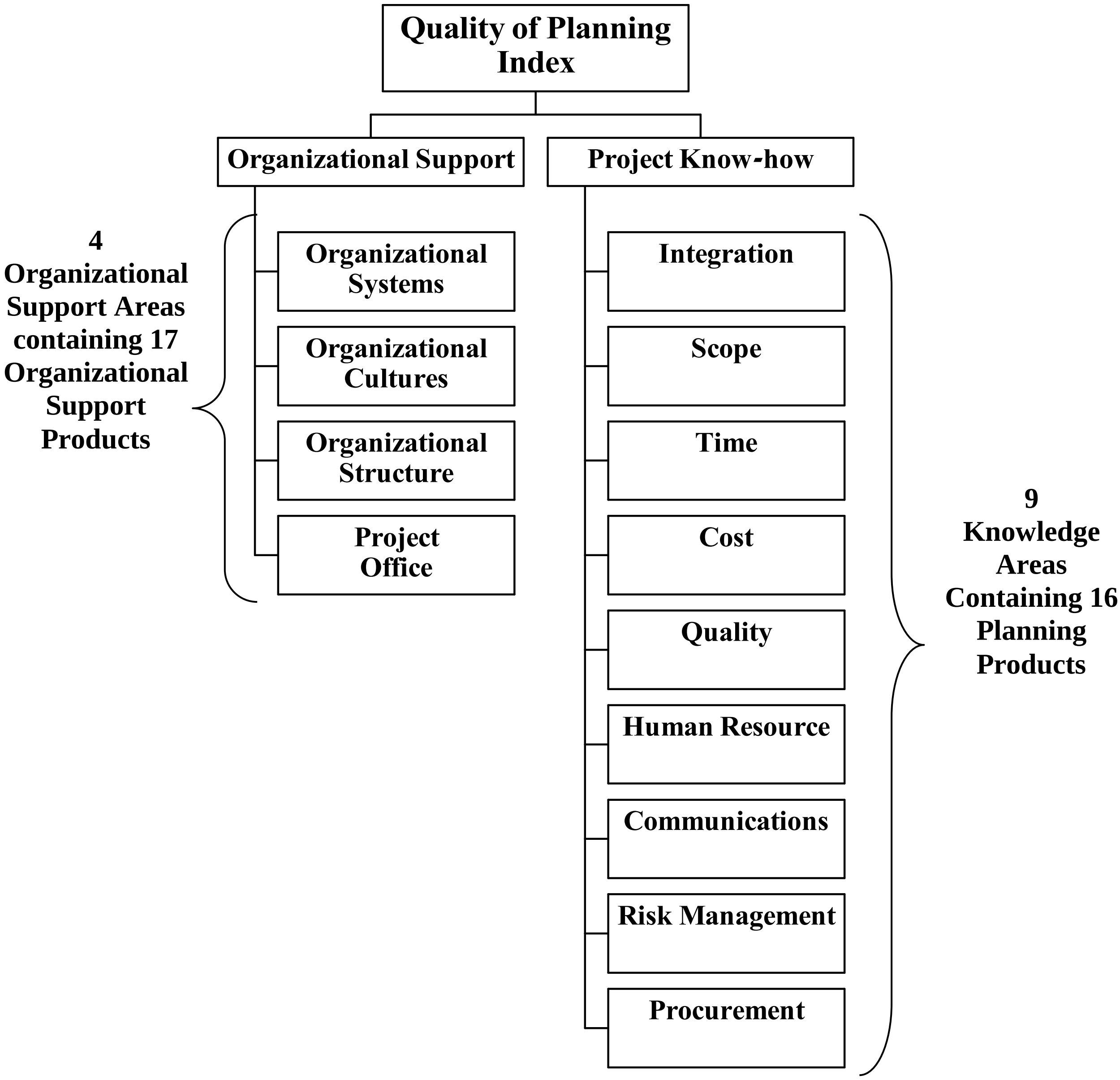

Figure 2 – The PMPQ Model Breakdown Structure

In addition, participants in the study were asked to evaluate four variables describing the success of projects. Cost overrun and schedule overrun were measured in percents from the original plan. Technical performance and customer satisfaction were measured on a scale of one to ten, one representing low technical performance and low customer satisfaction, while ten represents high technical performance and high customer satisfaction. In addition, subjective assessment for the quality of planning was also evaluated, 10 representing high quality plan and 1 low quality plan.

In order to justify the use of the model, it should be tested. Testing the model involves the evaluation of its reliability - the extent to which repetitive measures are of similar results, and its validity - the extent to which the model measures what it is supposed to measure. Initial testing used a sample of 26 participants. After the model was revised, based on the initial sample, it was also tested on a larger sample size.

The model's reliability was calculated using a number of statistical tests, such as Cronbach alpha. Results were considerably higher (0.91 and 0.93 respectively) than the minimum value required by the statistical literature (Garmezy et. al., 1967), both for the entire model, and for its components. Results were also found to be independent of the person answering the questions, be it a project manager or a senior manager.

The model's validity was evaluated by comparing the overall project planning quality indicator (PMPQ index) derived from the model, with the projects' success, as estimated by a separate set of questions. It was found that PMPQ index was highly correlated with the perception of projects' success, as measured by cost, time, performance envelope and customer satisfaction, as well as with the perceived quality of planning. The correlation remained very high and significant for several other options of weighting. A summary of the analysis is presented in table 3. All results are statistically significant with p-values under .01.

Success Measure	The Intersect	Regression Slope	R	p-value
Cost Overrun	108%	-25%	0.52	**< 0.001**
Schedule Overrun	94%	-18%	0.53	**< 0.001**
Technical Performance	6.2	0.5	0.57	**= 0.001**
Customer Satisfaction	6.1	0.6	0.51	**< 0.001**
Project Manager Subjective Assessment	2.3	1.5	0.66	**< 0.001**

Table 3 – Validity Tests for the PMPQ Model

The quality of planning was correlated with each of the project's final results and with the subjective assessment of the project manager regarding the quality of planning. The conclusion from the above statistical analysis is that the PMPQ model is reliable and valid and can be used to evaluate the quality of project planning.

Using the PMPQ model

The questionnaire was administered to 19 different workshops, of which nine were administered as part of an internal organizational project management-training program. Each of these nine workshops included an average of 13 individuals. Participants in the other 10 workshops came from companies in the area of Engineering, Construction, Software development etc. Altogether, 282 project managers and other individuals working in a project environment completed the model's questionnaire. A questionnaire was included in the final analysis, only in case that at least 80% of its data has been completed. Using this criterion, 202 questionnaires remained for the final analysis.

In the rare case of missing data, the missing values were filled in by the mode of that variable calculated from the observations of the same organization. For the variables of cost overrun and schedule overrun, the missing values were filled in by the average of the same variable from the observations of the same organization.

The quality of each knowledge area was calculated, based on data given to the processes included in the knowledge area. Figure 3 presents the average results of the project management know-how processes by nine project knowledge areas. All averages are based on data ranging from one to five, for each knowledge area.

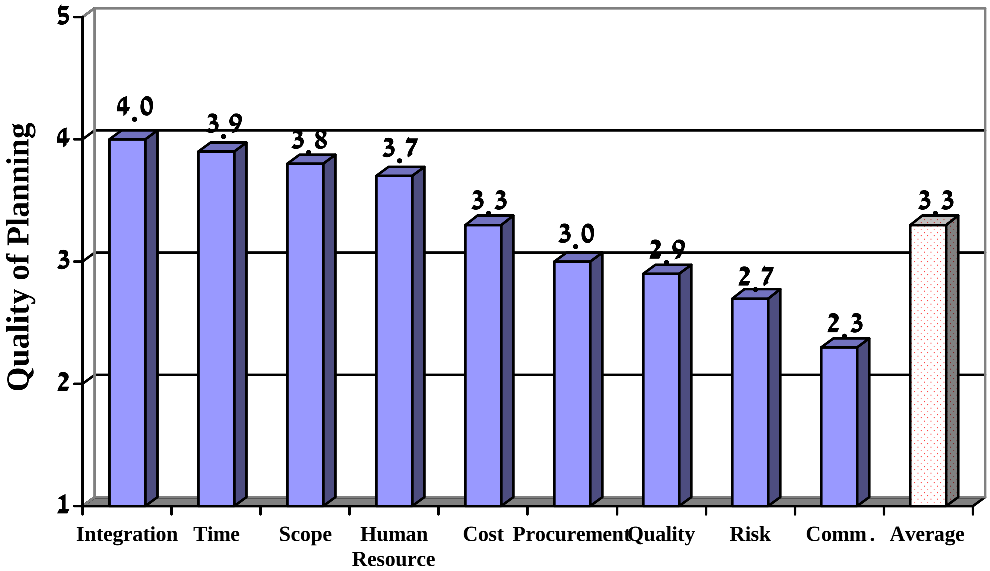

Figure 3 – Quality of Planning for the Nine PMBOK Knowledge Areas

By using cluster analysis it was possible to identify the following three groups of knowledge areas, which are significantly different in their quality score ($p<0.001$).

High quality areas include “Integration”, “Scope”, “Time” and “Human Resources”. The score of this group is around 4.

Medium quality areas include “Cost”, “Procurement” and “Quality”. The score of this group is around 3.

Poor quality areas include “Risk” and “Communications”. The score of both is around 2.5.

Similar findings were found in another research involving 38 companies (Ibbs & Kwak, 2000). The ranking of the knowledge areas score is compared in table 4.

Knowledge Area	Present Research	Ibbs & Kwak, 2000
Integration	1	No Data
Time	2	4
Scope	3	3
Human Resource	4	6
Cost	5	1
Procurement	6	5
Quality	7	7
Risk	8	8
Communications	9	2

Table 4 –Quality Ranking of Knowledge Areas in Two Researches

Keeping in mind that two separate models are compared, although the current research focuses on planning, while the other one treats the whole life cycle of the project, two knowledge areas, “Cost” and “Communications”, receive better treatment as the project progresses. A project has stronger budget constraints during the execution phase (spending the money), than during the planning phase. This may explain the improvement in the quality of the “Cost” knowledge area.

Although “Communications” is recognized as an essential and critical knowledge area, there is relatively little formal project knowledge and tools to support its planning processes. As a result, project managers do not know how to methodologically plan the relevant processes. Therefore, they mostly use their instincts for this process.

The following points are offered as a partial explanation of the other findings, which are similar in both researches:

The processes of “Time”, “Scope” and “HR”, belonging to the high quality group, are partially known to have structured knowledge and efficient tools to support the project manager during the entire life cycle of the project and are highly ranked in both researches.

The poor quality group includes the “Communications” and “Risk Management” knowledge areas. Unlike “Communications”, a relevant body of knowledge is available in the “Risk Management” knowledge area. A project manager’s lack of ability to execute high quality “Risk Management” processes (Couture & Russett, 1998; Mullaly, 1998; Ibbs & Kwak, 2000; Raz et. al., 2002) may derive from the nature of the tools, which are not user-friendly. Another possible reason may be derived from the fact that the functional managers, who are responsible for executing work packages in a matrix environment, are the ones that should perform the “Risk Management” analysis, since they are familiar with the work content. Since functional managers are not typically skilled in risk analysis, project managers may find themselves in a frustrating situation, where they do not have the basic needs for applying risk management (Globerson & Zwikael, 2002).

A similar analysis is performed for the organizational support processes. Figure 4 shows the average results for the four organizational support areas, based on data ranging from one to five, for each area.

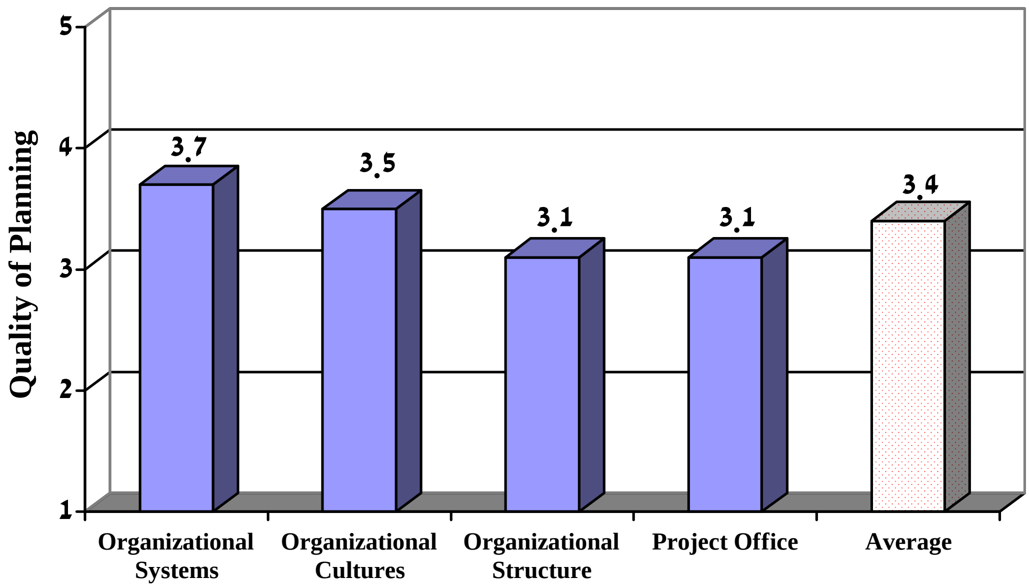

Figure 4 – Quality of Planning for the Four Organizational Support Areas

Via a scatter analysis of the organizational support areas, two groups, having a significant difference in quality of planning, were identified ($p<0.001$). The high quality group consists of “Organizational Systems” and “Organizational Cultures”, while the lower quality group includes the “Organizational Structure” and the “Project Office” areas. While analyzing organizational support processes, it was found that policy support processes such as “selection of a project manager”, obtained the highest quality score. However, most of the tactical processes, such as “ongoing project management training”, were poorly executed and obtained low quality scores. The only relatively high quality tactical support that organizations offer to their project managers is purchasing of project management software.

Since organizations that participated in the study came from different industries, it was also possible to test if planning quality is different among them. It was found that quality of planning is impacted by the nature of the industry. Engineering and construction organizations showed the highest quality of planning, probably due to the similarity of the projects carried out by these organizations. Quality of planning within production and maintenance was found to be the lowest, perhaps due to the difficulty these organizations face in comprehending the basic difference between managing a project in all its uniqueness and handling their day-to-day operations. Statistical analysis of the results proves that the difference between the two industries is a significant one ($p<0.01$), while the other two industries (software & communications and services) are significantly separated in a medium quality level.

The quality of planning level for each industry is presented in Figure 5.

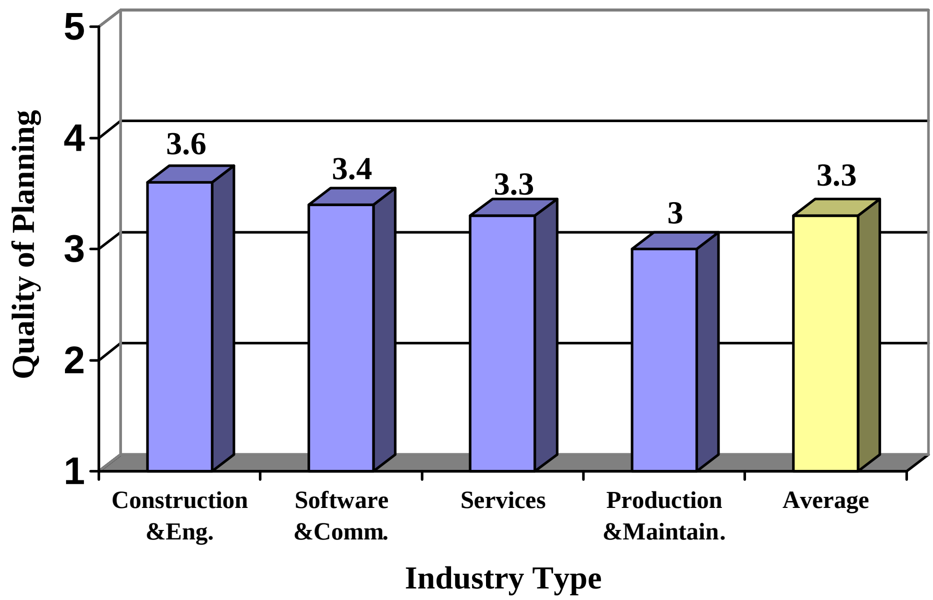

Figure 5 – Quality of Planning by Type of Industry

The above findings concerning the difference among industries were compared to two other studies, which dealt with the same topic; Ibbs and Kwak (2000), who evaluated the maturity of 38 US organizations (the “US” research), and Mullaly (1998), who evaluated 65 Canadian organizations (the “Canadian” research). Both studies grouped the organizations into industries as well. Although the two studies examined all project life phases, while the PMPQ model focused on the planning phase, the ranking of industries is similar; Construction & Engineering organizations perform project processes at the best quality compared to all other industries (3.4 in the US research and 3.6 in the current research). Production & Maintenance organizations were found to have the worst quality both in the Canadian research (2.4) and the current research (3.0).

Conclusion

A model (PMPQ) for evaluating the quality of project planning was developed and tested. It was found to be of high validity and reliability to justify its use in a projects' environment. Results of using the model identify the typically strong and weak points in project planning. The traditional points, such as time related processes were found to be the strong ones, while "Risk Management" and "Communications" processes are the 'Achilles heels' of project planning.

The quality of organizational support processes was lagging the project know-how processes, pointing out that organizations have not yet developed the proper project management infrastructure required for an effective support.

The use of the PMPQ model across industries enabled us to identify significant differences in the quality of project planning among them; Construction and Engineering companies were found to have the highest level, while Production and Maintenance companies have the lowest quality of project planning.

To conclude, it can be stated that the PMPQ model can be used effectively as a diagnostic tool for evaluating the quality of project planning in organizations.

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